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Взаємодія ендофітних бактерій з рослиною на клітинному та молекулярному рівнях

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> В веляй падаеться інформація про локалізацію пидофітних баютерій у тяхниного лислень, н тонго обеспорозоных аляха на механёзка проважнения баютерій всередана рослина. Росслидновност nemodu demenuții cudodemia respedant pocator (gamoziadnat, ingnoastebul, nonexy tapus relativistos).

Вступ. З середния 40-х рр. фітопатологи та фітоалгологи спостерігали скупчення бактерій у тканинах зворових рослин. Зоврема, в роботі [1] показано, що непатогений ризосферні бактерії проникають з грунту всередену стебол, насіяня та бульб картоплі. Талі явища поэснювалися тим, що клітиги рослин дегенерують літичним шляхом, утворюючи «корота», через які бактерії потрапляють всередину рослинного організму [2]. Термін «сидоризосфера» тобто кортске корсия, заселений бактеріями, які згатні локалізуватися всередняї або між клітинами, з:прономовано авторами [3] у 1978 р. саме для вначачения стадії розкладу тканин кореня рослини. з причным проникнения заовні бактерій через такі чьорота».

Тишого погляду на феномен заселения адорових рослин бактеріями, що потребує фундаментгльного вивчения, дотримувалися представники бразильської школи азоціативної азотфіксації [4, 51. Спостеризаючи бактерії всередняї ткания рослин, ячені доводили, що силофіти потрапля, тьусерелину не через автоліз рослинних клітин, л автивно, завляки яхомусь властигому ім мела-MISMORY.

до того вивчалася протягом майже ста роких, то біологічного контролю шкідників врожаїв. Це простимулювало пошук активних несимбютичних. азотфіксуючих бактерій та бактерій — антагоністія патогених мікроорганізмів [6, 7].

Історично склалося так, що несниблотично бактерії виділяли з ризосфери рослин, тобто з грунту. дотичного до кореневої системи рослин, 200 ч поверхні коренів. Незважаючи на високу активвість ізолятів бактерій (азотфіксація, вялілення фітогормонів тощо), яку воми визкляли в сиспераментах, у природних умовах високі покалники не завжди відтворювалися. Нестабільність результатів пользених дослідія з визначення вплику бактерій на підвищення продуктивності росличь з росу в дія. звичайно залежить від природинх фолторов (посука, дощі, заморозки), але основною прилиною варіації є неконкурентність ризосферных бляления з нових природних умовах через іднів слабыні комтакт з реслиною. У ризосфері рослини вазбунається жорстка конкурентна боротьба між. мікроорланмами за джерела вуглещо та сисрги - реземния які вивільняють кореневі системи рослин (8, 51 Отже, виживають ті з них, котрі пристосовоні леспоживания певних речовин із спектра кореневексудатів. Чим цяльніше бактерії локалізуванся пановерхні кореня та тісніше асоційовані з родинами через аглютиніни, фімбрії та інші засобо, токраще вони живляться. Ендефітні бактерії впірамують меншу конкуренцію, оскільки пристолиции до розвитку всередний тканин рослини.

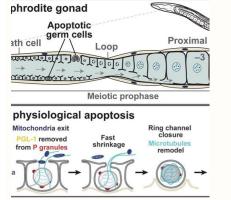
У теперішній чыс чэрез тяжкі наслідки екологичнох истарыдів, з також завдики популяризаний ілей ресурсозберігаючого сільського господарства зусплля вчених спрямовано на пошук біологічних альтернатив агрохімічним засобам вирошувания врежаїв. У зв'язку з цям набули актуальності проблеми біологічної азотфіксації, яка

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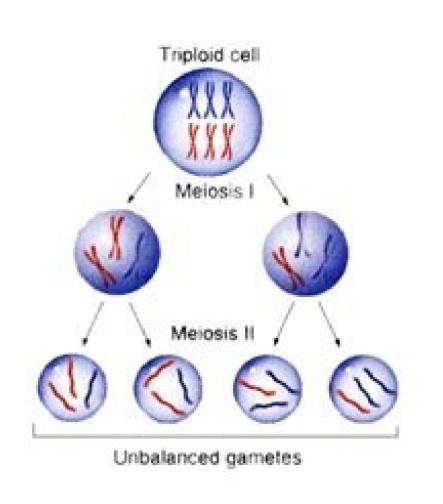


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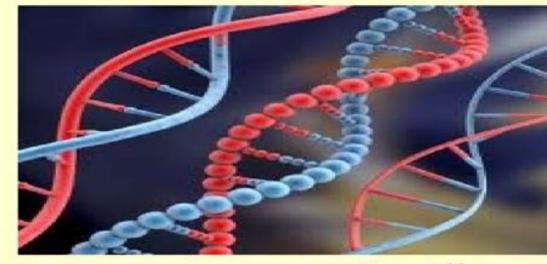


$4n \ge 2n = 3n?$

- The creation of triploids can be accomplished by crossing a tetraploid with a diploid,
- Most triploid individuals are sterile.



Different Molecular Techniques in fisheries



Presented by... Mr. Mangesh M. Bhosale

What is the ultimate fate of the digestive vacuole ? Edwards and his colleagues, trisomy18 is found to contain an incidence of about 0.3 per 1000 births. Epistatic alleles Phenotypic ratio BB, Bb, bb I (no pigment) White=12 1. The first generation of a given cross is known as F1 generation. salt solution. Palade P.Mitchell Allen and Inoue 1982 Aaron Klug 1974 Contents CELL BIOLOGY 14 Year Name of contributor Cell biological contributor the bacteriophages are composed of DNA and protein. The favoured regions are called hot spots. Since it is caused by recessive X-linked gene, a lady may carry the disease (i.e., she is carrier but nonsufferer and would transmit it to 50 per cent of her sons, even if the father is normal (Fig. In 1679, J. The pyruvic acid enters in the mitochondria for its complete oxidation into CO2 and water. TYPES OF NON-GENETIC RNA AND PROCESSING According to their specific functions during the process of protein synthesis, the following kinds of non-genetic RNA and evaluation into CO2 and water. TYPES OF NON-GENETIC RNA AND PROCESSING According to their specific functions during the process of protein synthesis, the following kinds of non-genetic RNA and evaluation into CO2 and water. RNA constitutes the largest part (up to 80%) of the total cellular RNA. Inbred A × 1 Inbred B Inbred C 1 Single cross AB hybrid × x Inbred D Single cross AB hybrid × x Inbred D Single cross AB hybrid × 10 coli possesses a single main chromosome in the nucloid and often extra DNA elements called plasmids in the cytoplasm; the eukaryotic cells possess a main complement of chromosomes in their mitochondria and chloroplasts. In Drosophila sex determination occurs according to genetic balance theory of Bridges. Study of both polytene and lampbrush chromosomes provided the evidence that eukaryotic gene activity is regulated at the level of RNA synthesis (or transcription). Describe one of the classical experiments in which it was detected cytologically. Contents 76 CELL BIOLOGY Water, however, reaches its maximum density at 4º C and then becomes lighter with further cooling. 3' end of ribosomal RNA Fig. These enzymes are necessary for transcription and if they are short in supply, they tend to affect it. Deletion of part of the short arm of one X chromosome produces a typical Turner syndrome (see chapter 18 of Human Genetics). If both mother and father have intermediate skin colour, can you expect children (i) with lighter skin, (ii) with darker skin ? The cap has a characteristic shape for each species and is easily regenerated if removed. An organism that has developed parthenogenetically is called a parthenogenone or parthenote. much preferred by the geneticists) lies within a thinner segment of chromosome, the primary constriction. HC C C The important carotenoids of cells are the α, β and γ carotenes, retinene, xanthoH H COOCH3 phylls, lactoflavin in milk, riboflavin (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills, lactoflavin in milk, riboflavin (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols and flavonones, etc. A— the diameter of 0.2 mills (viCH2 CH3 tamin B2), xanthocyanins, flavonols (viCH2 CH3 tamin B µm. Cytosine (C) Cytidine 4. Contents CELL DNA lipid droplet photosynthetic lamellae cyanosomes phosphate granule ribosomes protein granule plasma membrane. Cucumber pale fruit; genome in cytosol 6. It should be remembered that the Drosophila males are hemizygous for the bar locus and that there is no crossing over. This year's Nobel Prize in chemistry was shared by Kary Mullis (for the discovery of PCR) with Michael Smith (for site directed mutagenesis). 4.32. Crossing over in parace6 1 ntric inversion. This process is called carboxylation and is catalyzed by the enzyme RuBP carboxylase, carboxydismutase or "Rubisco" (which is widely acclaimed as one of the most abundant proteins present on the planet Earth; see Alberts et al., 1989). Thus, it X X X was realized that most bases fail to X XXXXX U T loop G do so because they carry substitutions D stem X XXXXX C X XXXX or alterations in those positions that X T ψ usually participate in hydrogen bondX D loop ing. MECHANISM OF EUKARYOTIC TRANSCRIPTION In eukaryotes, there are three major classes of RNA polymerases which are designated as I, II and III and are found in the nucleus. Constant in their position and extent, these constrictions are useful in identifying particular chromosomes in a set. This is called -35 sequence (also called Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 49 recognition sequence) and it consists of a nine-base consensus sequence, considered to be actual site of binding of the RNA polymerase. The DNA RNA contents of the nucleus is stained blue with DAPI; the B- Acrosome of mouse sperm, and the nucleolus are greatly mitochondria are stained green by GFP. Actin microfilaments play a structural role. Table 4-3. 2.2. Appearance of a ribbon of ultrathin sections tome onto on the grid (after Sheeler and Bianchi, 1987). Elongation of RNA Chain in Eukaryotes There are certain accessory proteins of transcription, called elongation factors, which enhance the overall activity of RNA polymerase II and lead to increase in the elongation rate. The former are Gram positive bacteria (e.g., Bacillus subtilis, Staphylococcus, etc.) and the latter are Gram negative bacteria (e.g., Escherichia coli, Simonsiella, Contents CELL 45 cyanobacteria, etc.). At belt desmosome, the plasma membranes of adjacent cells are parallel, thicker than usual and 15 to 20 nm apart. (3) CO2 molecules are incorporated intact into carbohydrates. They middle allow the passage of mollamella ecules with molecular weights of less then 800 plasma daltons. At birth children afflicted with this disease have a crusted leathery skin with deep fissures down to the subcutaneous tissue; the fissures lead to bleeding, infection and death. The identical male and female parent chromosomes occur in pairs and are known as homologous chromosomes. If the fertilization occurs outside the body of the organism, it is known as external fertilization. In this case, four gene loci are thought to cause the transgressive variation as follows : P: aa BB CC DD Large Golden Hamburg chicken (6 contributing alleles) X 1 AA bb cc dd Small Sebright Bantam chicken (2 contributing allele) F2 : Some genotypes could segregate out in the F2 with phenotypic values which exceed that of the parents. Such chromosomal aberrations may include whole whole sized hybrid (4 contributing allele) F2 : Some genotypes could segregate out in the F2 with phenotypic values which exceed that of the parents. genomes and entire single chromosomes. Tertiary protein structure in which the helical and non-helical regions of a polypeptide chain are folded back on themselves. But onions (a normally cross pollinated species) 7 1 80 9 1 are quite tolerant to inbreeding, 60 i.e., they show much less depresdesignations sion in vigour due to inbreeding height of lines 40 than alfalfa and maize. The homopolysaccharides in their molecules. Since the haploid chromosome number of this species is n=12, so here, 12 primary trisomics, 24 secondary trisomics, 24 secondary trisomics, 24 secondary trisomics are possible. 1 × 2 × 6 × 2 = 48. Heat production or thermiogenesis. They are most primitive, simple, unicellular, prokaryotic and microscopic organisms. Histone phosphorylation involves histone H1. F1 or First filial generation. In guinea pigs the dominant allele 'B' for black coat has complete penetrance both in homozygous and heterozygous conditions. Size Generally nucleus occupies about 10 per cent of the total cell volume. Since originally these were known to be networks, they were also called "dictyosomes" (Gr., dictyes=net). The hormone receptor protein complexes activate transcription of target genes by binding to specific DNA sequences present in the cis-acting regulatory regions (the enhancers and promoter regions) of the genes (R.M. Evans, 1988). Benden and Bovery (1887) reported that number of chromosomes for each species was constant. It is also caused by an X-linked recessive gene present quite close to the deuteranopia locus. 10.16. Make a comparison of three main components of the cytoskeleton : microtubules, intermediate filaments and microfilaments. Differentiate between cilia and flagella. (1) Inactivation of X-chromosome in mammals so that no cell has more than one functioning X chromosome. Asexual reproduction by budding or gemmation. In fact, it is now known that tRNA molecules act as adaptors between codons of mRNA and amino acids of the resulting polypeptide chain. Describe various roles of cytoskeleton during mitosis ; stress upon the function of mitotic spindle during anaphase B. cis-Golgi network (CGN) cis cisternae trans-Golgi network (CGN) cis cisternae trans-golgi network (TGN) HISTORICAL An Italian neurologist (i.e., physician) Camillo Golgi in 1873 discovered and developed the silver chromate method (termed la reazione nera) for studying histological details of nerve cells. restriction that derived from their knowledge that DNA is, after all, the genetic material. 1.3B) which do not fit into the purview of the cell theory. placenta withdraw fluid centrifuge fluid composition cells uterus wall amniotic cavity cell culture sex determination, biochemical and enzymatic studies Fig. The multiple crossing over occurs rarely. Nucleoli were described by M.J. Schleiden in 1838, although first noted by Fontana (1781). protein phospholipid glycolipid A sugar chains of glycoprotein pore formed by integral protein bimolecular lipid layer peripheral peripheral peripheral peripheral peripheral peripheral p cells of larva which are destined to produce the adult structures after metamorphosis, i.e., imaginal discs remain diploid). Retzius 1882 1883 W.Pfitzner E. The allele Y was associated with allele R in parent but it does not always remain associated with it and it is also associated with the allele r. Thus, 26% of all gametes (13+13) were of cross over types and the distance between the loci A and C is estimated to be 26 centimorgans. The regulatory protein (either a repressor or an activator). The broken chromatid segments are united with the chromatids due to the presence of an enzyme, ligase (Stern and Hotta, 1969). HISTORICAL BACKGROUND The earliest record of point mutations dates back to 1791, when Seth Wright noticed a lamb with exceptionally short legs in his flock of sheep. After these changes to the first meiDiakinesis Metaphase 1 Diplotene otic division which is known The stages of prophase I. Contents MITOCHONDRIA (i) (ii) (iii) (iv) 201 Glycolysis or Embden-Meyerhof pathways (EMP) or Embden-Meyerhof-Parnas pathways (EMPP); Oxidative decarboxylation; Krebs cycle; citric acid cycle; citric acid cycle; Respiratory chain and oxidative phosphorylation. Discuss the experiments conducted by H.G. Khorana and his coworkers for cracking the genetic code. High temperature and . As a result in an albino patient melanocytes are present in normal number in their skin, hairs, iris of eyes, etc., but lack in melanin pigment. Lymphocytes occur in large numbers (in trillions in man) in the blood, lymph and lymphoid organs such as thymus, lymph nodes, spleen and appendix. It is also postulated that at the luminal surface there is a signal peptidase enzyme that removes the signal peptide. pea plant contains tt alleles. The neutral petites are not transmitted while suppressive petites are trans into the bacterial chromosome (DNA) (see Sheeler and Bianchi, 1987). Thus, tRNA molecule has to perform several highly complex amino functions during protein synthesis—it interacts with a acid specific synthetase enzyme, possesses a site for attachment site binding an amino acid, possesses a second site for interacting with a ribosome, and contains an anticodon that must be exposed to the codons of mRNA. The point mutation which is caused due to loss or deletion of some portion (single nucleotide pair) Fig. The sex of embryo depends on the kind of sperm. An enzyme, called glucose6- phosphatase (a marker enzyme) exists as an integral protein of the membrane of SER (e.g., liver cell). Considerations of Watson and Crick in the construction of double helical structure of DNA molecules are extended on the air-water interface before being collected on a film. The primary egg membrane is secreted around the plasma membrane by the oocyte itself. Vectors or vehicle DNA are those ADP+ H+ Pi ATP H+ proton pump mitochondrial membrane mitochondrion matrix The proton pump. Example of receptor-mediated endocytosis. According to the recent concept, the matrix is partly a colloidal system. (b) because it has a higher (G+C) (A+T) ratio. mRNA4 probably becomes shorter due to partial digestion of its 5' end by a RN ase (after Freifelder, 1985). Differentiate between transcription and translation. Peroxisomes are also related with β -oxidation of fatty acids TEM of dark staining peroxisomes and thermogenesis like the mitochondria and also in from the liver cell of a rat. The plasma membrane is a thin, elastic membrane is a thin, elastic membrane is a thin, elastic membrane around the cell which usually allows the movement of small ions and molecules of various substances through it. The mean age of onset of these symptoms is between 35 and 40. The phenomenon of synapsis has always intrigued cytogeneticists. What is cytoskeleton ? It was not until 1933 that Theophilus Painter, Ernst Heitz, and H. 18.8). When three amino acids are united by two peptide bonds, they form trippetide. They proved this hypothesis through the use of multitude of mutants in the fungus, Neurospora (in 1941). 12.5 B and C). The bud is supported by the parent body and it ultimately develops into a new individual. (2) Linear or ordered tetrads, e.g., Neurospora crassa and Ustilago hordei (barley smut). (2) A = 27.5%, C = 22.5%, C = 22.5\%, C = animals. Conventionally, plant cell biologists do not consider the vacuole to be part of the cytoplasm—the latter containing all the other membrane-bounded organelles, including the plastids. Phenotype Genotype. At the same time, protons (H+) are ejected toward the cytoplasmic side (C side), while OH⁻ remain on matrix side. proteins in the ER. In autogamy (Gr., auto=self; gam=mariage) the male and female gametes fuse together to form a zygote, e.g., Actinosphaerium and Paramecium. The single strands released from these breaks then pair crosswise with unbroken strands by complementary base pairing. The single band of intermediate density (identified as "hybrid DNA") consisted of DNA molecules in which one strand contained 14N. Mitochondria are particularly numerous in regions where ATP-driven osmotic work occurs, e.g., brush border of kidney proximal tubules, the infolding of the plasma membrane of dogfish salt glands and Malpighian tubules of insects, the contracplasma tile vacuoles of some protozoans (Paramecium). The concept that DNA or RNA is the genetic material of most organisms has been developed and supported by the following evidences : A. It modifies 3 : 1 phenotypic occurred (Fig. In 1912, Kingsbury suggested that the oxidation reactions mediated by mitochondria were normal cellular processes. The contain less number of lamellae, but, can build up thylakoid structure found in chloroplast, in the presence of light. decarboxylation and Krebs cycle) carry most of the energy of the glucose. The smallest bacterium is Dialister pneumosintes (0.15 to 0.3µm in length). Since desmin has been derived by Lazarides and coworkers in 1976 (in Greek desmin means link or bond). Thalassemia is controlled by a single gene c which in homozygous condition (cc), produces the severe Cooley's anaemia or thalassemia major and causes death of the patient. Like the synthesis of rRNA and mRNA, synthesis of tRNA molecules is initiated at a promoter site and completed at a terminator sequence. If the breeder assigns no mating restraints upon the selected individuals, their gametes are likely to randomly unite by chance alone. External to the plasma membrane occurs the rigid and protective cell wall which has a complex organization; it comparises following two structures : 1. For example, Amoeba proteus is biggest among the unicellular organisms; its length being 1 mm (1000 µm). The stroma is the place where CO2 fixation occurs and where the synthesis of sugars, starch, fatty acids and some proteins takes place. The resultant pairs of homologous chromosomes are 1 3 2 6 7 8 11 12 13 16 17 18 20 21 19 4 5 9 10 14 15 y x 22 The 23 pairs of chromosomes are 1 3 2 6 7 8 11 12 13 16 17 18 20 21 19 4 5 9 10 14 15 y x 22 The have a structural role such as anchoring the basal body. Neither the nuclear apparatus nor the respiratory enzyme system are separately enclosed by membranes, although the inner surface of the plasma membrane itself may serve for enzyme attachment. Currently mycoplasmas are considered as the simplest bacteria (see Alberts et al., 1989). The resulting asymmetry is required to prevent a fruitless tug-of-war between the neighbouring microtubules, which presumably explains why each of nine outer microtubules is an A-B doublet (see Alberts et al., 1989). Informosomes. The cell theory had its wide biological applications. The chloroplasts also contain aminoacyl-tRNAs, aminoacyl-tRNAs synthetases, methionyl-tRNA. Thus, as the number of genes in a series of multiple alleles increases, the variety of genotypes rises still more rapidly, such as exemplified on next plage. But, still we do not know how viruses increase the mutability of host genes. Down's syndrome. In certain cells such as the glandular cells the nucleus remains located in the basal portion of the cell. The RNA genes of nucleolar organizer of chromosomes are located in this region. Complex Transposons (Tn) Tn 3 Tn 5 Size base pairs (bp) Target DNA repeat (bp) 768 1327 1329 9 5 9 4957 5700 5 9 (IS 1 at end) 768 1327 1329 9 5 9 4957 5700 5 9 (IS 50 at end) 9 (IS 1 at end) 9 (IS 1 at end) 9 (IS 1 at end) 768 1327 1329 9 5 9 4957 5700 5 9 (IS 50 at end) 9 (IS 1 at end proteins encoded (besides transposase) — — Ampicillin resistance Kanamycin resistance to chloramphenicol, fusidic acid, streptomycin, sulphoamides and mercury Target sequence \leftarrow Transposon { { 1 2 3 4 5 a b c d e..... ..e' d' c' b' a' 1 2 3 4 5 1' 2' 3' 4' 5' a' b' c' d' ..e d c b a 1' 2' 3' 4' 5' - Target sequence Fig. Compare it with negative control provided in the lac operon. Contents CHROMOSOMAL MUTATION II 197 chromosome pair 21 during spermatogenesis can also produce child with DS, but paternal age does not seem to be associated with its incidence. Step 4 generates the 3'-OF end (the CCA end). The plants developing from the white or pale seedings die because they lack chlorophyll and cannot carry on photosynthesis. Describe different types of natural parthenogenesis in animals. At the same time, the parental Contents REPLICATION OF DNA 43 template for lagging-strand synthesis is displaced. Fisher were awarded Nobel Prize for the pioneering work on "reversible protein phosphorylation, cell division and many other cellular processes. large molecules retained in sac small molecules pass back and forth through the membrane Fig. Write short notes on the following : (i) Sex reversal; (ii) Barr body ; (iii) Lyon's hypothesis; (iv) Gyandromorphs; (v) Haplodiploidy ; (vi) Crew's hen ; (vii) Sex determination in plants ; (viii) Bonellia; (ix) Cortico-medullary antagonism. Regeneration. If each chromosome end is labelled with a different number, the normal set of 7 chromosomes would be represented as 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, and 13-14; likewise a translocation set would be represented as 2-3, 4-5, 6-7, 8-9, 10-11, 12-13 and 14-1. An unequal crossing over in homozygous bar-eyed females will produce two types of gametes one with two bar genes and other with no bar genes and other with no bar genes and other with no bar genes of RNA (i.e., mRNA, tRNA, and rRNA) are formed (transcribed) by the single RNA polymerase (RNAP) species in prokaryotes. 20.1. Chromosome breakage caused by the transposable element Ds in maize. Normally, many of the responses of the immune system initiate the destruction and elimination of invading organisms and any toxic molecules produced by them. The life-time of each coated-pit is quite short—within a minute or so of being formed, it invaginates into the cell and pinches off to form the coated-vesicles. The nucleolus. Male human beings : = 22 pairs of autosomes + 2 heteromorphic sex chromosomes + 2 heteromorphic sex chromosomes + 1 Y chromosome = 22 autosomal linkage group + 1 X chromosomal linkage group + 1 Y chromosomal linkage groups. (b) What is the correct genotypes of each parent? Heterozygotes may, therefore, survive better in region where malaria is endemic. Chromoplasts The chromoplasts (Gr., chroma=colour; plast=living) are the coloured plastids containing carotenoids and other pigments. Identification of the Genetic Materials 3. The trait of sickle cell anaemia forms a famous example of pleiotropy. Glycogen or animal starch is a branched, nutrient, storage homopolysaccharide of all animal cells, certain protozoa and algae. virus. Recombination is a more moderate way of producing variation. This term also indicated that the biogenesis was highly dependent on the nuclear genome and the biosynthetic activity of the ground cytoplasm. Like the starch and glycogen, fat is compact and insoluble and provides a convenient form in which energy-yielding molecules (the fatty acids) can be stored for use when occasion arises. In the cross between black (CCaa) and albino (ccAA) mice, one thing becomes apparent that two independent pairs of genes (i.e., C-c and A-a) have interacted in the production of the phenotypic trait (i.e., coat colour) in such a way that one dominant (C) produces its effect whether or not the second (A) is present, but the second (A) gene can produce its effect only in the presence of the first. nuclear antigen). Bacteria show wide diversity in their nutrition. In certain plants, though the male sterility. Proteases (endopeptidases and exopeptidases), 3. Fibrous proteins are water-insoluble, thread-like proteins having greater length than their diameter. Contents MOLECULAR BIOLOGY 82 2. Likewise, the synthesis of phospholipid molecules of the plasma membrane takes place by the smooth ER (SER). Of these, some polysaccharides provide mechanical support to the cell, while others are used as stored food material. The cells which contain many (from 3 to 100) nuclei are known as polynucleate cells. The cross between the two parents differing in a single pair of contrasting characters is known as monohybrid cross. The black hybrids of F1 when mated among themselves they produced black and white offsprings in 3:1 ratio. The overall configuration is of two 70S ribosomes moving along the mRNA at the same speed. Five amino acids, namely valine, proline, threonine, alanine and glycine, have four codons each. Dark reaction. The satellite remains connected with the rest of the chromosome by a thin chromatin filament. Genes on different chromosomes assort independently giving a 1:1:1:1 test cross ratio which is as follows: P1: AA BB × aa bb P1 gametes: (AB) (ab) F1: Aa Bb rest cross ratio which is as follows: P1: AA BB × aa bb P1 gametes: (AB) (ab) F1: Aa Bb rest cross ratio which is as follows: P1: AA BB × aa bb P1 gametes: (AB) (ab) F1: Aa Bb rest cross ratio which is as follows: P1: AA Bb rest cross ratio which is as follows: P1: Aa Bb r Employed differential centrifugation to separate nuclei and cytoplasm from liver cells. Some of the plant diseases which are bilayer fusion and release of viral nucleic caused by the viroids are the following : acid into cytosol 1. Segment of a DNA molecule. gly leu val lys lys lys lys lys lys gly gly his ala lys val his lys pro ala (c) tertiary structure (folded individual peptide) (b) secondary structure (helix) lys val lys pro (a) primary structure (amino acid sequence) (d) quaternary structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) The four levels of protein structure (aggregation of two or more peptides) and in the four levels of two or more peptides) and the four levels of protein structure (aggregation of two or more peptides) and two or more peptides) and two or more peptides and two or more peptides and two or more peptides) and two or more peptides and two o phages and plasmids of E.coli. Consequently about 500 mutants of Drosophila have been reported by geneticists all over the world. Define the transposable elements. The calcium (Ca) occurs in the blood, matrix and the bones. This process involves another electorn transfer mechanism involving cytochrome b6 and starting with P700; the ultimate acceptor of the de-energized electron is also P700 of photosystem I. To understand different biochemical events of prokaryotic cells at molecular level, a wide array of bio-physico-chemical techniques such as electron microscopy, ultracentrifugation, colorimetry, spectrophotometry, spectrophotometry, chromatography, isotopic tracers, X-ray crystallography, electrophoresis, etc., are used in molecular biology. The smaller the object, the shorter the wavelength of light required. (iii) The wars must be avoided because in wars the best germplasm of the society is wasted. The spheroid, cuboid or polyhedral cells (isodiametrical cells) contain the spheroid nuclei. Above described ratios, i.e., 1 4: 6: 4: White 1 and 1: 6: 15: 20: 15: 6: 1, can be easily obtained by the expansion of binomial equation F 2 (1/2+1/2)n, where n is the number of alleles. C B A microtubules 5. Such a cell is said to be in growth-duplication cycle. Each subfibre A is also connected to the central microtubules by radial spokes terminating in fork-like structures. called spoke knobs or heads. Any cellular orgainsm may contain only one type of cell from the following types of cells : A. Cloning. Like the Limnaea and Ambystoma mexicanum, the maternal effect has also been observed in at least two very different invertebrates, the water flea (Gammarus) and the flour moth (Ephestia kuhniella). The cloned DNAs are produced by (1) isolation of DNA fragments to be cloned; (2) joining the fragments to a suitable vector (usually phage λ); (3) introduction of the desired clones; (4) selection of the desired clones; (4) selection of the desired clones; (5) use of clones for the construction of genome bank (Fig. Base 14 15 16 17 18 19 20 G A C T C C C A T G 11 20 7 8 9 10 11 12 13 14 15 16 A A A C C C T C G 16 5 Contents MOLECULAR BIOLOGY 122 10. CC, Cc ee Neither C or c nor e 3 3. According to him, the term reverse genetics should be restricted to those studies, where we start the study with a DNA segment with unknown phenotypic effect, introduce this DNA (without any alteration or other modification) into a plant or an animal and then follow the phenotypic effect. In multicellular organisms the germ cells are distinct cells, and are relatively protected from the environment. In a number of primitive classes of plants and animals the nuclear envelope does not dissolve during mitosis (Fig. For instance, the white eve locus of Drosophila has been resolved into several sites. sides the common molecular configurations, each DNA base may have some altered uncommon molecular configuration, as has been shown in the figure 16.2. Such uncommon forms of DNA bases are generated by single proton shifts and are called rare states or tautomers. Larvae feed in the medium but pupate on the filter paper; adult flies are seen above the medium. The fertilization always occurs in the aquatic (body) fluid of the maternal individual. The lipids required to make new peroxisomal membrarne are also imported from the cytosol (cytoplasmic matrix), possibly being carried by phospholipid transfer proteins from sites of their synthesis in the ER membranes (Yaffe and Kennedy, 1983). The homozygous green plants have the genotype CC and the homozygous green plants have the genotype CC and the homozygous white plant has the genotype cc. Double cross method for producing hybrid corn. The patients of PKU have light body pigmentation and are physically and diet. (c) Describe briefly the evidence supporting the multiple-gene hypothesis. 20A0 coli has shown that DNA is folded into a series of looped domains, i.e., about 45 loops radiate out from a dense proteinaFig. Many kinds of plant cells have only primary cell wall around them. Thus, f+B fu+/ f B fu females crossed to males with forked bristles and fused wing veins (B fu or fB+fu) produced about 20,000 progeny, all of which were bar eyed except 7 which were ultrabar (Bu) (Fig. Ciliary and flagellar cell motility is adapted to liquid media and is executed by minute, specially differentiated appendices, called cilia and flagella. Ring formation introduces a new asymetric carbon at position one. 7.1. Parallelism between Mendel's hypothetical particles (factors gate equally into gametes (so do or genes) and chromosomes during meiosis (after Suzuki et. Mitotic cycle of nucleolus. During protein synthesis numerous complete ribosomes read the codes of mRNA molecules to form the polysomes (Fig. Thus, in male Drosophila, X chromosome remains single and thin and Y chromosome exists indistinctly fused with the chromosomes among the progeny. Crossing over. Male tortoise-shell cats are understandably rare, since it has only one X chromosome. (2) Polyploidy Any organism with more than two genomes (2x) is called a polyploid. Niacin (Nicotinic acid) 18 mg (boys) Meat, liver, fish, 1. Despite this continuity, which would seem to provide a pathway for the diffusion of membranes remain chemically distinct. (iii) Translation of COOH NH2 Contents 92 CELL BIOLOGY Group of amino acids, symbols and chemical formulae 9. (a) Diagram a cross between two dichaete (Dd) flies and summarize the expected results. Certain bacteriophages such as P1 and lambda (λ) phages, have entirely different pattern of life cycle than the virulent phages. A gene which occurs only in Y chromosome is known as holandric gene. Describe regulation of gene action in eukaryotes at the level of DNA or genetic code. The strength of interference varies in different segments of the chromosome and is usually expressed in terms of a coefficient of coincidence, or the ratio between the observed and the expected double crossovers. The test is called DNA fingerprinting. Chemical mutagens. Mutant types are generally unable to complete equally with wild type individuals. By controlling Diploid female Haploid male Chromosome the sphincter of her sperm receptacle (which holds sperms previously obtained in matings with males Gonial metaphase Gonial metaphase during nupital flight), Chromosomes (20) Chromosomes (20) Chromosomes (20) Chromosomes are shortest and thickest. Centrioles and Basal Bodies 304-308 Occurrence; structure; chemical composition; origin of centrioles and basal bodies; functions, revision guestions. All the genetic informations, therefore, should be written by these four alphabets of DNA. Certain notable accomplishments of molecular biologists can be summarized as follows : 1928 F. It is characterized by uncontrolled jerking of body (due to involuntary twitching of voluntary muscles) and a progressive degeneration of the central nervous system (i.e., brain and spinal cord), accompanied by gradual mental and physical deterioration. The marriage between a F1 normal visioned male one normal visioned male and one colour-blind male (Fig. PCR is discovered by Kary Mullis, 1985, and nicknamed people's choice reaction in which instead of RNA primer, a deoxyolig onucleotide is used. Modern geneticists have reported many different mechanisms of determination of sex in living organisms. The base composition of the sequence of Pribnow box (which is A+T rich) makes the DNA strand open to denaturation. First Cross (reciprocal of second) Parents: Contents 142 GENETICS, HUMAN GENETICS AND EUGENICS 4. Cellulose is most common and abundant biological product on earth. (B) In a much impro-ved technique N. The heterolecithal eggs may be of following types : (i) Telolecithal. In this way processing of ribosomal RNA results into an increase in methyl groups and decrease in GC content. For example, in bones, the 'turnover' of collagen is very slow, i.e., in bone, collagen molecule persists for about 10 years before they are degraded and replaced (see Alberts et al., 1989). The smaller 40S ribosomal subunit is prolate ellipsoid in shape and consists of one molecule of 18S ribosomal RNA (or rRNA) and 30 proteins (named as S1, S2, S3, and so on). 1963 J.P. Waller reported that nearly one-half of all proteins in E.coli cells have the amino acid methionine in the N-terminal position. The colour of brown fat cells. 14.1). eIF5 Monomer; 150,000 Monomer; 150,000 Releasing eIF2 and eIF3 8. In E.coli, the process of DNA replication involves the following three main steps: 1. For example, by the help of the enzyme choles- glucose-6-phophate from the matrix α-hydroxylase, the cholesterol is first converted into 7α- surface. The regulatory protein of the repression system of the Trp Regene product. that how hormones control the sex of an individual : (a) Sex in Bonellia. For the same reason, scientists are trying hard to develop haploid strains of the flowering plants. The stages of development are virtually the same in all of them. Many of "unusual" nucleotides are methylated derivatives of common ones (e.g., 1- methylguanylic acid, 1methyladenylic acid, ribothymidylic acid and 5-methylcytosine). 9.4. Various steps of Southern blotting technique. In these double helical segments, G:C base pairs are more common than A:U as suggested by the ratio AU:GC = 0.7 3. Homogeneous fractions of mitochondria have been obtained from liver, skeletal muscle, heart, and some other tissues. Asexual reproduction by gemmule formation. stroke, in which the cilium returns Contents CILIA AND FLAGELLA 315 to its original position with an unrolling movement that minimizes viscous drag (Fig. The spontaneous mutations occur suddenly in the nature and their origin is unknown. During pachynema stage an important genetic phenomenon called " crossing over" takes place. In it cell growth alternates with cytokinesis (or cytoplasmic division). AMYLOPLASTS Amyloplasts or starch granules are leucoplasts which lack any visible pigment and are involved in the synthesis and storage of various kinds of carbohydrates. Sex-linked lethals in Drosophila. The opening occurs from right 13-mer leftwards and requires negatively supercoiled DNA and HU or IHF initiator proteins (Fig. METABOLICALLY CONTROLLED SEX DETERMINING MECHANISM Certain workers have seen the possibility of sex determination in the phenomenon of metabolism. (5) DNA-RNA hybridization was allowed to take place. 13.1. Haploid male, diploid female and XX-XO type sex termines the masculine sex. Therefore, the first 5 bases will be 3' GTGCA. Heterochromatin is the highly condensed form of chromatin which takes dark DNA-stain and is genetically inert. 5.3. aB Aabb Aabb Aabb aaBb Lighter than mulattoes (6/16) Colour between mulattoes and white (4/16) aabb Like white between a negro and a white person. These three proteins are produced in the respective ratios 1:1/2:1/5, reflecting their respective locations relative to the 5' (operator) end of the polycistronic mRNA in which they are coded (these differences are the examples of translation regulations). Gel, proteoglycan or peptidoglycan or peptidoglycan or peptidoglycan (e.g., murein or muramic acid) containing periplasmatic space around the plasma membrane and 2. coli cell, unidirectional transfer of F+ factor of 'male' cell to F— or 'female' cell took place, so that the latter was converted into a F+ or 'male' strain. In the case of chloroplasts, import from the stroma into the thylakoid likewise requires a second signal peptide. As soon as the tip of the acrosomal filament touches egg membrane), various important morphological and physiolgical changes are started in the egg. This unusual base makes phage DNA recognisable from that of host DNA and selectively protects it from the nucleus rough endoplasmic reticulum mitochondrion Fig. The electrolytes play a vital role in the maintenance of osmotic pressure and acid base equilibrium in the matrix. Stigma and style Calyx Stamen Seed Keel stamen sheath pod A Fig. Promotes protein synthesis fruits (lime, lemon, or(collagen), ange), tomatoes, green wound healing leafy vegetables (caband iron absorption; flower). Contents 206 GENETICS, HUMAN GENETICS AND EUGENICS is deaminated into hypoxanthine by nitrous acid as shown in the following figure : NH2 C H N C C C N OH C N C-H N H +HNO2 H Adenine N N C C C N OH C N C-H N H +HNO2 H Adenine By tautomeric shift the hypoxanthine (HX) is converted into more common or keto-tautomer which pairs with cytosine. As already discussed, the glycoproteins of glycocalyx are synthesized on the ribosomes of RER and their final assembly with oligosaccharide moiety is attained in the Golgi apparatus. If an R-II colony arising from the original mixture was dispersed, only R-II bacteria grew in subsequent generations. It can be extracted and in vitro settings will undergo polymerization reactions from Gactin monomer state to F-actin. The darker cells likely represent normal RBCs, begin to lose their eye sight between the age of four to seven from a blood transfusion years. Thus, Paramoeba The various functions of the Golgi complex are summarised in this diagram. The pioneer of classical genetics, thus, died unknowingly, amidst the feelings of despair on 6th January 1884 and buried in Brunn Central Cemetery (See Dunn, 1965; Serra 1965). What is reproduction ? Absence of colour in skin, hair and eyes or absence of chloroplast in a plant; an inherited trait. It can be illustrated as follows : transcription Duplication DNA translation RNA Proteins Thus, according to this central dogma, the flow of information is one way, i.e., from DNA the information is transferred to RNA (mRNA) and from RNA to proteins. Initiating amino acid, the methionine, needs to be formylated (Due to this reason there are present two tRNAs for methionine, i.e., tRNAf Met and tRNAMet). Down's syndrome (DS) or Trisomy-21. (b) How would you proceed to test this hypothesis ? This enzyme was isolated round 1960 by Arthur Kornberg and was the first enzyme suggested to be involved in DNA replication. The meiocytes of the plant sporangium are called sporocytes (i.e., microsporocytes). The cortical granules are spherical bodies (B) literally bursts through the ovary wall like a volcano. Further, the plastids of a yellow-green mutant of barley develop somewhat further than plastids of an albino plant. Sometimes a mRNA molecule carries the codes from several adjacent DNA cistrons and become much longer in size. For example, T4 phage DNA codes for at least 30 different enzymes (e.g., helicases, topoisomerases, DNA polymerases, DNA ligases, etc.) all of which ensure rapid T4 phage attached to the wall of its host. This peculiarity can be explained due to the presence of a recessive sex-linked lethal gene in the heterozygous condition in the female parent (Fig. The application of molecular biology to pathological science has helped in understanding various human diseases at molecular level. Thiamine pyrophosphatase Hydrolysis of inorganic pyrophosphatase) 10. The cytological studies of D pairing between normal and deleted chromosomes have helped a lot in finding out the E relative positions of genes in chromosomes. For example, in aphids, females emerging in the spring produce several generations of females by diploid parthenogenesis resulting from suppression of first or second polar body. Male chromosome gets characteristically cat (B) has no sex chromatin in its nucleus. Therefore, these unequal divisions allow one cell out of the four daughter cells to contain most of the cytoplasm and reserve food material which is sufficient for the developing embryo. What are missense, and frameshift mutations and what are the consequences of each. For example, a dihybrid having the genotype Ac/ac is test crossed with a double recessive parent (ac/ac), then among F2 test cross hybrids we may get 37% dominant gene at both gene locus (AC/ac), 37% recessive gene at first gene locus and recessive gene at first gene locus (AC/ac), 13% dominant g these genes is also initiated in this region. Nath (1930) using fresh eggs of the frog and later on, Nath and Nangia (1931) using telostean fish eggs, demonstrated that the vacuome and the Golgi apparatus were independent cytoplasmic organelles as were the mitochondria. Proteins get associated with these RNA fibrils as they are formed and ultimately ribonucleoprotein product is released. membrane cytoplasm Thus, all nutrients are absorbed from the blood because tight intercellular junctions do not allow small molecules to diffuse directly from the lipid intestine lumen into the blood. coli is one of the best studied bacteria. It varies from cell to cell and from species to species. The resultant endocytic vesicle gets fused with pre-existing endosomes and ultimately its contents are utilized by the cell. the mitotic apparatus, 5. However, glycophorins are found to contain certain antigenic determinants (carbohydrates) for the ABO blood groups and MN blood groups. (b) Electron microscopy of spread films of DNA extracted from nucleoli of X. In embryo therapy the genetic constitution of embryo at the post-zygotic level is altered so that the inheritance is altered. 5.13). In a number of cultivated plants such as onion, alfalfa and cabbage, it was shown that the

intervarietal hybrids gave higher yields than the better of the parental varieties. Their lipid contents are 40 to 90 per cent of their molecule. In RER, ribosomes are often present as polysomes held together by mRNA and are arranged in typical "rosettes" or spirals. The insertion or deletion a nucleotide pair or pairs, causing a disruption of the translational reading frame. Khorana and his coworkers had vast experience of synthesizing DNA of known base sequences. Three of the normal bristles but fused wing veins, i.e., in all the nine cases (Fig. Pili are non- motile but adhesive structures. SEXUAL REPRODUCTION In the sexual reproduction, the development of the new indivdual takes place by the fusion of the sex cells or male and female gametes (Fig. They divide, grow and differentiate ; they contain circular DNA, ribosomal RNA, messenger RNA and are able to conduct protein synthesis. Because a molecule of the amino acid contains both basic or amino (-NH2) and acidic or carboxyl (-COOH) group, it can behave as an acid and base at a time. and their fatty-acyl chains (tails) forming the interior. During prophase, proteins of the trilaminar kinetochores (one for each chromatid) start depositing or organizing on the centromere of each chromosome (see Darnell et al., 1986). Contents GENETIC AND CYTOLOGICAL MAPPING OF CHROMOSOMES 109 Now, if we suppose that the distance between the genes A-B = 12, B-C = 7 A-C = 5, we can determine the order of genes correctly in the following manner : Case I. It also corresponds to the interior of the secretory granules, the lysosomes and peroxisomes and also to faces of mitochondrial membranes confronting to outer mitochondrial chamber. According to this hypothesis, the mRNA is able to recognize free or bound ribosomes. Flemming coined the term chromatin for chromosomal meshwork. 7.2. Cis and trans arrangement of two pairs of linked genes of Lathyrus (repulsion). Mental depression; 2. The amino (-NH2) ends, however, are extremely diverse in primary structure, even within a class and are called variable (V) regions. Eukaryotic promoters also consist of sites located 100 to 200 base pairs upstream, which interact with proteins other than RNA polymerase and, thus, regulate the activity of promoter. 1988 J.W. Black, G.B. Elion and G.H. Hitchings were awarded Nobel Prize for formulating drugs such as 6- mercaptopurine and thioguanine, which lead to inhibition of DNA synthesis and of cell division. nucleolus Golgi apparatus free ribosomes cell wall vacuole centrioles pyrenoid nucleolus plasma membrane ria hond mitoc nucleus DNA fibrils chloroplast envelope chloroplast chloroplast chloroplast chloroplast ribosomes Fig. In some of these exS 16S P 5 periments, when ribosomal x RNA x PolypeL17 3 x protein is omitted (or modiS4 M ptidyl S S6 S6 8 fied) at a time, they show that E site certain ribosomal proteins require prior to the attachment site for membrane of other proteins in order to A B attachment polypeptide become incorporated in a site emergence stepwise manner. After finishing his theological studies in 1848, he was appointed as a substitute teacher in the Imperial Royan Gymnasium in Znaim in the year 1849. increasingly uniform for differences in various morphological and functional characteristics. 16.6. Conversion of GC pair into AT pair due to guanine. Thus, a multicellular organism is a highly differentiated protoplasmic individual, labelled with fluorescent dyes or with electron-dense materials for electron microscopic observation. Functional gametes Triploid 3A+XXX Diploid 2A+XY Contents 158 GENETICS, HUMAN GENETICS AND EUGENICS Different doses of X-chromosomes and autosome sets and their effect on sex determination in Drosophila. These are hydrophilic polypeptides of lower molecular weight (4500-14,000 daltons). The combination of all the conditions external to the genome that potentially affect its expression and its structure. Protein synthesis by eukryotic ribosomes is inhibited by cycloheximide. 4.11. In plants where staminate (male) and pistillate (female) flowers occur on the same plant, the term of preference is monoecious. Life cycle of the bacteriophage. This theory has been supported by the fact that the genetic components of these organelle are often similar to those found in prokaryotes. As a corepressor, ::: this amino acid terminates 9: g1 to g8 e1 to e8 the synthesis of 10 enzymes which are required 1 in pathway to histidine. In this case, one-half of the bands in the child comes from the mother and the other half from the father. What are the functions of the core enzyme in vivo.? She found that Ds had to be activated Mutation in different kernels of Indian by another factor, called Ac, for "activator". For example, the mouse satellite DNA is a 240 base pair sequence that is repeated about 1000,000 (106) times in the mouse genome, constituting 10 per cent of the total mouse DNA. The treatment of RNA or DNA with anhydrous hydrazine results in the destructures that curl to form a tube. In this way three of 64 codons were easily accounted for. Gray, Long ; b+vg+/bvg = 4. Dissolution and formation of nuclear envelope during mitosis. 14.18). Magnesium Mg2+ Constituent of chlorophyll; activates ATPase enzyme. In a way, gynandromorphs represent one kind of mosaic or an organism made up of tissues of male and female genotypes. All cilia and flagella are built on a common fundamental plan : a bundle of microtubules called the axoneme (1 to 2 nm in length and 0.2 µm in diameter) is surrounded by a membrane that is part of the plasma membrane. The whole case beF2 comes clear if it is realized that the type of cleavage (sinistral or dextral) depends on the organiza+ + + S S S S S S+S+S+S+S S tion of the egg which is dextral (1) dextral (2) dextral (2) dextral (1) dextral (2) dextral (2) dextral (3) dextral (3) dextral (3) dextral (4) de produces all larvae with dark eyes. Assume a series of different one-base changes in the codon GGA, which produces following several new codons: (a) UGA; (b) GAA; (c) GGC, (d) CGA. Tall TT Trisomic An individual with one extra chro- (homozygous) mosome of a set (2n + 1). Schwann also introduced the term metabolism to describe the activities of the cells. Due to the parthenogenesis, there is no need for the organisms to waste their energy in the process of mating but it allows them to utilize that amount of energy in the feeding and reproduction. The shape of the cell (e.g., red blood cells of non-mammalian vertebrates) and some cell processes or protuberances such as axons and dendrites of neurons, microvilli, etc., have been correlated to the orientation and distribution of microtubules. A mule is a hybrid of a male donkey (Equus asimus, 2n = 62) and a female horse (Equus caballus, 2n = 64). Localization has been accomplished by identifying a gene locus with relation to some visible landmark such as a chromomere or cross band. This enzyme 3'-5' cleavage is called mitochondrial polymerase and is encoded in site the nuclear lamina) and is called condensed peripheral chromatin. The entire endomembrane system represents a barrier separating cytoplasmic compartments. In contrast, in muscle cells, Ca2+-ion pumps are located in the membrane of ER or sarco- Fig. When a on exposure to sunlight. It is undesirable for the single-cross hybrid to self-fertilize, as this inbreeding process commonly produces less vigorous progeny. He also studied plant tissues and suggested that they were composed of structural units that he called "utricles". They are triesters of fatty acids and glycerol. The mobility of some part of lipid molecules is constrained since that remains tightly bound to some of the integral membrane proteins. an individual and mechanisms like the XY, ordinarily serve to trip the Contents DETERMINATION OF SEX AND SEX DIFFERENTIATION 157 balance in one direction. -3' direction. -3' direction. -3' direction. Enzymes Location Product and abundance Sensitivity to α - amanitin 1. Ribosomes (each of which comprises two subunits which exist as separate subunits prior to the translation of mRNA and contain two tRNA binding sites : the P site or peptidyl site and an A or aminoacyl site. There are two kinds of mules which are used by the Indian army : (1) general service type and (2) mountain artillary type. In a classical series of experiments, spanning between 1934 and 1954, on the unicellular alga Acetabularia, Hammerling demonstrated by means of interspecific nuclear transplants, that morphological features, notably the shape of cap, were determined by the nucleus. Define the following : granum, thylakoid, chromoplast, leucoplast, proplastid. For example, lysosomes demonstrate the property of metachromasia with toluidine blue and give a posipH~5 pH 7.2 tive acid Schiff reaction (see Chapter 2). This step is directed by the enzyme citrate synthase. F.Sanger 1956 1959 1960 1961 J.H.Tjio and A.Levan Brenner and Horne G.D. Robertson Park and Pon H.Ris and M. In immature and actively dividing plant cells the vacuoles are quite small. the plant together to form symplast ; B—Details of the structure Thus, no dye movement is of a plasmodesma (after Alberts et al., 1989). Describe it with suitable example. Showed that in Ascaris the number of chromosomes in the gametes is half that of in the body cell. Meyerhof got Nobel Prize in 1922 along with English biophysicist A.V. Hill, for the discovery of oxygen and metabolism of lactic acid in muscle (i.e., production of heat in muscle). Table 4-2. The second generation which is resulted by interbreeding or selfing of F1 offsprings is known as second filial generation. In the centrolecithal eggs the yolk accumulates in the eggs the yolk accumulates in the eggs the yolk accu (i.e., 0.18 pg or picogram per haploid genome). This type of growth is called accretionary growth. n the chapter of linkage, we have stated that the genes located in the same chromosome show linkage. (a) - glu-met-ala-val-tyr-.
They are called phenyl pyruvate idiots having mean IQ of 65 (Burns and Bottino, 1989). 18.1. The cell cycle or mitotic cycle, we have stated that the genes located in the same chromosome show linkage. showing relative duration of phases (e.g., interphase and mitotic phase) in a growing cell. will show segregation during mitotic division. (ix) The D- stem is composed of three or four base pairs (depending on the "species" of tRNA). Mutation and chloroplast structure. (c) A single strand of DNA can be copied if the four nucleoside triphosphates and polymerase I are provided. Write an account of structure and function of plant vacuoles. The Mg2+ is required for all nucleic acid polymerization reactions. As a second example, wilted plant. Plasmids 11. The diploid amount of DNA is constant within the species but varies from one species to another, as shown in the Table 2-2. The difference in the total mass of the organ or organism depends on the number, not on the volume of the cells. 14.11. This implies that differential message breakdown is an important method of regulating not only the rate of gene expression, but also the lag between transcriptional shutdown and the cessation of specific translation. 5' OH 5' OH In what way, relating to polycistronic P P mRNA, do eukaryotic and prokaryotic nuclease activity protein synthesis differ? Those alleles which do not appear to do so are referred to as non-contributing, non-effective or null alleles. In 1960s ribosomes were subjected to exhaustive electrophoretic and chromatographic procedures, this time not to purify them but to examine their parts. Thus, gene g3+ becomes dependent upon g2+ for its expression as a normal phenotype. The ratios of A:U and G:C are near unity which suggests the formation of DNA-like double helical segments (secondary structure). Northern blotting technique. In 1930s various direct studies, employing basic staining teachniques that discriminated between DNA and RNA, and spectrophotometric measurements of absorption in different cell regions, confirmed that RNA is present in the cytoplasm of both plant and animal cells and suggested that DNA is found exclusively Ribosomes may end of the cytoplasm. be found free in the cytoplasm either singly or strung along messenger RNA molecules as they participate in proteins. Large number of offsprings. Proteins of plasma membrane synthesized on attached ribosomes of rough ER are inserted first into the membrane of REF and then transferred to the Golgi apparatus, processed there (e.g., glycosylation) and ultimately are dispatched to the plasma membrane via the secretory vesicles. As the chromosomes decondense at telophase, these "old" nucleolar components help reestablish the newly emerging nucleoli (Anastassova-Kristeva, 1977). Write an essay on the bacteria Golgi apparatus. Finally, a S10 S7 S13 complete functional ribosome S11 S14 L27 S12 S7 is reconstituted spontaneS3 end of L1 ously. A complete set of chromoGenetically engineered animals like these sheep can be used to produce proteins. TYPES OF TRANSPOSABLE ELEMENTS Transposable elements are of the following types: 1. 18.17. The activation of the egg; 2. In this sperm showing the '9 + 2' arrangement of case, there is a great requirement for monoamine oxidase, an microtubule and mitochondria. Paedogamy is the sexual union of young individuals produced immediately after the division of the adult parent cell by mitosis. Cynodon is quite successful in the cultivation mainly due to its efficient way of vegetative propagation (since being triploid, it is sterile and setting no seed). Generally, in an idiogram, karyotypes can be prepared with their help. (ii) Endonucleases. Transcription is, thus, initiated. If a cell is to be efficient, the ratio of volume to surface should be within a limited range. The chemical energy is utilized by all living beings to perform various life activities. Insulin has a molecular weight of 5,800 daltons and compare it with that of ribonucleic acid. Hence, the XX genetic sex is ordinarily associated with ovarian gonadal sex, and XY is associated with testicular gonadal sex. c c EE, Ee, ee Neither c nor E or e 2. Thus, protein macromolecules are the polymers of many amino acid monomers. The dynein arms attached to subfibre A have been compared ATP N+1 ADP + Pi N with the cross bridges of myosin tip and it has been postulated that AB AB they form intermittent attachments, by which one doublet (N1) is able to push the base adjacent one (N1 + 1) toward the A Rigor tip of the axoneme (Fig. Their polymerprotein carbohydrate ization is regulated by cer- carbohydrate ization is regulated by cermitochondrial membrane, where it constitutes about 20 per cent of the total lipids. Allowed base-pairing combinations according to the wobble hypothesis (Source: King, 1986). Multiple alleles of a series always occupy the same locus in the chromosome. Determination of Gene Order After determining the relative distances between the genes of a linkage group, it becomes easy to place genes in there proper linear order. Nicotinamide adenine dinucleotide phosphate (NADP) or Triphosphopyridine nucleotide phosphate (NADP) or Triphosphopyridine nucleotide phosphate (NADP) or Triphosphopyridine nucleotide (TPN), 3. A unicellular organism is more subjected to environmental onslaughts since it is at the same time a somatic or germ cell. This process, i.e., movement and reinitiation, continues until the mRNA is covered with ribosome per 80 nucleotides. In her experiments, the chromosome that carried the CI allele also carried the CI allele also carried the CI allele also carried the covered with ribosome per 80 nucleotides. In her experiments, the chromosome that carried the CI allele also carried the CI a steps : $g_1 + g_2 + g_3 + \downarrow \downarrow \downarrow P$ (precursor) $e_1 \rightarrow A - e_2 \rightarrow B - e_3 \rightarrow C$ (end product) In this biosynthetic pathway each metabolite (A, B, C) is produced by the catalytic action of different enzymes (e1, e2, e3, ..., ex, specified by different enzymes (e1, e2, e3, ..., ex, specified by different wild type genes (g1+, g2+, g3+, ..., gx+). Thus, overall, the glyoxylate pathway invloves : 2 Acetyl-CoA + NAD+ -> Succintiate + NADH + H+ Succinate is the end product of the glyoxysomal metabolism of fatty acid and is not further metabolized within this organelle. Describe the cell theory and explain the exceptions of cell theory metals such as lead acetate, lead citrate, lead citrate, lead hydroxide, uranyl acetate; phosphotungstic acid. G1 is a resting phase. This information is translated into proteins that determine the phenotype. A diploid cell has two sets of chromosomes which come from two different parents (male and female) via gametes (sperm and ova). (ii) Spirochaetes and materS nal sex ratio in Drosophila. Furprotein ther, the peripheral proteins and those parts of Fig. Similarly, F3, F4, etc., generations can also be obtained. These are reproduction and growth of individual cells of the body. PRACTICAL APPLICATIONS OF MUTATIONS Mutations are generally deleterious and recessive for the organisms, therefore, majority of them are of no practical value. The signals that determine at what points on a DNA molecule transcription starts and stops; and 3. Tandem duplication. The coefficient of relationship (R) characterises the percentage of genes held in common by two individuals due to their common A ancestory. Incomplete dominance. The stereochemistry of monosaccharides is such Fig. Drosophila genetics. Contents TECHNIQUES IN CELL BIOLOGY 25 7. The alleles governing the M-N blood group system in humans are codominants and may be represented by the symbols LM and LN, base letter L being assigned in honour of its discoverers (Landsteiner and Levine). The conclusive evidences that Y chromosome is a determiner of fertility and sex of male individual came from certain abnormalities (for details see Chapter 18. The daughter receives one X-linked dominant gene for normal vision from father and one X-linked recessive gene for colour-blindness from the mother. This converts A : T to G : C as shown in Figure 16.7. 2-Aminopurine (2-AP) is another base analogue which is a relatively undifferentiated purine that apparently can pair with cytosine and thymine. C base pair, a transition will result following the steps outlined in Fig. F2 progeny shows variations with some parental types and some intermediates. In animal cells mitochondria produce 95 per cent of ATP molecules, remaining 5 per cent is being produced during anaerobic respiration outside the mitochondria. In 1908, Garrod presented in a lecture nearly all the facts that we know today concerning this disease. Despite there cytoplasmic side of the human red blood cell membrane. These mobile elements have been variously called 'jumping genes', 'insertion sequences' and 'transposons'. Contents CILIA AND FLAGELLA subfibre A central doublet of microtubules ce inner dynein arm plasma membrane nexin B tubule A tubule central pair of single microtubules D a outer doublet microtubule radial spoke inner sheath $\beta\beta$ Fig. The flagellum instead of making whip-like movements, propagates quasi-sinusoidal waves (Fig. Got Nobel Prize for his studies on chlorophyll and other plant pigments. 13.6. Dupraw's folded fibre model of chromatin in molecule. Only when the ciliary membrane is extracted with a detergent, the axoneme enters in a state of rigor in which the attachment is produced (Fig. 5.15). The average plant heights of two inbred tobacco varieties and their hybrids have been measured following results : Inbred parent (P1)=47.8 inches, inbred parent (P2)=28.7 inches, F1 hybrid (P2×P2)=43.2 inches. The probe may be partially pure mRNA, a chemically synthesized - - - ligation by cohesive ends blunt ends using linkers homopolymer tailing circular recombinant DNA introduction into host cells by - transformation, transfection, in vitro packaging with
phase or cosmid DNA host's cells containing. recombination DNA selection of cells by - direct phenotypic selection - nucleic acid hybridization - immunological tests - hybrid arrest translation clones of gene library Fig. 4 3 DEFGH (The full stop depicts the centromere) and if the chroFig. The aperture is limited to something less than 90° since that would have the lens and specimen in contact with one another. Haemoglobin is one of the fully sequenced protein. (1977) has synthesized cDNA on mRNA that codes for a rat growth hormone (RGH) which comprises 190 amino acids. This DNA is called satellite DNA because upon ultracentrifugation, it separates from the main component of DNA. Genetical Terminology 12-21 Symbols of genetics; revision questions. Crossing Over by Breakage and Union It is well evident that crossing over occurs in the homologous chromosomes only during the four stranded or tetrad stage. Occurrence With rare exceptions such as the human erythrocytes, microtubules are found in all eukaryotic cells, either free in the cytoplasm or forming part of centrioles, cilia and flagella. 1966, on lysozyme P.Leder. The haploid secondary oocyte and first polocyte pass through the second meiotic division. These haploid cells either become or give rise to gametes, which through union (fertilization) support sexual reproduction and a new generation of diploid sporangium organisms. The polypeptide in its turn determines the phenotype of the organism. Unlike DNA polymerase, this enzyme can start a new polynucleotide triphosphates together (after Alberts et al., 1989). 13.4 B) is considered to be a relatively advanced feature. The appearance of nucleolus changes dramatically during the cell cycle. The common example of ZW-ZZ sex-linkage is plymouth rock chicken. If the mutation rate of a certain gene is directly proportional to the radiation dosage and the mutation rate of a substance at the surface of a solution is known as adsorption (L.,ad=to, sorbex=to draw in). Some large enzyme (multienzyme) aggregates O S La carry out whole series of reactions without losing contact CH3-C-HS with the substrate. Cohen et al., for the first time reported the cloning of DNA by using plasmid as vector. The crossing over results basically from an exchange of genetic material between non-sister chromatids by break-and-exchange following replication. M phase or Mitotic phase. Contents 166 CELL BIOLOGY C H A P T E R 7 Golgi Apparatus F or the performance of certain important cellular synthetic products (proteins), production of exocytotic (secretory) vesicles and differentiation of cellular membranes, there occurs a complex or golgi apparatus in the cytoplasm of animal and plant cells. In an experiment, the 200 bp of DNA + H1 H1 and linker DNA histones are removed from the metaphase chromosome by adding the Fig. But now one more polymerase, namely, DNA polymerase δ is also found to be involved in eukaryotic DNA replication. The code has polarity. In fact, genetics contributed the modern prototype for all of the biology. Its attached chromatid is thereby carried to a spindle pole. In a thin section, in the tight junction two adjacent plasma membranes appear to be fused at a series of points. eIF4A Monomer; 15,000 Monomer; 15,000 Multimer; 15,000 Binding mRNA 5' end; unwinding Assists mRNA binding (also binds ATP) Contents 86 MOLECULAR BIOLOGY 6. those that carry out the oxidation reactions of the respiratory chain; 2. These thread-like structures are known as the chromatin (Gr., chrome=colour) substance or chromatin fibres. Sir Hans Adolph Krebs (German biochemist in England; born 1900), in 1937, worked out various reactions of the citric acid cycle (or tricarboxylic acid or TCA cycle). Linkage group. However it was later shown that protein S20 is identical to L26, thus, the correct number of S proteins is reactions of the citric acid cycle (or tricarboxylic acid or TCA cycle). 20. 18.10. Mitochondrial DNA. Significance of Mitosis The mitosis has the following singificance for living organisms : 1. Results of reciprocal crosses between these and animals of low-cancer-incidence strain depend on the characteristic of the female parent. These microvilli are 0.6 to 0.8 µm long and 0.1 µm in diameter. A scientist checking a genetic map of mice. Water leaves the cell and the plasma membrane shrinks centration of NaCl solution away from the cell wall (B,C). These genes have been suggested to be X-linked (see Burns and Battino, 1989). In most of the plant cells, the cell wall is made up of cellulose, hemicellulose, pectin and protein. Walter Flemming (1878) introducec the term chromatin to describe the thread-like material of the nucleus that became intensely coloured after staining, tion. The chromosomes besides having the primary constriction or the centromere possess secondary constriction of the chromosome. DNA segment to be magnified double 3' stranded DNA 5' sepa-3' rated stranded of of pea plant. Give a brief account of multiple allelism ? Ultimately, ingested contents are digested, small breakdown products such as sugars and amino acids diffuse to cytosol. DIFFERENTIATIONS OF CELL SURFACE The cell surface of certain cells performs various physiological activities such as absorption, secretion, transportation, etc. emulsion in the dark room Pulse-labelling technique is used for those cases where biological molecules undergo considertop view side view able modifications after their synthesis layer of silver grain (e.g., ribosomal RNA). In the metachronic type of rhythm the cilia of a row beat one after the other, while in the synchronous or isochronic rhythm, all the cilia of a row beat simultaneously. This will certainly increase great financial burden on human society. Such genes which are nonallelic and affect the phenotype of a Height in humans is under polygenic control. The double stranded but non-helical RNA occurs as the genetic material in some plant viruses (e.g., reoviruses). For exFig OH or hydroxyl groups in glycerol are linked to fatty acids, while the third —OH group is linked to phosphoric acid. A second type of primer topoisomerase (i.e., topoisomerase II) replisome RNA forms a covalent bond to both strands of Okazaki DNA helix at the same time, making transfragments sient double-strand break in the helix. Non-functional ribosomes exist in the form of separated subunits which are suspended freely in the cytoplasm. worked in Belgium and their ap- Contents 176 CELL BIOLOGY proach was biochemical one. 13.3. XY Type Man Meiosis n+ Y n+ X n+ X 2n + XX B. They demonstrated that the DNA injected by a phage particle into a bacterium contains all the information required to synthesize progeny phage particles. coli (Fig. A of CCA sequence during polypeptide synthesis. A diagram of structures seen in the prokaryotic (bacterial) cells (after Sheeler and Bianchi, 1987; King, 1986). The initiation codon for this sequence is located near the 5' end of the message. Inheritance via genes found in cytoplasmic organelles. Electron microscopic observations have shown that kappa particles are about 0.4µ long symbiotic bacteria, Caedobacter taeniospiralis; 20 per cent of kappa bacteria of the killer strain containing "R body" and are called "brights". These chromosomes have satellites that correspond to nucleolar organizers. The concentration of the potassium ion is the reverse, generally 20 to 40 times higher inside the cell. XvXv Vermilion female (or mother) (Xv) (Y) 1/2 XvY Vermilion female (or father) (Xv) (Y) 1/2 XvY Vermilion somewhat similar to sickle cell anaemia. This enzyme functions by catalyzing formation of 5'-3' phosphodiester bonds of the RNA "backbone" by "reading" the DNA template in the 3'-5' direction. A case of complete linkage; B-Diagram of the segregation of two pairs of allelomorphic genes on the same chromosome between which crossing over takes place during meiosis. male lacking in one X chromosome produces two types of sperms: half with X chromosome and half without X chromosome. However, in each case RNA is synthesized only at the rate of few copies per cell in comparison to normal cells where thousands of copies are made. Gonocytes of the male (XY) migrate deeper into the gonadal blastema forming the medulla and female gonocytes (XX) remain at the periphery, forming a thick cortical layer. It uses Giemsa stain and identifies the G bands. Phenotypic expression of dominant sex-influenced gene for horned trait Table 12.1. occurs only in male sheep. Internally the cell's composition is more or less diffuse. It may help in the differentiation of ciliary membrane; i.e., the rings of particles may retain proteins that would otherwise diffuse out and be incorporated into ciliary membrane. TYPES OF RIBOSOMES Recently accroding to the size and the sedimentation coefficient (S) two types of ribosomes have been recognised (Fig. Cleavage at AAUAAA sequence and cept yeast) which perhaps provides a sigpoly adenylation at the cleaved 3' end. The movement of a (bottom) resulting from a translocation and showing only gene within the same chromosome is called about 50% of the normal number of kernels. Certain developed mutants of rice are found to contain increased contents of proteins and lysine. Wheat has 42 chromosomes, but careful study reveals that in hexaploid there are six rather similar but not identical sets of seven chromosomes. CI— The larger subunit of Na+- K+- ATPase performs the actual function of cation transport. The topic of this chapter is how the information present in the sequence of bases (=triplet codons) of the mRNA is translated into a sequence of amino acids in proteins. Lysases. In prokaryotes this tRNA molecule is acylated with the modified amino acid N-formyl methionine (f Met); the tRNA is often Crystal structure of 70s ribosome containing 3 bound tRNA. hen it became evident that the chromosomes were the organs of heredity, because (i) they formed the only link between two generations, (ii) they
carried linearly arranged genes, (iii) they occurred in every organism in specific number or morphology affected the phenotype of the species, then, various attempts were made by early molecular geneticists to identify the physical and chemical nature of genes. The growth of multicellular animals and plants in relation to growth and multiplication of their individual cells falls under the following three categories: (1) Auxetic growth. 12.16. which they can be classified as Ig G, Ig M, Ig A, Ig D or Ig E, each with its own class of H chain, such as, y (gamma), μ (mu), α (alpha), δ (delta) and ϵ (epsilon) respectively (see Table 10-1.) Light chains can likewise be typed as λ). The astral microtubules also help in anaphase B by their attractive interaction with cell cortex. These factors are eIF1, eIF2, eIF4D, eIF4 which may be quite variinvolved in RNA splicing. Contents 172 GENETICS, HUMAN GENETICS Further, structural abnormalities can occur in both homologous chromosomes of a pair or in only one of them. In hexoses such as fructose and glucose, a six-membered pyranose ring is formed (Fig. This new fatty acyl-CoA is then recycled through the same series of reactions until the final two molecules of acetyl-CoA are produced. A peptide is then formed to join the amino group of p-tRNA. Monoecious Separate female (O) and male (O) flowers, but on the same plant. G.P.O., Mumbai-400 001. SER is found related to glycogenolysis or breakdown of glycogen. Contents PROTEIN SYNTHESIS Primary structure Quaternary Tertiary structure of haemoglobin containing 2 alpha and 2 beta chains Fig. Cajal were jointly awarded the Nobel Prize. (i) Complete parthenogenesis. Typically mitochondria with many cristae are associated with mechanical and osmotic work situations, where there are sustained demands for ATP and where space is at a premium, e.g., Contents MITOCHONDRIA 193 between muscle fibres, in the basal infolding of kidney tubule cells, and in a portion of inner segment of rod and cone cells of retina. The cells which synthesize specific proteins for the intracellular utilization and storage often contain large number of free ribosomes. As a produce a substance that could act locally or via result, she has testes in her abdominal cavity. ergosterol and stigmasterol found in plants. During 1961–1968, the genetic code of DNA was solved by M.W. Nirenberg, J.H. Matthaei, p.Leder, and H.G. Khorana. If your answer to : (a) is no, why are inversions referred to as crossover-suppressors ? Esterase Substrate Phosphate monoesters Oligonucleotides, phosphodiesters b-Galactosides Acetylhexosaminides, heparin sulphate b-Glucosides Glycogen a-Mannosidase Sialic acid derivatives Mucopolysaccharides, bacterial cell wall Hyaluronic acid, chondroitin sulphates Polysaccharides, mucopolysaccharides, mucop binding of aminoacyl tRNAs with blocked α NH2 groups (e.g., formylmethionine tRNAf Met); positions f-Met—tRNAf Met in P site of ribosome. A cross can occur only if the parents are of different mating types. Contents CROSSING OVER 103 2. 8.7). Lipid molecules very rarely migrate from one lipid time = 40 minutes monolayer to other monolayer of lipid bimolecular layer. Further, in the first meiotic division the reduction of chromosome number takes place and, thus, two haploid cells are resulted by this division. Due to slow growth rate, the time of blooming of an autopolyploid is delayed. To understand the three-dimensional organization of ribosomal proteins in the ribo- head platform valley A ridge + base + large subunit small subunit central ridge valley head protuberance ribosome B stalk platform base small subunit + large subunit ribosome Fig. Proplastids develop according to the need of each differentiated cell. All known transcription factors may recognize either DNA sequences, another factor or RNA polymerase. According to minor Watson and Crick DNA molecule consists of groove ° two such polynucleotide chains wrapped heli34 A cally around each other, with the sugar-phosphate chain on the outside (forming ribbon-like backbone of double helix) and purines and pyrimidines on the inside of the helix (projecting ° major 10 A between two sugar phosphate backbones as transgroove verse bars). The colloidal system due to its stable phase determines the polarity of the cell matrix which cannot be altered by centrifugation of other mechanical means. The increasing number of human diseases that are being discovered to have a genetic basis lend great importance to the development of such euphenic measures. The albino coat totally lacks in pigmentation and the eyes of an albino also remain pink due to lack of pigment in iris of eye. In a negative regulated system, an inhibitor is present in the cell and prevents transcription. Such a DNA replication, where the leading strand is synthesized continuously and the lagging strand is synthesized discontinuously, is called semidiscontinuous replication. When the F1 hybrids were allowed to mate among themselves, they produced long-winged and vestigial-winged information (Fig. The analytical ultracentrifuge provides information Angle-headed rotors concerning the mass and the shape of a A variety of rotors used in a preparative ultracentrifuge. the DNA of chloroplast codes for chloroplast mRNA, rRNA, and ribsomal proteins. Huntington's chorea. Additional studies that take into account the subgroups of the A antigen indicate that IA allele may occur in at least four allelic forms. Syngamy. In mitochondria, ribosomes appear to be tightly associated with the inner membrane. The cytoskeleton extends throughout the cytoplasm and is a complex network of three types of protein filaments (IFs). Thus, 1 per cent crossing over can also be expressed as 1 centimorgan (1cM), 10 per cent crossing-over as 1 decimorgan and so on The Y-linked genes are commonly known as holandric genes (Greek, holos = whole, and andros = man). The proteoglycans are amorphous and form gels which are able to hold large amounts of the egg, decreases the exchange of phosphate and sodium ions between the zygote and the surrounding media. The simplest possible code is a singlet code (a code of single letter) in which one nucleotide amino acid could be specified. The female gametes are passive and have comparatively large size and known as the macro-or megagametes. a3. During the step of cleavage only two enzymes are used: aldolase) and triose isomerase). 4.9. Chemical peptidoglycans (in formula of sucrose. Prokaryotic repicons. In these, the centromere occurs near th tissue-forming eukaryotes are quite different from those of prokaryotes. The sugars shown in shaded form form the 'core-region' of this oligosaccharide. Type IV collagen lacks a distinct fibrillar structure. Fission; 2. Certain external agents such as heat shock, chemicals, radiations, etc., have profound effect on crossing over. Camerarius in 1694 described sexual reproduction in plants for the F2. However, in the recent years, large number of sub-cellular structures such as ribosomes, mitochondria, chloroplasts, etc., have been discovered and studied in detail. For these reasons reducing compounds such as vitamin E or enzymes such as superoxide dismutase could play a role in keeping the healthy state of a cell. A A breaks randomly Typically, a cross-shaped configuration is seen in A D C B E A D C B E prophase-I. As already described in Chapter 5, the promoter (p) is the site of RNA polymerase attachment. Cock-feathering is characterized by long, pointed, curving neck and tail feathers. or to move particles in the medium, as in air passages and oviduct. Flagellar movement is also powered by ATP hydrolysis. In either case the newly previous last fragment of single-stranded region lagging fragment of lagging strand must be exposed for next replicated strands in strand lagging strand have been fragment of lagging adjacent units will synthesized strand to be synthesized strand strand lagging adjacent units will synthesized strand to be synthesized s Because, oxygen is important in the formation of H2O2 and HO2 in irradiated water and these products may induce breaks in DNA molecule. Genotype class 1 2 2 4 YY RR YY Rr, Yy Rr Y Rr, Yy Rr Yy Rr, Yy Rr Yy Rr, Yy Rr Yy Rr, Yy Rr Yy Rr, Yy Rr, Yy Rr Yy Rr, Yy Rr Yy Rr, Yy Rr Yy Rr, Yy Rr Y Rr, Yy Rr Y Rr, Yy Rr Yy Rr Yy Rr, Yy Rr Yy Rr Yy Rr, Yy Rr Yy Rr Yy Rr Yy Rr, Yy Rr Yy Rr Yy Rr Yy Rr, Yy Rr Yy Rr, Yy Rr Yy Rr Yy Rr, Yy Rr Round Yellow Round=9 Homozygous Green Round Heterozygous Green Round=3 Homozygous Green Round + 3 green round : 3 green round : 3 green round : 1 green Round Heterozygous Green Round Heterozygous Green Round + 3 green round : 1 green Round Heterozygous Green Round + 3 green round : 1 green Round + 3 g wrinkled. However, often faint protein spokes are radiate out to each triplet from a central core, forming a pattern like a cartwheel. Mitochondria also perform certain biosynthetic or anabolic functions. During & ATP molCoA-SH ecules are utilized for the FAD O II activation of a fatty acid R-CH2-C-SCoA (e.g., 16-carbon containing FADH2 O palmitic acid); thus, one O II II ATP is used by acyl-CoA CH3-C-S-CoA C2 R-CH=CH-C-S-CoA II O chondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria acyl-CoA synthetase outside the miC2 O + tochondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria acyl-CoA synthetase outside the miC2 O + tochondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria; another ATP C2
II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria; another ATP C2 II O H 2O (i.e., GTP) is used by mitoCH3-C-S-CoA II O chondria; another ATP C3 II O chondria; another A cristale. Evolution. Beadle, Tatum and Laderberg got Noble prize in 1958. Thus, their gene regulatory systems are adapted to provide the maximum growth rate in a particular environment, except when such growth would be deterimental. 10.6), one protein subunits of ATPase and a few hydrophobic four proteins. These glycoproteins are known to act like the glue to increase the strength of the wall. When a polymer contains similar kinds of monomers in its macromolecule it is known as the heteropolymer. The monocotyledon plants contain large-sized chromosomes than the dicotyledon plants. In phase contrast microscope these bent rays are used to form patterns of destructive interference, yielding sharp contrasts. The paper chromatography (Fig. Two such films can combine tail to tail to make a phospholipid sandwich or self-sealing lipid bilayer, which is the structural basis of cell membranes Enumerate various types of light microscopy. An egg fertilized by a X-bearing sperm, produces a female, but, if fertilized by a Y-bearing sperm, a male is produced (See Fig.13.3). The percentage of desirable traits can be increased by adopting following measures : 1. In 1942, using cytochemical procedures, Brachet demonstrated the presence of another nucleic acid, RNA, and not long there after, Mirsky and Pollister (1946) showed that there were proteins associated with chromosomal material. RNA is a carrier of genetic informations and it plays very significant role in the mechanism of protein synthesis. The G1 phase, S phase are combined to from the classical interphase During transcription stage copies (that is, transcripts) of an individual gene or genes are synthesized. 7- dehydro-cholesterol is found in the skin where it is responsible for the synthesized. 7- dehydro-cholesterol is found in the skin where it is responsible for the synthesized. were used two different types of RNA viruses, namely TMV (tobacco mosaic virus) and HRV (Holmes rib-grass virus). spread over the surface of water, there forms a monolayer film of phospholipid molecules; in this thin film, tail regions pack together very closely facing the air and their head groups are in contact with the water (Fig. They suggested the wearing of kilts as one solution. Acidification of lysosome and accumulates H+ inside the organelle (Reijngond, 1978). A series of abnort T malities in humans due to monosomy for the X chromosome (XO). Contents GENETIC ENGINEERING 6 the organelle (Reijngond, 1978). Specify some of the physiological activities that might be interrupted by an appropriate antibiotic and the reason why human cells are not harmed. Such chromatin fibres are observed only in the interrupted by an appropriate antibiotic and the reason why human cells are not harmed. organisms ranges between 20 to 30 µm. The dominance hierarchy of this allelic series can be depicted as follows : IA = IB > i. n 2. 3.9. A dihybrid cross between a yellow round and a green wrinkled pea plant. The views of various geneticists about the phenomenon of linkage can be represented as follows : IA = IB > i. n 2. 3.9. A dihybrid cross between a yellow round and a green wrinkled pea plant. 9:7; (4) 12:3:1; (5) 9:3:3:1; (6) 13:3. Aquatic Ecosystems : Estuaries, biotic communities 181-194 Estuarine ecology : types of estuaries, biotic communities of estuaries, physico-chemical aspects of marine environment — light, temperature, pressure, zonation of marine environment, stratification of marine environment, salinity, currents and tides; marine communities of coral reef as a specialized oceanic ecosystem, biotic communities of coral reef; revision questions. Biosynthesis of ribosomal proteins. Since molecules each of the two double helices or duplexes conserves only one of the parent polynucleotide strands, the process is said to be semiconservative. What is recombinant DNA and how is it made ? The elements of two lateral lines usually appear densest, while the element central chromatin of sister chromatin of sister chromatids of central line is of variable promi- chromatids 1 and 2 elements 3 and 4 (maternal) nence. Single celled organisms such as E.coli, yeast, Amoeba, etc., and somatic cells in culture are examples of a growth-duplication cycle. During the process of conjugation, a F+ or donor bacterium (equivalent to male) passes a piece of DNA or plasmid containing fertility or F gene to the F or recipient bacterium (equivalent to female). They represent localized circular areas of contact about 0.5 µm in diameter, in which the plasma membranes of two adjacent cells are separated by a distance of 30 to 50 nm. ATPase Removal or addition of phosphate 11. (2) Regulation at some autosomal loci so that homozygous dominants do not produce twice as much product as the heterozygote. Due to this fact, mutant and wild type flies showed same intensity of eye colour in male and female flies. Because, most flies have normally developed wings, so, it can be easily concluded that gene L+ is the original form of gene or allele from which the other form of gene or allele (Lvg) might have originated by certain mutational event at sometime in past. A karyotype exhibiting large differences in smallest and largest chromosomes, is called an asymmetric karyotype (Fig. When electrons of FADH2 and NADH are passed through ETS, they release 5ATP molecules for each of the first 7 acetyl - CoA molecules formed by Boxidation of palmitic acid, i.e., 7 × 5 = 35 ATP molecules. The environment includes not only ecological factors such as hormones and enzymes. Introduced the term chromosome. A L4 blocks translation of polycistronic mRNA L4 S10 B L3 L4 L23 L2 L22 S19 S3 L16 L29 S17 L16 L29 S17 L16 L29 S17 when L4 binds to rRNA, translation may proceed S10 L3 L4 L23 L2 L22 S19 S3 L4 23S rRNA Fig. 2.7), an insoluble medium is packed into a glass tube; the length and width of this tube influence the separation of the molecules. When the male plants raised thus were used to pollinate the female flowers on female plants, only two third of them showed segregation indicating that the sex is controlled by a single gene. In Figure 6.3., it has been shown that an overlapping code can mean coding for four amino acids from six bases. Simple transFig. (d) Why is selection within a pure line futile ? Why is linkage an exception to Mendel's second law ? They are generally found at the interface between columnar cells, just below the region of tight junctions. (a) Assuming reciprocal classes are equal, how many map units apart are these mutants? In Drosophila the recessive alleles for vestigial wings in homozygous conditions have complete penetrance. Further, according to Einstein's photoelectric theory, it takes one photon to eject one electron. Osmosis. They are then lysed by sonication and their envelopes separated on density gradient centrifugation. Isomerases. Where dark reaction takes place? Gray, Vestigial; b+vg/bvg = 2. Detailed cytological study disclose Ph1 to be a number 22 chromosome that Normal Homozygotic translocation Heterozygotic translocation 1 1 6 6 1 1 6 6 1 1 6 6 1 1 6 6 1 1 6 6 1 1 6 6 1 1 6 6 2 2 7 7 2 2 7 7 2 2 7 7 3 3 8 8 8 3 3 3 8 8 3 4 4 9 9 9 9 4 4 4 9 9 4 Fig. Branch of origin of the male parent Branch of origin of the male parent Branch of origin of the female parent Branch of origin of the female parent Branch of origin of the male parent Progeny Green Pale or white Variegated Green Pale or white V white Green, pale or white, variegated Green Pale or white, variegated Green Pale or white, variegated Green, pale or white, variegated Green, pale or white, variegated The iojap trait, thus, exhibits classical maternal inheritance once it has become established in an ij/ij plant. Carbon dioxide sensitivity may even be induced in normal flies by injections of cell free extracts of sigma particles parents from CO2 sensitive flies. 4.8. Chemical formula of maltose. outer and inner nuclear membranes; 2. She has shown that the genome of the chloroplasm. Phytol (C20 H39) is a long straight- chain alcohol containing a single double bond. S.C. Maheshwari of Dept. Chromosome movement 3. Sexual reproduction cycle in Chlamydomonas sp. Schramm showed that tobacco plants could be inoculated with purified RNA from the tobacco mosaic virus (TMV), and TMV-like lesions could later be identified on the tobacco leaves. DNA outside the host's chromosome (i.e., in Contents CELL BIOLOGY 38 the host's cytoplasm) essentially as a plasmid* (e.g., P1 bacteriophage) or it may attach itself to the host's chromosome as an episome* (e.g., lambda phage). Flagella and other structures. Where are they located in the cell? Initiation of transcription factors (TFs) in the following order : (i) TF II D binds at TATA box; (ii) the step (i) permits the association of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA polymerase II associates to promoter site; (iv) RNA pol II is accompanied to the promoter by TF II F to form a transcription complex; (v) orderly addition of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA
polymerase II associates to promoter site; (v) addition of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II H and TF IIB; (iii) TF II B forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II E forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II E forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II E forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E, TF II E forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II E forms the so-called DB complex and RNA polymerase II associates to promoter site; (v) addition of TF II II J helps the initiation process. Rather, initiation of assembly occurs at microtubule organizing centres (MTOCs). a3), ubiquinone or coenzyme Q10, non-heme copper and iron, ATP synthetase, succinate dehydrogenase; β-hydroxybutyrate dehydrogenase; b-hydroxybutyrate dehydrogenase; β-hydroxybutyrate dehydrogenase; β-hydroxybutyrate dehydrogenase; β-hydroxybutyrate dehydrogenase; carnitive fatty acid acyl transferase (Fig. The pentoses and hexoses are the most abundantly occurring monosaccharides of the matrix. Explain, how is the growth of cell biology linked with the improvement in instrumental analysis ? 17.6 B). How would you define an enzyme ? The mechanism of endocytosis is found to involve the contraction of microfilaments of actin and myosin present in the peripheral cytoplasm (ectoplasm) which causes the plasma membrane to invaginate and to form the endocytic vacuole (pinosome/phagosome). Cyanobacteria occur as individual cells, as small clusters or colonies of cells, or as long, filamentous chains. 10.1. Different coat colours in rabbits (cafter Burns 1969). 9.2. Technique of formation of a genomic library using recombinant DNA technique Therefore, of the lungs would pull water molecules together so tightly to protect itself from such pH variation the that the sacs would collapse. The whole process of receptormediated endocytosis, includes the following events : Contents PLASMA MEMBRANE AND CELL WALL 137 cytoplasms 1. It means that 100 per cent of the genome can be expressed during the lampbrush stage. B Chinchilla Genotype = cchcch, cchch cchc. Antibody binding also marks or 'tags' invading microorganisms for destruction, either by making it easier for a phagocytic cell to ingest them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (such antibodies are called opsonins) or by activating a system of blood proteins, collectively called complement that kills them (invaders. protein molecules RNA The cytoplasm of the bacterium is 30S subunit polysome bounded by a typical fluid mosaic plasma membrane and Cell Wall A plasma membrane. Contents CELL BIOLOGY 112 C H A P T E R 5 Plasma Membrane and Cell Wall A plasma membrane and Cell Wall A plasma membrane and Cell Wall A plasma membrane. microscopy. Deoxyribonucleic acid (DNA). Spontaneous nucleation, as seen in vitro (Fig. These are water soluble, basic, light weight, arginine rich polypeptides. Structurally, gap junctions consist of hollow channels round which a series of six protein subunits are located ; a channel has a diameter of about 1.5 to 2 nm. The male pronucleus swells up by absorbing the water from the surrounding ooplasm and it becomes vesicular. coli is about 2 minutes, because it is attacked by the cytoplasmic ribonuclease enzyme. The existence of an organized fibrous array or cytoskeleton in the structure of the protoplasm was postulated in 1928 by Koltzoff. Red blood cells sickleBlue, Bb shaped only under Fig Fisher (1930) called it superdominance. Incorporation of bases into the molecule is random and does not require a DNA template. Contents 20 GENETICS, HUMAN GENETICS, HUMAN GENETICS Siblings or Sibs. Before trying to arrange these two polynucleotide chains into a regular helix of the required dimensions, however, Watson and Crick placed a further restriction on their model—a An X-ray diffraction image of DNA. The protein synthesis is started. The mt DNA is localized in the matrix and is probably attached to the inner Fig. Bb BB B b Procupine man. The calm lysogenic period is ended by some DNA circularizes type of shock (e.g., temperature changes, UV irradiation or conjugation of a enic bacterium integration of with a non-lysogenic bactambda DNA into synthesis of viral terium) to the lysogenic host chromosome proteins needed for induction culture. The correlation between such chromatin decondensation and transcription activity is readily proved by autoradiography using tritiated precursors of RNA. Nass M.Calvin 1962 M.F. Perutz and J.C.Kendrew 1963 J.Eccles, A. Immunology 126-144 Cellular basis of immunity; molecular structure of immunoglobulins or antibody diversity); B lymphocytes and the immune response — precipitation of soluble antigens, agglutination, complement fixation, clonal selection theory, allelic exclusion, immunologic memory, autoimmune disease; major histocompatibility complexes — class I MHC antigen, class II MHC antigen, class I MHC antigen, clas regions between a and b and between d and e. Neither g3+ nor its recessive allele g3 has any effect on the phenotype. Syntenic Genes If two or more specific human gene products and a given human chromosome are both present in the same hybrid cells, then those genes are located in the same chromosome; that is, they are syntenic. Experiments C Heat - killed S III strain does not kill mouse demonstrated that transforming activity is not heat + live mouse lost by reaction with either (a) purified proteolytic (proteinD R II strain, both of hydrolyzing) enzymes which are separately nonlethal, kill mouse trypsin, or a mixture of both or (b) ribonuclease (an heat + live mouse dead mouse enzyme that depolymerizes RNA). Differences between the 'universal genetic code' and two mitochondrial genetic code' and two mit reduction of the chromosome number do not occur. Theories of Organic Evolution (Lamarckism, Darwinism, Modern Synthetic Theory, Germplasm Theory of inheritance of acquired characters); examples of Lamarckism; theory of natural selection (Darwinism), facts that influenced Darwin's thoughts, pangenesis hypothesis, Darwin-Wallace theory; Weismann's germ plasm theory; mutation theory; mutation theory; mutation theory; mutation theory, types of mutation, advantages of mutation theory, objections to mutation theory; revision questions. Biogenesis of Peroxisomes At one time it was thought that the membrane 'shell' of the peroxisomes is formed by budding of the endoplasmic reticulum (ER), while the 'content' or matrix is imported from the cytosol (cytoplasmic matrix). The existence of two or more genetically different classes in the same interbreeding population at the same time, in the same habitat, is known as polymorphism. Genetic interactions; kinds of epistatic interaction: dominant epistasis (12:3:1), recessive epistasis (9:3:4), duplicate genes with cumulative effect (9:6:1), duplicate recessive genes; 9:7), duplicate dominant genes; 9:7), duplicate dominant genes; penetrance; expressivity; pleiotropism; revision questions and problems; answers to problems. In plant cells, the acetyl-CoA, the product of β-oxidation chain is not oxidized by Krebs cycle, because it remains spatially separated from the enzymes of Krebs cycle, instead of it, acetyl-CoA undergoes the glyoxylate cycle to be converted into succinate. The wastage of best type of germplasm can be avoided by adopting following measures : (i) The selection of marriage partners should be made with intelligence. Thus, in above equation the P/O ratio is 3 because 3Pi and 1/2 O2 are used. This repressor molecule or substance inhibits synthesis of mRNA by all genes specifying enzymes in the synthetic pathway. The Sudan Black B is a specific stain for phospholipids and is used to stain Golgi apparatus. The cause of this general property of lipids is the predominance of long chains of aliphatic hydrocarbons or benzene ring in their molecules. As in all prokaryotes, the DNA molecule of blue green algae is circular, double-
stranded helix and occurs in the centroplasm. According to them these puffs represent regions where the tightly coiled chromosomal fibres open out to form many loops. lamarckiana one of the Renner complexes is called gaudens and the other is called velans. Certain algal cells such as Pinularia and Microsterias, contain largest and most complicated Golgi apparatuses. 1992 Edwin G. A polynucleotide is held together by 3', 5' phosphodiester bonds and a nuclease enzyme will attack either the 3' or the 5 end of this linkage. The walls of the vesicle are invaginated due to rapid growth of ciliary shaft. FUNCTIONS OF ENDOPLASMIC RETICULUM The endoplasmic reticulum acts as secretory, storage, circulatory and nervous system for the cell. (3) Cells originate only from other cells, i.e., no cell can originate spontaneously or de novo, but comes into being only by division and duplication of already existing cells. man beings have a meter Contents 56 CELL BIOLOGY long "tails" or axons. The molecular weight of the fertilizins and antifertilizins become active after the chance collision of the sperms with the ova. The molecular weight of the fertilizins and antifertilizins become active after the chance collision of the sperms with the ova. BIOLOGY Once an open-promoter complex has formed, RNA polymerase is ready to initiate RNA synthesis. Polyploidy in humans have been found in liver cells and contain a relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains, relatively large amount of chemical bonds between atoms and contains atoms atom B—Overlapping of means that after one amino acid is coded, the second amino acid codon due to two bases; C— will be automatically coded by the next three letters and that no Overlapping of codon due to two bases. The genes which exclusively occur in Y chromosome are called holandric genes. Discovered coenzyme A (a key compound in cell metabolism) and got Nobel Prize in 1953 for his studies on this coenzyme. Karl Nagli (1842) observed rod-like chromosomes, while male cells contain one X and one Y chromosomes. (v) Scleroproteins. It is now known that benzopyrene (found in charcoal-broiled meat) is not carcinogenic, but under the action of aryl hydroxylase enzyme in the liver, it is converted into 5, 6-epoxide, which is a powerful carcinogen (see De Robertis, Jr., 1987). For example, the ecdysone hormone has been found to form puffs (Balbiani rings) in the giant chromosomes of insects. The dominant epistasis modify the classical ratio of 9:3:3:1 into 12:3:1 into 12:3:1 into 12:3:1 into 12:3:1 ratio. Why the feFig. Sexual reproduction performs the basic function of providing a great variety of genotypes than could arise under asexual reproduction. F group: 19 to 20 pairs - Metacentric 7. Microvilli Microvilli are finger-like, Fig. DEVIATION FROM MENDEL'S DIHYBRID PHENOTYPIC RATIO The Mendelian dihybrid phenotypic ratio of 9:3:3:1 is obtained only when the alleles at both gene loci display dominant and recessive relationship. One example is hypophosphatemia (vitamin D-resistant rickets). Prosthetic Groups and Coenzymes Certain enzymes such as cytochromes are the conjugated proteins and contain prosthetic group as metalloporphyrins complex in their molecules. Due to twists the coils are formed and these are known as relational coil. Such Fig. For example, Millon reaction, diazonium reaction and Naphthol Yellow 5 stain are used for the proteins; alkaline fast green is used for histone (basic protein); Feulgen reaction (using Schiff's reagent) is used for DNA; methyl green-pyronine stain) is used for DNA; methyl green-pyronine stain (Unna-Pappenheim stain) is used in distin- Contents 20 CELL BIOLOGY guishing between DNA and it stains DNA green and RNA red; acetocarmine and acetoorcein stains are used to stain chromosomes of dividing cells; periodic acid-Schiff (PAS) reaction is used for the demonstration of polysaccharide materials such as starch, cellulose, hemicellulose, and pectin in the plant cells and mucoproteins), hyaluronic acid and chitin in animal cells; and fat soluble dyes such as Sudan Red and Sudan Black B are used for the lipids. These are genes which have greater effect than the standard gene, i.e., they Contents 128 GENETICS, HUMAN GENETICS and EUGENICS produce much phenotypic change. Describe an experiment which established the genetic nature of RNA in certain viruses. These RNA viruses are taken in by the host cell by receptormediated endocytosis and are delivered to the endosomes (which are special vesicles having acidic medium or low pH between 5 to 5.5 and recycle the receptors; see Chapter 5). By varying the relative compositions of U and A in the random copolymer and determining the percentage of the different amino acids in the proteins formed, it was possible to deduce the composition of the code for different amino acids. Contents REGULATION OF GENE ACTION 8. Describe their origin, structure and function. Direct Observation of Mitochondria in living cells is somewhat difficult because of their low refractive index. Write short notes on the following : (i) Polymorphism in lysosomes; (ii) Lysosomes and disease; (iii) Lysosomal enzymes; (iv) Lysosomes of plants. In consequence, viruses can only reproduce inside the host cells which may belong to animals, plants or bacteria. Contents GENETICS, HUMAN GENETICS 84 C H A P T E R 7 Linkage T he hereditary units or genes which determine the char acters of an individual are carried in the chromosomes and an individual usually has many genes for the determination of various different characters. enzyme involved in the transcription of m RNA and release of newly synthesized mRNA in the cytoplasm. The 5.8S, 18S and 28S rRNAs are transcribed as a much larger molecule in the nucleolar organizer (NO) which contains many copies 5.8S, 18S and 28S rRNA genes or ribosomal DNA (i.e., there is gene redundancy or amplification). In body head a frontal view, the 50S subunit appears 30S subunit bilaterally symmetrical and shows three prolateral crest tuberances arising from a rounded base ("arms") (maple leaf structure). Vacuoles in animal cells are many and small. Cytoplasm. Similarly, flower size in tobacco had the same pattern of inheritance. In terminal meiosis, the meiotic division occurs immediately before the formation of gametes or gametogenesis and will be discussed in detail in Chapter 20. Synchronous splitting of each centromere during prophase is evidently caused by an increase in cytosolic Ca2+. Describe the behaviour and presumed role of centrioles during mitosis. Draw a well labelled diagram of "Fluid mosaic model" of the external genitalia and the genital ducts. Slide is placed between the condenser and objective lenses and the image viewed in the ocular lens. The euploids are those organisms which contain balanced set or sets of chromosomes in any number. Fish liver, egg-yolk, butter, fresh milk; also produced by our body when skincholesterol is exposed to ultra-violet rays of sunlight. Chemical Nature of Genetic Materials (i.e., DNA and RNA) 4. Haemoglobin molecule is highly symmetric; it can be divided into two identical halves, each consisting of an αβ- dimer. The wavelength of an electron depends on the magnitude of the voltage and may be 0.01 A^o or ocular magnetic lenses objective glass lens specimen condenser condenser electron source light source Fig. Describe the structure and processing of tRNA. sensor site regulates the activity of Fig. Among cells of a third type, differentiated but highly active, pore densities are often 15 to 20 pores/µm2. The heterochromatin occurs around the nucleolus and at the periphery. 5S RNA (or 5S rRNA) synthesis. 2.9. Dialysis. The following three methods are used for the determination of DNA sequences : 1. Positive Eugenics attempts to increase consistantly better or desirable germplasm and, thus, to preserve best germplasm of the society. Contents 18 GENETICS, HUMAN GENETICS AND EUGENICS Mutation. There are some mutagens which interfere with the synthesis of nitrogen bases of nucleic acids such as purines or pyrimidines. A-Sol condition in of the cytosol (cytoplasmic matrix) which gelatin particles form continuous phase (net depends on various physiological, mework), enclosing water as discontinuous phase, protein synthesis • phosphorylation of GlcNAc median • addition • ad fixed bacteria are treated with the basic dye, crystal violet, they become blue or purple. The four kinds of deoxyribonucleosides and deoxyribonuc Ca2+-ATPase transports Ca2+ from the cytosol to the interior of the sarcoplasmic reticulum for causing the relaxation of the muscle cells. Viruses such as vaccinia, cowPHI × 174 bacteriophage pox, extromelia and Orf vi(12 capsomeres) ruses) and those with tadpole-shaped structures in which each part has different sort of symmetry (e.g., T-even phages of E.coli: T2 phage has an icosahedral pentamere shaped tail fibres). Arginine and lysine at physiological pH are cationic and can interact
electrostatically with anionic nucleic acids. In a few invertebrate embryos the cilia are probably under nervous control since their movement may be stopped upon stimulation of the embryo. Developed the fundamental principles of heredity. Cairns' observations also clearly supported the semiconservative nature of replication. Test Cross : F1 Tall Dd Test cross progeny : ½Dd Heterozygous tall × 1 Dd Heterozygous Tall × 1 : × 1 : Homozygous Dwarf dd P1 Tall DD ½Dd or all tall. molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previously synthesized molecules and have the effect of 'chasing' the previo (1) a reverse repeat in chromosome 4 causes dominant (Ey); (2) a tandem duplication in chromosome 3 causes confluens (Co) resulting in thickened veins, and (3) another duplication in chromosome 4 causes hairy wing (Hw). The iron is reversibly oxidized during the electron transfer. The genotype or phenotype that is found in nature or in the standard laboratory stock for a given organism. Further, for terrestrial plants and animals, cooling produced by the evaporation of Rh antigen (Rh blood phenotype) depends on three closely set autosomal genes (pseudoallels). Herpes virus is another most extensively studied animal virus. A— Location of gap junctions between two cells. The 80S ribosomes occur in eukaryotic cells of the plants and animals. (a) Of what nucleic acid molecule is this codon a part? In Figure 4.4 hydrogen is shown with its one electron which it may share with an oxygen atom. Gene Mutation 1 7 . (b) Yes, samples 1 and 3. In cattle, when twin calves of different sexes occur, the female member is usually a sterile intersex called a freemartin. The protein : DNA weight ratio averages about 1:1. ER AND ENDOMEMBRANE SYSTEM The endoplasmic reticulum is the main component of the endoplasmic reticulum is the main component of the endoplasmic vacual system or cytocavity network. The P1 Long Black Vestigial Gray F 1 Long Gray F 2 9 Long Gray F 2 9 Long Gray F 2 9 Long Gray T Vestigial Black Fig. Vapour and Fluid Theories Early Greek philosophers such as Pythagoras (500 B.C.) proposed that every organ of animal body gives out some type of vapours. Further, since the adjacent representation of the arrangement of microtubules into outer doublets actively slide against parallel sheets with protein cross bridges between them as each other, a force must be generated seen in a T. As a result, their sperms are haploid and viable. The possible containing 300 or so bases. The terms prokaryotic and eukaryotic were suggested by Hans Ris in the 1960's. Each secondary spermatocyte passes through the second maturation or second meiotic or heterotypic division and produces two spermatids. How many types of cell division occur in living organisms ? In fact, membrane biogenesis is a multi-step process involving , first, the synthesis of a basic membrane of lipid and intrinsic proteins and

thereafter the addition of other constituents such as enzymes, specific sugars, or lipids. The plasma membrane and other intra-cellular membrane and other intra-cellular membrane are very selective in nature. The acetylation converts the normally basic lysine side chain to a neutral acetyl lysine, and, thus, reduces the net basic charge of the aminoterminal ends of the affected histones. Telophase 13. Unfortunately Sutton could not prove his predictions experimentally. Some of the products stored by vacuoles have a metabolic function. Mineral deposits occur in cuticle in the form of calcium and the two broken ends are tree to dangle. Certain well known dominant and recessive human genetic traits have been enlisted in Table 18-3. A diploid cell produces four diploid cell produces four diploid cells by a mitotic division. Certain most important examples of extra-nuclear inheritance in eukaryotes are the following : 1. The dominant allele G determines gold-coloured plumage, and its recessive allele g determines silver-coloured plumage. Animal genetics. At least 35 genetic diseases have been detected in human beings by this technique; some of them have been listed in Table 18.1. If a disease is detected by this method, abortion of such a foetus can then be recommended. The strength of the cell coat varies from cell to cell. However, smaller dea b c d e f g h letion in heterozygous condition can be tolerated by the organisms. Another model is most significant and universally accepted one and is called nuclesome model which was proposed by R.D. Kornberg (1974) (Fig. The nuclear sap or nucleoplasm; 3. Therefore, the two daughter cells resulting from cytokinesis require more plasma membrane than in the plant cell. 13 1 2 3 12 14 nm 11 4 10 13 1 transverse 12 section 11 or 5 9 295 2 3 4 10 9 6 8 7 protofilaments 5 8 7 6 A colchicine assembly protofibril 8nm monomer tubulin pool α dimer α β B β tubulin molecule disassembly C Fig. Lastly, the structures of a cilium at the base and tip are slightly different from features described above (Fig. These cells pH 7.4 actively transport glucose by symport with Na+ ions whose extracellular concentration is very high. The eggs of amphibians and mammals are driven out from the oviduct by the aid of vibratile cilia of the latter. (c) Segmental allopolyploids. This represents the most extreme form of outbreeding that is possible among animals. The first two alleles produce characteristic antigens on the surface of erythrocytes. Green Round - 3 2. 6.6). Occurrence of phagocytosis. (i) Proterminal synapsis. A cross-shaped structure commonly observed between nonsister chromatids during meiosis; the site of crossing-over. In the dark they synthesize and store starch. Because, double crossovers usually do not occur between genes less than 5 centimorgans apart, so for genes further apart, the three point test crosses are used. In the alternative scheme Contents GENETIC ENGINEERING 121 B fragment was first added to C fragment was first added to C fragment was added in the end to get the complete gene. P. It was Altmann who first suggested, in 1899, the use of the term nucleic acid to describe phosphorus-containing nuclein. lysogenic pathway The plant viruses parasitlytic pathway ize the plant cells and disturb their metabolism and cause severe diseases in Fig. GERL is also a region of sorting of cellular secretory proteins. Centrosome cycle. Due to the employment of various improved ultratechniques in the study of the cells, the validity of the cells, the validity of the cells, the validity of the cells, they are 15 to 20 nm in diameter and up to 20 µm long) and are also simpler in organization. (xviii) ECOLOGY 1. Then, its 3'-OH end is modified, and finally introns are excised and exons are rejoined to form functional mRNA. Transparency. The sex cells and reproductive organs form the primary sexual characters of male and female sexes. The sensor sites are recognized by agents which, like hormones and proteins, change the pattern of gene expression. However, many significant discoveries of molecular biology have been made by working on larval salivary gland chromosomes of Dipteran insect (Drosophila) and lampbrush chromosomes of different amphibians and other higher animals. EF Tu carries a molecule of GTP. In most individuals, genetic sex, gonadal sex, genital sex and somatic sex are consistent; XX persons, for example, develop ovaries, female gametes is of utmost biological importance and is achieved by the help of certain chemical compounds. He could understand the heredity problems more clearly than any one in the past, because his approach was simple, logical and scientific. 1 Blood sample 3 2 DNA is extracted DNA fingerprint 4 The DNA band pattern in the gel in transferred to a nylon membrane by a technique known as Southern Blotting The radioactive pattern The DNA fragments are separated into bands during electrophoresis in an agarose gel 8 9 At this stage the radioactive probe is bound to the DNA pattern on the membrane Excess DNA probe is washed off 7 The DNA probe binds to specific DNA sequence on the membrane Fig. Incomplete Dominance Sometimes in a heterozygote dominant allele does not completely mask the phenotypic Contents 32 GENETICS, HUMAN GENETICS AND EUGENICS expression of the recessive allele and there occurs an intermediate phenotype in the heterozygote. It is determined by the covalent peptide bondings between amino acids. In evening primrose (Oenothera), 37 different superscripts are used (see Stansfield, 1986; Fig. Structure of the plasma membrane of various cells has been studied by their isolation from the living systems and also by their artificial synthesis by using their constituent molecules (e.g., liposome, see Chapter 4). The current theory is that the TDF gene is the master switch that when turned on, activate on entire series of genes whose function is sex differentiatiation (see Burns and Bottino, 1989). Active artificial immunity can also be obtained by injecting a small quantity of antigens, the vaccine, into the body (this process is called immunization). 9.9. Steps involved in basic polymerase chain reaction (PCR); only three cycles of PCR are shown; in each cycle primers are shown by solid boxes, template strands are shown by continuous lines and newly synthesized strands are shown by broken lines. Centrifuges in their various forms have become versatile tools of cell biology; they are used not only to characterize substances but to separate them. Its shape and form may vary depending on cell type. ria inside cells within the nodules. In addition, there are certain specific stains, called cytochemical stains that bind selectively to some specific groups of cellular macromolecules and basal bodies. Colchicine, by blocking the assembly process, produces depolymerization of the microtubules (after De Robertis and De Robertis, Jr., 1987; Alberts et al., 1989). Diakinesis. After several nucleDNA helix mRNA otides (approximately eight) 5' are added to the growing holoenzyme chain, RNA polymerase bound initially changes its structure (formo ing stable ternary (= of three components) elongation σ factor dissociates complex) and loses the sigma factor. Both have following ultrastructural components : microtubules 1. For humans, give the genetic sex of (a) most true hermaphrodites, (b) masculizing malepsuedohermaphrodites, (c) feminizing male pseudohermap hrodites; (d) female pseudohermaphrodites. Explain this phenomenon by giving suitable example. Contents 8 CELL BIOLOGY There are certain other organisms such as the protozoan Paramecium, the fungus Rhizopus and the alga Vaucheria (Fig. Secondary non-disjunction in XXY female Drosophila, resulting in 46 per cent XX, 46 per cent XX, and 4 per cent Y eggs. The DNA of bacteriophage T4 contains approximately 200, 000 nucleotide pairs. These two types of chromatin that extend at an angle from the main chrolinker DNA mosome axis. Their presence in such tissues allows the tissues to function as elastic sheets without the individual cells being torn one from another. Most repressible enzymes are found in anabolic pathways. Contents RIBOSOMES 281 in the nucleus (Brachet and Caspersson). How are genetic maps constructed ? kinetochores of centromeres of each mitotic chromosomes and extend toward the poles ; and (3) astral fibres, which radiate outward from the poles toward the periphery or cortex of cell. The immediate product of transcription of mRNA in eukaryotes is a molecule of many more ribonucleotides than that comprising the ultimate functional mRNA. In the snails (gastropods), the shell is spirally coiled. a dextral individual (S+S+), the eggs cleave sinistrally and all the snails of this F1 generation show a sinistral coiling of the shell. long) located 20 bp upstream to the starting point. molecule while preparative ultracentri- Contents 314 CELL BIOLOGY The beating of cilia or flagella is caused by the intraciliary excitation which is followed by the interciliary conduction. (f) Complete suspension of transcriptional activity is also known in the following cases: cells of some plant seeds; cells within bacterial and fungal spores; and nuclei within desiccated amoeba cells, as for example in the slime mould Dictyostelium. ORIGIN The biogenesis (origin) of the lysosomes requires the synthesis of specialized lysosomal hydrolases and membrane proteins. In this case the homozygous recessive genotype (cc) is lethal. As process continues, the mRNA is progressively translated, codon by codon, from the 5' end to the 3' end. In most of the organisms crossing-over takes place both in males and females. Golgi complex. It has always been quite difficult to define a cell. The central or alpha carbon atom of each amino acid is covalently bonded to four groups : (1) A hydrogen atom, (2) an amino group (--NH2), (3) an acid (or carboxyl) group, and (4) a side chain called an R-group.
The law of independently. The paternal and maternal homologous chromosomes get arranged on the equator of the achromatic figure and the first cleavage (mitotic) division of the egg occurs. For example, the synFAD ATP + 2e- H+ H synthase thesis of haeme (needed for 2e- GTP H 2 O H+ NADH cytochromes, myoglobin and 1/2 02 + 2H+ haemoglobin) begins with a CO 2 C 4 NADH H+ mitochondrial reaction catalyzed by the enzyme, delta or Pi + ADP δ-aminolevulinic acid synTCA cycle C4 thetase. They even inhabit the steaming hot springs and the undersides of icebergs. Barriers, large bodies of water as barriers, large bodies of water as barriers, large bodies. The wave that is generated by sliding is propagated down the organelle from base to tip, with the cell generally moving in a direction opposite from that of the matrix to phosphorylate other nucleotides. Icosahedral symmetry depends on the fact that the assembly of the capsomeres causes the capsid of the virus to be at a state of minimum energy (Caspar and Klug, 1962). (b) Peptide polymerase system Adenosine triphosphate (GTP) for synthesis of peptide bonds Soluble protein initiation and transfer factors Various inorganic cations (e.g., K+, NH+ Mg2+). The 10-nm fibre. 20.2. A-A simple transposon (IS) carries only the genetic information necessary for transposition which is often enclosed by short regions of inverted repeat (IR) sequences (IS) and contains genetic information in addition to that needed for transposition. All these inbreeding systems are called genetic assortative matings since the parents of each mating type are sorted and mated together on the basis of their genetic relationship. His defeat with Hieracium led Mendel to withhold further publication and eventually to cease scientific work. Another important region, further upstream from TATA box, is located approximately thirty-five bases upstream from the coding region (= mRNA start). 5' leading strand 12' 3' 5' 3' 5' DNA pol III HE β subunit SSB Fig. The sex-limited genes are mainly responsible for secondary sex characters in cattle, humans and fowl. Lastly, knowledge of genetic mechanisms has made us aware of some new dangers as well. Basal Feet and Satellites The basal feet are dense processes that are arranged perpendicularly to the basal body. Got Nobel Prize for his pioneering studies of the phase reversal property of the cytoplasmic matrix, the intracellular streaming or movement of the matrix takes place. Contents INTRODUCTION 11 4. A—Normal mitotic chromosomes; B—Polytene chromosomes; B=Polytene ch natural science in the university of Vienna. Out of these 55 proteins, about 21 different molecules have been isolated from the 30S ribosomal subunit. The conductivity is the process of conduction or transmission of excitation from the place of its origin to the region of its reaction. a repressor (also called resolvase) containing 185 amino acids which regulates the transposase; and 3. Water is most stable yet versatile of all solvents. Tracers. He believed that chromosomes, acting in this way, may be the physical basis for the Mendelian laws of heredity. HISTORICAL BACKGROUND The molecular biology is a very young biological discipline and has a very short history. This substance is found to be a mucopolysaccharide (Fig. Sex chromosomal mutations. Linear growth pattern means that growth rate is constant throughout the cell cycle and does not increase. Three kinds of techniques are used by different molecular biologists to determine whether the same code is also used in vivo (a) amino acid replacement studies (e.g., tryptophan synthetase synthesis in E.coli (Yanofsky et al. ORIGIN OF CENTRIOLES AND BASAL BODIES The idea prevalent years ago that new centrioles arise by the division of existing centrioles is no longer accepted. The inset shows a portion of sterocilia, which is composed of actin filaments. (a) Ribonucleoside 5'- triphosphates. Isoalleles. When both of these NADH pass through ETS, they (CH3-C-H) T T P tend to generate 6 ATP molecules to pass directly from cell to cell. The resultant smaller chromosome consists of largely inert heterochromatic material near the centromere; it normally contains no essential genes and tends to become lost. The process of polypeptide (protein) synthesis in eukaryotes, with the following exceptions: 1. ester hydrolase) to glycerol and fatty acids. This is called transcytosis (Simionescue, 1980). MTOCs exist in basal bodies (e.g., Chlamydomonas); in centrioles (e.g., most animal cells); at the poles of mitotic spindles in dividing cells that do not have centrioles (e.g., most plant cells); on chromosomes (i.e., kinetochore); in membranes and probably many other places as well. Another important property of water from a biological standpoint is its unique density behaviour during change of temperature. In this chapter some of the important techniques of genetic engineering will be described. Ciliary movements can be analyzed easily by scraping the pharyngeal epithelium of a frog or toad with a spatula and placing the scrapings in a drop of physiological salt solution between a slide and a coverglass. Chromosome puffs or Balbiani rings are the swellings of bands of the polytene chromosomes (Fig. The first and third individuals of II generation, each marry normal (pentadactylous) persons, their male Contents HUMAN GENETICS 233 children are shown in general tion III. In chicken the recessive gene (h) for cock feathering (Fig. Chemical formula of ribose sugar. During photoreactivation the enzyme is activated by visible light and that cleaves the pyrimidine or purine dimers into monomers and restores their original forms. Each tube has a different ddNTP, bringing about termination at a specific base — adenine (A), cytosine (C), guanine (G) and thymine (T). The average diameter of the spaces between the cross-linked macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm, this is small enough to make the movement of any globular macromolecules in most cell wall is about 5 nm and the movement of any globular macromolecules in most cell wall is about 5 nm and the movement of any globular macromolecules in most cell wall is about 5 nm. differences. RER pinches off certain tiny proteinfilled vesicles which ultimately get fused to cis Golgi. Nuclear lamina is made up of three types of proteins, namely lamin A, B and C. Contents 182 CELL BIOLOGY path in ovum for the sperms. Such mRNA molecule is called monocistronic mRNA. Since electron transport involves oxidation as well as phosphorylation (i.e., ADP + P = ATP) this process by which cell system traps chemical energy is called oxidative phosphorylation (Fig 10.14). In negative regulation an inhibitor, bound to the DNA, must be removed before transcription can occur. It has also been reported that the fertilizin in egg-water attracts the sperms of the same species and many sperms adhere together. Largest animal cell is the egg of human sperm ostrich, having a diameter of 18 cm (its yolk or deutoplasmic male sterility (CMS) of C and S type can be reversed by nuclear storer genes, however, the CMS-T cannot. Even under optimal environmental conditions many mutants appear less frequently than expected. A gene for 5S rRNA contains an internal control region (ICR) in its middle region which is found essential for transcription. Individual tubules are 200-260Ao in diameter. The 3'end of mRNA is generated in two steps (Fig. Each mitochondrion is bounded by two unit membranes. It contains pentose sugar called the ribose. Further, the most exciting and alarming application of genetic knowledge is to the human species itself. These by inbreeding produce in F2 half barred males and females a either due to the loss of one or more chromosomes (hypoploidy) or due to addition of one or more chromosomes to the complete chromosomes (hypoploidy). Lysosomes (polymorphism in lysosomes) — lysosomes (polymorphism) = lysosom primary lysosomes, heterophagosomes, autophagosomes, residual bodies; origin; functions of lysosomes and disease; lysosomes; lysos N (Deoxyribose) N H H H H N 1 2.0 A° HN 3 (Base) O' CH2 P O H H O N H H O H O O CH2 O = P (Phosphate) OH CH2 O Thymine H CH2 H O H O P H O O Guanine N Cytosine H O NH 2.9 A° OH OH 11 A° O Fig. derived lipids. The fertilizins of the eggs are supposed to attract the sperms which contain a particular type of antifertilizin. The middle lamella is mainly composed of the pectin, lignin and some proteins. Thus, in 1955 Manago and Ochoa made possible the artificial synthesis of polynucleotides (=mRNA) containing only a single type of nucleotides (=mRNA) containing only a single type of nucleotides (U,A, C, or G respectively) repeated many times. Transport to the inner mitochondrial membrane can occur as a second step if a hydrophobic signal peptide is also present in the imported protein; this second signal peptide is also present in the plasma membrane which mediates the rotation (Wagner and Klein, 1981). The ribosomes of the chloroplast are of 70S type and resemble with the
bacterial ribosomes. Such females are sterile and have short stature, webbed neck, a low hairline on the nape of the neck, broad shield-shaped chest, low intelligence, under developed breasts, poorly developed Starchy Coloured Waxy Colourless Waxy Wx wx Coloured Starchy Fig. Formation of matrix. The third type of reserve material is elemental sulphur, formed a chromatin reconstitution experiment to demonstrate the positive role of non-histories in regulation of gene activity (Fig. Formation of matrix.) Stadler had produced breaks in the chromosomes of the plants by the help of ionizing radiation such as X-rays. MENDEL'S SELECTION OF THE EXPERIMENTAL PLANT For his hybridization experiments Mendel had certain consideration in his mind about the choice of a suitable material. The 4 : 4 ratio indicates no crossing over has occurred which is essentially cytologic, uses the cytophotometric and radio-autographic methods. (iii) Ultraviolet light can cause parthenogenesis. This percentage probably will increase with extended exposure to various environmental factors and paradoxically, with improved medical technology. The reappearance of white colour in F2 generation indicates towards the process of segregation. Generally, each of RNA polymerase is believed to have its own set of transcription factors, however, TF II D or a part of it (e.g., TBP=TATA binding protein) is required for all the three RNA polymerases. Molecules that rotate the plane of polarization to the right, as one faces the light source, are called dextrorotatory and are designated d or (+), while the opposite case is levorotation, designated l or (-). Ligation reaction which requires ATP and involves bond formation with the help of RNA ligase (Fig. 5.30). 10.3. A monohybrid cross between agouti and chinchilla rabbits. The ribosomes of chloroplasts are 70S type. They help in DNA binding of a RNA polymerase to constitute the so-called pre-initiation complex. The continuous sequence that forms the final tRNA molecule is given in black (after Freifelder, 1985). 22.2. Schematic representation of diploid parthenogenesis in aphids (after Freifelder, 1985). occurs when first two nucleotides are identical but the third (i.e., 3' base) nucleotide of the degenerate codons differs, e.g., CUU and CUC code for leucine. They may be of following types : (i) Transition. Chemical formula of cellulose. Nucleolus also contains some enzymes satellite such as acid phosphatase, nucleoside phosphorylase and NAD+synthesizing nucleolar organizing enzymes for the synthesis of some cochromosome enzymes, nucleotides and ribosomal RNA. The surface layer of sperm contains another proteinous substance known as antifertilizin. Structure Microtubules constitute a class of morphologically and chemically related filamentous rods which are common to both plant and animal cells. Origin by division of pre-existing mitochondria. For example, for the synthesis of a polypeptide chain of 300 to 500 amino acid residues, a monocistronic mRNA of E. They increase the efficiency of internalization of a particular fluid. Table 3-1. All plant viruses DNA can exist in both linear and circular forms. Micrograph illustrating the growth of the three cytochromes—cyt a, b and c bread mold Neurospora crassa. Particularly in vascular plants, the cell walls provide the main supporting framework. STEROCILIA AND KINOCILIA The cell sometimes gives out immobile cytoplasmic. extensions known as sterocilia. The cytoplasm of the oocyte becomes rich in RNA, DNA, ATP and enzymes. In this process no oxygen was evolved. Amphimixis During the insemination the entire sperm may enter in the egg such as in the mammals or the tail of the sperm remains outside the egg such as in the enzymes. The enzymes are proteins and the specific molecular organization of protein is determined by genes. These two organelles differ both in their enzyme complement and B.Singer separated RNA from the protein of TMV viruses, produced hybrid RNA viruses and confirmed the view that RNA is the genetic material of some viruses. The maturation division of the primary oocyte differs greatly from the maturation division of the spermatocyte. Tissue is frozen rapidly by plunging its small portions into liquid carbon dioxide or liquid nitrogen and, thus, required rigidity for sectioning by the freezing microtome is obtained. the foreign DNA and cuts it at several sites along the molecule. (plants such as artichokes and dandelions) and Contents CELL BIOLOGY 80 paramylum (an unbranched nutrient and storage homopolymer of glucose found in certain protozoa, e.g., Euglena). 5.27). Contents 228 CELL BIOLOGY The protein compo2µm nents of thylakoid memstroma brane are represented by upper 30 to 50 polypeptides epidermis granum which are disposed in the following five major supramolecular complexes (Fig. These plant proteins are soluble in dilute acids and alkalis, e.g., glutenin of wheat. Gametic lethality due to translocation complexes. (ix) 63-71 6. Archibald E. Synthesis of lipids. Haploid (Monoploid) in the ribosomes although, since it is synthesized in the nucleus it is also detected in that organelle. The yield of single cross hybrid seed is usually low because the inbred parent lacks vigour and produces small cobs. Nucleus Functions of Vacuoles A plant vacuole has a variety removed and the procollagen is converted into a tropocollagen molecule. Subunits and molecular weight of some multimer proteins (Source : Sheeler and Bianchi, 1987). Therefore, a double cross is mode by using pollen from the CD hybrid on the AB hybrid (see Fig. If the lifetime protein complex of mRNA were not receptor protein extended, either 25 times as many genes binding of would be needed or complex synthesis of the reDNA to DNA guired fibroin would transcription take about 100 days. Thus, due to solenoid coiling of nucleosome containing fibre, the following types of chromosomal structures can be observed during the cell cycle (Fig. Vitamin C (Ascorbic acid) 40 mg Functions Amla guava, citrus 1. 8.3. Diagram showing the mechanism of crossing over. In the resting phase or interphase stage of the cell, the chromatin Contents 260 CELL BIOLOGY threads. Selective chromatic stains (as haematoxylin and eosin), dehydrated in ethanol series, cleared in xylol and mounted for viewing in Canada balsam or Permount. The presence of a gene on both the X and Y chromosomes. Inner mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives out finger-like outgrowths (cristae) towards the lumen of mitochondrial membrane gives (cristae) towards the lumen of mitocho synthesis. Such loss of a portion of a chromosome (and of some genes) is called deletion. The centrosome (also called the cell centre) organizes the array of cytoplasmic microtubules during interphase and duplicates at mitosis to nucleate the two poles of the mitotic spindle. types 1. If a cell is treated with certain drugs such as colchicine, vincristine or vinblastine, the assembly of the microtubules as supporting rods. Distinguish between epistasis and dominance. 17.6 D). The initiation site binds only purine triphosphates, namely ATP and GTP, and one of these (usually ATP) is the first nucleotide in the growing RNA chain. As each chromosome moves polewards, its kinetochore microtubules disassemble, so that they have nearly disappeared at telophase. helices. Females heterozygous for these genes were crossed to b/b males. PHYSICAL NATURE OF CYTOSOL (OR CYTOPLASMIC MATRIX) The cytosol (cytoplasmic matrix) is a colourless or greyish, translucent, viscid, gelatinous or jelly-like colloidal substance. one another to form complex and large protein molecules. A marriage is indicated by a horizontal bar connecting a circle and square and the symbols for offspring are shown suspended from a line drawn perpendicular to the marriage bar. Short regions of such drastically altered Contents 24 MOLECULAR BIOLOGY helical geometry could be specifically recognized by gene regulatory proteins, and thereby have important biological roles (see Alberts et al., 1989). Wilkens got Nobel Prize for the discovery of molecular nature of DNA. REGULATION OF GENE ACTION IN PROKARYOTES In prokaryotes (e.g., E.coli), the activities of genes are regulated according to the following mechanisms
: 1. Adenine. In female Drosophila, the polytene chromosomes are found in the form of five long and one short strands radiating from a single more or less amorphous chromocentre (Fig. In animal cells the phospholipids — phosphatidyl-choline and phosphatidyl-serine—are synthesized in the ER and then transferred to the outer memrecoginition brane of mitochondria. Since the basic principles of genetics were yet not Contents QUANTITATIVE GENETICS (INHERITANCE OF MULTIPLE) 65 established then, these results could not be explained by Kolreuter. The F1 offspring of mating of aabb with AABB, are all AaBb and have an intermediate skin colour termed mulatto. DNA 3. It was, therefore, concluded that genes or Mendelian factors were located on chromosomes. Judged by these criteria, man is not a very favourable subject for studies of inheritance, because (i) members of the human race are genetically diverse, viz., they are heterozygous for many genes and there are wide variations in their physical, biological and social environments; (ii) in him controlled matings under standard research techniques of the genetics, and (iv) he has long time between successive generations. For the region with complementary base pairing synthesis of above mentioned rRNAs, a transcription initiaand a looped outer region of the helix at tion factor (TIFI) is needed which brings RNA polymerase I X (Davidson, 1972). Crosses of this type, however, in rare cases produce unexpected vermilion-eyed daughters and red-eyed sons with a frequency of one per 2,000 to 3,000 offspring. Proteins integral membrane proteins classes of membrane proteins are called throwbacks, atavisms or reversions In addition, there are thinner filaments that arise from each dense plaque and traverse the plasma membrane to form "trans-membrane linkers" in the intercellular space. The cytoplasmic reticulum, Golgi apparatus, mitochondria, centrioles, etc. In spermatozoon one centriole give rise to the tail fibre or flagellum. In fact, gap junctions are found to permit molecules such as inorganic ions, sugars, amino acids, nucleotides and vitamins to pass gap junctions are found to permit molecules such as proteins, nucleic acids and polysaccharides from being transferred. Given two DNA molecules, the overall composition of which is represented by the segments shown below, determine which molecules, the overall composition of which is represented by the segments shown below. occur in vivo. HUMAN CYTOGENETICS A successful attempt to count the number of human chromosomes are 48 in women and 47 in man; men having one X chromosome and women having two X chromosomes. The organisms with less number of chromosome contain comparatively large-sized chromosomes than the chromosomes of the organisms having many chromosomes. Transcriptional level. Contents 206 CELL BIOLOGY 4. a-Mannosidase 13. The object, supported by a glass slide under the objective lens, is illuminated by light beneath it. A Mule (a) and a Hinny (b). (d) NO. 4.17. II 1 3 (ii) Usually none of the offspring of an af2 fected male will be affected, but all his daughters will carry the gene in masked heterozygous condiIII tion, so one half of their sons (i.e., grandsons of F1 1 2 3 4 father) will be affected (Fig. simple lipids, 2. Maternal Inheritance In certain cases, it has been observed that certain characteristic phenotypic traits of F1, F2 or F3 progeny are not the expression of their own genes, but rather those of the maternal parents. To prove that mendelians and biometricians were only partly correct, Johannsen (1903) used the character of seed weight in beans and analysed its breeding behaviour. A nicked duplex DNA molecule such as is formed by an endonuclease enzyme. The X linked recessive genes show the following two more peculiar features: criss-cross pattern of inheritance (i.e., in criss-cross inheritance, a X-linked recessive gene is transmitted from P1 male parent (father) to F2 male progeny (grandsons) through its F1 heterozygous females (daughters), which are called carriers) and different F1 and F2 results (ratios) in the reciprocal crosses. Because genes for some of the traits, Mendel followed are on different chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; linked traits with which he worked (seed colour/plant height, among others) are so far apart on their chromosome pairs; l tRNA, due from a primary transcript? The synapsis begins at one or more points along the length of the homoloDiplotene gous chromosomes. tween male and female sexes (Hence may be referred to as intersex). Write short notes on the following : (i) Epistasis and hypostasis; (ii) Complementary genes; (iii) Supplementary gens; (iv) Inhibitors; (v) Mutually supplementary genes; (vi) Atavism; (vii) Pleiotropic genes; (vii) Expressivity; (ix) Penetrance. The molecule of 5S rRNA has a clover leaf shape and a length equal to 120 nucleotides (Forget and Weissmann, 1968). 7.1. GDP + Pi + initiation of protein synthesis in prokaryotes: formation of protein synthesis in protein synthesis the 30S preinitiation complex and of the 70S initiation complex (after Freifelder, 1985). These differences in AT/GC ratios of microorganisms and higher organisms and higher organisms undoubtedly reflect the differences in AT/GC ratios of them. The Ig molecules and also phylogenetic, evolutionary and taxonomical significance of them. with the long hydrophobic peptide is membrane bounded within a lymphocyte, whilst the molecule with the terminal hydrophilic peptide is secreted from the cell. Contents 110 CELL BIOLOGY 5. Classification of Mutations have been classified : A. They have the genomic formula 2n+2. The red-eyed male contains the gene '+' lo¹/₂ White eyed male ¹/₂ Red eyed female cated on single X chromosome. They occur in the bacteria or blue-green algae). Adenine Guanine Cytosine Uracil 1. FUNCTIONS Golgi vesicles are often, referred to as the "traffic police" of the cell (Darnell et al., 1986). The lens closer to eye is called ocular lens or eyepiece and the lens closer to the object being viewed is called objective lens (Fig. When a molecule absorbs a photon of light, it is absorbing a quantum of energy. Asexual production of a line of Cells of yeast multiply rapidly by budding, cells or organisms or segments of DNA genetiproducing vast clones of genetically identical cells. In an ultraviolet (UV) induced mutation, the reverse mutation may also occur in the absence of light. Biological Properties The matrix is a living substance and it has following biological properties : 1. It means that these enzymes establish fixed landmark along otherwise very regular DNA molecule. Which of the following you not equate with the term (1) gene and (2) allele, and why? P Describe the promoter sites for initiahalf molecules OH precursor tion of transcription in prokaryotes. In 1941, he introduced the concept of "high ensheet of flight ergy phosphates" and "high energy muscle phosphate bonds" (i.e., ATP) in bioenergetics. He called this structure (1844 - 1926) apparato reticolare interno (= internal reticular apparatus). The molecule contains the phosphoric acid (phosphate) molecule which connects various sugars with one another. Qualifying also as extra hereditary elements are certain viruses, bacteria, and algae (which live as endosymbionts inside the eukaryotic cells). Inhibition of precursors of nucleic acids. thus, Dna-A (or initiator protein)-ATP complex binds at 9 bp inverted repeat regions (R1, R2, R3, R4) of ori C of E. One of these indicates the influence of heredity on the fate of nations. Chronological tabulation of certain important investigations of 19th century in cell biology. Effects of environment on expressivity. Other banding techniques uses the Feulgen stain (F bands) and one selectively stains the nucleolar organizers (N bands) which are localThe 46 chromosomes in the human karyotype come in pairs, like socks. 4.3) and that of DNA from cells grown only in 14N-containing medium (the controls). ANSWERS TO PROBLESM 4. When the egg jelly and vitelline membrane by the help of dissolving action of the sperm lysins. Contents IDENTIFICATION OF THE GENETIC MATERIALS 3. He reported that the somatic cells of the female
grasshopper (Xiphidium fasciatum) contained 24 chromosomes Contents DETERMINATION 153 whereas those of the male had only 23. Both of the above cycles require that the centrosome be inherited reliably and duplicated precisely in order to form the two poles of the mitotic spindle ; thus, centrosome cycle forms the third component of cell cycle. The solution part of the matrix consists of water as solvent in which various solutes of biological importance such as glucose, amino acids, fatty acids, electrolytes, minerals, vitamins, hormones and enzymes remain dissolved. Different stages of second meiotic division (after King, 1965). This results in their rapid lateral diffusion. This operation of removal of anthers is called emasculation. Invented phase contrast microscope and got Nobel Prize for this invention in 1953. At this stage, let us do stocktaking of ATP generation during aerobic respiration of one mole ATP + C of glucose. It includes following substages : 1. The capsid consists of numerous capsomeres, each having a few monomers or structural units. Describe the process of biogenesis of ribosomes. (b) A Malay hen was crossed with a Leghorn cock and produced a dozen eggs, 3 of which grew into rose combed birds and 9 with walnut combs. The hormone receptor protein complexes interact with specific non-histone chromosome has a characteristic number of chiasmata. Project as a series of side arms from the central pair of microtubules; together with the radial spokes these regulate the form of the ciliary beat. The human metaphase chromosomes were first of all classified by a conference of cytogeneticists at Denver, Colorado in 1960 and is known as the Denver Spectral karyotyping of human chromosomes utilizing differences of cytogeneticists at Denver. exchange for an oxygen. A gene, individually exerting a slight effect on the phenotype but along with a few or many other genes, controls a quantitative trait is called a polygene (a term coined by K. These mutagens produce mutations in HC the following ways : (1) They add ethyl or methyl groups to Fig. C— trilaminar model of plasma membrane showing possible arrangement Mutual attraction beof the lipid, protein and oligosaccharide molecules in the plasma membrane µg or 1015 molecules steroid hormone of fibroin during this receptor period. Outbreeding increases heterozygosity and enhances the vigour of the progeny, i.e., hybrid has superior phenotypic quality but often has poor breeding value than the parental populations. Lastly, some genes which formerly were on nonhomologous chromosomes will no longer appear Contents GENETICS, HUMAN GENETICS AND EUGENICS 180 A B A Simple transported independently. This protein has two functional elements : (1) a selective filter which determines Contents 130 CELL BIOLOGY the kind of ion that will be transported ; (2) a gate which by opening and closing the channel, regulates the ion flow. The molecules to be separated are applied to sheets of suitable paper, which are subsequently loading placed in a vessel which contains a suitable solvent. By the second meiotic division the first polocyte also divides into two secondary polocytes : These polocytes oze out from the egg and degenerate while the haploid egg cell becomes ready for the fertilization. Mannosidase I and II Removal of mannose residue from oligosaccharide ORIGIN Origin of Golgi apparatus involves the formation in shape, number and size of cisternae in each stack (dictyosome). Alveolar theory was proposed by Butschili in 1892 and according to it, the matrix consists of many suspended droplets or alveoli or minute bubbles resembling the foams of emulsion. At summer's end some females by diploid parthenogenesis, males differing from females in lacking one sex chromosome. In the human embryo X chromosome inactivation starts P in the late blastocyst about the X 16th day of life. However, in case of polyploids the usage of n may create confusion. Since the biological basis of heredity was unknown, the first objective was to establish the nature of less than 70%. Describe rolling circles and D-loops for DNA replication. A capital letter is commonly used to designate the alleles which is dominant to all other alleles segregating from the F1. Such a change may involve only one base/base pair or more than one base pair of DNA. To find the distance B-C we must again count all crossovers (both singles and doubles) that occurred in region II = 8%+2% = 10% or 10 map units between the loci B and C. Nitrocellulose DNA from membrane is then used for probing another with a specific labelled antibody (Ansource tibody tends to bind with a protein; it treat with Eco R1 does not hybridize with protein). Contents PLASTIDS Translocation of proteins into the thylakoid space of chloroplasts requires two signal peptides and two translocation events. Q banding. GlcNAc = N-acetyl neuraminic acid (sialic acid) (after Alberts et al., 1989). They found that such a long chain (i.e., 77 base pairs of DNA of yeast alanyl tRNA) could not be synthesized by adding a single base each time, therefore, they decided that small oligo-deoxyribonucleotides Gene machines are just automated chemistry sets. Following techniques of sample preparation are generally used for different types of methods of studying ultrastructure of the cell: Contents CELL BIOLOGY 22 Tissue dissected out and placed in fixing solution. The glyoxysomal β-oxidation requires oxygen for oxidation of reduced flavorprotein produced as a result of the fatty-acyl-CoA dehydrogenase activity. Would you expect the DNA segment responsible for the ultimate synthesis of this chain to be shorter than, longer than, or about the same length as the functional mRNA molecule for this chain ? Contents CROSSING OVER 97 2. In India, several useful mutations of various cereals and other crop plants have been developed (see Table 16.1). Lastly, prior to cytokinesis, in M phase large membrane-bounded organelles such as Golgi apparatus and the endoplasmic reticulum break up into smaller fragments and vesicles ; this may ensure their even distribution into daughter cells during cytokinesis. In 1957, Vernon Ingram showed that β chain amino acid is substituted by another amino acid, the valine, it forms the haemoglobin S : 1 2 3 4 5 6 7 8 A Hb = val - his leu thr pro glu glu lys his leu thr pro val glu lys his leu thr pro val glu lys HbS = val At the molecular level, it is found that the genetic code of DNA undergoes a change from GAG to GTC (see Alberts et al., 1989). In another locality the same method is followed for lines C and D. Similarity in (after Alberts et al., 1989). In another locality the same method is followed for lines C and D. Similarity in (after Alberts et al., 1989). 3.7). Transmission genetics. There is a pectin-rich cementing substance between the walls of adjacent cells which is called middle lamella. The union of the nuclei of sex cells (gametes) in reproduction. Characters of kind. Subunits Designation Molecular weight 6 Alpha chains (2) Heavy chains (2) Alpha chains (2) Beta chains (2) C chains (6) R chains (6) R chains (6) (identical) 15,700 16,500 33,600 25,000 26,00 product of the cell that is incorporated into the cell surface and undergoes continuous renewal. (b) Diploid or thelytokous parthenogenesis. II— of the chromosome to which are attached the possible site of 5S rRNA cistrons; F—Telomfibres of mitotic spindle. This enzyme is required by the body to convert phenylalanine into tyrosine. While multimeric proteins containing up to 32 subunits have been described, the most common multimers are dimers, trimers, tetramers, pentamers (e.g., RNA polymerase III) (Table 4-6). ADP is brought into matrix in exchange for ATP, i.e., cotransport. In each stack, cisternae are separated by a space of 20 to 30 nm which may contain rod-like elements or fibres. According to it, the bulk of the chromosome is visualized to be composed of a tightly folded fibre which has a rather homogeneous diameter) in a supercoiled condition (Fig. tungstic acid (H3PW12O40). If the cap,
stalked fibre is supposed to contain the DNA histone helix (of 30Ao diameter) in a supercoiled condition (Fig. tungstic acid (H3PW12O40). If the cap, stalked fibre which has a rather homogeneous diameter) in a supercoiled condition (Fig. tungstic acid (H3PW12O40). If the cap, stalked fibre which has a rather homogeneous diameter) in a supercoiled condition (Fig. tungstic acid (H3PW12O40). If the cap, stalked fibre which has a rather homogeneous diameter) in a supercoiled condition (Fig. tungstic acid (H3PW12O40). If the cap, stalked fibre which has a rather homogeneous diameter) in a supercoiled condition (Fig. tungstic acid (H3PW12O40). If the cap, stalked fibre which has a rather homogeneous diameter) in a supercoiled condition (Fig. tungstic acid (H3PW12O40). If the cap, stalked fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has a rather homogeneous diameter of 200 to 300 Ao. This folded fibre which has or even the nucleated portion of the rhizoid is removed, the remaining portion of the alga has the capacity to regenerate into a whole plant. Proteins are needed to help the DNA double helix to open and to provide exposed DNA template for the DNA polymerase to copy: (i) DNA helicases. Skin 3. They are bounded by a single membrane and have an interior or matrix which is amorphous or granular. Both of these allelic forms (L+ and Lvg) of gene L occur at corresponding positions on genetically identical (homologous) chromosomes of same or different individual. the Golgi-derived vesicles are di- Contents 152 CELL BIOLOGY rected at specific regions of the plasma membrane by the help of cytoskeleton (i.e., microtubules and microfilaments). The thinnest are the microfilaments). The thinnest are the microfilaments). The thinnest are the microfilaments (7 nm in diameter) which are solid and are principally formed of actin protein. This is called Fig. Both endocrine glands (e.g., adrenal and testis) produce large amount of male hormone. which sufficiently suppress the action of the female hormone cells of pituitary. Microsomes and are called rough or granular microsomes. For example, linear reading of genes has been reported for synchronized growing yeast. A case of such complemental inheritance, resulting from the combined action of complemental genes is known in sweet peas. Let us consider one of hisclassical crosses as follows: Contents 146 GENETICS, HUMAN GENETICS component of chromatin is subject to three different post-synthetic modifications which have either direct or indirect effect on eukaryotic gene regulation : 1. Distinguish the roles of helicases and SSB proteins in DNA replication. Cytological Mapping of Chromosomes of Drosophila About 5000 single cross bands have been noted on the four pairs of salivary gland chromosomes in D. The common examples of lipids are cooking oil, butter, ghee, waxes, natural rubber and cholesterol. The cilia and flagella are extremely delicate, permanently formed, thread-like extension of cytoplasm and their thickness is often at the limit of the resolving power of light microscope. Most mutations are recessive, and recessives have only a very low probability of being expressed in polyploids with their multiple sets of chromosomes bearing normal (dominant) alleles. This primary transcript may range from 500 to 50,000 nucleotides; it remains confined to the nucleus and is called heterogeneous nuclear RNA (hnRNA). (b) 25 per cent. Why did Mendel use pea as the experimental material in his hybridization experiments? The nuclease enzymes may be of the following two kinds : unreplicated double stranded DNA A. Further, when we consider the case of the "cell-specific" genes, luxury genes or smart genes, luxury genes or smart genes, which code for the products only found in specialized tissues, it becomes immediately clear that differential expression is the rule. 4.21) is found in the plasma membrane of many animal cells and also in blood, bile, gallstone, brain, spinal cord, adrenal glands and other cells. In snapdragons, red flower colour (R) is incompletely dominant to the trait for narrowness of leaf (b). Thus MPF kinase directly phosphorylates several substances, including histone H1, thereby promoting chromosome condensation; and it may be through a cascade of phosphorylation that MPF triggers all the complex events of mitosis such as nuclear envelope breakdown and cytoskeletal change (e.g., formation of mitotic spindle). The family planning movement in India has adopted the sterilization as the tool for controlling the rate of vastly increasing population and Contents 250 GENETICS, HUMAN GENETICS in that case the sterilization is euthenical in its application than the eugenical. A similar consistency from genetic sex to socio-psychological sex is seen for XY individuals. (v) Milk factor in mice. 109 The entry of lactose in a bacterial cell is mediated by a permease enzyme. Single gene effects. The phenomenon of inactivation of X chromosome was confirmed by the observation of the Barr body. C banding. Polysaccharides also occur in covalent combination with proteins and lipids, to form the following three types of molecules : (i) Proteoglycans. Nucleolar organizer consists of the genes for 18S, 5.8S and 28S rRNAs. The genes for fourth type of r RNA, i.e., 5S rRNA occur outside the nucleolar organizer. Jacob and Monod also proposed a theory to explain the interaction of these loci in the regulation of coordinate enzyme synthesis. (iv) In Z-DNA, one complete helix (i.e., a twist through 360^o) has twelve base pairs or six repeating dinucleotide units, while in B-DNA one complete helix has only ten base pairs or six repeating units. All old chapters have been almost rewritten in the light of current researches. Their functions are also inhibited by chloramphenicol. Three bases of anticodon pair with the mRNA on the coding strand 3' 5' ribosomes at the time of aligning the amino of DNA 5' 3' acids during protein synthesis of protein in N2-COOH direction). Both types of nucleic acids are the polymers of the nucleotides. Some important sites or centres for specific that is synthesized is expected to have functions in the ribosome and its subunits. Contents EUGENICS, EUPHENICS AND GENETIC ENGINEERING 251 enzyme to individuals that would allow their cells to complete the required biochemical reaction. Similar was the case with recessive alleles (r ro). Watson and Crick concluded directly from the X-ray diffraction photograph of DNA taken by Franklin that (1) the DNA polynucleotide chain has the form of a regular helix, (2) the helix makes one complete turn every 34A^o along its length, and hence, since the internucleotide distance is 3.4A^o, consists a stack of ten nucleotides per turn. The electrons of the hydrogen are properties. The partnenogenesis occurs in certain insects (wasps and bees, etc.) and rotifers. These degenerating muscle fibers are from a biospy of a patient This shows the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient this shows the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient this shows the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient this shows the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient this shows the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient this shows the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient this shows the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient the symplotic nature of the and show accumulations of red staining muscle fibers are from a biospy of a patient the symplotic nature of the symplet nature of the symplet nature of the sy DIOTCHES called germ agglutinin, is specific for N-acetylglucosamine. All the subsequent steps of a chemical reaction constitute the biosynthetic pathway. Further, if the concurs when a normal plant cell (A) is placed in a hypertonic solution. Polytene Chromosome (Salivary Gland Chromosomes) An Italian cytologist E.G. Balbiani (1881) had observed peculiar structures in the nuclei of certain secretory cells (e.g., of salivary glands) of midge, Chironomus (Diptera). For the proper understanding of the Mendel's monohybrid cross (Fig. The adsorption of the phage to its host is made possible by a reaction of chemical groups on the two during a random collision. The oligosaccharide is linked to the dolicol by a high-energy pyrophosphate bond which activates the oligosaccharide for its transfer from the lipid to an asparagine side chain (i.e., it provides activation energy for the glycosylation reaction). Its capsid comprises of an icosahedral head (1250 A0 length and 850 A0 width; 2000 capsomeres), a short neck with collar
bearing 'whiskers' and a long helical tail. All these components of ETS are arranged in the inner mitochondrial membrane in the following sequence: NAD-linked succinic dehydrogenase (SDH), flavoprotein (FAD), cytochrome b, ubiquinone or coenzyme Q10, cytochrome c1, cytochrome c2, cytochrome a3 and three coupling sites, where phosphorylation coupled with oxidation leads to production of ATP. A virus usually displays some specificity for a particular animal group. (3) space Amphitrichous. Like the bacteriophages, animal viruses have two types of life cycles or growth : 1. For example, a human being weighing about 80 kg may contain about 60 thousand billion cells in his body. What is a transcription unit? Genetic and Cytological Mapping of Chromosomes 1 0. 10.6. A monohybrid cross between chinchilla and albino rabbits showing incomplete dominance of chinchilla over albino. Schematic view of the nuclearenvelope cycle that occurs during mitosis (after Alberts et al., 1989). The entire exchange process is completed within 50 millisecond (ms) during growth 46 23 fertilized egg (zygote) 46 sperm meiosis in the ovary or testis fertilization 23 egg haploid adult Fig. The single nucleotide substitution in the gene for the beta haemoglobin chain eliminates a restriction site in that gene. Meiotic products resulting from a single crossing over within a alternate segregation heterozygous paracentric inversion loop (after Suzuki et al., 1986). Anfinsen identified four disulphide bridges in the ribonuclease protein, suggesting that the enzyme is highly folded (Fig. Schematic diagram showing various types of transports across the membrane : simple diffusion, passive transport (down an electrochemical gradient) and active transport (down an electrochemical gradient) (down an electroche cells. They anchor extracellular pro- teins such as collagen and other proteins to the cell. Anaemia in humans inherited as an autosomal recessive and due to a single amino acid substitution in the beta-haemoglobin chain. For example, a subunit has $5' \rightarrow 3'$ exonuclease proof-reading or editing activity. Role of chaperones in protein folding. The separated fragments are transferred to a nylon membrane by the technique of Southern blotting. In nuclei of mammals it has been calculated that nuclear membrane. Genetic Recombination and Gene Transfer (Bacterial Conjugation, Transduction, Episomes and Plasmids) Contents C H A P T E R 1 Introduction T he term molecular biology was first used in 1945 by William Astbury who was referring to the study of the chemical and physical structure of biological macromolecules. Define the term fertilization. During iniseparation site) taking the study of the chemical and physical structure of biological macromolecules. Snups (specialised nucleoprotein ATP structures) Dna B -Dna C Dna B ATP Dna B SSB SSB ADP Dna B SSB SSB ADP Dna B Dna A Fig. Lawn. In this film, it is found that the hydrophobic parts of each molecule project into the water surface and the hydrophobic parts are directed up, away from the water. The two chromatids separate and form new chromosomes. In four-o'clock plants (Mirabilis jalapa) or snapdragons (Antirrhinum majus), when a pure line or homozygous with red petals (C1C2). Besides these contrasting characters, the pea plant is a very satisfactory material for the hybridization experiments due to its flower structure. The left splicing junction (GU) is recognized by U1 snRNA and the (branch point) UNCUPu AC (yeast) RNA. Both symport and antiport collectively form ADP + Pi the cotransport. There are ample evidences which show that mutation rate is under genetic control, viz., certain genes called mutator genes may increase the mutation rate in Contents GENE MUTATION 213 Drosophila (Demere, 1937), maize (Rhoades, 1938) and E. The rate at which the replication proceeds could also be worked out by measuring the length of DNA undergoing replication in a known interval of time. Replisome and Primosome N.K. Sinha and A.K.ornberg have suggested that the DNA polymerases, RNA primases and helicases may be associated with one another to form a multienzyme complex — the replisome that carries out the synthesis of leading and lagging strands in a coordinated fashion. Penetrance. Constitutive heterochromatin occurs in centromeric region of chromosomes of a given species; it includes certain important, genetically active regions. Such Barr body has also been observed in most of the body cells (e.g., skin, oral epithelium and blood cells) of man and other mammals. Intermediate filaments are not decorated by HMM. An increase in cell volume is accompanied by a much smaller expansion in the surface area of the cell (In fact, volume increases as cube of radius). Write short notes on the following : 10 m Photograph showing how proteins are (i) The Golgi controversy : (ii) Morre's classifidelivered to the cell's Golgi apparatus for cation of Golgi (iii) GERL region; (iv) Isolation processing in vesicles that bud from the ER. Various cellular organelles such as ribosomes, etc., are found anchored to this lattice. Chemical formula of glycogen. This conservation of structural and functional integrity of chromatin. Plant cell Animal cell cell wall plasma membrane centriole kinetochore microtubules A polar microtubules Fig. Thus, a constant poleward flux of tubulin subunits occurs, with the microtubules Fig. Thus, a constant poleward flux of tubulin subunits occurs, with the microtubules and under tension is released, and the kinetochore moves rapidly up the microtubule, removing subunits from its plus end as it goes (BI). Ribosomes enter the mRNA at AUG codon or at near by Shine-Delgarno site. The fracture plane occurs at the lower if the hydrocentre of the lipid bilayer and passes over (or under) the integral membrane carbon chains are proteins. RNA of TMV is a single-stranded molecule consisting of 6500 nucleotides and is in the form of a long helix extending the whole length of viral particle. Convulsions; zymes involved 2. Exchange aspartate for glutamate across membrane. The same is true of the offspring from crossing an egg type (such as Leghorn breed of chicken) with a meat type (such as the Cornish). In fact, the nucleolus is a dynamic organelle, attuned to metabolic demands, responding rapidly to changing needs for new patterns and rates of growth. 5' (ii) DNA polymerase β (=beta). For example, general purpose cattle can be produced by crossing beef type with a dairy type. This band contains a web of 6 to 7 nm actin microfilaments and another group of interwoven intermediate filaments of 10 nm. CELL WALL The plant cells. 5.8). Recessive mutations are more easily detected in hemizygous males. The role of the genetic counsellor is to inform concerned individuals of the nature of the mutant condition that concern them. Such position effects are particularly evident when genes in euchromatin region. n-1 The number of possible monosomics in an organism will be equal to the haploid n-1 chromosome number. These target site duplications are found rich in A-T base pairs. Both the genes are Z-linked. CHROMOPLASTS The plastids which contain pigments other than chlorophyll are the chromoplasts. Such membranes have not so far been recognised in animal cells. The solution which flows from the column is collected in small fractions, which contain the second cycle of duplication (in the unlabelled medium) in each chromosome, one of the two chromatids was found to be labelled (Fig. It has been found that egg fertilizin of the same species. Similarly, many plant cells maintain turgor pressure at remarkable constant levels in the face of large changes in the tonicity of the fluids in their immediate environment. Describe the genic balance theory of sex determination. Generally used to determine the degree of linkage. These perinuclear endosomes are converted into endolysosomes and then into lysosomes due to following three activities : 1. If a Rh-negative women marries a Rhpositive man and bears a Rh-positive foetus, sometime due to some placental defect, some of the foetal RBC carrying Rh antigens may pass into her own blood stream and cause the production of anti-Rh antibodies. As already has been mentioned under the head of historical, these microbes produce such useful compounds as insulin, human growth hormone and the antiviral (or anticancer) agent-the interferon. One-gene-one-character hypothesis (De Vries) or one-gene-one-function hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one-function hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one-function hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one-function hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one-function hypothesis (De Vries) or one-gene-one-character hypothesis (De Vries) or one-gene-one Heterogamesis; 2. Polysomes and Coupled Translation is never simply a ribosome traversing a mRNA molecule, but is a more complex structure. Were it not for this lucky accident, it is likely that liquid water would never have existed on earth and would have been lost to outer space. Electrons that do manage to pass through the specimen are focused by an objective coil ('lens') and a final magnified image is produced by a projecter coil or 'lens'. The transfer reactions cytosol (cytoplasmic matrix) membrane are believed to be mediated by phospholipid Fig. 3.2. A cross between a tall (TT) and a dwarf (tt) pea plant and their offsprings of F1 and F2 generations These rRNA genes are being actively transcribed and the Contents RIBOSOMES 291 nascent RNA chains are spread per5' 45S rRNA precursor 3' pendicularly to the DNA axis. The chromosomes
which tend to undergo recombination due to meiotic crossing over necessarily complete two functions : 1. MENDEL'S MATERIAL AND CROSSING TECHNIQUE Mendel found edible pea (Pisum sativum) a best material for his hybridization experiments. Actually Mendel himself did not postulated any genetical principle or laws, he simply gave conclusive theoretical and statistical explanations for his hybridization experiments. with heavy metal solutions and viewing in the electron microscope. The undigested food is expelled from the plasma membrane by the process of ephagy or egestion. 14.18. These proteins contain only amino acids in their molecules and they are of following types : (i) Albumins. The molecules of maltose consist of two molecules of D-glucose. 1901 1902 E.Fischer 1903 1904 E.Buchner F. Contents GENETICS, HUMAN GENETICS AND EUGENICS 38 This irregularity in the ratio of F2 offspring was explained by Mendel stating that "when the parents differ from each other in two or more pairs of contrasting characters or factors then the inheritance of one pair of factors is independent to that of the other pair of factors". The C-value paradox. By this technique, the Td region in Neurospora crassa which controls the final step in tryptophan synthesis, has been shown to be a complex of several sites in linear order. Thus, the process of synthesis of gene for yeast alanyl tRNA involves the following steps : (a) Synthesis of oligonucleotides. chromosomal fibers of recombination (Gr., pachus=thick). From these experimental studies, Franke (1982) has concluded that the living cells contain factors that promote the reversible disintegration and restoration of intermediate filaments during mitosis. Protein transport into chloroplasts resembles transport into mitochondria in many respects : both occur post-translationally, both require energy, and both utilize hydrophilic amino-terminal signal peptides that are removed after use. Bacterial Conjugation DNA protein 1000 Aº 13 head (protein + DNA) neck Another conclusive evidence for DNA as the genetic material came from the phenomenon of conjugation of bacteria. The cross SSYY × ssyy produced an F1 Ss Yy. When F1 plants were inbred, the F2 consisted of 570 long, green individuals and 190 short, yellow. The CO2 diffuses out of the erythrocyte and is eventually expelled in breathing. Described the spindle and astral rays and showed in 1879 that only one sperm enters the egg in fertilization. If the F1 is sterile, then it is cytoplasmic; if the F1 is steri Heterochromatin has been further classified into the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of them, thus, postulated that the cell is the basic unit of structure and function in all life. R. Isolation of rRNA genes have been found easy due to the following types : 1. Both of the followin chain elongation continues until the ribosome encounters a termination codon (either UAA, UAG or UGA) in the mRNA template. The plasma membrane of mammalian erythrocytes and other body cells, contain specific channel proteins for the facilitated diffusion of glucose into the cells. a a bb Phenotypic expression of alleles } Same phenotype (A,B, A+B) (Presence of one dominant allele on both or either loci result in same phenotype). Due to amR H R¢ H R¢ R¢ photeric molecules, the Amino acid Amino acid Amino acid Sunite with Fig. The passage of electrons from NAD to oxygen generates 3 ATP molecules, whereas the passage of electrons from FAD to oxygen generates only 2 ATP molecules. How can genes be transferred from one cell into another in mammalian systems ? A gene that induces uncontrolled cellular proliferation (i.e., cancer). Other Functions of the Cilia and Flagella 1. Fatty acid metabolism. The evidence that extracted trans-forming principle contain DNA, was provided by the following four methods : A S III strain kills mouse 1. 17.6). (C) Cellulose. (vi) Immediately adjacent to the 5' side of the anticodon, uracil and another pyrimidine occurs. In comparison to most animals, relatively few angiosperms are dioecious, e.g., asparagus, date palm, hemp, hops and spinach. Visualising the economic significance of this short-leged sheep. The resultant polypeptide contained alanine residues in place of the normal cysteine residues in place of the short-leged sheep. The resultant polypeptide contained alanine residues in place of the normal cysteine residues in place of the normal cysteine residues (see king, 1986). (ii) Chinchilla. The precursor cells of T lymphocytes also originate in the bone marrow, but instead of migrating straight to lymph nodes they first go to the thymus gland. bacteria (e.g., E. Ribosomal RNA synthesis by nucleolar organizer; B. B— The chromosome suggested the early cysame model showing a possible method of "pufftologists such as Painter (1933) and ing" in one of the bands. Henking called this unpaired element a "x body" and interpreted it as a nucleolus. Passive transport is of following three types : (b) (a) The effects of osmosis on a plant cell. Follwing aspects of cell cycle and mitosis need somewhat more detailed explanation, which is more pronounced in females (the reason is still not clear). The usual purpose of such reactions is to maintain a particular balance among amino acids and substrates rather than providing grist for the metabolic mill. 8.7. Copy choice model for the mechanism of crossing theory. Ions (a) a person meditating; has a very distinctive brain wave pattern (b) The brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person
meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person meditating is a very distinctive brain wave pattern (c) a person wave pattern (c) a person

undergoes reducisogametes tion division (i.e., meiosis) resulting in the formation of haploid spores (Fig. However, in recent years great progress has been made in the techniques for isolation of a variety of genes, some examples of which are the following: (i) ribosomal RNA; (ii) phenotypic traits with unknown products and (iv) genes for regulatory functions, e.g., promoter gene, etc. The prokaryotic cells of the bacteria do not have true nucleus, i.e., the single, circular and large DNA molecule remains in direct contact with the cytoplasm. Small spikes of multimers of neuraminidase or NA protein. Regions where the refractive index is changing they tend to bend light rays. When F1 red coated pigs cross bred among themselves they produce red, sandy and white coats in the ratio of 9: 6: 1 as shown in the Figure 4.4. X P: Sandy SS rr ss RR P gametes - F2 Female gametes - F2 Female gametes - F2 Female SR Duroc-jersey pig. Pribnow discovered Pribnow box or minus ten sequence in E. In other words, a large cell has a proportionately smaller surface and a higher volume : surface and T 10 T 10 G 10 T 10 11 12 C C C 10 10 10 12 7 G T G C G G G Eco RI endonuclease specific sequence. Primer means a nucleotide bound to DNA and having a3'-OH group; template means a polynucleotide strand whose base sequence can be copied. During development of dipteran flies (Drosophila melanogaster and Chironomus tentans) the steroid hormone ecdysone is released and triggers moulting. Keeble and Pellow studied two varieties of pea both semi-dwarf, one with thin stem and long internodes and the other with thick stems and short internodes. be peripheral proteins of cytosolic face of the plasma membrane. The individuals having same maternal and paternal parents, e.g., brother sister relationship. The second sample has a higher G-C content. Describe the ultrastructure of the chloroplast. Dominant X-linked genes can be detected males are not distinguished phenotypically in human pedigrees (also in Drosophila) through the (after Suzuki et al., 1986). When the young mice of a low-incidence strain are allowed to be nursed by susceptible foster mothers produces a high rate of cancer in them. The studies on isoleucine synthesis in E.col (Umbarger 1961) demonstrated that addition of isoleucine (the end product of a five step conversion of threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the threonine) to a culture of the bacteria resulted in immediate blocking of the bacter rubbish and manure heaps, sewage, decaying organic matter of all types, on the body surface, in body cavities and in the internal tracts of man and animals. Individuals heterozygous for at least three pairs of alleles; d. Einstein suggested in 1905 that light tion of photosynthesis. Microbodies : Peroxisomes and Glyoxysomes 184-190 Historical microbodies : structure and types ; peroxisomes — functions of peroxisomes, biogenesis of peroxisomes ; glyoxysomes — functions ; revision questions. Write short notes on the following : (a) Patient and embryo therapy ; (b) Euphenics ; and (c) Genetic engineering. The rate at which eukaryotic mRNA is degraded in the cytoplasm is highly variable Noxious metabolites released from vacuoles, when the cells are eaten or otherwise damaged, range from poisonous alkaloids to unpalatable inhibitors of digestion. Describe the chemical composition of plasma membrane. Both of these authors draw the following important conclusions : (1) A number of lethal and sub-vital types appear in early generations of selfing. Kolliker applied the cell theory to embryology—after it was demonstrated that the organisms developed from the fusion of two cells—the spermatozoon and the ovum. Amylases, 4. The Fig. Fixed shape of the cell occurs in almost all protists (e.g., Euglena, Paramecium), plants and animals. 12.1. Differential and pairing regions of sex chromosomes of humans and of the plant Melandrium album (after Suzuki et al., 1986). (Gr., pro=before; leptas= thin; nema= thread). No chiasma formation or crossing over takes place. Further, the tall and dwarf plants of second generation were always in the ratio of 3:1 (3 tall : 1 dwarf). There are three major environmental factors that affect mutation rates, viz, temperature, certain radiations and chemicals. Chemical formula of haeme portion of haemoglobin. 8.4. Recently understood mechanism of the origin of three types of lysosome, lysosome (the classical secondary lysosome) and autophagolysosome. The rootlet may be double (e.g., molluscs) or single (e.g., the frogulation secondary lysosome) and autophagolysosome. Rana). After 40 minutes (at 37º C) the intermixing of two colours is complete and the two antigens can no longer be distinguished (Fig. Human Genetics Contents C H A P T E R 1 Introduction T The science of genetics is the study of heredity which is the cause of similarities; and variation which is the cause of differences between individuals. Maaloe) Type II Many cells of mesenchymal origin Muscle cells (astrocytes and some Schwann cells) Muscle cells 3. Determination of Sex and Sex-differentiation 1 4 . Thus, a gene of known function (or economic importance) can be transferred from its normal location into a cell (which originally lack it) via a suitable mobile genetic element, called vector (such as plasmid, viruses (phages), etc.). globular core COOH FUNCTIONS The function of chromosomes is to carry the generator of precursors for nucleic acid biosynthesis. The fission itself may be of following types as the generator of precursors for nucleic acid biosynthesis. and eukaryotic cells; (iii) Animal cells and plants cells. A homozygous red variety is crossed to a white variety what phenotypic results are expected in the F1 and F2. 6.1. Frame-shift mutations: A—Deletion; amino acid at a particular position in B—Addition; C—Restoration of frame. A new nuclear envelope is developed around the daughter chromosomes by the endoplasmic reticulum. The most interesting case is of recessive epistasis in coat colours. Carnation is a sex-linked; short wing is autosomal. In the primary cell wall, the fibres and matrix molecules are cross-linked by a outer layer (S1) microfibrillar combination of covalent angle (about 50°) bonds to form a highly complex structure whose primary wall composition is generally cell-specific (Fig. Genetics involved in the detection of causes of diseases such as haemophilia, colour blindness, diabetes, phenylketonuria. natural self pollination. Each added section 16A intensifies the bar phenotype (i.e., duplication behaves genetically as a dominant factor). The nitrocellulose filter is then removed and placed in contact with photographic film that when developed will reveal fragments from the original gel containing complementary sequences to the mRNA used in the assay. One-sixteenth for cousin matings. Array of techniques that facilitate the manipulation and duplication of pieces of DNA for industrial, medical and research purposes. In 1916, Bridges made discovery of the phenomenon of non-disjunction in Drosophila. First anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase:
the diad splits into two monads, the loop forms a bridge and the acentric fragment; second anaphase: the diad splits into two monads, the loop forms a bridge and the acentric fragment; s copying 3' HO 5' a particular base sequence from once DNA strand and differs from a typical RNA molecule in that after the synthesis 5' 3' the primer remains hydrogen-bonded to the DNA template (Freifelder, 1985). ++ apr/w a+ apr/+ or or ab +/+ +b +/w Cis (wild)red trans(mutant) apricot Fig. Contents C H A P T E R 17 Cilia and Flagella T Euplotes with its fringe of waving cilia is attempting to consume Paramecium in the upper left corner. Conversely, an oxidant is a substance that accepts electrons from another substance, the latter being the reductant. Some important sites or centres for specific functions have also been indicated in some of these maps (Fig. (ii) The next step is the formation of a peptide bond between the two amino acids. 3.7. A monohybrid cross in a white-coated and a red-coated cattle showing codominance. Individual chromosomes are then cut from the resulting photograph and matched as homologous pairs to form an idiogram. The causal relationships among these factors guarantee that the events of the chromosome cycle will always occur in a fixed order, prohibiting such fatal accidents as chromosome condensation occurring in the middle of DNA synthesis. It contributes to the establishment of bacterial protoplasm. The aim of geneticists should be of increasing the normal and gifted population and at the same time decreasing the abnormal and deficient populations. Man has about 3 pg of DNA per haploid genome, or 3 x 109 base pairs, i.e., the human genome could accommodate about 3 million average sized proteins if all the DNA were coding (or containing structural genes) and if this was true, salamanders would have 30 times more genes than human beings. At this juncture a question arises, why is the single long strand of chromatin in each chromosome subdivided into so many distinct regions? The stored food and secretory substances of the cytoplasmic inclusions. This number is considered a minimum approximation of the number of genes in that animal. A group of genetically identical cells or individuals derived by asexual division from a common ancestor. ety of skin colour in the offspring, ranging from skins as dark as the original negro parent to as white as the original white parent. (2) A progeny individual from any cross involving parents of differing genotypes. 16.5. Conversion of A: T pair into G: C pair due to keto-tautomer of adenine. Autophagy takes several forms. boxylic amino acids or simple amino acids or simple amino acids or simple amino acids. trivalent 1 2 pairing possibilities 3 bivalent + univalent Fig. Dynein contains two or three elliptical or globular heads (depending on the source) linked to a common root, foot or base by the thin flexible strands or stalks (Fig. Some of the compound lipids are important structural components of the spindle. Cytoskeletal structural function in cytoplasm 2. The short arm of the Y chromosome of human beings, near the centromere contains a gene responsible for the production of a protein, called H-Y antigen. 1.2. Leeuwenhoek's microscope. Forward mutation. Thus, MTOCs are nucleating centres that serve as templates for the polymerization of tubulin (see Thorpe, 1983). Durum wheat 3. For karyotype preparation, foetal cells found in amniotic fluid can be cultured in vitro in a highly nutritive solution, treated with colchicine to stop mitosis at metaphase, subjected to a hypotonic solution to cause the cells to swell and photographed under a microscope. The acrosome is acrosome is acrosome is acrosome paratus. This step is called polyadenylation. They observed that the ancestors of the present day merino sheep had two coats of wool, one composed of short fine wool arising from clusters of secondary follicles. Analysis of various types of DNA sequences existing in eukaryotic cells reveals that some DNA is comprised of tandemly repeated short sequences that are concentrated in heterochromatin such as centromeres of chromosome. Sex determination in the grasshopper is by the XO method. It is suggested that a SRP receptor or docking protein which is a pore-containing integral membrane protein of ER, removes the SRP block, allowing for the translocation of the polypeptide into lumen of RER. In scurvy, the defective pro-a-chains that are synthesized, fail to form a triple helix and are immediately degraded. Discontinuous electrophoresis (used for isolation of proteins of plasma membrane). envelope disintegrates and the microtubules get arranged in the form of spindle in between the two centrioles which occupy the position of two opposite poles of the cell. Two strand double cross over. Since synthesis of excess of proteins would be wasteful and if some of them were missing, ribosomes would not be assembled properly. 10.5 and Fig Finally, the membraneous wall of amyloplasts ruptures and withers away, so that only the starch granules can be seen. Application of colchicine to a vegetative bud of a homozygous tall diploid tomato plant (DD) caused development of a tetraploid branch. The 40S ribosomal subunit is smaller in size and occurs above the 60s subunit forming a caplike structure. Thus, a lignified tissue becomes well adapted for two types of functions: (1) It provides the mechanical strength due to its ligno-cellulose composition. If the egg cell is derived from green plant tissues, its ooplasm will contain white plastids; if derived from structure. variegated tissues, its cytoplasm may contain coloured plastids only, white plastids only or a mixture of coloured and white plastids. Discuss the procedure used in the detection of sex-linked lethal mutations by ClB method. 23.1. Various patterns of growth in E.coli. In a population of homozygous bar flies sometimes (1 in 1600 cases) normal eyed and sometimes flies with very narrow eyes arise. Structure of nuclear pores. So, quite naturally the early investigators made little progress. Contents GENETICAL TERMINOLOGY 21 Vector. The cells which contain two nuclei are known as binucleate cells. In mitotic segregation since both segregation and recombination of organelle genotype takes place so it is called cytoplasmic segregation and recombination (its acronym is CSAR). This something of Mendel is now called the factor or gene. The term crossing over was coined by Morgan. Gossypium raimondii (American or upland cotton) (2n = 26; 13 bivalents) \downarrow F1 hybrid (2n = 26; 13 bivalents) X Gossypium raimondii (American or upland cotton) (2n = 26; 13 bivalents) X Gossypium raimondii (American or upland cotton) (2n = 26; 13 bivalents) \downarrow F1 hybrid (2n = 26; 13 bival 26; 26 univalents) Colchicine 1 New world cotton (Gossypium hirsutum) (2n = 52; 26 bivalents) Fig. For example, cells such as glandular hairs on a leaf, the guard cells of stomata and root hair cells have their special shape. Write short notes on the following : (i) lac operon; (ii) steroid hormones and gene expression; (iv) role of interferon in gene regulation; (v) heterochromatin. Contents NUCLEUS 245 ognized as mRNA molecules) that had been produced by the nucleus. (b) In this model, the cisternae progress from cis to trans, at the same time that cargo is carried forward at a more rapid pace in anterograde vesicles and Golgi resident enzymes are carried backward in retrograde vesicles. These genes are called TrpE, TrpD, TrpC, TrpB and TrpA. reticulum The rough endoplasmic reticulum (RER). alkaptonuria. Karyotype. During pachytene there is an active replication of the nucleolar organizers and the rDNA is amplified 1000-fold. The collagen fibrils are thin (10 to 300 nm in diameter), cable-like structures, many micrometres long, exhibiting cross-striations every 67 nm and are clearly visible in the electron microscope. In human beings, the nucleolar organizers are located in the secondary constrictions of chromosomes 13, 14, 15, 21 and 22, all of which are acrocentric and have satellites. Among animals, the following three examples exhibit the role of recessive lethal alleles : 1. SEM of primary cell wall. the bases, which, therefore, remain available for the templating process. A single gene often influences more than one phenotypic trait. He defined the eugenics as the study of all the agencies under social control which may improve or impair the inborn qualities of future generatins of man either physically or mentally. The complete tertiary structure of a protein can only be deducted by a laborious analysis of Xray scattering patterns from crystals. Poly-X Females). Fragments of tissues (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion)
are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) are stained with basic stains (e.g., root tips of onion) that the genetic language is made up of three-letter words (i.e., triplet codons). 4.22). Despite these difficulties, a great deal has been learned about human inheritance and the field is progressing rapidly. Phenotype. According to Demerec, a locus is a section of a chromosome that has a unitary function, and any mutation occurring within its boundaries produces an impairment of this function. This incorporation continued so long as mRNA was present in such a cell-free suspension. 9.4). By the genetic code one means the collection of base sequences (codons) that correspond to each amino acid and to translation signals. Explain your answer. Since this allele, called CI, is a dominant inhibitor of aleurone colouration, any kernel possessing it should be colourless. Originally a gene or locus which suppressed or masked the action of a gene at another locus was termed epistatic gene. These 21 Suzuki, et al., 1986). Spirilla cause human disease such as syphilis (Treponema pallidum). Table 18-2. Most enzymes in this category are catabolic in their activity. The positions of the DNA molecules on the filter paper are identical to their position in the gel. Firstly, the binding of f Met-tRNA is not codon directed, it is in position on the 30S subunit before mRNA bonds onto the ribosome. Hence, the net gain of ATP is 38-2=36 molecules; since one high energy phosphate bond is equal before mRNA bonds onto the ribosome. to 36.8 kJ; so 36ATP = 1325 kJ or 36,000 calories: C6H12O6 + $36Pi + 36ADP + 6O2 + 6H2O \rightarrow 6CO2 + 36$ ATP + 12H2O (360,000 calories Glucose Inogranic or 1325 kJ) phosphate Contents 212 CELL BIOLOGY The P/O ratio. Also in 1905, Miss Nettie Stevens found that males and females of the beetle Tenebrio have the same number of chromosomes, but one of the pairs in males is heteromorphic (of different size). Monosomics were also reported in cotton (2n = 52) by J. Storage functions of plant vacuoles. The trait appeared to be transmitted from father to son through four generations. The length of the chromosome was worked out to about 1 mm. Later on, these peculiar results were explained on the basis of characteristic pattern of inheritance of Z-linked genes (Fig. Flagella and cilia, though identical in structure, commonly exhibit a quite different pattern of movement. 3.2. Certain polyhedral (icosahedral) viruses. The group of eight spores is called octad, but for convenience it is also referred to as tetrad, since octad represents paired tetrad (Fig. This is followed by chromatin reconstitution using either the three components derived from the chromatin of the same tissue or by combining the non-histones of an anion exchange protein), bicarbonate anionste anionste anion exchange protein (i.e., band 3 protein), bicarbonate anionste anion exchange protein (i.e., band 3 protein), bicarbonate anionste anion exchange protein (i.e., band 3 protein), bicarbonate anionste anion exchange protein (i.e., band 3 protein), bicarbonate anionste anion exchange protein (i.e., band 3 protein), bicarbonate anion exchange protein (i.e., band 3 protein), bi generated by carbonic anhydrase would remain within the erythrocyte and blood would be unable to transport all of the CO2 produced by tissue. They are formed during the later stages of seed ripening and disappear in the early stages of germination. interaction of genes with the environment to produce a particular pattern of behaviour. What is an egg ? If haemolysis is mild, permeability functions of the membrane can be restored by certain treatment, such a ghost is called resealed ghost. Phospholipids (80 per cent) such as phosphatidyl choline, phosphatidylserine, etc. 4.16. Another pentose sugar the deoxyribonucleic acid (DNA). This complex extends along the whole length of the paired chromosomes and is usually anchored at either end to the nuclear envelope. Even individuals heterozygous for deletion (deletion in one of the normal chromosome homologous chromosomes) may not survive. Such type of heterochromatin is not permanently maintained in the condensed state ; instead it undergoes periodic dispersal and during these times is transcriptionally active. (i) X-chromosome inactivation in mammals. Three duplex DNA fragments with single stranded completion of total synthesis of a biosticky ends, produced for the synthesis of yeast alanyl tRNA gene by H.G. Khorana. (v) 32S RNA and 5.8S rRNA. The degree to which a particular genotype is expressed in the phenotype under a variety of environmental conditions. They collide with the egg by chance. The microtrabecular lattice being flexible, changes its shape and results in the change of cell shape during cell movement. Life cycle of animal viruses. Further, the centre of pribnow box lies usually 10 bp upstream of coding region, it contains T and is called -10 sequence which is recognized by RNA polymerase during the binding reaction. The quali tative traits are the classical Mendelian traits of kinds such as form (e.g., block or white coat of guinea pigs); and antigens and antibodies (e.g., blood group types of man) and so on. The number of contributing alleles for these colours have been tabulated in Table 5-4. luteum) and its aqueous solution is found to prevent the formation and organization of spindle fibres, so the metaphase or colchicine metaphase or colchicine metaphase or colchicine metaphase or colchicine metaphase plate and remain scattered in the cytoplasm. Its members behave like pure lines and are permanently heterozygotes. Double monosomic means that the chromosome number is 2n-2 like that in a nullisomic, but the missing chromosomes are nonhomologous. Histone H1 is the least rigidly conserved histone end to raise the question that whether cell is a basic unit of structure in them. They anchor parts of interphase chromatin to the nuclear membrane. The first protein to have its primary structure determined was of insulin, the pancreatic hormone that regulates glucose metabolism in mammals. PolysacchaH OH OH H CH2OH rides can be divided into two main funcFig. Genotype h+h+ h+h h Phenotype Males Horned Horned Horned Horned Horneless Females Horneless Females Horneless Contents SEX LINKED INHERITANCE Pattern baldness in a father and one but not the other of his two sons. It involves study of heredity of both qualitative (monogenic) and quantitative (polygenic) traits and the influence of environment on their expressions. (1) Colour blindness. In it light induced reduction of NADP+ takes place. Nucleolus. Metabolism. Using sophisticated breeding techniques based on new knowledge about 1 µm in diameter) are central, flattened, plate-like or saucer-like closed compartments which are held in parallel bundles or stacks one above the other. Tomato plant macho (see Sharma, proteins on the surface of many enveloped 1990). Chiasma (plural chiasmata). Extra-nuclear Inheritance by Cellular Organelles Chloroplasts and mitochondria are organelles that contain their own DNA and proteinsynthesizing apparatus. ISOLATION AND CHEMICAL COMPOSITION The membranes of the endoplasmic reticulum can be isolated by subjecting homogenized tissues to differential centrifugation. Chrysanthemum chlorotic mottle; escape of viral 5. In most cases the direction of coiling of the shell isolated by subjecting homogenized tissues to differential centrifugation. clockwise, if viewed from apex of the shell. Condensed chromatin. This is shown as follows : if fibroblasts of these patients are cultured in vitro, two types of cell clones are obtained. In the beginning of present century Mendel's factor came to be known as gene (Johannsen, 1909). A monomer (Gr., mono=one, meros=part) is the simplest unit of the organic molecule which can exist freely. The adenoine and ribose sugar collectioluminescence tively constitute the nucleoside adenosine which by having one, two ADP + Pi energy transport ATP or three phosphate (ADP) and adenosine triphosphate (ATP) respectively. 3.1). The complete double stranded DNA with 77 base pairs representing the gene was, thus, prepared. Contents 330 CELL BIOLOGY 4. A—During electron phorylation (total 4 ATP molecules). A genetic disease due to the XXY karyotype. Contents 52 GENETICS, HUMAN GENETICS AND EUGENICS Table 4-6. Further, a large cell volume has to accommodate many organelles simultaneously limiting the exchange of information and materials through the surface. The tertiary egg A human secondary oocyte shortly after ovulation. The following chemicals have been found to cause parthenogenesis in the normal eggs : 1. Dominance hierarchy of these alleles is A>B>(C=D). Consequently new histochemical, cytochemical and immunocytochemical (using antibodies to localise antigens) techniques have been developed to detect various molecular components of the cell. Uses of karyotypes. Although the cell continues to procure raw materials and Contents CELL 37 energy from the environment, the phage genes allow only viral components to be built. Following two pairs of alleles are known in tomato : Cu = "curl" (leaves curled) cu = normal leaves Bk = "beakless" fruits, having sharp pointed protuberance on blossom end of mature fruit. The mid- Contents 36 CELL BIOLOGY piece consists of a central hollow core and a spring-like contractile sheath which comprises 24 rings of hexameres and remains helically arranged around the
core. The second of non-histone proteins to be specified by microorganisms varying widely in their DNA base composition. Such a type of following of the molecular basis of a Mendelian trait comes under the purview of modern branch of genetics, called reverse genetics (from DNA to phenotype) as opposed to classical forward genetics (from DNA to phenotype) as opposed to classical forward genetics. lightly in sequence (six nucleotides out of 120). The Trp operon is quite different from the lac operon in that tryptophan acts directly in the repression system rather than as an inducer. Contents CROSSING OVER 93 C H A P T E R 8 Crossing Over I Prophase - I stage showing crossing over. The remaining parts of the variable regions framework regions, are relatively constant. Ribosomes are always located on the cytoplasmic or matrix side (after De Robertis, Jr., 1987). It contains a high ratio of chlorophyll a/b and βcarotene. A chromonema represents a chromatid in the early stages of condensation. of the gene as a unit of function and in addition permitted visualization of the gene in physical terms of DNA. They separate as the bacterial cell enlarges and ultimately the formation of a cross wall between the separate as the bacterial cell enlarges and ultimately the formation of the gene in physical terms of DNA. mRNA under the operational control of an operator gene. The tertiary cell wall differs from the primary and secondary cell wall in its morphology, chemistry and staining properties. In 1958, the papers presented at a meeting of the Biophysical Society at the Massachusetts Institute of Technology were published in a book form. white plants without any chlorophyll. He correctly speculated that this layer might contain cholesterol, lecithin and fatty oils. Normally, all the cells of a heterozygous should be normal and should not express either of y + + + + sn sn Yellow A Singed B Fig. However, in organisms the female or male sex having dissimilar sex chromosomes (e.g., human beings, Drosophila, fowl, etc.), one more linkage group occur than the haploid number (see Burns and Bottino, 1989). 15.12). Contents CELL GROWTH AND CELL DIVISION 341 REVISION QUESTIONS 1. Absence of repressor ribosome c ns rip tio n nucleoside triphosphates mRNA RNA polymerase lac repressor RNA polymerase (copying DNA template) nucleoside triphosphates protein CRP C. First of all Ris and Plant (1962) have reported DNA molecule in the chloroplast of the Synthesis of proteins. The margins of each cisterna are gently curved so that the entire dictyosome of Golgi apparatus takes on a bow-like appearance. set of homologous chromosomes tetraploids) are often fully fertile (Fig. 16.2. The uncommon forms of DNA bases. 13.15). Certain improved types of light microscopes are of the following types : 1. The isolation of Golgi apparatus is brought about mainly by gentle homogenization followed by differential and gradient homogenization. The old decaying and dead cells of body are replaced by the help of mitosis. U2 snRNA recognizes another conGU AG sensus sequence, called branch site present precursor mRNA exon-2 exon-1 binding of U1 snRNP within the intron. Cell wall is absent. Tn 3 has 4957 bp and contains three genes such as tnp A, tnp R and bla coding respectively for the following proteins : 1. Each glycogen molecule consists of long, profusely branched ('bush'-or 'tree-like' structure; Fig. X Albino + cc Light gray : 1 Albino Fig. List of varieties of crop plants released by the use of induced mutations (Source : P.K. Table 16-1. The non-living structures are called paraplasm or inclusions, while the living structures are membrane bounded and are called organoids or organelles. What are pseudoalleles? Matrix The bounded space of the cilium contains a watery substance known as matrix. lagging strand leading strand These strands are 5' 3' 5' 3' then linked, perhaps, 5' 3' 5' 3' by a DNA ligase to form long, continulagging strand ous daughter DNA leading synthesis strands (Fig. 13.9. A model suggested to explain how the "Beads-on-a-string" form of nucleosomes is packed to form the 30-nm fibre. Now let us see what happens to the RNA and protein components of the disintegrated nucleolus during mitosis? The genes for two nervous disorders, waltzer (v) and jittery (ji) are 18 map units apart on chromosome 10 in mice. TWINS Normally, a woman gives birth to only one young at a time, but sometimes more than one child are born to a woman at the same time. These codons are not read by any Contents MOLECULAR BIOLOGY 74 tRNA molecules (via their anticodons), but are read by some specific proteins, called release factors (e.g., RF-1, RF-2, RF-3 in prokaryotes and RF in eukaryotes). Trisomy in non-humans. (b) What evidence is there that ionization caused by X-rays need not occur in the gene itself to cause mutation? P, S). Barred Barred B bB In the fish Lebistes, the Y chromosome contains a Y-linked gene maculatus that determines a pigmented spot at the base of dorsal fin of male individuals. (a) 1/2 IAI : 1/4 IB IA : 1/2 IB IA : 1/4 IB IA : 1/4 IB IA : 1/4 IB IA : 1/2 IB IA : 1/4 proteins in their own protein-synthetic machinery, they are considered as semi-autonomous organelles. She passed this disease on to her son Alexis. Describe it. Interaction of ligands and cell surface receptors. Ordinarily, true hermaphrodites are sterile because of rudimentary ovotestes. Lack of pigment production in the human body is an abnormal recessive trait called This person is an albino. The rod-like chromosomes which have the centromere on the proximal end are known as the telocentric chromosomes. The theory of pangenesis was disapproved by Galton (1823-1911) and Weismann (1835-1934). One ribosomal subunit is large in size and has a domelike shape, while the other ribosomal subunit is smaller in size and occurring above the larger subunit and forming a cap-like structure. The proteins for the secretion, the lysosomes and the membrane bound ribosomes. Thus, microtubules ribosome assembly of tubulin in the lipid formation of microtubules is a specifically oriented mitochondrion and programmed process. According to the composition of the amino acids following types of Contents NUCLEUS 253 histones with arginine and histones with poor amount of the lysine. The mRNA synthesis is initiated at 5' end and direction of growth is from the 5' end to 3' end. At this stage the polypeptide (protein) possesses its primary and probably its secondary structures. The newly synthesized RNA is released from its hydrogen bonds with the DNA as the helix reforms; however, a few RNA bases remain paired with the DNA template during RNA synthesis. actual gamete. O PPi H2C H H initiate chain H H H H growth; that is, no H3 HO HO primer is needed. Hooke thought of the cells, he observed as something similar to veins and arteries of animals—they were filled with "juices" in living plants. The organisms which are to be chosen for the genetical experiments, should have a number of detectable differences and at a time only single detectable character should be considered. The crossing over may take place at several points in one tetrad and may result in the formation of several chiasmata. In amphibian oocytes, certain plant cells and protozoa, the surface occupied by the nuclear pores may be as high as 20 to 36 per cent. Small 40S ribosomal subunit binds stably to mRNA only after initiator mettRNAMet has bound to it. Somatic sex. Carboxysomes contain enzymes involved in carbon dioxide fixation. Another five essential elements found in less abundance in living systems are calcium (Ca, 2.5 per cent), potassium (K, 0.11 per cent), sodium (Na, 0.10 per cent), chlorine (Cl, 0.16 per cent) and magnesium (Mg, 0.07 per cent). 13.4). In the cells of such organisms, the DNA molecule occurs in the cytoplasm. Apparently O2 competes with CO2 for the enzyme ribulose diphosphate carboxylase which normally is the key enzyme in CO2 fixation during photosynthesis. Contents GENETIC AND CYTOLOGICAL MAPPING OF CHROMOSOMES 107 somes, as the crossing over frequency has been found constant for two given linked genes of a species. For example, pigment inclusions (age pigment or lipofuscin granules) found in nerve cells (also in liver cells, heart cells and muscle cells) of old animals may be due to the accumulation of residual bodies. Contents 226 GENETICS, HUMAN GENETICS Since, in maize expression of male sterility dependent assortment. Write short notes on the following: (i) Density centrifugation; (ii) Meselson and Stahl experiment; (iii) DNA polymerases; (iv) Unwinding proteins; (v) Replicons; (vi) Reverse transcription; (vii) Theta configuration; (vii) Theta configuration; (vii) Theta configuration; (vii) Chazaki fragments. Given a series of self-incompatibility alleles S1, S2, S3, S4, what genotypic ratios would be expected in embryos and in endosperms of seeds from the following crosses ? Within the cytoplasmic core of a microvillus fine microfilaments are observed which in the underlying cytoplasm form a terminal web. They lack flagella but are able to perform movement by rotatory motion or gliding over a gelatinous layer secreted through the cell surface. (ii) Direct template translation by codon-amino acid pairing. In such cases, mRNA occurs in the form informosomes. Homolecithal. 14.8). In ordinary microscopes light is reflected on the object by a mirror having concave and plane surfaces. The empty protein coat (ghost) left outside. (polypeptide chains) that are synthesized almost exclusively in the cytoplasm. The unlabelled precursors are Step-by step procedure for the preparaincorporated into the newly synthesized tion of an autoradiograph. Like lysosomes they are not only responsible for the accumulation and mobilization of reserve lipids, but also for the digestion of other cytoplasmic components incorporated by phagocytosis. An individual containing both dominant and recessive genes or traits or characters of a
allelic pair is known as heterozygous or hybrid. While the resealed ghosts can be used for the study of - + β-keto thiolase Acetyl-CoA - Glyoxysomes perform following biochemical activities of plants cells : 1. 3.17). This latter condition will retain the single stranded feature of chromosomes. However, cells of bacteria and yeast lack nucleolus. L-ascorbic acid synthesis. At intervals, samples are removed from the solution; in case of smaller tissues, the samples are sectioned and mounted on glass slides or grids. It is also for this reason that metabolically active cells, tend to be smaller in size. Chargaff, in 1950, discovered the equivalence rule which suggested that despite wide compositional variations exhibited by different types of DNA, the total amount of pyrimidines (A+G=T+C); the amount of adenine equaled the amount of thymine (A=T) and the amount of the recessive alleles; the parental phenoIAIA type that is not expressed in a heterozygote. At the time of gametogenesis two types of gametes are produced by F1 hybrids in equal numbers. These two gears cause the carbon fixation gear to turn, with resultant production of carbohydrate (PGAL; triose) from CO2 (after Berns, 1983). The PPLO cells contain many enzymes which may be required for DNA replication, the transcription of different kinds of RNA molecules and translation involved in protein synthesis, and also in the biosynthesis of adenosine triphosphate (ATP) by anaerobic breakdown of sugars. Four samples of nucleic acid were analyzed for the proportion of the different bases present, with the following results: (1) A = 30%, C = 30% G = 20%, T = 20%. If the equal divisions of the primary oocyte might have been resulted, the stored food amount would have been SEM through a primary oocyte showing an egg distributed equally to the four daughter cells and surrounded by follicle cell. The displaced parental strand is replicated in the usual way by means of precursor fragments Assume a chromosome with the following gene sequence (the full stop (.) represents the centromere) : ABCD. DNA ligase enzymes are capable of catalyzing phosphodiester bond formaion between free 3'-OH and free 5'-P groups of a nick of DNA which is created by endonuclease enzyme, thereby restoring an antact DNA duplex. Diakinesis and (iii) Localized pairing or metaphase Random synapsis. In this complex a local unwinding ("melting") of the DNA helix occurs starting about ten base pairs from the left end of the position of the first transcribed base. Later on, RNA was found to be the genetic material of some viruses. The kind of pigment produced depends upon another locus, thus, B- produces black and bb produces brown. The DNA coding for the 5S rRNA is also highly repetitive, but the molecule is synthesized outside the nucleolus. Phospholipase A1 Removal of non-specific fatty acid chains from phospholipids 13. Phenomenon of Dominance in Plants Besides pea plant the phenomenon of dominance has also been observed in the following plants (see Table 3-2). Name the stages of cell cycle. A second cross of the same IAIB IAIB i i generation are reversed. The results of these experiments, thus, are clearly indicating that the trait located on a sex chromosome alternates the sex from one generation to the next generation, i.e, the trait of white eyes transfers from P1 father to F1 daughter and from F1 daughter and from F1 daughter to F2 son. The nucleus of the sperm is known as the male pronucleus. Lysosomes are 0.2 to 0.5µm in size. molecule. T-loop contains seven unpaired bases and is involved in the binding of tRNA molecules to the ribosomes. ISOLATION AND CHEMICAL COMPOSITION Chloroplasts are routinely isolated from plant tissues by differential centrifugation following the disruption of the cells. complementary (or copy) sor tRNA gene, synthesized by Khorana. They are used as recognition molecules for the sugar components of glycoproteins. Chloroplasts The chloroplast (Gr., chlor=green; plast=living) is most widely occurring chromoplast of the plants. Antirrhinums showing incomplete dominance. In the domestic fowl (Gallus domesticus) the gene for plumage colour is sex-linked (Sturtevant, 1912). 21 less. The separation of allelomorphic (allelic) genes into different gametes at meiosis; or, separation in its offspring of traits which are combined in a hybrid. Further crosses, reveal that cch allele for chinchilla though is recessive to c+ allele for agouti coat or skin, is incompletely dominant over Himalayan (ch) and albino (c) alleles (Fig. They have been classified variously according to different criteria as follows : 1. REVISION QUESTIONS AND PROBLESM 1. The cell wall of yeast, Saccharomyces cerevisiae, can be enzymatically removed by the help of a snail gut enzyme, and the resultant protoplast serves as a source of plasma membrane in a manner similar to that of mammalian erythrocytes. Powers regarded the heterosis as a phenomenon encountered in quantitative inheritance and he has shown following relationship between F1 hybrids and their parents (see Table 6-1.). The Morgan unit is named in honour of T.H. Morgan; however, most geneticists prefer map units. Osmium tetroxide (OsO4) selectively impregnates the outer face (cis face) of the Golgi apparatus. All these ten subunits are needed for DNA replication in vitro; however, all having different functions. The chromosomes with two chromatids become short and thick. When these events happen, we say that the molecule is in an excited state. For example, 'weedy' relatives of agriculturally important crops may carry genes for resistance to specific diseases. 21. When he analyzed the DNA differs according to its biological source. has lost most of the distal part of its longer arm (22 q-). 23.1). The amplification of specific genes is not a common event. Characters of degree. Now the question Working with X-ray pictures of gels, a scientist compares the relative positions of bands of DNA in sequencing "ladders". Explain sliding microtubule hypothesis of ciliary movement. Complete Penetrance Most dominant and recessive genes in homozygous conditions and many completely dominant genes even in heterozygous conditions give their complete phenotypic expressions. The process of active transport proteins or pumps, consuming energy in the form of ATP molecules. The best defined are types I, II, III and IV. Both types of radiations induce mutations by following methods : (i) Ionizing radiations as mutagens. If genetic informations might have occurred in an articulated language, the DNA molecule might require various alphabets, a complex system of grammar and ample amount of space on it. 16.1). Meyerhof showed the formation of ATP from phosphopyruvate and Kalckar related oxidative phosphoryalation to respiration. (c) Describe what is meant by a tautomeric shift? The cytological studies have shown that the X chromosomes of most NRY organisms are straight, rod-like and comparatively larger than Y chromosomes. 143 plaque 1975, 76, 77, 78, 80, 81, 83 (Twice) 1985, 86, 87, 89, 90, 91, 93, 94, 95, 97, 98, 99, 2001, 2002, 2003 Reprint 2004 First Multicolour Edition 2004 ISBN : 81-219-2442-1 PRINTED IN INDIA By Rajendra Ravindra Printers (Pvt.) Ltd., 7361, Ram Nagar, New Delhi-110 055 and published by S. The rearrangement of gene may (B) Pairing between two normal chromosomes and two that occur in number of genes per chromohave exchanged sections. Thus, if a tree 3'-OH group on a primer strand lies opposite a thymine on a template strand (see Fig. 11.2) gene f and fu had separated as a result of recombination. An inversion can occur in the following way : suppose that the normal order of segments within a chromosome is 1-23-4-5-6; breaks occur in regions 2-3 and 5-6 and broken piece is reinserted in reverse order. During metaphase I, the microtubules of the spindle are attached with the centromeres of the homologous chromosomes of each tetrad. This results in the formation of recombinants or crossovers in new sets of chromatids (Fig. Attardi, Attardi and Aloni (1971) reported the 70S type ribosomes inside the mitochondria. The porphyrins (Gr., porphyra = purple) are complex carbon-nitrogen molecules that usually surround a metal, i.e., it is formed from four pyrrol rings linked to pyrrol contents CYTOPLASMIC MATRIX 89 rings. Thus, anaphase B increases the distance between two spindle poles and in contrast to anaphase A, is accompanied by the polymerization of X-Linked Gene for Eye Colour in Drosophila. RF-A or SSB proteins bind to unwound single stranded DNA. Their growth is inhibited by tetracyclines and similar antibiotics that act on metabolic pathways. Phage T2 DNA is estimated to consist of about 200,000 deoxyribonucleotide pairs. The saprophytic or saprotrophic species of bacteria are of great economic significance for man. (b) If you had several human pedigrees for a simply inherited trait, what criteria would you use to determine whether the trait was due to a dominant or a recessive allele? The cytoecology is the science in which one studies the effects of ecological changes on the chromosome number of the cell. In 1954, Arnon, Allen and Whatley used 14 CO2 to show fixation of CO2 by isolated chloroplasts. This process involves the following steps : (i) GTP binds to eIF2 and to this complex becomes associated Met-tRNAMet -eIF2-GTP. Following three regions have been identified in the nucleolus (Fig. During this process the presynthesized nuclear pores reassemble and the dephosphorylated lamins reassociated to form the nuclear lamina; one of the lamina protein (lamin B) remains with the nuclear membrane fragments throughout mitosis and may help in nuclear membrane fragments throughout mitosis and others showed that following microsurgery, nucleated halves of various protozoans survived and grew, whereas the enucleated halves degenerated and died. Mode of action of DNA helicase (after Alberts et. The RNA copy has the opposite polarity from the
template, so that, for example, the sequence \rightarrow in TACAAC DNA is transcribed as \leftarrow in RNA. In the next two decades, he, Cajal and other histologists developed staining methods and laid the foundations of microscopic anatomy. In linkage units this gene is located at 1.5 in the X chromosome. Such individuals function normally with fetal haemoglobin even as adults. (after Sheeler and Bianchi, 1987). Animal breeding. DNA is purified from a small sample of blood, semen, or other DNA-bearing cells, and digested into smaller fragments with restriction endonucleases. Mechanical function. A calcium pump is a 100,000 M.W., polypeptide, forming 80 per cent of integral membrane protein of sarcoplasmic reticulum Y-linked. The trypsin inhibitors commonly found in seeds and the wound induced protease inhibitors of leaf cells (to inhibit both insect and microbial proteases), both accumulate in the vacuole and it spans the full chain enzymes membrane cytoplasmic matrix thickness of outer membrane. mRNA to first 2. (III) Transfer RNA (tRNA) The RNA which possesses the capacity to combine specifically with only one amino acid in a reaction mediated by a set of amino acid in a reaction mediated by a set of amino acid specific enzymes, called aminoacyl-tRNA synthetases; anticodon transfers that amino acid in a reaction mediated by a set of amino acid specific enzymes, called aminoacyl-tRNA synthetases; anticodon transfers that amino acid specific enzymes. from the "amino acid pool" to the site of protein synthesis and recognises the codons of the mRNA is known as the apoenzyme. Carrier. sons, all of which exhibited the same Contents SEX LINKED INHERITANCE 143 trait. Cystic fibrosis the codons of the mRNA is known as the apoenzyme. Duchenne muscular dystrophy Gaucher's disease 4. Calcium Ca2+ Constituent of plant cell walls; matrix component of bone tissue; cofactor of coagulation enzymes. 13.8. Male and female Bracon hebetor and their gonial metaphase ized egg (a diploid zychromosomes. b-galactosidase 9. In addi- Fig. When ribosomal RNA synthesis restarts at the end of mitosis (in telophase), tiny nucleoli reappear at the Contents CELL BIOLOGY 256 chromosomal locations of the ribosomal RNA genes (NOs). Mitochondria also the 55S ribosomes, called mitoribosomes. When they are opposite to each White F 2 Ova WR CC WR CC Roan Roan RR CC Red Fig. Further, the number of pairs of loops gradually increases during meiosis till it reaches maximum in diplotene. DNA being the only permanent component of chromosome structure, is the sole genetic material of eukaryotes. They differ from the bacteria in the following respects : 1. As prophase progresses, the chromatids become shorter and thicker and two sister chromatids of each chromosome are held together by a special DNA-containing region, called the centromere or primary constriction. On the other hand, when a substrate is oxidized via a flavoprotein-linked dehydrogenase, only 2 mol of ATP are formed, i.e., P/O ratio is 2. pumped out and 2K+ ions are pumped in (after Alberts et al., 1989). The larger 60S ribosomal subunit is round in shape and contains a channel through which growing polypeptide chain makes its exit. (i) Use of trinucleotides or minimessengers in filter binding (Ribosome-binding technique). Within a H chain class or L chain type, these segments exhibit very little variation in primary structure from one individual to another and are called constant regions (C). The changes a cell experiences during a cell experiences during a cell experiences during the fluctuations in rates of DNA, RNA, and protein synthesis that regularly occur with respect to the time of mitosis can also be placed in this category. Described the ultrastructure of mitochondria. The longitudinal binary fission occurs in certain ciliates and flagellates, e.g., Vorticella and Euglena (Protozoa) and some corals (Anthozoa). Zygotic lethality due to translocation complexes. The protein eIF2 in mammals and wheat plant has three subunits, namely α, β and y; eIF2 α binds to eIF2 GTP; eIF2 y binds to Met tRNA and eIF2β may be a GDP GTP recycling factor. For example, if an IS (= inserted into an operon, it interrupts the coding sequence and inactivates the expression of the target gene into which it inserts as well as any gene downstream in that same operon. It can be increased by using oils to fill the space between the specimen and the objective lens. Is it possible to cross two agouti rabbits and produce both Chinchilla and Himalayan progeny ? A chromosome map; an abstract map of chromosome map; an abstract map of chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both Chinchilla and Himalayan progeny ? A chromosome map; and produce both chinchilla and Himalayan progeny ? A chromosome map; and produce both chinchilla and Himalayan progeny ? A chromosome map; and produce both chinchilla and Himalayan progeny ? A chromosome map; and produc recombination (or crossing over) was regarded to involve a breakage between two beads followed by their exchange between paired chromosomes in a bivalent are pulled away from each other. When a white eyed female Drosophila is crossed with a red eyed male Drosophila, all the female individuals in the F1 generation are red eyed (Fig. 17.1. A ciliary apparatus in L.S. showing fundamental structure of cilium or shaft, basal bodies and ciliary rootlets. Termination of RNA synthesis (or transcription) occurs at specific base sequences in the DNA molecule. Among plants, colonial green algae exhibit cell constancy. (c) Assuming allelism, what cross could you use to determine s and r occupied the same or differentiation of the ciliated epithelial cells that line the oviduct and the trachea, the centriole pair migrates from its normal location near the nucleus to the apical region of the cell where the cilia will form. It is apparent that if the code is read in opposite directions, it would specify two different proteins, since the codon would have reversed base sequence : Codon : Polypeptide: -> UUG AUC GUC UCG CCA ACA AGG Leu Ile Val Ser Pro Thr Arg Val Leu Leu Ala Thr Thr Gl gene is Contents 166 GENETICS, HUMAN GENETICS AND EUGENICS Barr body nucleus of somatic cell of XX female black and orange cats may be either male or female 'tortoise-shell' cats are always female X-linked, so if one X chromosome contains the dominant allele B and other X chromosome the recessive allele b, random inactivation will allow both coat colours to be expressed. C2 4 6 HN 1 5 HN 3 5 4 2 6 C 5 CH N N Fig 3.3. Chemical formula of quanine (2-amino- 6- hydroxypurine, mw= 151.13 daltons). One type of ganglioside, called GM2, may accumulate in the lysosomes of the brain cells because of a genetic deficiency that results in the failure of the cells to produce a lysosomal enzyme that degrades this ganglioside. 5.22. Many of the remaining 50 per cent of nonhistones include all the enzymes and factors that are involved in DNA replication, in transcription and in the regulation of transcription. α- Globin Immunoglobulin L chain Immunoglobulin H chain Yeast mitochondria cytochrome b Ovomucoid Ovalbumin Ovotransferrin Conalbumin α-collagen (procollagen α) Number of introns 2 2 4 6 6 7 16 17 52 The actual mechanism of cutting and splicing is not completely understood; however, it is known that the border regions of each intron usually contain similar sequences (called consensus sequences), usually started with a GU and ending with an AG (called GU-AG rule): and that a small nuclear RNAprotein particle, called the snRNP particle, is involved in RNA splicing, carbonic H+ N C anhydrase + 2. Certain dominant and recessive characters depend on the sex of individual and are sex-linked. molecules or spikes. Generally, ribosomal RNA and tRNA are synthesized continuously throughout the eukaryotic cell cycle. He stained mitochondria with alizarin and crystal violet. But, in addition to intra-allelic genetic interactions, non-allelic or inter-allelic genetic interactions, non-allelic or inter-alle while being synthesized, all Contents PROTEIN SYNTHESIS 81 prokaryotic proteins have M-formylmethionine at the amino terminus. This cylinder is open on both ends, unless it carries a cilium or flagellum (then it is called basal body or kinetosome). Laderberg and Tatum (1946) found that when an F+ ('male') E. unique orientation distribution of mitochondria in different types of cells. Other dipteran species have more DNA, for
example, Chironomus has 16000 DNA molecules in their each polytene chromosomes. In each core protein strand, three carbohydrate bearing regions may be identified. What is oogenesis? Chemically it contains many layers of peptidoglycans and proteins, neutral polysaccharides and polyphosphate polymers such as teichoic acids and teichuronic acids. H1 is present twice) and is rather loosely associated with DNA. Animal cells are generally small in size. Enzymes of DNA Metabolism Different prokaryotic and eukaryotic cells have been found to contain three kinds of nuclease, polymerases and ligases. The hypothesis of a solenoidal structure, with coils of coils had renewal since nucleosomal substructure has been discovered. In step 5 six bases, all in or near the loops of tRNA molecule, are modified to form pseudouridine (4tU). Progeny. The C gene in Rabbit (Coat Colour) The coat of rabbit may have following different colours : (i) Full colour. If a chromofibrillar material forming the "corona" of the some breaks, the broken ends can fuse centromere (after De Robertis et al., 1975). The third class of essential molecules for DNA polymerase enzymes are template strands. Later these botanists came across the research paper of Mendel and rediscovered it in 1900. The nematode worms and arthropods have no cilia. Table 2-1. The life cycle of certain insects includes two generations, the sexual generation, both of which alternate to each other. The F1 was intermediate in size between the parents and fairly uniform, but mean size of the F2 was about the same as that of the F1, but the variability of the F2 was so great that a few individuals were found to exceed the size of either parental type (showing transgressive variation). Alcohols of the steroids are called steroids. nucleation (= process of grouping around a central mass) step of tubulin polymerization in vitro. Steps Fixation Dehydration Embedding Sectioning Comparison between light and electron microscopy. OH (a) What is mRNA ? Two special promoter regions have been identified that appear in all organisms. According to this hypothesis, the mitochondriate the mito are originated "de novo" (L. Enzymatic Synthesis of RNA The essential chemical characteristics of the synthesis of RNA are the following : (1) The precursors in the synthesis of RNA are the four ribonucleotide 5'-triphosphates (rNTP)— ATP, GTP, CTP and UTP. The fertilization provides new genetic constitution to the zygote. Cytopathology (Cytology and Pathology). One species of Euglena is found up to 500 µm (0.5 mm) in length. Primed and unprimed symbols of the same kind (e.g., 3 and 3', d and d') represent complementary base pairs. Similarly, many important crop plants include autotetraploids such as rye (Secale cereale), corn (Zea mays), red clover (Trifolium pratense), berseem (Trifolium alexandrium), marigolds Diploid (18) (Tagetes), snapdragons (Antirrhinum), Phlox, grapes, apples, Monoploid Oenothera lamarkiana (which was recognized as mutation by chromoHugo de Vries). The transcription factors (TFs) can be defined as proteins, which are needed for initiation of transcription, but are not part of the RNA polymerase. Nucleoli are absent in metaphase and anaphase but reappear early in telophase at twice their original number, as new nucleolar organizer sites in each daughter nucleolar organizer sites called sex reversal. Gilbert first of all used the terms exon and intron (for split genes). 313 to resist the sliding motion). A sex cell having haploid set of chromosomes and arising due to meiotic cell division of diploid germ cell is known as gamete. Thus, the second chiasma restores the order which was changed by the first chiasma and it produces two non-cross over chromatids. Viruses have the following three different types of symmetry : 1. Therefore, ice floats rather than settling on the bottom of lakes and ponds. Because, the chlorophyll pigment of chlorophyll pigment of symmetry is related with photosynthesis of food and leukoplasts are incapable to perform photosynvariegated main shoot all green branch thesis, so the white or pale parts of plant survive Fig. Comparison of monozygotic twins (Source : Kapur and Suri, 1984). the chromosome number in the F1 hybrids. This arrangement gives cartilage its resilience and tensile strength. 15.2. The minus ends of microtubules in cells are generally embedded in a microtubule-organizing centre ; while the plus ends are often near the plasma membrane (after Alberts et al., 1989). In hybrids, greater resistance to diseases and to insect infestation and increased tolerance to diseases and to insect infestation and increases and to in plants. It requires more than 540 calories (2259 joules) to change 1 gram of liquid water into water vapour. formance of this anticodon triplet. Occasionally, an arrow pointing at a particular affected individual is added to indicate that this is the person who brought the trait to the geneticists attention. Behind the replication fork, the single DNA strands are prevented from rewinding about one another (or forming doublestranded hair-pin loops in each single SB proteins. In 1853, he took the membership of Zoological-Botanical Society of Vienna. There is evidence that the cytosine methylation in DNA alters the structure of the double helix in a fundamental way and favours the transition from B-form to Z-form DNA (Bele and Felsenfeld, 1981). β-thalassemia Defective β-globin chain 1. The cell wall which is formed immediately after the division of cell, constitutes the primary cell wall. revolutionised the agriculture, horticulture, animal husbandry and many other branches of science. Unwinding of the template DNA helicases, acting in concert, one running along the leading strand and the other along the lagging strand. This enzyme has enabled the molecular biologists to synFig. 13.4. Karyotypes : A-Symmetric; B- Asymmetric; B- Asymmetr second type is non-ionizing radiations such as ultraviolet and visible light. It is sugtocytes. 17.7. Maternal inheritance of cytoplasmic male sterility. Augustinian Monk Gregor Mendel was the first investigator who laid the foundation of our modern concept of the particulate theory. In Nitella a division cycle of 18 hours has been cinematographically recorded for the chloroplast. This theory provided a mechanism of transmission to explain the behaviour of Mendel's factors and brought together two independent desciplines- the genetics and the cytology. 12 WO3. In certain plants (e.g., Vallisneria spiralis, Dioscorea sinuata, etc.,) and inMeiosis sects specially those of the orders Ova n+ n+ o Hemiptera (true bugs) and OrX n+X n+X thoptera (grasshoppers and Sperm roaches), the female having two Fertilization X chromosomes (hence, referred to as XX) and are, thus, homoga2n+XX 2n+XO metic, while the male having only one X chromosome (hence, referred to as XX). (Chaetognatha), Sepia (Mollusca), Echinodermata) and in seveal species of insects, shark, amphibians, reptiles, birds and mammals (humans). 17.6 A). The deleted part of autosome 22 is translocated to one of the larger autosomes (most frequently to the distal end of chromosome 9). If crossing over occurs between the centromere and c locus (Fig. Transferases, and 10. Draw a labelled diagram of a typical plant cell as seen through an electron microscope. Examples : 1. In 1917, Langmuir (Nobel Laureate of 1932 in chemistry) fabricated a trough or film balance (Fig. The cilia may be thicker at the base and may become thinner gradually along the length. Differentiate between paracentric and pericentric inversions. The gap junctions or connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of
adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, made up of two connexons of adjacent cells are believed to line up to provide a continuous channel, occurs in the sol-phase of the matrix and is effected by the hydrostatic pressure, temperature, pH, viscosity, etc. When a red flowered pea plant (rr) then the F1 hybrid pea plant (rr) then the F1 hybrid pea plants are found to have pink flowered pea plant (rr) then the F1 hybrid pea plant (rr) the flowered pea plant (rr are formed after mitosis in a human diploid cell, although they are rarely seen as separate entities because they quickly grow and fuse to form the single large nucleolus typical of many interphase cells. dehydrogenase, turning it off whenever ATP levels are high). Budding in Hydra. Eukaryotes 1. 6.6. Diagram explaining the signal hypothesis (after De Robertis and De Robertis, Jr., 1987). AUGUUG 2. Likewise, crosses between chinchilla and agouti (Fig. Prokryotic Origin of the mitochondria from the prokaryotic cells. peptide bond formation is supplied by the dissolution of the aminoacyl bond between the first amino acid and its carrier tRNA, this energy having originally been donated by ATP. coli). The two strands run anti-parallely—that is, have opposite directions. This results in unwinding of DNA duplex and the replication from Contents 40 MOLECULAR BIOLOGY ori C proceeds in both directions); SSB binding occurs on single stranded regions and two Dna B complexes (= primosomes are loaded one on each strand. It results due to the loss of an X-chromosome fails to be incorporated in a daughter nucleus and is lost forever (Fig. Thus, the mitochondrial matrix contains the following enNADH2 zymes : malate dehydrogenase, isocitrate dehydrogenase, fumarase, deh. Mode of translocation of proteins into stroma and thylakoid of chloroplast by the help of signal peptides (after Albert et al., 1989). 5-Bromouracil Thymine Freese in 1959. The plasma membrane of the unfertilized eggs of certain fishes allows nothing to pass through it except the gases. In the fly Sciara, large metacentric heterochromatic chromosomes are found in the gonadal cells, but are absent in somatic cells. would be labelled. In some plant tissues such as potato tuber, amyloplasts can grow to be as large as an average animal cell. highest eukaryotes ; for example, the β- tubulins of sea urchin flagella and chick brain cells differ only in one amino acid. In fact, however, the more important configuration is the cyclic one; it is an isomer having an oxygen bridge between two of the carbons. The paramecin is water soluble, diffusible and depends for its production upon cytoplasmically located particles called kappa. Chromosomes of group D also contains satellites. DNA of chloroplast. Contents CELL GROWTH AND CELL DIVISION 325 Duration of different phases of mitosis in certain plants and animals. Explain (b) Why is it often difficult to distinguish between cytoplasmic gene (plasma genes) and viruses? It dimer is a small transmembrane actin glycoprotein (single-pass membrane protein) having molecular weight of 55,000 daltons and 131 amino acid residues. During protein synthesis many ribosomes read the codes of single mRNA (messenger RNA) molecules and form polyribosomes read the codes of single mRNA (messenger RNA) molecules and form polyribosomes read the codes of single mRNA (messenger RNA) molecules and form polyribosomes read the codes of single mRNA (messenger RNA) molecules and form polyribosomes read the codes of single mRNA (messenger RNA) molecules and form polyribosomes read the codes of single mRNA (messenger RNA) molecules and form polyribosomes read the codes of single mRNA (messenger RNA) molecules and form polyribosomes read the codes of single mRNA (messenger flagellated or non-ciliated protozoans (such as amoebae). Dynein-like force generating protein may be involved in such a directed movement of chromosomes. In the diploid eggs. In India, DNA fingerprinting tests are carried out at the Centre for Cell and Molecular Biology (CCMB), Hyderabad. Cellular organelles : (i) Mitochondria * Prokaryotic cell Eukaryotic cell Eukaryotic cell Absent Commonly present Present Present Present Present Present Present Inear double-stranded DNA : genes frequently interrupted by intron sequences, especially in higher eukaryotes Present Rare Absent Present Intron is an intervening sequence of nucleotides in DNA, located within a gene that is not included in the mature mRNA. Both Fig. This polarization is called cis-trans axis of the Golgi apparatus. The chromo- Blue eyes are considered a recessive trait in humans. Plasmid. These four types of gametes (pollens or ovules) of F1 hybrid unite at random in the process of fertilization and produce sixteen types of individuals in F2 generation which are given in their original combinations because of their location in the same chromosome was advanced by T.H. Morgan in 1911. The complex formed between the DNA of the promoter and RNA polymerase serves to initiate strand separation and sense strand selection, so that mRNA synthesis can begin when the start codon within the operator is reached. During interphase, when cells are actively growing, nucleoli are prominent and synthesize ribosomal RNA at a high rate. Individuals of epistatic genotype, cc, are incapable of pigment production and are called albinos. It emits chemicals that attract sperm. In such cases, if the parents mm MM female parent is mainly derived Mm from the egg which is obtained from the male sterile female parent (Fig. Three of the polypeptides are coded by mt DNA and assembled on mitochondrial ribosomes. (4) The DNA molecule being transcribed is double-stranded, yet in many particular regions only one strand serves as a template (Fig. Endoplasmic reticulum (ER). Later by

using RNA and proteins separately in tests for infectivity, it was shown that RNA alone was able to cause infection (Fig. The manner of coiling and folding of DNA was a matter of debate and dozens of models were available for this purpose; of them only two stand out and are important. the imported phospholipids are decarboxylated and converted into cardiolipin (diphosphatidyl glycerol). Intron. 5.8. The types of movement possible for phospholipid molecules in a lipid bilayer (after Alberts et al, 1989). Otherwise, the capacity of DNA as an information carrier would be too severely limited. Immunogenetics. The fertilization cone is composed of the plasma membrane and hyaline cytoplasm. Describe various examples of sex chromosomal mechanisms of sex determination. During cells. Codominance Pollens Sometimes both alleles of a gene F Gametes 1 r R in a heterozygote lack the dominant and Ovules recessive relationship, i.e., each allele is capable of some degree of pheno- F 2 typic expression. They may be of following types : (a) Extragenic suppressor. Thus, the cilia and flagella serve many physiological processes of the cell, such as locomotion, alimentation, circulation, respiration, excretion and perception of sense. If the functional ovary of a hen Proboscis is destroyed, the rudimen(Prostomium) tary gonad develops into a testis (Crew, 1923). Silicon ions occur in the epithelium cells of grasses. The former are most often 46, XY and external genitalia are ambiguous. These are as follows : 1. Polyadenylic acid or poly (A) 3. The union of sperms and ova of F1 offsprings may produce four possible types of F2 individuals : 1. Chromatid. Similarly, Gamow's idea of direct template relationship between nucleic acid and polypeptide chain was challenged when Crick proposed his adopter hypothesis. Complete degeneracy occurs when any of the four bases can take third position and still code for the same amino acid (e.g., UCU, UCC, UCA and UCG code for serine). The 3-keto acyl-CoA looses a two carbon fragment under the action of the enzyme thiolase to generate an acetyl-CoA and a new fatty acyl-CoA with two less carbon atoms than the original. A lac operon contains three structural genes or cistrons, namely z, y and a, whose products (=enzymes) are involved in the breakdown (catabolism) of the sugar lactose (Fig. There are certain clues polydactylous in the pedigree that must be female male sought. One should maintain careful records of the offsprings of many generation. 267 Spermatid Liver Liver Mean DNA-Feulgen content Presumed chromosome set 1.68 (1C) 3.16 (2C) 6.30 (4C) 12.80 (8C) Haploid (n) Diploid (2n) Tetraploid (4n) Octoploid (8n) Thus, each species has a characteristic content of DNA which is constant in all the individuals of that species and has, thus, been called the C-value. Included in this group are cellulose (found in plant cell wall), H mannan (a homopolymer of mannose found in yeast cell walls), chitin O (in the exoskeleton of arthropods and the cell walls of most fungi and some green algae), masses of hyaluronic acid, starch OHCH2 O keratin sulphate and globules chondroitin sulH HO phate (these three are H CH2OH found in cartilage and other connective tisH OH sues) and the Fig. Are these two pairs of genes linked ? The X-ray crystallographic studies of Astbury were continued by Wilkins and his associates who managed to prepare highly oriented DNA fibres that allowed them to obtain an X-ray diffraction photograph. These include (i) biologist's preoccupation with speculation concerning Darwin's theory of evolution "origin of species" which appeared in 1859; (ii) obscurity of the journal in which Mendel published his results; and (iii) unaccoustomedness of professional biologists of ninteenth century to think in the statistical manner which Mendel introduced in the study of hybridization. Certain well known diseases of the animals are also caused by baspirochaete spirillium cilli, e.g., anthrax (Bacillus anthracis) and black leg (Clostridium monotrichous chauvei). Give the genotypes and phenotypes for each sex in the F1 and F2. Contents TECHNIQUES IN CELL BIOLOGY Chloroplasts at the same magnification (x25,000), by light microscopy (left), and by electron microscopy (left), and by electron microscopy (left). Regulation of synthesis of 70S ribosomal proteins. The tetraploids have been produced from the diploids by colchicine treatment. No metabolic energy is consumed in passive transport. Mode of action of mutually supplementary genes for coat colour in pig. In the polynucleotide strand of RNA, the ribose and phosphoric acids of nucleotides remain linked by phosphodiester bonds. Because DNA is the only genetic material of most living organisms, so deserves priorty in discussion. pore in nuclear envelope pre-mRNA new proteins Fig.8.11. Without the surfactant hydrogen bonds in the water lining the small sacs amount of excess acids or bases. During anaphase A, a surprisingly large force acts on a chromosome as it moves from the metaphase plate to the spindle pole. MINIMUM NECESSARY MATERIALS Success in polypeptide synthesis in in vitro cell free systems shows that the minimum necessary materials are the following : 1. Approximately 7 nucleotides per recon. An ultracentrifuge differs from other centrifuges only in attaining higher rotor velocities (i.e., up to about 70,000 revolutions per minute or rpm). Contents 168 CELL BIOLOGY species has two Golgi apparatuses and nerve cells. Thus defined, cising four different mutational sites. A few pieces of filter paper soaked in buffer are placed under the gel. It is also called fibrous lamina, zonula nucleum limitans, internal dense lamella, nuclear cortex and lamina densa. The paired chromosome homologues are not condensed as usual chromosomes would be; instead, they are very long and stretched out. y E Just as a flow of water from a higher to a lower level can be utilized to turn a water wheel or a c c c c hydroelectric turbine, the energy released by the a Intermembrane flow of the protons down the gradient is utilized in space the synthesis of ATP (see Reid and Leech, 1980). The normal right handed helical sense of B-DNA (A) and rare left handed helical sense of Z-DNA(B). They range in between 30 to 3000 nm or 300 to 3000 A° in size, so they can be observed only by electron microscopy and X-ray crystallography. Heterolecithal. This type of mRNA is called polygenic or polycistronic mRNA. A hypothetical series of 20 multiple alleles is known for a certain locus. breaks A B fusion dissociation B + A Fig. (a) All offspring yellow; (b) All females wild type, all males yellow; (c) All offspring wild type; (d) all females and males : 1/2 wild type : 1/2 wild type : 1/2 yellow. The chemistry of DNA and RNA has been worked out by A. Epistatic alleles 1. This so-called "sneak synthesis" endows the cell with enough enzymes to transport a few lactose molecules through the plasma membrane; these will be catabolized to the true inducer (i.e., allo-lactose) so that derepression can occur. Describe the ultrastructure of nucleus. Hope stunt; and Fig. Epistatic alleles 1. Hence n or x (or 2n or 2x) can be used interchangeably. The number of mitochondria in a cell depends on the type and functional state of the cell. Oligosaccharides. The phosphorylation of the lamins occurs at many different sites in each polypeptide chain and causes them to disassemble, thereby disrupting the nuclear lamina. Tetrad analysis is the technique of using each of the individual spores of a tetrad for analysis to acquire information on linkage and recombination. APPLICATION OF GENETIC ENGINEERING The foremost application of genetic engineering has been in understanding the structure of eukaryotic genes such as exons, introns, promoters, enhancers, etc. viruses are thought to catalyze the fusion of Prions For example, of those patients admitted to paediatric hospitals in North America, 30 per cent estimated to have genetic diseases. 11.1. This classical concept of allelism has to be modified due to experimental results of several workers working on Drosophila. Triangular AA BB (AB) Triangular Phenotype of either or both dominant alleles, i.e., A or B or both Triangular=15 Recessive phenotype of a and b alleles Top-shaped=1 X \downarrow X Top-shaped=1 X \downarrow X Top-shaped a bb (ab) Triangular Aa Bb Contents GENETIC INTERACTION AND LETHAL GENES F1 Male gametes \rightarrow AB F2 Female gametes \downarrow AB Ab aB Aa Bb Aa Bb Aa Bb Triangular Triangular Triangular Triangular Triangular AA Bb AA bb Aa Bb Aa bb Triangular Triangula +120 +1 5S RNA gene ers can function at great distance (often A many kilobases) from the genes they tRNA RNA polymerase III enhance and repress respectively. Give an account of various types of eggs of animals. 18.2. Diagrammatic summary of mitosis in the animal cell (after Burns and Bottino, 1989). (b) Removal of introns. In 1914, Robert Feulgen demonstrated a colour test known as Feulgen reaction for the DNA. The lipid composition and state of fluidity of two halves of the lipid bilayer are found to be strikingly different. Type IV collagen is present in basal laminae or basement membranes of epithelia. Contents 20 MOLECULAR BIOLOGY Physical, Molecular or Geometrical Organization of DNA The first person to give any thought to the three dimensional structure of DNA was W.T. Astbury who by his X-ray crystallographic studies of the long axis o molecule and was situated every 3.4 A^o along the stack. The eggs can also be grouped into two types on the basis of the distribution of the yolk in the cytoplasmic matrix. Such eggs are viable and develop further. These transposons are about 5900 base pairs δ) sequence, which is long and are bounded at each end by a DNA segment called the delta (δ approximately 340 base-pairs long. The practical application of genetic analysis for development of purebreeding lines of domestic animals suited to human purposes.
Non-disjunction at second division 1. In cross section each microtubule appears to have a dense wall of 6 nm thickness and a light or hollow centre. G-V Eggs V G R-C Pollens V R Eggs C R inhibited inactive G-G G-V dies C V-V dies viable Fig. The cyclosis has been observed in most animal and plant cells. Both of these types of regulations of gene activities in eukaryotes, now, are considered to occur at the following levels involving diverse mechanisms: 1. Bateson confirmed Mendel's work by a series of hybridization experiments. In most animals inbreeding is found to have less remarkable effects on vigour. Certain mice carrying the recessive allele (v) in homozygous condition move about erratically until exhausted. Iron- sulphur proteins transfer one electron at a time. Chemical Nature of Genetic Materials (i.e., DNA and RNA) 16-26 Historical; deoxyribonucleic acid or DNA, considerations of Watson and Crick in the construction of double helical structure of DNA molecule, Watson and Crick's model of DNA, ploymorphism of DNA helix (or alternative forms of DNA helix (or alternative forms of DNA, replication of genetic RNA) - molecular structure of RNA, replication of genetic RNA, replication of cycle repeats until the stranded and would cover the whole entire sequence is made. The phenomenon of sexual dimorphism has been a biologists of all time. Mendelian genetics. These gemmules are at first collected in the blood and later on are concentrated in the reproductive organs. The allopolyploids, thus, produced resembled the cultivated New world cotton and when crossed with it gave fertile F1 hybrids (Fig. The complete blindness is followed by mental degeneration and finally death before adolescence. phosphatidyl ethanolamine or cephalin; 3. Mitochondria are granular in primary spermatocyte or rat, or club-shaped in liver cells (Fig. 10.3). The proton pump of the mem- exchange permease of human erythrocytes operates as an brane of the lysosome (after antiport to the exchange of Cl--- for HCO --- (Alberts et al., 3 Darnell et al., 1986). However, it may be that one gene may cause evidently well marked expression of some phenotypic trait (major effect) then the others with less evident phenotype (secondary effect). In euchromatin, DNA is found packed in 3 to 8 nm fibre. This is called translocation and consists of the following three steps : (a) Ejection of discharged tRNAf Met from the 'P' site. Prior to performing the actual experiments, they tested the ability of a cell-free protein synthesizing system to incorporate radioactive amino acids into newly synthesized proteins. 17.4). The substitution mutation when O O involves the substitution or C C replacement of a purime with a pyrimidine or vice versa then HN C Br HN C-CH3 that type of substitution is called transversion C CH c CH mutation. In the merogamy (Gr., meros=part; gam=marriage), the fusion of smallersized and morphologically different gametes (merogametes) Fig. LYSOSOMES IN PLANTS Two out of the three siblings in this picture Plants contain several hydrolases, but they are not are suffering from Pompe's disease, a always as neatly compartmentalized as they are in animal rare inborn disease. The eIF2 is released as a binary complex, of mRNA ATP AUG eIF2-GDP. Many centuries later, owing to the invention of magnifying lenses, the world of microscopic dimensions was discovered. Both central fibrils are connected by a bridge and are enclosed in a common central sheath. Bacteriophage Mu. The bacteriophage Mu (Mu = mutator) is a temperate In these Drosophila eyes, the patches of red are caused by excision of a transposable element restoring normal eye colour to an otherwise peach-coloured eye. During the late 1970's, the science of genetics entered a new era dominated by the use of recombinant DNA technology or genetic engineering to produce novel life forms not found in nature. The oogenesis is completed in the following three successive stages : 1. Both phagocytosis and pinocytosis are active mechanisms in the sense that the cell requires energy for LDL binding site LDL plasma membrane cholesterol molecule (a) LDL receptor phospholipid protein molecule coated pit cholesterol molecule coated pit cholesterol molecule coated pit cholesterol molecule (a) LDL receptor phospholipid protein molecule coated pit cholesterol molecule (a) LDL receptor phospholipid protein molecule coated pit cholesterol molecule coate proteins coated-pit (b) surface protrusion or protein molecule A LDL LDL receptor LDL receptor protein with defective coated pit binding site B plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated pit binding site B plasma membrane endocytosis coated pit binding site B plasma membrane endocytosis coated pit binding site B plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated pit binding site B plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated pit binding site B plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coated vesicle uncoating return of LDL receptors to plasma membrane endocytosis coat lysosome Fig. Produced first heterokaryons of mammalian cells by the virus-induced fusion of human and mouse cells. The RNA transcripts do not ordinarily remain hydrogen-bonded with their DNA templates as DNA daughter strands do. Maurice H.F. Wilkins (1916-). The exopeptidase enzyme may remove some amino acids from N-terminal end or the C-terminal end of polypeptide chain. In the so-generated nucleosome-free DNA, additional transcription factors and RNA polymerase bind. Finally, in 1871, Miescher's report was published, but it made little immediate impact. Write an essay on the growh of living organisms. In 1839, the Czech biologist J.E. Purkinje (1787–1869) coined the term protoplasm to describe the contents of cells (animal embryos). Hence, the lifetime of mRNAs may also be correlated with the number of free ribosomes available at any given Contents REGULATION OF GENE ACTION 99 moment to translate mRNA molecules. van Beneden O.Hertwig 1878 1879 Schleicher W.Flemming 1881 Reinke and Rodewald E.G. Balbiani Described mitosis in plant cells and in 1882 introduced the terms cytoplasm and nucleoplasm. Dominance hypothesis of heterosis. ULTRASTRUCTURE OF THE CILIA AND FLAGELLA An eukaryotic cilium or flagellum is composed of three major parts : a central axoneme or shaft, the surrounding plasma memberane and the interposed cytoplasmic matrix (Fig. The cytoplasmic matrix contains only RNA, while DNA exclusively remains concentrated in the nucleus. Gas chromatography (for the separation of lipids, oligosaccharides and adopt the faminine gender role under whatever culture pattern has been established in the society of which they are members. The 20 - naturally occurring amino acids. Codon 1. They may be derived in part from smooth portion of the ER and in part from smooth portion of the ER and in part from smooth portion of the ER and in part from smooth portion of the ER and in part from smooth portion of the ER and in part from fragments of plasma membrane, Golgi apparatus, endosomes and Contents 158 CELL BIOLOGY mitochondria. Barbara Thomas Hunt Morgan McClintock and Harriet Creighton working at Cornell University, 1866-1945. Ox liver 17.1 27.3 33.9 21.7 5. The animal without pigmentation in skin, hairs and eyes is called albino. Gynomonoecious Perfect (O) and female (O) flowers on the same plant. (a) All loci are linked. The 28S rRNA has the molecular weight 1.6 × 106 daltons and its molecule is double stranded and having nitrogen bases in pairs. The mating of homozygous white polled (PP WW) cattle with a homozygous red horned (pp ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These hornless, roan and genotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes
(dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with the phenotype of Pp Ww. These horned (pr ww) cattle produces F1 heterozygotes (dihybrids) with theterozygotes (dihybrids) with P1 : Phenotype Hornless White × Horned Red Genotype PP WW pp ww 1 P1 Gametes : PW pw F1 : Pp Ww Hornless Roan : 3 Hornle homozygous. The synthesis of certain cell engulfs polysaccharides and glycolipids. A cross between a non-barred hen and a barred cock showing sex-linked (Z-linked) inheritance. Genetic counselling. The figure of homunculus (Fig. The nucleohistones have high molecular weight, e.g., 10,000 to 18,000 daltons. Enzymatic degradation of mRNA is from the 5' to the 3' end, i.e., the end of the RNA that is first synthesized is also the end that is first degraded. At what stage of meiosis does crossing over occur? For example, the enzyme NAD-cytochrome-b5-reductase is synthesized in the cytosol (cytoplasmic matrix) and then becomes incorporated in various parts of the endomembrane system (i.e., RER, SER and Golgi apparatus) and in the outer mitochondrial membrane (Borghese and Gaetani, 1980). A—A brachydactyl hand show5. is vertebrate brain— high densities of microtubules exist in axons and dendrites of nerve cells. This is because an IS contains transcription and/or translation termination signals that block the expression of other genes downstream in an operon. Forms coen-1. What is the number of autosomes present in a human male and female ? Contents 124 GENETICS, HUMAN GENETICS AND EUGENICS Parents Pollen Egg cell Progeny Self-fertilization or crosses between parents of same genotype S1/S2×S1/S2 S1 S S S2 1 2 S1 Cross-fertilization S1/S2×S2/S3 S2 S S3 2 3 S1 None S1 S1/S3 S1/S2×S3/S4 S3 S S4 3 S4 S1 S2 S2 S2/S3 S1/S3 S2/S3 S1/S3 S2/S3 Fully incompatible S2/S4 S1/S4 Fully compatible S2/S4 S1/S4 Fully compatible S2/S4 S1/S4 S1/S4 Fully compatible S2/S4 S1/S4 S1/S4 Fully compatible S2/S4 S1/S4 and Triticum. Despite its strength, the plant cell wall is fully permeable to water and solutes. Some of minerals occur in matrix in non-ionizing state. The eukaryotic (lucleated) cells may have arisen 1.4 billion years ago (Vidal, 1983). coli the task of coordination of synthessis of 54 ribosomal proteins and 3 rRNAs may be quite difficult. Post-transcriptional and are the following : 1. We can consider here in detail the following technique : Isolation of Ribosomal RNA Genes in Xenopus As already described elsewhere, ribosomes consist of ribosomal proteins and ri- Contents GENETIC ENGINEERING 117 bosomal RNA (rRNA). able. For bulk transport of large-sized molecules, plasma membrane performs endocytosis, receptor-mediated endocytosis, receptor-mediated endocytosis, receptor-mediated endocytosis, plasma membrane performs utilise energy in the form of ATP molecules. Flavin adenine dinucleotide (FAD), 5. The percentage or frequency of crossing over, thus, appears to be closely related to physical distance between genes, When, one knows all the genes, linkage groups and number of linkage groups a over as a tool, he may determine the relative distances between the genes in a linkage group and also their order and may give diagrammatic representation of chromosomes showing the genes as points separated by distances proportional to the amount of crossing over. 10.2). Due to the phenomenon of incomplete dominance the allele R for red colour partially expresses itself in hybrids of F1, while the allele r for white colour remains latent or recessive. The science of well born, improving the inborn qualities of race and obtaining the better heritage by judicious breeding. The low pH in the endolysosome dissociates the lysosomal hydrolases from this of F1 and obtaining the better heritage by judicious breeding. receptor, making the transport of the hydrolases unidirectional. Such a receptor is a transmembrane protein which contains two specific binding site at the inner or cytosolic face of the plasma membrane. Protects body against infections; 3. Birnstiel A-13 tubulin molecules (subunits of protofilaments) in cross section; B-Side view of a short section of a microtubule, with the tubulin molecules aligned into rows, or protofilaments. Radial spokes (29 nm) 5. The outer cellular coverings include an outermost gelatinous or slimy layer, the capsule, a middle cell wall and an innermost lipoproteinous plasma membrane. Such molecules may influence the transcription rate by changing the available energy. 18. In a given plant long leaves (S) and yellow vein syy. Cholesterol is especially abundant in the plasma membrane of mammalian cells and absent from prokaryotic cells. This type of parthenogenesis is genetics & evolution known as the partial or incomplete or cyclic parthenogenesis. 9.5. Method of construction of a recombinant DNA molecule using a restriction enzyme. Characteristically the Fig. β' Thus, β and β' subunits form the $\alpha \beta'$ catalytic centre of RNA-P and help $\alpha \omega \sigma \omega + \alpha$ RNA polymerase in unwinding of $\beta \sigma$ DNA molecule for the purpose of α β transcription. Two replicating forks are then believed to travel in opposite directions until they reach either end of that unit, the two end points being nucleotides can be called termini (T). Thus, in fruit plants, if heterosis is once achieved, it may be maintained for long. Duplicate Dominant Genes (15:1) If the dominant alleles of both gene loci produce the same phenotype without cumulative effect, the 9:3:1 ratio (Table 4-9). The rest is protected from digestion and remains as double-stranded DNA fragments 146 nucleoside pairs long bound to a specific complex of 8 nucleosome histories (the histories (the histories and remains as double-stranded DNA fragments 146 nucleoside pairs long bound to a specific complex of 8 nucleosome histories (the histories (the histories and remains as double-stranded DNA fragments 146 nucleoside pairs long bound to a specific complex of 8 nucleosome histories (the histor octamer). That trait is known as dominant trait, e.g., in pea, round character of seed is dominant over wrinkled character of seed. Plasmids have various curious properties : 1. Different stages of first meiotic division (after King 1965). capillaries become clogged with the remains of red blood cells and bile is being absorbed by the blood. Contents GENETICS, HUMAN GENETICS AND EUGENICS 92 ANSWER TO PROBLEMS 3. After the karyokinesis, in each haploid meiotic cell, the cytokinesis occurs and, thus, four haploid cells are resulted. In most animal cells IFs form a "basket" around the nucleus and extend out in gentle curving arrays to the cell periphery. 19.4) and echinoderms. Each stack of Contents GOLGI APPARATUS 169 cisternae forms a dictyosome which may contain 5 to 6 Golgi cisternae in animal cells or 20 or more cisternae in animal cells or 20 or more cisternae in plant cells. The genes they carry may not be absolutely essential for life and so a plasmid can sometimes leave one bacterial cell and enter another, thereby transferring genetic traits between cells. (2) Lopeptidoglyphotrichous. The resulting young one is an abnormal sterile male showing the following features : small testicles, mental retardation, longer arms, feeble breasts, higher pitched voice and sparse body hairs (Fig. It is a fragment of DNA molecule which is enzymatically isolated and cloned. For example, the largest chromosomes been observed in urodele amphibian. From these results three facts became established : 1. They can survive Contents 42 CELL BIOLOGY heat, ionizing and UV radiations, and chemical treatment that normally inactivates viruses (i.e., they are resistant to inactivation by phenol or nuclear enzymes). The DNA is the only phosphorus containing substance in the phage particle; the proteins of the shell, which contain the amino acids methionine and cysteine, have the only sulphur atoms. Thus, in regard to anaemia the HbA allele is dominant. Some examples of abnormal conditions caused by dominant alleles in humans are achondroplasia (a kind of dwarfism), Huntington's corea and brachydactyly (very short fingers). A child suffering from cri-du-chat syndrome. The cell wall also determines the shape of plant cells. Each ribonucleotide contains a pentose sugar (D-ribose); a molecule of phosphate group and a nitrogen base. Each daughter centriole grows to mature size in late prophase maintaining their close proximity to and orientation, bacteria produce marked changes in the environment in a short period. These findings led Pontecorvo (1952) to suggest that each gene has many linearly arranged mutable sites between which recombination can occur. Spores grow zygote (2n) into multicellular male meiocytes (spore mother cell) and female haploid (gametophyte) structures, which through AND EUGENICS 196 A. 5.6. Frye and Edidin's experiment demonstrating the mixof movement is called flip-flop or ing of plasma membrane proteins on mouse-human transbilayer movement and ochybrid cells. (d) TAC. Among plants, few hundred viral diseases are caused, e.g., mosaic diseases of tobacco, cabbage, cauliflower, groundnut and mustard; black-ring spot of
cabbage; leaf roll of tomato; leaf curl of papaya, cotton, bean and soyabean; yellow disease of carrot, peach; little-leaf of brinjal. Both of these types of persons are normal and none has natural anti-Rh antibodies in their blood plasma. The protein synthetic mechanism of chloroplasts is inhibited by chloramphenicol like that of mitochondria and bacteria (Ellis, 1969). A closed, circular DNA molecule of restricted size (i.e., a few tens of thousands of nucleotide pairs), existing only in the cytoplasm (of bacteria); incapable of integration into the bacterial "chromosome". They act by inhibiting incorrect molecular interactions which are not possible in their absence (In fact chaperone is an English word which means a 'person', usually a married or elderly woman who, for the sake of propriety, accompanies a young unmarried lady in public as guide and protector). In lipid metabolism inhibits (Maize is deficient in production of niacin). These are cytosine triphosphate (CTP), uridine triphosphate (UTP) and guanosine triphosphate (GTP). According to the data of rRNA 50S rRNA 5.8S + 5S 60S electron microscopy the dimension of the + 5S 34 proteins dry particles of 70S ribosomes are 170 × 40 proteins 170 × 200 Ao (Hall and Stayter, 1959, Huxley and Zubay, 1960). The instability involved chromosome breakage and was found to occur at sites where transposable elements were located. They also contain FAD, NAD and NADP coenzymes. F1 : red; F2 : 9/16 red : 6/16 brown : 1/16 white. The chromonema remains ary constriction; I or nucleolar organizer; C— connected with the spherules of the centromere. If, alternatively, acetyl-CoA remains in the cytosol, it is reconverted into fatty acids and ultimately to neutral fats. Swammerdam studied development of a minute but preformed individual. In a criminal case, if there was no identifiable fingerprint left behind at the crime scene, there was no case. The membranes of Golgi vacuoles form the double membrane (unit membrane of lipoprotein) sheath around the acrosome and forms the cap-like structure of the spermatozoa. In endospore formation, a part of the protoplasm. Cyanobacteria or blue-green algae. Such enzymes are called repressible enzymes; while the end product is called corepressor. For example, Quinby and Karper (1946) studied heterosis in Sorghum and observed that the heterozygote mama. Direct evidence that the nucleolus is responsible for the synthesis of rRNA was obtained in 1964, when it was discovered that an anucleolate mutant (O-nu) of the South African frog Xenopus laevis, was unable to synthesize rRNA Brown and Gurdon, 1964). 4.20. Further in cattles also sexinfluenced genes occur as spotting in cattle. chromosome, the emulsion was exposed and created visible grains. The allele C' on the short arm of chromosome 9 produces normal pigmentation (after Gardner et al., 1991). The vitelline membrane usually remains closely adhered to the plasma membrane but in later stages a space is developed between the plasma membrane and this space is known as the perivitelline space. Origin of Chromoplasts restored transforms into a chromoplast, it has been observed that some yellow coloured droplets called globulins appear in the former. Dermatitis of eyes, nose (salmon), whole cereand mouth; in amino acid als, yellow corn, lemetabolism in 3. The C4 pathway. Assignment of codons with known sequences. The cell physiology has helped in understanding various complicated physiological activities at cellular level. 125 What potential benefits and/or dangers for the human race do you see in recombinant DNA? His condition resulted because of a mutation. This highquality strain is resistant to disease; furthermore, it matures two weeks earlier than other commercially used strains—a very important factor where the growing season is short. Water has a high surface tension. Ultimately, the tubul are chloroplast from submicroscopic proplastid in dark. Each extremity of the chroFig. Further, emanating from the convex surface of outer layer of kinetochore, in addition to the microtubules, a "corona" or "collar" of fine filaments has been observed. On the other hand, when it is crossed with recessive parent, both phenotypes appear in the progeny. Annulate Lamellae Usually the endoplasmic reticulum has no pores or annuli in it but in certain cases the pores or annuli have been reported, e.g., ER of invertebrates, ovocytes and spermatocytes of the vertebrates. Due to endosmosis or exosmosis the water molecules come in or go out of the cell. In procentric synapsis the homologous chromosomes start pairing from their centromeres and the pairing progresses towards the ends of the homologues. They also contain a specific DNA for the cytoplasmic inheritance and ribosomes for the protein synthesis. Altogether, no more than 5–10 per cent of mitochondrial Contents 214 CELL BIOLOGY H+ components can be attributed to mitochondrial genes. In meiotic division the chormosome number is reduced to half in the daughter cells. C.B. Anfinsen initiated and confirmed the notion that, acting in concert, the specific primary structure of a polypeptide and the innate properties of the side chains of its amino acids cause the polypeptide to spontaneously assume its biologically active tertiary structure. cally identical to the original. Phosphoproteins are proteins in combination with a phosphate group, e.g., casein of the milk and ovovitellin of eggs. Gamow (1954) pointed out that since the genetic language contains only four letters, A, U (=T), C and G, if all code words are of the same size, codons must be at least three bases long. Once the in vitro gene correction or gene augmentation has been achieved at the cellular level (in the cells can be implanted into a suitable region either in an organ of the patient or in the embryo. Contents CYTOPLASMIC MATRIX 109 zag fashion. Both of these genes reduce the viability of flies up to greatest extent. 2.6. Paper chromatography. Some rule must be enacted to encourage the marriages among desirable mates. Diagram of chromosomal exchange in the four-strand stage gous chromosome is very exact and of terminalization during first meiotic division. PPLO reproduce by binary fission, budding, formation of small spore-like bodies and by growth of large branched filaments that ultimately fragment. Such a role for them has been conceived by comparing the geometric design of centrioles (with their disposition in pairs at the right angles and their ninefold symmetry) with manmade devices such as radar scanners, that detect directional signals (Albrecht-Buehler, 1981). TEM of plasmids in bacterial cytoplasm. He found nucleus to play an important role in hereditary mechanism. Tsuchiya. Contents MICROBODIES: PEROXISOMES AND GLYOXYSOMES 187 Recently, a possible relationship has been stressed between peroxides and free radicals (such as superoxide anion-O2-----) with the process of aging. Lamellar form or cisternae (A closed, fluid-filled sac, vesicle or cavity is called cisternae); 2. In this case, the female possesses single Z chromosome and half without any Z chromosome in its body cells (hence, is referred to as ZO) and is heterogametic, producing two kinds of eggs, half with a Z chromosome in its body cells (hence, is referred to as ZO) and is heterogametic, producing two kinds of eggs, half with a Z chromosome and half without any Z chromosome in its body cells (hence, is referred to as ZO) and is heterogametic, producing two kinds of eggs, half with a Z chromosome in its body cells (hence, is referred to as ZO) and is heterogametic, producing two kinds of eggs, half with a Z chromosome and half without any Z chromosome and half without any Z chromosome in its body cells (hence, is referred to as ZO) and is heterogametic, producing two kinds of eggs, half with a Z chromosome and half without any Z chromosome and h The non-genetic RNA is heterogeneous and includes the following three genera : ribosomal RNA (rRNA), transfer RNA (tRNA) and messenger RNA (tRNA). 10-8. The pH of plant vacuoles may be as high as 9 to 10 due to large quantities of alvacuole chloplast kaline substances or as cell wall low as 3 due to the accumulation of quantities of Cytoplasm acids (e.g., citric, oxalic and tartaric acids). MORPHOLOGY Number Usually the cells contain single nucleus but the number of the nucleus may vary from cell to cell. Conjugated proteins. Loss, or gain, of a part of the chromosome set (aneuploidy) 2. The organic compounds usually contain large molecules which are formed by the similar or dissimilar unit structure known as the monomers. A— Top view of 30-nm fibre; B—Side view of 30-nm fibre (after Alberts et al, 1989). soluble components of the sample mixture will Fig. According to this theory during the late pachytene of meiosis, the homologous chromosomes pair and become spirally twisted around each other. RNA polymerase II Nucleoplasm 3. However, gametes of wheat contain 21 chromosomes, hence, 2n = 42 and n = 21 (see Suzuki et al., 1986). The produc is electron opaque and appears as dark regions in the cell where catalase is present. It occurs only in mature cell walls and is made of an insoluble hydrophobic aromatic polymer of phenolic alcohols (e.g., hydroxyphenyl provides a physical basis of heredity. after labelling 2nd metaphase All known DNA molecules, with duplication without, after labelling labelled thymidine only few exceptions, replicate as circles (or dubbles/eyes) and, hence, Fig. 6.4. Two forms of genetic code. 4.1. Semi-conservative model of DNA replication. At this low cells, thus, can be stored for 100 or more temperature, embryos can be preserved almost indefinitely. When a log is to be burned in a fire place, the log must first be chopped up into Pyruvic acid Acetyl CoA smaller chunks of Fatty acids fuel. The number of the nucleoli in the nuc genetics was derived from the Greek root gen which means to become or to grow into and it was coined by Bateson in 1906 for the
study of physiology of heredity and variations. Subunit Gene Molecular weight (daltons) Location Function 1. Its wild type or normal dominant would have the same lower case letter but with a+ as a superscript. Kinds of phagocytosis. This showed that ribosomes sedimented at discrete peaks in the 40S-70S range. The transmission Short tt Tt of certain phenotypes from one parental type to all tt the progeny; such inheritance is generally produced by organelle genes. He proposed the following reaction for all photosynthetic organisms : CO2 + Hydrogen acceptor -> chlorophyll Hydrogen donor (H2O or H2S) (CH2O) Reduced acceptor + 2A + H2O Dehydrogenated donor (1/2 O2 or S) In 1932, Emerson and Arnold carried out the flashing light experiment and showed the existence of light and dark reactions. Collectively, these fibres are termed as the cytoskeleton. Monoploidy is common in plants and rare in animals. The average lifetime of many mRNA molecules of E.coli is only two minutes at 370C. In one species of rotifer, Martini (1912) always found 183 nuclei in the brain, 39 in the stomach, 172 in the cornea epithelium, and so on (see Hickman, Sr., et al. Her elder sister was diagnosed too late to begin the the urine. In the nutshell the prokaryotic cells are distinguished from the eukaryotic cells primarily on the basis of what they lack, i.e., prokaryotes lack in the nuclear envelope, and any other cytoplasmic membrane. linker DNA The 30-nm fibre consists of closely packed histone H1 nucleosomes. They are found at the periphery of the organelle, usually at the ends Secetory vesicles leaving the trans region. Often some breast development, as in females, occurs. What is coupling and repulsion hypothesis ? 145 transmembrane linkers plaque tonofilaments CELL COAT The plasma membrane is surrounded and protected by the cell coat. By such a microscope though, one can see considerable details in most cells, there is also a great deal that cannot be seen. normal pollen grains Fig. The mitochondrial ribosomes are small in size and resemble the ribosomes of the 3'-OH group, so leading-strand synthesis proceeds by elongation from this terminus. 3.8. Schematic diagram to show how fusogenic 7. Recently and resemble the ribosomes of the bacteria. besides ATP, certain other energy rich chemical compounds have been found to be active in the cellular metabolism. When the growth of the cytoplasm and nucleus of the primary oocyte is completed it becomes ready for the maturation phase. Small 30S ribosomal subunit can engage mRNA before binding of initiator met tRNAf Met. Pseudoalleles show complementation, thereby, indicating their functional individuality. LNLN Reaction with antisera: Anti-M Anti-N + + - - + + Blood group (Phenotype) M MN N 3. store energy. The 50S cleft vaulted seat subunit is often compared with an armchair, with the rounded base forming a vaulted tunnel 50S seat, the central protuberance forming the subunit back and the lateral protuberances the arms base of chair. The first meiotic division includes a long prophase in which the homologous chromosomes become closely associated to each other and interchange of hereditary material takes place between them. These questions refer to eukaryotic RNA : (a) What is a cap? For example, if a and b are two alleles, the allelic test can be shown as in Fig. Animal viruses. 1:2:1:3:4:2. Provide an explanation for this phenomenon. The word 'reproduction implies replication, and it is true that biologic reproduction almost always yields a reasonable facsimile of the parent unit. The exchage of the genetic material takes place between the non-sister chromatids of homologous chromosomes. one which has no obvious phenotypic effect in heterozygotes and 2. Most mutations occur spontaneously by the environmental effect, however, they can be induced in the laboratory either by radiations, physical factors or chemicals (called mutagens). Telophase II The chromatids migrate to the opposite poles and now known as chromosomes. Contents TECHNIQUES IN CELL BIOLOGY 31 5. Yeast Ty elements. (4) Vibrios (singular vibrio). 18.4. Mitotic metaphase spindle structure in (A) a plant cell and (B) an animal cell. The plasma memmolecule pectin molecule brane of one cell is continuous with that of its neighbour at each plasmade at this point is commonly referred to as bivalent or dyads because it consists of G - LATE ANAPHASE two visible chromoD DIPLOTENE somes, or as a quadrivFig. The F1 hybrids which receive a X-chromosome with + gene from the female and a X-chromosome with + gene from the female because gene '+' is dominant over gene 'w'. FUNCTIONS OF PLASMA MEMBRANE The plasma membrane acts as a thin barrier which separates the intracellular fluid or the cytoplasm from the extra-cellular fluid in which the cell lives. 'Bent', a dominant sex-linked allele B, in the mouse, results in a short, crooked tail; its recessive allele, b, produces normal tails. Thus, a XX female with tra/tra genotype will be a normal male fly. In the chicken an incompletely dominant gene (cp) in heterozygous condition. Cell theory does not have universal application, i.e., there are certain living organisms which do not have true cells. Contents CHROMOSOMES 263 Chromosome satellites are a morphological entity and should not be confused with satellite DNAs which are highly repeated DNA sequence. Meiotic products resulting from a single crossover within a heterozygous pericentric inversion (after Suzuki et al., 1986). Pace and S. (ii) Haemoglobin. In a multicellular organism, the shape of the cell depends mainly on its functional adaptations and partly on the surface tension, viscosity of the protoplasm, cytoskeleton of microtubules, microfilaments and intermediate filaments, the mechanical Contents CELL 55 action exerted by adjoining cells and rigidity of the plasma membrane (i.e., presence of rigid cell wall in plant cells). The bacterial protoplast is bound by a living, ultrathin (6 to 8 nm thick) and dynamic plasma membrane. The ATP synthetase can either synthesize ATP by harnessing the proton motive force (A) or pump protons against their electrochemical gradient by hydrolyzing ATP (B). How will you distinguish between autopolyploids. Sometimes in primary oocyte karyokinesis forms a nucleus of the first polocyte. Red blood Bb cells sickled-shaped; contain one type of haemoglobin, i.e., Black, BB Splashed white, bb haemoglobin S. Contents 216 CELL BIOLOGY Mitochondrial ribosomes. Their genitals are affected by developmental abnormalities. Slight scratches, accidental injuries, or even bruises, which would not be serious in normal persons, may result in fatal bleeding for the haemophiliac. Alwine et al., developed northern blotting technique in which mRNA bands are blot transferred from the gel onto chemically reactive paper. Swine or Pig 7. Contents MICROBODIES: PEROXISOMES 185 called glyoxysomes, were discovered in 1969 by Beevers in the endoplasm cells of germinating castor bean (Ricinus). Dominant phenotype. 11.11. 1 NH New numbering system Fig. 8.5. B b A A B C c 4 Diagram showing the results of single and double crossing over. When the nuclei of both the species are present in the same cytoplasm, an intermediate type of cap develops. Z-DNA A-DNA RIBONUCLEIC ACID (RNA) Uracil. However, sexual reproduction, practiced by the majority of animals, plants and microorganisms, produces diversity needed for survival in a world of constant change (i.e., evolution). Describe the energetics of glucose oxidation and compare it with that of fat oxidation. These are tabulated as follows : Table 3.4. Normal human traits. The macromolecules (ligands) bind to complementary cell-surface receptors. B—Finer structure of unit structure or connexion of gap junction. OTHER FUNCTIONS OF MITOCHONDRIA Besides the ATP production, mitochondria serve the following important functions in animals: 1. When both parents are crossed the union of both types of gametes takes place to give the F1 hybrid (Yy Rr). pollination, (3) temperature shock (cold treatment), (4) colchicine treatment, (5) distant (interspecific or intergeneric) hybridization), (6) anther or pollen culture. A—Ultrastructure of seed before germireticulum. Insects : (i) Hymenoptera (Micromalthus debilis), (iv) Thysanoptera (Anthothrips verbasi). This is done for all the four reaction mixtures on adjoining lanes in the gel. Fine Structure of Gene 1 2 . In the tissues of multicellular animals, the plasma membranes of two adjacent cells usually remain separated by a space of 10 to 150 A^o wide. Sometimes centrioles can serve first one function and then another in turn : for example, prior to each division in Chlamydomonas, the two flagella resorb and the basal bodies leave their position to act as mitotic poles. As a process, mitosis is remarkably similar in all animals and plants. Like DNA, RNA is synthesized in the 5-3' direction from the single-stranded region of the DNA template. Bridges (1916-1919) who studied the inheritance pattern of sex-linked lethal characters which have arisen spontaneously in a population of Drosophila. The initiating nucleoside triphosphate binds to the enzyme in the open-promoter complex and forms a hydrogen bond with the complementary DNA base (Fig. In Contents 100 GENETICS, HUMAN GENETICS AND EUGENICS succeeding divisions of the recipient cell, the donor segment is lost (see Burns, duplication 1969). For a molecule of n-deoxyribonucleotide pairs, give a mathematical expression that can be used to calculate the number of possible sequences of those nucleotide pairs if only the "usual" bases are present. Vimentin and synemin containing IFs can be observed in the chicken erythrocytes. They occur either freely in the matrix of mitochondria, chloroplasmic reticulum and nucleus. Describe meiosis in a translocation heterozygote. He further suggested that the two Ro R William Bateson (1861 - 1926) ro genes are found in coupling phase or in repulr sion phase, because they r
ro Ro are present on the same chromosomes Fig. i.e., short legged sheep could not cross the low stone fence and damage the crop fields in the vicinity, he produced a flock of lock sheeps, each of which having short legs by employing artificial breeding techniques. GTP seems to be necessary for binding of this factor to ribosome. A—Thorax of a fruit fly heterozygous for y (yellow body) and sn (singed hairs and bristles) with a twin spot; B—Mechanism of crossing over leading to homozygosity for distal genes. What similarities occur between nuclear envelope and endoplasmic reticulum ? What functions seem relegated mostly to smooth endoplasmic reticulum ? 13.10. One of the autoploid species of Chrysanthemum. As the furrow deepens the animal cell divides (Cynodon dactylon) which is quite Flower of one of the autoploid species of Chrysanthemum. As the furrow deepens the animal cell divides (Cynodon dactylon) which is quite Flower of one of the autoploid species of Chrysanthemum. into two. Although a number of inherited diseases can be treated in a similar euphenic manner, but these constitute only a small fraction of known inherited disease. The bar phenotype is characterized by Contents FINE STRUCTURE OF GENE 129 a narrower, oblong, bar-shaped eye with fewer facets. The operator is found to comprise 26 base pairs The era of molecular genetics followed the discovery of DNA structure (i.e., 1953) when the fundamental unit of Max Delbruck 1906-1981. Numerous 10-nm thick intermediate filaments, converge towards the microvillus actin filaments of keratin protein, called tonofilaments, converge towards the microvillus actin filaments of keratin protein, called tonofilaments of cross cell) basal lamina Fig. Urea and sucrose. In differential centrifugation mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at the centrifugation (20,000 to 400,000 g) mitochondria are deposited intact at th multiple points including their ends (i.e., phosphorylated 'head' and 'tail'). (B) Column chromatography. The three subunit microtubules have been designated A, B, and C, with the innermost tubule being A. TYPES OF CROSSING OVER According to its occurrence in the somatic or germ cells following two types of crossing over have been recognized 1. Various immunological and chemical cross-linking procedures have made possible the construction of the gene is estimated to consist of about 150 amino acid residues. Contents MULTIPLE ALLELES 125 REVISION QUESTIONS AND PROBLEMS 1. For example, Octaploid (72) the size of lower epidermis of leaf of a tetraploid Saxifraga pensylvanica was found greater than the diploids (Fig. Acid phosphatase 7. What is the simplest explanation that will account for this genotype ? Contents GENETICS, HUMAN GENETICS AND EUGENICS 104 CYTOLOGICAL DETECTION OF CROSSING OVER Creighton and McClintock's experiment. About 10 types of triplet-stranded collagen mol- in tropocollagen ecules have been found to assemble from various combinations of 20 types of α-chains. As the free energy of combustion of palmitic acid is 9791 kJ/mol, the process of β-oxidation captures as ATP molecules on the border of 48 per cent of the total energy of combustion of the fatty acid (see Mayes and Granner, 1985). Some of the split proteins are apparently specific for each ribosomal subunit. It is a multimeric enzyme or holoenzyme having ten subunits such as alpha (α), beta (β), epsilon (ϵ), theta (θ), tau (τ) gamma (γ), delta dash (δ'), chi (χ), and psi (ψ). ells, and organs are composed of chemicals, many of which are identical with those found in nonliving matter, while others are unique to living organisms. For the discovery of lysosomes and a brilliant series of experiments on them, de Duve shared the 1974 Nobel Prize for physiology with Palade and Claude, both were pioneer cell biologists. Three pairs of hydrogen molecules are accepted by NAD+, reducing it into NADH, and one pair by FAD, reducing it into FADH2 (this pair of electrons comes directly from the succinic dehydrogenase reaction). Gene bank or genomic library is a complete collection of cloned DNA fragments which comprises the entire genome of an organism (Dahl et al. 1981). LPS have antigenic property and anchor the proteins and polysaccharides of the surrounding capsule (see King, 1986). 5.19). Of the particular importance was the eugenics movement in England in the last part of the nineteenth century. The membrane, thus, is composed of a bimolecular layer of phospholipids in which 'float' proteins of various sorts. Linkage. (c) State what the ultimate effect of continued outbreeding in a population. Later on, these pieces are fused with the help of ligase enzyme to form an intact lagging strand. Nuclear pores contain octagonal pore complexes which regulate exchange between the nucleus and cytoplasm. Beadle and E. Effect of Chemical Mutagens on Nucleotide Sequence (a) Alteration in Resting Nucleic Acid 1. Contents 198 GENETICS, HUMAN GENETICS AND EUGENICS Cytology of trisomics. The technique of DNA fingerprinting relies on developments from recombinant DNA technology and allows an examination of each individual's unique genetic blueprint-DNA. It is also surrounded by less organized intermediate filaments chromatin (Fig. In both animals and plants, male and female gametes unite during fertilization to produce a zygote in which the diploid chromosome number is restored. East and Mangelsdrof (1925) proposed a series of self-sterility alleles, labelled S1, S2, S3, S4 The transition from a state of physiological "twoness" is most closely coordinated with duplication of nucleolar organizers and formation of nucleolar individuals of a species resemble closely with one another in shape and size. Contents 192 GENETICS, HUMAN GENETICS AND EUGENICS (i) Triticum spelta is a hexaploid wheat which was artificially synthesized in 1946 by E.S. McFadden and E. CC, Cc EE, Ee Both C+E (complementation)* Epistatic alleles write = 7 Coloured=9 * Chromogen ntation of C and E (i.e., dominant epistatic and hypostatic alleles). They synthesized small RNA molecules (mRNAs) of known composition and observed which a mRNA molecule is not translated at all until a signal is received. They do not contain cell wall and mesosomes. Marianne GrunbergManago and Severo Ochoa isolated an enzyme from the bacterial cells. This disease is caused by an autosomal dominant gene. ribosome endoplasmic membrane stalk cleft messenger RNA 40S subunit 287 60S subunit growing polypeptide Fig. The size of mitochondrial genome is very much large in plants than in animals. Translational Control In bacteria, most mRNA molecules are translated about the same number of times with only fairly small variation from gene to gene. sheath 1000 A^o core tail fibres basal plate From left : Dr. E. Palade (1956) has observed secretory granules in the cavity of endoplasmic reticulum. They contain different sets of genes and are like any other brothers and sisters, but just happen to grow simultaneously in the same uterus. The genotype R-P-produces walnut comb, characteristic of the Malay breed : R-pp produces rose comb, characteristic of the Wayandotte breed; rr P-produces pea comb, characteristic of the Brahma breed ; rr pp produces single comb, characteristic of the Leghorn breed. It was named amber after a graduate student named Bernstein (= the German word for 'amber' and amber means brownish yellow) who helped in the discovery of a class of mutations. The prophase of first meiotic division is very significant phase because the most cytogenetical events such as synapsis, crossing over, etc., occur during this phase. At each turn of the Krebs cycle, four pairs of hydrogen atoms are removed from the substrate intermediates by enzymatic dehydrogenation and two CO2 molecules are released. Retention of ions in the matrix produces an increase in osmotic pressure and, thus, the entrance of water in the cell. The growth in all multicellular organisms. Histonesome is flat and that each histone octamer has two turns depleted chromosomes are found to of DNA sealed off by
histore H1. Aphids give birth to live young produced by the process of parthenogenesis. One of the important discoveries that has come from chemical studies is that the primary structures of histores have been highly conserved during evolutionary history. The differential region of each chromosome (i.e., X) contain genes that have no counterparts on the other kind of sex chromosome. Light chain Heavy chain Percentage of total blood Ig k or λ μ 10 1 (Monomeric) 5 (Pentameric) 7. As shown in Figure 10.11, in this chain of reactions, the product of one enzyme serves as a substrate for the next reaction. In a solution the particles of solute should be less than 1/10,000 millimetre in diameter. Pollution : types of pollutants; air pollution by human activities, types of air pollutants, ecology of air pollutants, ecology of air pollutants, ecology of water pollutants, effect of air pollutants, effect of air pollution - sewage pollution, industrial pollution, thermal pollution, silt pollution, water pollution, water pollution; revision questions. For example, the gene (w) Contents GENETIC AND CYTOLOGICAL MAPPING OF CHROMOSOMES 113 for white eyes is in bands 3C2. Human Genetics 231-245 Pedigree analysis; amniocentesis; twins, fraternal or dizygotic twins, fraternal or dizygoti rolling, inborn errors of metabolism — phenylketonuria, albinism, sickle-cell anaemia; human cytogenetics : banding techniques; sex determination; sex linkage; chromosomal aberrations; revision questions. This is the reason that brothers and sisters with the same parents resemble each other and with their parents. (X-linked), recessive lethal mutations. The insertion Freifelder, 1985). Every kind of animal cell is bounded by a living, extremely thin and delicate membrane or plasma membrane of plasma membrane. The gel is used for autoradiography so that the position of different bands in each lane can be visualized. The basement membranes of endothelial cells are the best examples of extraneous coats. According to this model, periodic enzyme production initiates end product repression by negative feedback. Most of the trisomics were identified by the size, shape and other morphological features of the fruit of jimson weed (Fig. Table 7.1. Differences between prokaryotes and eukaryotes) in the mechanism of translation (i.e., polypeptide synthesis). The chromosomes which have no relation with the sex and contain the genes which deNettie Stevens. Protein kinase (Endoenzyme of erythrocyte) 16. Nirenberg has also stated that the genes which deNettie Stevens. throughout the evolution of living organisms. The tryptophan (trp) operon of E.coli is responsible for the synthesis of the amino acid tryptophan. 4.1. Supplementary inheritance. Apparently, to give uniformity the other two termination codons were also named after colours such as ochre for UAA and opal or umber for UGA. A prokaryotic cell of Escherichia coli. In this case the duplicated region is not situated adjacent to the normal section. Both centroles are found in a specially differentiated region the centrosome, cell centre or centrosphere. Such haploids, since are obtained from the polyploids (i.e., cross of tetraploid emmer wheat and diploid goat grass), they are called polyhaploids, just to differentiate them from the normal monoploids. phenyllactic acid homogentistic acid (alkapton) (iii) Albinism. Biotechnology emerged as a new discipline due to marriage of biological science Howard Temin (1934-94). Lipoic acid (LIP or S2), 7. 15.8) or octaploid triticale (2n = 8x = 56; Fig. Glyoxysomes consist of an amorphous protein matrix surrounded by a limiting membrane. The genes remain arranged linearly on the chromosomes and they have no option before them, except to behave according to the chromosome inherit together and are said to be linked with each other to form linkage groups. Photorespiration is a wasteful process for the plant cell, since, it significantly reduces the efficiency of the process of photosynthesis (i.e., it returns a portion of fixed CO2 to the atmosphere). All the paternal bands in child's DNA fingerprint must match with the alleged father for positive paternity identification. It is postulated that the chloroplastic envelope has receptor sites that recognize the proteins that are to be incorporated into the organelle. This pattern is called lysogeny and is characterized by delayed lysis after phage infection. In animals and simpler plants, the zygote matures to a new diploid organism. Towbin et al., developed the western blotting technique to find out the newly encoded protein by a transformed cell. (v) Histone acetylase and deacetylases. In the diagram, letters and numbers have been used instead of nucleotides to make repeats easier to read. Exchange on mole-for-mole basis citrate between matrix and cytosol. In photorespiration, glycolic acid (glycolate), a two-carbon product of photosynthesis is released from chloroplasts and oxidized into glyoxylate and H2O2 by a peroxisomal enzyme called glycolic acid oxidase. People of LMLN genotype have both antigens. IV. They are the nuclear lamins which form highly organized two dimensional sheets of filaments. Among livestock and fowl, viruses cause encephalitis, foot and mouth disease, fowl plague, Newcastle disease, pseudorabis, hog cholera and a variety of warts and other tumors. Although at some points the polypeptide chain loops and folds. inside the host cell are liberated There are two styles to this persistence of phage DNA : the phage Fig. Transferase enzymes are found to be located in the membranes of Golgi, not in the lumen of cisternae (Thorpe, 1984). factor was present in some maize stocks, but absent in others. The chromonemata form the gene-bearing portions of the chromosomes. The gene for chinchilla is represented as cch. The fixed pattern of bands and interbands in a Drosophila polytene Fig. The suffix "--ploid" refers to chromosome "sets". brane-bound vacuolar structures having the diameter of 25 to 500 µm. Because in genetical experiments sometimes we have to rear genetically pure parents by methods of controlled mating. Epistasis. Mesolecithal. These results are plotted as histograms in Fig. apposition, separated by a space of only 2 to 4 nm. The daughter chromosome except for portions "copied" from the donor chromosome except for portions (~40 pores/µm2) and the oocytes from Xenopus laevis (~50 pores/µm2), both of which are very active in transcription. The processing of proteins, i.e., glycosylation, phosphorylation, Contents CELL 61 sulphation and selective proteolywhite cells is. Consequently in the salivary gland cells the chromosome number always appear to be half of the normal somatic cells, e.g., D. Plant cells are larger than CCA3'...... Beside getting the ratio of 3: 1 of the monohybrid crosses Mendel got the ratio of 9: 3: 3: 1. An individual lacking one chromosome of a set (2n - 1). If such enucleated spheres are normally fertilized, they may develop into dwarf larvae. Their F1 progeny would be male fertile Rr. However, if the male parent is male fertile rr, the F1 progeny would be male sterile rr. The F1 hybrid when test crossed with recessive (rr ro ro) parent, the test cross ratio was 1 blue or purple long : 7 red long (RR ro ro) (rr Ro Ro) F1 : All Blue or purple Long (Rr Ro ro) × P1 Red Round Test cross : F1 Blue or purple Long Parent : (Rr Ro ro) R.C. Punnett (1875 - 1967) R (rr ro ro) Test cross progeny : 1/16 Blue or purple Long : 7/16 Blue or purple Round or 1 : 7 : 7 : 1. Structure Viruses are quite a varied group (Fig. OCCURRENCE Mutations occur frequently in the nature and have been reported in many organisms, e.g., Drosophila, mice and other rodents, rats, rabbits, guinea pigs and man. New histone is required in massive amounts immediately at the start of the S period of DNA synthesis to provide the new DNA with nucleosomes. Positive Control Many bacterial genes are under positive control. This type of unequal division has the great significance for the egg. 19.3. Budding in a tunicate. termination. In the first few cleavages of amphibian development, the nuclear envelope initially forms around individual chromosomes, forming several vesicles that then fuse together to form a single nucleus. Uses of Genetic Maps The genetic maps have following uses : (i) The chromosome maps display the exact location, arrangement and combination of genes in a linkage group or chromosomes. For example, due to forward mutation the adenine : forward mutation the adenine is changed into guanine and backward mutation the adenine : forward mutation the adenine : forward mutation the adenine : forward mutation the adenine is changed into guanine and backward mutation the adenine : forward muta Guwahati-781 001. The electrophoresis method is used in the separation of proteins, nucleic acids and their building blocks. The nucleases are encoded in T4 phage genome to degrade only the DNA of host cell. The first protein found primarily in red muscle and largely responsible for the colour of that tissue. Linkage data do not correspond exactly with cytological locations, but the linear sequence of genes can be verified from salivary preparations. The fine difference between these two types of alleles becomes clear by the following chart : (see page 64). The enzymes involved in the detoxification of aromatic hydrocarbons are aryl hydroxylases. 1978-79 W. 11.4. Different kinds of chloroplasts containing variable number of thylakoids per granum. Different kinds of chloroplasts containing variable number of thylakoids per granum. species of Chrysanthemum. 4.24). plastic block. Soon after the nuclear membrane breaks and the bivalent chromosomes move towards the opposite poles due to contraction of chromosomes move towards the small effect, are segregating to produce quantitative variation) has long been the basic model of quantitative genetics. Each enzyme is specific and it attaches with the specific and cent
homozygosity n In a heterozygote the inbreeding increases the probability of homozygosity of deleterious recessive ns i alleles in a inbred population. E.coli lacks mitochondria, and respiratory chain enzymes of Krebs cycle, NADH, acid phosphatase, etc., are attached to inner face of the plasma membrane. Water is required for this process and two hydrogens are removed by coenzyme NAD. eIF4C 9. The W chromosome is not a strong female sex determining element (see Stansfield, 1986). Both the processes can be studied in detail under separate headings. What is sex determining element (see Stansfield, 1986). LDL particles are bound Fig. Demonstrated the feasibility of the electron microscope. Huxley K. Proteins synthesized by free ribosomes may be inserted into the plasma membrane following their completion and release from the ribosomes may be inserted into the plasma membrane following their completion and release from the ribosomes. the coordination of iodine ions in the interior of the helix. Hence, the two dominant pairs of alleles repelled each other. The digested material has low molecular weight and readily passess through the membrane of the lysosomes to become the part of the matrix (Fig. SIGNIFICANCE OF MUTATION The vast majority of mutations are deleterious to the organism and are kept at low frequency in the population by the action of natural selection. Since the triphosphate of the primary transcript is absent, the molecule has been processed. 4.39. crossing over occurs at four strand stage and not at two strand stage; it will produce (2:2:2:2 ratio). What percentage of mutations would be expected at 3500 R? Immature lymphocytes retain antibody and simply insert the Ig molecules into their plasma membranes, whereas following stimulation with antigen, the same lymphocyte becomes secretory, releasing antibody molecules into circulation. The infected host cell is said to be lysogenic because dormant virus may at any time become active and begin directing the synthesized which subsequently, after losing segments of RNA by cleav- B age, gives rise to tRNA. 2.4. Detailed structure of a T2 bacteriophage. The pyranose or furanose ring is considered to be in the plane of the paper; thus, in gluco-pyranose, carbon atom 5 and the ring oxygen lie behind the plane of the paper. When two male pronuclei unite with a female pronucleus, the union is known as polyandry, e.g., man and rat. 12.10) ZLZL × Z1w Dark male Light female Gametes: (ZL)(ZL) (X1) (w) sperms ova F1: 1/2 ZLZ1 : 1/2 Z Dark female 1 1 Gametes: (Z)(Z) (ZL) (W) sperms ova F1: ZLZ1 1/2 Z1W Dark female Light male or 1:1 ratio Fig. (b) What F1 phenotype would indicate allelism? Each globin chain envelops its haem group in a deep cleft. This proved effective in cancer chemotherapy. These radicals may act on DNA molecule to produce mutations altering the

transcription into mRNA and the translation into proteins. All genes of E.coli are contained on a single supercoiled, double-stranded, circular DNA molecule, which occurs in a clear zone of cytoplasm, called nucleoid, and is attached to the plasma membrane at one point. Gynandromorphs. degradation of the amino acids. The chemical organization of the nucleus has been investigated by two main approaches. But, because viruses are primitive and simpler units of life, therefore, they should be discussed prior to other cells. If life is defined as being Contents CELL 35 capable of making new life directly through its own metabolic efforts, then viruses are not living. The kind of antigen produced is likewise genetically determined. The initiation event seems to involve the formation of some multimeric "nucleating" centre, following which the addition of more subunits proceeds rapidly during elongation. Year Name of contributor Cell biological contributor Cell biological contribution 1900 C.Garnier J.Loeb E.Strasburger T.H. Montgomery Introduced the term ergastoplasm. The steroids consist of a system of fused cyclohexane and cyclopentane rings. Gene Number of the chromosome 1 1 1 1 1 1 1 Amylase (pancreatic) Actin, skeletal muscle alpha chain Xeroderma pigmentosum A Rhesus blood antigen (Rh) Histone cluster B : H3, H4 Cystic fibrosis antigen Acid phosphatase 13 13 14 14 14 2 2 2 2 2 2 2 Elastin Interferon-1 Collagen III Collagen IV Glucagon Tubulin, alpha, testis specific 3 3 Rhodopsin Somatostatin 4 4 4 Huntington's disease MN blood group Diabetes insipidus 15 16 16 17 18 19 19 20 5 Fibroblast growth factor, acidic 6 6 Tubulin, beta M40 Insulin - dependent diabetes mellitus 7 7 7 7 Actin, cytoskeletal beta Collagen I alpha 2 Histone cluster A : H1, H2A, H2B Non-histone chromosomal protein-2 8 8 Polymerase, DNA, beta Carbonic Anhydrase cluster 9 ABO blood group 10 11 11 12 12 Hexokinase-1 Catalase Insulin Salivary protein complex Collagen IV, alpha-2 chain Ribosomal RNA T-cell leukemia-1 Immunoglobulin heavy chain gene cluster Ribosomal RNA Haemoglobin alpha Haemoglobin zeta Nonhistone chromosomal protein-1 Growth hormone releasing factor, somatocrinin Ribosomal RNA Myoglobin Ribosomal RNA Polymerase DNA, alpha Gonadal dysgenesis, XY female type Haemophilia A, factor VIII Haemophilia B, factor IX Deutan (green) colour blindness; red cone pigment Ocular albinism Azoospermia-third factor Stature H-Y antigen Testicular determining factor (TDF) Pseudoautosomal segment (PAS) Contents 112 GENETICS, HUMAN GENETICS AND EUGENICS If crossing over in region I and II were independent, we should predict 0.035 X 0.184 = 0.6 per cent double crossovers, where as only 0.1 per cent was observed So, coincidence = = 0.167 Linkage Maps of Different Organisms By adopting the above mentioned techniques geneticists have constructed the linkage or genetic maps of various organisms, such as, viruses, bacteria, fungi, tomato, barley, wheat, rice, sorghum, morning glory, garden pea, maize, Drosophila, chickens, mice, man (Table 9-2), etc. Dissociation and reconstitution (self-assembly) of the ribosomes. A-Schematic representation of a phospholipid molecule; B—Formation of micelle and monolayer film; C— Formation of a fat droplet by triglycerides; D—Formation of self - sealing lipid bilayer (e.g., liposome); E— Cross section of a liposome (after Alberts et al., 1989). From this experiment, they concluded that a genetic code is in triplet form, because the addition of one or two nucleotides has put the reading of the code out of order, while the addition of third nucleotide resulted in a return to the proper reading of the message. The mRNA code word for phenlalanine was, therefore, shown to be UUU. Chain lengths vary from several O hundred to several thou of order, while the addition of third nucleotide resulted in a return to the proper reading of the message. of celluOH OH OH OH OH OH OH ose may contain more than 20,000 glycosyl Fig. First observed the centriole. The products of a single meiosis may consist of four or eight spores, called ascospores), retained in a sac-like structure, the ascus, and are deNeurospora asci. How many types of RNA and proteins are found in the 70S and 80S ribosomes ? Fine Structure of Gene 127-133 Gene concept : test of allelism — bar locus in Drosophila, lozenge locus, apricot eye colour in Drosophila, cistron, recon and muton, complex gene loci; revision questions and problems; answers to problems; answers to problems and prob oocytes of all animal species, both vertebrates and invertebrates. muscle cells and are also characteristic of cancer cells. This hormone operates by derepressing appropriate genes in the aleurone cells, which then begin to crank out new hydrolytic proteins (see Thorpe, 1984). Hypertonic and Hypotonic sea waters. Outline one form of evidence for each statement. And lastly, in regard to haemoglobin, there is codominance. An individual of genotype Aa is a carrier of a if there is complete dominance of A on a. For example, in prokaryotes some enzymes are synthesized constitutively (i.e., continuously), indicating that transcription of mRNA is constantly occurring in them. 9.11. 4.6. A – Unidirectional DNA replication; B – Bidirectional DNA replication; B life processes was an DNA is the genetic material of almost all organisms. To a great extent, this hypothesis has been found correct. How does a mutation act? Belling believed that crossing over might occur during duplication of homologous chromosomes and might brought about due to novel attachments formed between newly synthesized genesited. Occurrence in the first meiotic division of males produces XY Contents SEX LINKED INHERITANCE AAXvXv Parents: × Vermilion female Gametes : Eggs: (A + (numerous) Sperms : X + Xv F1: 1. It shows incomplete dominance. Meiocytes. The protein oplasts are the protein storing plastids which mostly occur in seeds and contain few thylakoids (Heinrich, 1966). Describe the method of wild type symbolism. In column chromatography (Fig. Describe, with the help of an illustration, the genetic effects of inbreeding and to the viability of offspring. Exceptions to this pattern are found in Amoeba. Such hybrid viruses (or chimeras) were allowed to infect tobacco leaves, and the progeny were examined. NADH dehydrogenase complex (monomer) b-c1, complex (dimer) cytochrome oxidase complex (dimer) b-c1, complex (dimer) inner mitochondrial membrane matrix space H+ NADH (from oxidative reactions) cyt a cyt b Cyt b Q cyt c QQ QQ Q cyt a3 2e- Q Q 1/2O2 2H- 2H+ B NAD+ Q H 2O Fig. The phaeoplast (Gr., phaeo=dark or brown; plast=living) contains the pigment fucoxanthin which absorbs the light. Respiratory enzyme complexes. coli cell is rRNA. A polytene chromosome of Drosophila salivary gland has about 1000 DNA molecules which are arranged side by side and which arise from 10 rounds of DNA replication (210 = 1024). When out of two phenotypes, one phenotype is of much more common occurrence in the population than its alternative phenotype, one phenotype is of much more common occurrence in the population than its alternative phenotype. advacne to AUG codon by linear scanning. 3.11). During this phase of dark reaction, three molecules of carbon dioxide (3C) are attached to three molecules of ribulose 1,5, biphosphate; 15C) to produce short-lived six-carbon intermediates. Protein synthesis and cell growth. Such molecular probes are used to detect the unique repetitive DNA patterns characteristic of each individual. In an icosahedral virus the minimum number of capsomeres is 12 or its multiple such as 32, 42, 72, 92, 162, 252, 362, 492, 642 and 812. This condition is called Tay-Sachs disease and leads to paralysis, blindness and retarded development of human beings. Contents C H A P T E R 2 Identification of the Genetic Materials W Computer-generated model of DNA molecule. It is of following two kinds : 1. Discovered cytochromes. Cytogenetics is that branch of cell biology which is concerned with the cytological and molecular bases of heredity, variation, mutation, phylogeny Contents INTRODUCTION 15 morphogenesis and evolution of organisms. Generally, polyploidy is common in monocots) but rare in animals. At the time of cell division two pairs of centrioles are formed and form the spindle of microtubules which help in the separation and movement of chromosomes during concluding stages of cell divisions. Bridges, beginning in 1934, made extensive and detailed investigation of the salivary gland chromosomes and, in the course of his investigations, developed a tool of practical usefulness in relating genes to chromosomes. They usually have the diameter from 50 to 190 µm and occur almost in all the cells. Na+-K+ ATPase (Ectoenzyme of erythrocyte) 7. (2) Due to slower rate of cell division, the plant's growth rate decreases. The four bases, ribonucleosides and ribonucleosides presence of light, the inner membrane grows and gives off vesicles into the matrix that are transformed into discs (Fig. RNA polymerase I Nucleolus Not sensitive 2. microtubule side arm of MAP-2 Fig. The transcript is then processed into the functional rRNA molecules. The children should be instructed about basic laws of health and they should be encouraged to develop a physically and Contents EUGENICS, EUPHENICS AND GENETIC ENGINEERING 249 mentally healthy body. Such termination sites are believed to be present away (sometimes up to one kilobase away from the site of the 3 end of mRNA). (3) Cross links are formed between macromolecules, making the preparation more stable and minimizing shrinkage upon drying. Active transport uses specific transport proteins, called pumps, which use metabolic energy (ATP) to move ions or molecules against their concentration gradient. propagation of a flagellum, such as that found in sperm ; B— Effective stroke common with cilia of all types ; C—Recovery of 17.4B). But as the ribosomes easily bind the basic dyes so it is concluded that
RNA is exposed at the surface of the ribosomal subunits, and the protein is assumed to be in the interior in relation to non-helical part of the RNA. (b) Haemophilia B. 5S RNA synthesis. which might prove insufficient for the developing embryo. DNA (cDNA) using mRNA as a template. The molecule of a mRNA is single-stranded like the rRNA molecule and it is DNA-like in its base composition so that GC contents of mRNA correspond to the GC contents of the genomes total DNA. Polyguanidylic acid or poly (G) Configuration UUUUUU AAAAAA CCCCCCC GGGGGG Thus, the action of polynucleotide phosphorylase can be represented in the following way : GENETIC CODE (RNA)n + Ribonucleoside diphosphate polynucleotide phosphorylase 69 (RNA)n+1 + Pi The polynucleotide phosphorylase enzyme differs from RNA from DNA in that : (i) it does not require a template or primer; (ii) the activated substrates are ribonucleoside diphosphates (Pi). Write short notes on the following : (a) Aneuploidy; (b) Euploidy ; (c) Nullisomic ; (d) Evolution of wheat ; (e) Raphanobrassica ; (f) Colchicine treatment, (g) Down's syndrome ; (h) Trisomy-18; and (i) Patau syndrome. Suppose you were given two recessive mutants of Drosophila, short wing (s) and reducing wing (r) both autosomal and both belonging to the same linkage group. Because the female gamete contributes almost all of the cytoplasm to the zygote and male gamete (sperm or pollen) contributes only a nucleus, an inheritance pattern that differs between reciprocal crosses suggests a cytoplasmic involvement. Thus, to gain divergent types of information regarding cell's structure, molecular organization and function, cell biologists have developed and employed various instruments and techniques. In the technique of autoradiograliquid emulsion phy, for the study of DNA metabolism of cell 3H-thymidine is used; for RNA mesection tabolism 3H-uridine is used; for protein dipping vessel synthesis various tritiated (3H-tagged) amino acids are used; and for polysacstore slides in dark box until ready to charides and glycoproteins tritiated dip slides into process monosaccharides such as 3H- mannose radiation-sensitive and 3H-fucose are employed. Total light reaction can be summarized as follows : 4hv H2O + 2NADP + 2 ADP + 2Pi $\rightarrow \frac{1}{2}$ O2 + 2 NADPH + 2ATP \rightarrow 2. Nuclei can then be harvested by differential centrifugation. nitrogenous bases have been found in four kinds of deoxyribonucleotides of DNA : two are heterocyclic and two-ringed purines, adenine (A) and guanine (G), and two are one ringed pyrimidines, cytosine (C) and thymine (T). Are the chemical units the same in both eukaryotes and prokaryotes? Hence, genes are available for transcription only at specific periods of the cell cycle. (b) White eved female × Red eved male. Plasma membrane intrusions. As soon as growing polypeptide chain reaches the cisterna, it folds into its secondary and tertiary structures and thus trapped in the cisterna of the rough ER. Homozygous recessive stocks; f. Actin of micro-filaments and tubulins Bacterial chromosome does not contain histone proteins, however, chromosomes of some species are found to contain small quantities of a small heat-stable (HU) proteins that may be analogous to eukaryotic histones. Intensive artificial selection was maintained for animals Contents 80 GENETICS, HUMAN GENETICS and EUGENICS with more uniform production of fine wool and a lesser amount of coarse wool. EXPRESSIVITY A trait though penetrant, may be quite variable in its phenotypic expressions. Metallic Ions 23S 16S 5S RNA RNA 40S core proteins 23S core proteins Fig. This species is mainly self-pollinated. The leukocytes, certain infusoria, glandular cells of some insects and spermatozoa contain the irregular shaped nuclei. PS II works as a light trap in photosynthesis and is mainly present in the stacked thylakoid membranes of grana. Elongation of this short cylinder occurs by direct Contents 298 CELL BIOLOGY addition of new heterodimers at one end of the tubule (i.e., the plus end of tubule). It is not clear which component of the phragmoplast—the microtubules or the actin filaments (or both)—are responsible for the movement and guidance of this is a dominant notch-wing mutation in B F A Drosophila. Evidently genetic factors determine growth patterns, but some differences are nutritional. The open circles represent secretory proteins which are destined for secretion or incorporation into organelles (lysosomes, plasma membrane) (after Sheelar and Bianchi, 1987). In the process of micropinocytosis, the plasma membrane) (after Sheelar and Bianchi, 1987). of further sperms in the egg. When eggs are unfertilized Parents : X sa Haploid (sa) Sperm = 1/4 (sb) Haploid male + 1/4 (sb) DNA) mRNA gene expressed inactive inhibitor Fig. Molybdenum MoO42- Cofactor or activator of certain enzymes (e.g., nitrogen fixation, nucleic acid metabolism, aldehyde oxidation). Eugenics. At each step larger metal rotor. The water contents of the cellular matrix of an organism depend directly on the age, habitat and metabolic activities. 1.3. Vaucheria B Organisms forming exceptions to the cell theory : A—Three types of viruses; B—Three cases of cellular organization. arrangement of tubules forming the so-called prolamellar body. Write short notes on the following : (a) Base substitution; (b) Ionizing radiation; (c) Balanced lethal; (d) Somatic mutation; (e) Acridine dye; (f) Lethal mutation. In the phragmoplast region, a region of membranes and microtubules, a cell plate forms and grows until it separates the cytoplasm into two daughter cells. In contrast, the mitochondria are the "power houses" that by oxidation, release the energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and make other forms of chemical energy contained in the fuel molecules and mole (Fig.10.9). (xvi) 50-68 6. Some refined techniques as amniocentesis and fetoscopy provide information about possible genetic disease at early stages of pregnancy. are different, the protein is called heteropolymer and is said to have a heterogeneous guaternary structure, e.g., haemoglobin and immunoglobulins. Quaternary proteins are usually joined by hydrophobic forces. An enzyme, carried within the coat of the retroviruses, that makes double-stranded DNA from a single-stranded RNA template. The A tubule has 13, 40-45Ao globular subunits around its perimeter. Hair Form Colour Pigment Curly Dark Normal (with melanin) Colour Brown Straight Light None (albinism, without melanin pigment) Blue 2. When a mutation occurred and that mutated gene reverse the effects of primary mutation suppressors. Intersexuality occurs when the chromosomal contribution is inconsistent with the site where already primary mutation suppressors. qonadal or other secondary sexual characters. Contents 236 CELL BIOLOGY H Photoynthesis Chloroplast Mitochondrion C H C OH CO2 + H2O HO C H ATP Aerobic respiration H C - OH C H C OH CO2 + H2O NADH NAD+ + chemical (ATP) NADP+ O2 sun Light energy H:O:H (water) (contains low-energy electrons) (• •) H:O:H (water) An overview of the energetics of photosynthesis and aerobic respiration. The Na+- K+ ATPase in the plasma membrane actively pumps Na+ out and K+ into a cell against their electrochemical gradients. Another advantage is that fixation is rapid enough to arrest some cellular functions at their critical electron microscope light junctures which can then (inverted) microscopy be observed and compared. Contents 246 CELL BIOLOGY cells are the osteoblast (polykaryocytes of the bone morrow) which contain about 100 nuclei per cell and striated muscle fibres each of which contains many hundred nuclei. The ribosomes of mitochondria and chloroplasts are always smaller than 80S cytoplasmic ribosomes and are comparable to prokaryotic ribosomes in both size and sensitivity to antibiotics, although their sedimentation values vary in different phyla, e.g., 77S in mitochondria of fungi, 60S in mitochondria of mammals and 60S in mitochondria of animals in general. The results of this example has been shown in Figure 4.6. Table 4-10. At this stage (time) the gonad has already been invaded by the primary XX or XY cells. Y a progeny showing a ratio of 2:1 since homozygous yellow (A A) individuals are never borned due to lethal effect of AY gene : Parents : Yellow X A AYa (Hybrid of yellow and agouti) 1 (Hybrid of yellow and black) 1AYAY : 2 AYA : 1 Aa Homozygous Yellow or 2 Yellow : 1 Agouti or 2:1. Beard development in human beings is a sex limited trait as men normally have beards,
whereas women normally do not. The Weismann's germ plasm theory, Mendel's laws of inheritance and the concept of gene could be well understood only after the application of cytological concept to the genetics. LMLM 2. lymphoid organs. The constructive processes such as biosynthesis of proteins, lipids, carbohydrates and nucleic acids are known as catabolic processes. 18.3. Various steps of amniocentesis technique (after Suzuki et al., 1986). The sexual reproduction is the most common type of reproduction is the most common type of reproduction among the plants and animals. 68 µm. Conductivity. Thus, 1300 genes are found to be located on the autosomes, 107 on X-chromosomes and only one on the Y-chromosomes. Genetics has come to the rescue of the courts and now the following new questions are routinely asked in the courts : (1) Is the drop of blood found at the crime scene from suspect on trial? tary variant has yellow colour, when the larvae of wild type Drosophila with brown body colour are raised on food containing silver salts, they develop into yellow bodied flies. Interspecific hybridization combined with polyploidy offers a mechanism whereby new species may arise suddenly in natural populations. 23 Major groove Minor groov side and by way of secretory vesicles, may fuse with specific portions of the plasma membrane. 4.23. It was first of all observed in E.coli by Laderberg and Tatum in 1946. NAD+, FMN and FAD are important coenzymes not only in mitochondria but also in chloroplasts. The repressor when present on the operator site (C), it is an obstacle in the path of RNA polymerase. Lysozyme 15. As a result, the concentration gradient of glucose across the membrane is increased, allowing the facilitated diffusion to continue to import glucose. Ultrastructure and function Fig 12.7. A satellited chromosome and an attached of nucleolus. Peroxidase 8. Three types of translocations which occur in nonhomologous chromosomes. Contents GENETIC INTERACTION AND LETHAL GENES 61 drome. 15.14. Each contributing allele in the series of multiple genes produces an equal effect. Define the terms inbreeding coefficient and describe them. 1979 Khorana reported completion of the total synthesis of a biologically functional gene. posed of parallel microfilaments; 3 to 7 nm in diameter, which in turn are formed of globular subunits. The disproved hypothesis that genes are arranged on the chromosome like beads on a necklace, indivisible into smaller units of mutation. They contain DNA, ribosomes and complete protein synthetic machinery. Acrocentric. Lastly, the direcFig. In mammalian cells undergoing mitosis, the transient phosphorylation of several serine residues on the lamina to reversibly Contents 248 CELL BIOLOGY disassemble into tetramchromatin DNA and nucleoplasm ers of hypophosassociated endoplasmic proteins phorylated lamin A and reticulum (chromatin) lamin C and membrane associated lamin B. Such type of lipids form the major constituent of cell membranes. Chitin is an extracellular structural polysaccharide found in the cell walls of fungal hyphae and the exoskeleton of arthropods. The quantity of polymerized tubulin is high at interphase (cytoplasmic microtubules) and metaphase (spindle microtubules), but low at prophase and anaphase. Successive generations of progeny in a controlled series of crosses, starting with two specific parents (the P generation) and selfing or intercrossing the progeny of each new (F1, F2) generation. Contents INTRODUCTION 5 produced a hybrid having characteristics of both parents. Death of the individual occurs either in the prenatal or postnatal period prior to sexual maturity. It is the largest of the respiratory enzyme complexes, with a mass about 800,000 daltons and more than 22 polypeptide chains. Sections are floated from the knife of ultramicroFig. Zymogen of exocrine pancreatic cells; 2. ° Life-Span of mRNA In most prokaryotic occurs in mitochondria. But its position may change from time to time according to the metabolic states of the cell. TRANSGRESSIVE VARIATION In some types of quantitative inheritances, sometimes, F2 offsprings do not display continuous variation but some individuals exhibit great degree of variability and do not resemble with their either parent. or even remote ancestors in that quantitative trait. For example, nucleoplasmin is an abundant, pentameric nuclear protein having distinct head and tail domains. Multiple allelic series with A dominant over B, C and D; B dominant over C and D; C and D with intermediate dominance. 17.8. Inheritance of cytoplasmic male sterility and effect of restorer R.W. Siegel in 1952. Griffth; (ii) O.T. Avery, C.M. Macleod and M. Development of a chloroplast from a submicroscopic proplastid in the presence of light. Mitosis (or nuclear division) marks the end of the growthduplication cycle in eukaryotic cells and is usually preceded by DNA replication. include certain enzymes, hormones, blood groups, saliva, gastric mucin, ovomucoids, serum, albumins, antibodies or immunoglobins (see Table 4.3). A-Portion of the keel which encloses the reproductive organs has been cut open to show the stamen and stigma; B-The mature fruit (pod) containing seeds that develop from the fertilized pea flower. The developing mRNA (or hn RNA) is antiparallel and its nucleotides are complementary to those of the DNA template strand. These were later shown to be transmembrane integral protein particles (Fig. BUe G ... In it loops of NO centre chromatin three types of rRNAs, namely 18S, dense 5.8S and 28S r fibrillar RNAs, are trancomponent transcription scribed as parts of factor a much longer precursor molecule granular transcript) units of rRNA processing (RNA nucleoplasm particles splicing, for ex5S rRNA ample) by the help large subunit (as RNP) precursor nuclear of two types of (65S) envelope proteins such as ribosomal proteins nucleolin and U3 sn RNP (U3 is a small subunit large subunit 250 nucleotide cytoplasm containing RNA, assembly with mRNA and translation factors to form functional sn RNP represents polysomes small nuclear riboFig. (d) Discuss the statement : No new principles of genetics have originated from the study of quantitative characters. Regions Genes Percentage crossovers Map-distances (in map units) I c-Sh 3.4 3.4 + 0.1 = 3.5 II Sh-wx 18.3 18.3 + 0.1 = 18.4 Double crossover c-Sh-wx 0.1 Table 9-2. mix fragments cut ends 2. (Haploid sets) 2 24 18 44 48 80 16 Lastly, while 'n' normally signifies the gametic or haploid chromosome number, '2n' is the somatic umber in an individual. Likewise, the genes for male voice, body hair and physique are autosomal in human beings, but they are expressed only in the presence of androgens which are absent in females. Z-DNA can also be found high-ionic strength, such as 2M NaCl. In Z-form of DNA, the molecule still consists of two anti-parallel chains, but, otherwise, it is quite different from the A or B form (Fig. coli 25.3 28.8 24.7 21.2 Further, some RNA molecules contain significant proportions of some methylated bases and an unusual nucleoside known as pseudouridine (ψ U), in which the glycosidic bond is associated with position 5 of uracil rather than position 3. The external genitaFig. Each chromosome contains a clear zone, known as centromere or kinetocore, along their length. In this system, the symbol plus (+) is used to indicate the normal allele for wild type. The transformed 3' T T T T n 5' bacterial cell containing a plasmid Sl nuclease hook cleaved to cleave hook with DNA copy of an mRNA 5' 3' molecule is known as cDNA 3' T T T T T 5' this is duplex DNA clone. Describe the structure and function of microfilament in the cell. Alexandria type (white eye) = A A, A an, A a ; Normal type (Yellow eye) = a A. They occur in the prokaryotic cells of the blue green Fig. When the trait fails to show linkage to any known nuclear linkage groups and assort independently from nuclear genes, a cytoplasmic mode of inheritance is suggested. Since it is difficult to get copy of original mRNA cDNA from the double stranded DNA molecules, therefore, most Fig 9.1. Synthesis of cDNA from mRNA, using reverse tranof the cDNA clones are prepared scriptase enzyme. The actin-myosin interaction pulls the plasma membrane down into a furrow. Every living cell in a higher wall (after Thorpe, 1984). Similarities between Z-DNA and BDNA (1) Both are double helical. All of them transfer electrons by reversible valence changes of the iron atom (trivalent ferric or Fe3+ bivalent ferrous or Fe2+). Further more, two affected individuals cannot have an unaffected child. Mobility of membrane proteins due to fluid property of lipid bilayer was demonstrated by a classical experiment of D. Quantitative genetics. Describe the nuclear envelope and the structure of its pores. Other polysaccharides are branched and, like many proteins, assume a globular form. condensed and inactivated. For example, when the pH in the environment drops, the flux of H+ into the vacuole. Like the maternal inheritance this is a case of uniparental inheritance. These are then inherited by the offspring. Prions are also found to cause a Scrapie-like disease, called Creutzfeldt-Jakob disease of nervous system of humans and Kuru disease of brain of cannibalistic tribes of New Guinea. These are water Fibrin threads and red blood cells are clearly visible in this soluble proteins found in all body cells blood clot. The reducing end (-OH group containing end) is denoted by the letter R. Tubules. Autopolyploid y results in gigantism of plant cells, i.e., leaves, flowers and fruits of an autopolyploid are larger in size than a diploid plant. ecules of cytosol are isolated by a variety of biochemical techniques such as chromatography, dialysis and electrophoresis. Gene Mutation Historical background occurrence ; kinds of mutations ; classification of mutations, classification of mutations, temperature as mutagen, chemical mutagens, classification of
mutation according to the direction, classification of mutation according to magnitude of phenotypic effect, classification of mutation; practical application of mutation; practical application; revision questions and problems; answers to problems. Another hypothesis suggests that certain cytoplasmic elements other then chloroplast mutations come into being or residence in ij/ij cells, are later inherited in the absence of this "susceptible" or "permissive" genotype, and bring about the bleaching of chloroplasts. Type of transposable element A. 1. Addition E D of ATP to axonemes in the state of To adjust polarity The extended rigor restores motility and causes doublet N+1 slides dynein arm (Fig. coli at H H PPi H H H H 37°C. The F1 hybrids of these species then would have one A genome and another B genome. It grows Fig. surface tension and tend to collect at the interface between its liquid phase and other phases. Reticular layer exists just beneath the basal lamina and is composed of fine reticular fibres of reticular layer exists just beneath the basal lamina and is composed of fine reticular layer exists just beneath the basal lamina and is composed of fine reticular layer exists just beneath the basal lamina and is composed of fine reticular layer exists just beneath the basal lamina and is composed of fine reticular layer exists just beneath the basal lamina and is composed of fine reticular layer exists just beneath the basal lamina and is composed of fine reticular layer exists just beneath the basa characteristics by a more complex mechanism called sex differentiation. Time-lapse microcinematography of living cells shows that mitochondria are remarkably mobile and plastic organelles, constantly changing their shape. A nicked double helix suffers a localized disruption of its secondary structure. The acrossmal filament is the rigid tube which protrudes out plasma membrane of sperm nucleus sperm nucleus distal centriole proximal centriole 357 tail of sperm mitochondria of middle piece acrosome egg envelope A acrosomal granule B plasma fusion of plasma membranes of egg egg and sperm C D fertilization cone E Fig. Such cytological maps are often used to verify the genetic maps (based on linkage analysis) of these organisms. The exact nature of microtubules was brought into light when Sabatini, Bensch and Barnett (1963) made use of the glutarldehyde fixative in the electron microscopy. (a) What effect does inbreeding have on (1) allele frequency and (2) heterozygosity ? Normal beaked plants are double heterozygous in this case, and should produce about 6 per cent (1/16) of progeny with this phenotype. Further, if the cell is growing rapidly, each nuclear pore needs to export about three newly assembled ribosomes per minute to the cytoplasm, since ribosomes are produced in nucleus but function in the cytoplasm. Unfortunately, he did not recognize them as chromosomes, and his report remained buried in the literature. Ph : 24651135, 4744815 Mai Hiran Gate, Jalandhar - 144008 . The cilia occur in the protozoans of the class Ciliata and members of other classes and ciliated epithelium of the Metazoa. If we suppose that four gene loci are contributing to a G.H. Shull. The ammonia during to a G.H. Shull. formed during deamination may be immediately excreted or organized into another molecule before excretion; for example, in human being the ammonia is converted into urea molecules by the liver cells before being sent via the blood to the kidney. vary from animal to animal and from cell to cell. For this purpose Mendel crossed two varieties of pea plants which were differing in two pairs of contrasting characters. Discuss the current concept of the gene and the evolution of this concept beginning with Mendel's factors of inheritance. enzyme present in outer mitochondrial membrane that oxidatively deaminates monoamines including neurotransmitters (acetylcholine). The enzyme is said to be denatured. In other words, during the rising phase K+ is extruded through the K+ channels. Further, a mRNA molecule being synthesized has a free 5' terminus and translation also occurs in the 5'-3' direction, so each cistron contained in the mRNA immediately starts its translation. The Golgi apparently are incorportated into the membrane of the cell plate and the vesicle contents enter the forming cell wall (after Novikoff and Holtzman, 1970). lipoid Consequently, they safely concluded that erythrocytes were covered by a layer of lipids two molecules thick (lipid bilayer) oriented with polar groups toward the inside and interior outside of the cell. In the amoeboid movement the cell changes its shape actively and gives out cytoplasmic projections known as pseudopodia. Replicons ging stranded or single st (of pink family Caryophyllaceae). What is meant by 'classical period of cell biology' ? Growth of multicellular organisms. Contents CYTOPLASMIC MATRIX 81 units long. A set of genes which show the genetic basis of Rh+ and Rh- phenotypes. Thus, a poleward flux of tubulin subunits occurs, with the microtubules remaining stationary and under tension (Fig. The production of superoxide anion (O2-----) in mitochondria and cytosol (cytoplasmic matrix) is regulated mainly by the enzyme superoxide dismutase. Assortative matings. Contents MITOCHONDRIA 197 The two mitochondrial membranes have been separated by density gradient centrifugation. There are more than 25 different types of molecules. What is cell wall ? Certain chemical substances have molecular structure similar to the usual DNA bases that, if they are available, such analogues may be incorporated into a replicating DNA strand. Since the enzymes themselves were normal, it was concluded that this mutation had occurred in a so far unidentified controlling element which was given the name operator (o). Mitotic spindle contains three main types of fibres (Fig. P1 : P1 gametes Autogenous regulation of the translation of a polycistronic mRNA coding for 11 ribosomal proteins (after De Robertis, Jr., 1987). Recently some biologists have tried to understand the mechanism of self-sterility at the molecular level. In 1924, he showed that chromosomes contain DNA. Membranebound inclusions are the gas vacuoles and the carboxysomes. The core 5' core enzyme moves along the bound shortly DNA, binding a nucleoside after initiation triphosphate that can pair with the next DNA base and opening the DNA helix as it moves; o thus, during elongation phase addition of 40 bases-per secFig. There are sevcan layer in periplasmic eral flagella at one pole. Its molskeleton of this grasshopper. Death usually occurs within hours or days, but the foetus may abort spontaneously. Lysosomes exhibit great polymorphism, i.e., undigested remains of there are following four types of bacterium removed by exocytosis lysosomes (storage granules), secondary lysosomes (digestive vacuoles), reMethod by which lysosomes digest material. Small eggs produce males, where as eggs 27 times as large always develop into females. The male buffalo differs from the female in having a well-developed mane. It is believed that during anaphase, addition of dimers to one end of a microtubule is accompanied by the loss of dimers from the other end. Type IV Nuclear lamins A, B and C (65,000-75,000) Nuclear lamina of all cells Neurons 3. Barr body. Lipids are all made of carbon, hydrogen and sometimes oxygen. 4.17). However, some sets of proteins may be coordinately regulated, particularly those proteins that characterize a cell phenotype. Natural parthenogenesis; 2. In the guppy a dominant allele, M, results in the presence of a black spot on the dorsal fin. Lipids in the tissues of animals inhabiting warm climates contain larger quantities of saturated fatty acids. Among the forage crops, tetraploid barseem is a very popular crop in Northern India. (ii) Globulins. Cattle 4. The adult female is about an inch (2.53 cm) long and has fairly complex anatomical organization. A chlorophyll and other photosynthetic pigments to trap the light energy. Gates (1921) demonstrated the effects of pseudodominance. The kind of studies that Mendel performed are now included in the discipline of transmission genetics. The regeneration is the best means of asexual reproduction in certain protozoans, sponges, coelenterates, planarians (Fig. When this barred male with the gene BB is crossed with unbarred female containing single recessive gene 'b' in its Z chromosome (W chromosome contains no genes) produce in F1 only barred males and females (Fig. It is most commonly observed fact that the highly placed persons of the society often have great ambitions for the future life. outside through phagocytosis and endocytosis. Each loop axis appears at a constant position in the chromosome e formed chromosome mapping. microcrystalline, electronedense deposits may become visible. of axostyle (after Berns, 1983). These compounds, however, derive the energy from the ATF by nucleoside diphosphokinases (Fig. In humans several diseases are XY-linked. (Simple lipids) H2O Simple lipids) H2O Simple lipids are assembled from newlymade molecules in the host cell and are released when the host cell bursts. The exchange of molecules by the process of osmosis, diffusion and active transport occurs through the membranes of endoplasmic reticulum. T A 3' P In vitro P G C DNA polymerP P ization. The cell coat also contains the receptor sites for the influenza virus and for various lectins. Contents MENDEL AND HIS WORK somes of similar size and nature often form pairs during meiotic cell division and such identical chromosomes are known as homologous chromosomes. Plant vacuoles can store many type of molecules. Microlecithal. Sprague (1963) experimented with maize suggested that virus may cause mutation. Bacteria thrive well in warmth, but some can survive at very cold tops of high mountains such as Alps or even in almost boiling hot springs. A genetic element Down's syndrome. The process by
which the water concentration is known as osmosis (Gr., osmos=pushing). For example, in some crosses of beans certain F1 Contents INBREEDING, OUTBREEDING AND HYBRID VIGOUR (a) Mule: Offspring of a female horse and pods than their parents; however, the gross size of plant remain unaffected. 9.10. They do so by changing the somatic pressure of the cytoplasm and vacuole—in part by controlled breakdown and resynthesis of polymers such as polyphosphate in the vacuole, and in part by altering transport rate across the plasma memplasma central cell wall membrane brane and the tonoplast. In Normal product case of 8 figure formaA B C D Deletion product tion, both normal chroA mosomes move to one Deletion product pole and both translocaA D C B E Inversion product tion chromosomes move to the other pole at anaphase-I. The insertion of transposable elements invariably disrupts the integrity of their target genes. Heterozygotes customarilly are designated by colouring half of the symbol blacks (Fig. 12.7. A marriage between a normal visioned female and a colour-blind man and result of the marriage of F1 carrier female with a normal male. Phase contrast microscopy and interference microscopy an coenzyme A and showed its significance in intermediary metabolism. Incorporation of bacterial chromosomal genes in the fertility plasmid, with subsequent transfer to a recipient cell in conjugation. In some microscopes, a third lens, called condenser lens, is located Dark - ground microscopy. 3.14. (a) From what substrates is RNA made? Tight junctions are composed of thin bands that completely encircle a Tight junctions. 20.2. Formation of acrosome of sperm. SYMBOLISM FOR MULTIPLE ALLELES The dominance hierarchy is defined at the beginning of each problem involving multiple alleles. The mitotic spindle plays an important role in determining where and when cleavage occurs Salamander 8. Chemical formula of vitamin C or ascorbic acid. Red blood cells never sickled; F Blue, Bb 2 they contain one type of haemoglobin, i.e., haemoglobin, i.e., haemoglobin, i.e., haemoglobin, i.e., haemoglobin, i.e., haemoglobin, i.e., haemoglobin A. Bacteria (singular bacterium) are amongst the smallest organisms. PPLO were later on included under the genus Mycoplasma by Nowak (1929) and these organisms are now commonly called mycoplasmas. However, the 70S ribocompleted somes contain more RNA (60 to polypeptide 40%) than the proteins (36 to 37%), e.g., the ribosomes of E. The SSB proteins prevent the helix from rewinding and prevent intramolecular base pairing from occurring. For instance, the myelin sheaths of the nerve fibres (36 to 37%), e.g., the ribosomes of E. The SSB proteins prevent the helix from rewinding and prevent intramolecular base pairing from occurring. contain a lipid known as sphingomyelin which contains sphingosine and phospholipids in its molecules. 8.2. The lactose operon of E.coli and its regulatory gene (after Lewin, 1990). These precursors have distinct polarity, containing terminal Fig. The code degeneracy is basically of two types : partial and complete. Studies suggest a recombination frequency of about 0.15. Stevens found a similar situation in Drosophila melanogaster which has four pairs of chromosomes, with one of the pairs being heteromorphic in males (Fig. It appears that complex gene structure is basic to all organisms. Write short notes on the following : (ii) Viroids; (iii) Prions; (iv) TMV; (v) PPLO; (vi) Bacteria; (vii) Blue green algae (Cyanobacteria). Primary lysosomes are newly formed organelles bounded by a single membrane and typically having a diameter of 100 nm. Exception to cell theory. The mode of synthesis of proteins of chloroplasts indicates towards their semiautonomous or symbiotic nature. The energy released by the protons when they diffuse across the thylakoid membrane into the stroma (along H+ concentration gradient) is used to produce ATP molecules, by CF0 - CF1 ATP synthetase in the membrane. Stahl performed a density-gradient experiment (using heavy isotope of nitrogen, 15N) in bacteria to confirm the Watson and Crick's semiconservative theory of DNA replication. Robinson and Brown J.Rhodin L.Pauling Fawcett and Porter Demonstrated the nucleus (= nucleoid) in the bacteria. (This is called molecular cloning). At least three parts of the nuclear envelope complex must be considered during its breakdown (at prophase) and reassembly (at telophase) : 1. Twenty termination sequences have so far been determined and each has the characteristics shown in Figure 5.9. Termination region consists of the following three important regions : 1. 5.1. 1 Number of contributing alleles Phenotypic ratio 4 Red 1 3 Medium red 4 2 Light red 6 1 Very light red 4 } 0 White 1 } Colourel (15/16) Colourless (1/16) Results of a cross between two varieties of wheat having red kernel and white kernel showing cumulative effect of alleles. The discharged tRNA in the P site is immediately ejected out. Differences between Z-DNA has right-handed helical sense, while B-DNA has right-handed helical sense (Fig. 14.13. The enriched fraction is subjected to isopycnic ultracentrifugation on discontinuous or continuous sucrose density gradient. A carnation-eyed female, otherwise wild-type, was crossed to a normal-eyed, short-winged male. The genes which occur exclusively on the X chromosome (in birds and other species with ZO or ZW and other species with mechanism of sex determination) are called X- or Z -linked genes. These vacuoles arise initially in young dividing cells, probably by the progressive fusion of vesicles derived from the Golgi apparatus. which acted as messengers of Contents 258 CELL BIOLOGY heredity. The function of chromoplasts is not clear but in many cases (e.g., flowers and fruits) the colour they produce probably plays a role in attracting insects and other animals for pollination or seed dispersal. This cycle acts (c) (a) Intestinal epithelial cells have a very rapid turnover; the entire gut lining is replaced every few days. They can be originated from chloroplasts and also from leucoplasts. In Drosophila, rare females regularly produce female and male progery in the ratio of 2:1, which indicates that half of the male prog-F1 Nonbarred B barred by Barred B barred proteins form the "junctional complex" of deformable, net-like meshwork of the cytoskeleton. One of two or more forms that can exist at a single gene locus, distinguished by their differing effects on the phenotype. Values over 1.0 or under 0.5 produce weak and inviable flies called super females) and supermales (metamales), respectively. Valine (Val, V) CH3—CH—COOH | NH2 CH3 CH3 4. Describe the major features of each meiotic phase. Contents CENTRIOLES AND BASAL BODIES 305 STRUCTURE Centriloles and basal bodies are cylindrical structures which are 0.15-0.25µm in diameter usually 0.3-0.7µm in length, though, some are as short as 0.16µm and others are as long as 8µm (see Fulton, 1971). In the mature chloroplast the thylakoids are no longer connected to the inner membrane, but the grana remain united by intergranal thylakoids. Using the allelic symbols w and w', indicate all possible genotypes and the phenotypes thereby produced in men and women. generation, to be expressed in their sons. Shortly thereafter, at telophase, nuclear membrane vesicles associated with the surface of individual chromosomes are fused to re-form the nuclear membranes which partially enclose clusters of chromosomes before coalescing to re-form the nuclear membranes which partially enclose clusters of chromosomes are fused to re-form the nuclear membrane vesicles associated by some types of specific proteins, called fusogenic proteins (Blumenthal, 1987). In this type of male sterility, the sterility, so that the F1 progeny would be fertile and in F2 generation, the fertile and sterile individuals will be segregated in the typical 3 : 1 ratio (Fig. Amniocentesis. The masked gene issue) said to be hypostatic. One can now diagnose hereditary or genetic disease before or soon after birth, and in some cases we can provide secondary treatments. William Astbury, who was referring to the study of the chemical and physical structure of biological macromolecules. Proteins occur in the form of globular molecules and they are dotted about here and there in a mosaic pattern. Biotic Communities ; composition of communities , niche and 109-126 bioindicators) Characteristics of a community; size, number of species, dominants, ecological amplitude ; horizontal stratification, vertical stratification ; characters used in community structure : quantitative structure of plant communities — frequency, density, abundance, cover and basal area, qualitative characteristics of plant communities — presence and constance, fidelity, dominance, importance value index and polygraph construction; habitat and niche; community metabolism; communi breeding which has been defined as the mating of animals in such a way that their descendents will be kept closely related to an unusually desirable individual. BASIC REQUIREMENTS TO BE MET BY GENETIC MATERIAL According to the molecular biologists certain requirements must be met by any molecule if it is to be qualified as the substance that transmits genetic information from one generation to next. Because the lateral loops have 25µm DNA, Fig. Nucleoproteins are proteins in combination will show dextral dextral segregation among broods, just as in the cross examined first. The progeny of F1 plants was then obtained by self-fertilization and it forms the F2 generation. 63. Biotin (Vitamin H) 0.3 mg Yeast, liver, egg-yolk, Acts as coenzyme in metabolism of milk, kidneys. Pusa Parvati (French bean). 4.29. The flagellum is attached at its base, by a short flexible hook that is rotated, like a propeller of ship, by the flagellar rotatory "motor" (i.e., basal body; Fig. The wild type allele is nearly always dominant, while the other mutant alleles in the series may show dominance or
there may be an intermediate phenotypic effect. Phosphatases 6. of Agriculture Botany of Meerut University (Gupta and Srivastava, 1970). Na+ are crucial to electrical activity in the brain, which can be monitored and recorded. The number of thylakoids per granum may vary from 1 to 50 or more. Determine the types of flowers produced in the progeny from the following crosses : (a) NN female x Nn male ; (b) Nn female x Nn male ; (c) nn female x Nn male ; (selective transporter. (i) A heterozygote. The genetic basis of petite character is a cytoplasmic factor ρ + (rho) which may be absent or defective in petites. It is a double stranded, helically coiled, macromolecule which is composed of phosphoric acid, deoxyribose sugar, two pyrimidenes (cytosine and thymine) and two purines (adenine and guanine), It is found to be most stable biological molecule which contains encoded genetic informations. The phenotype of genotype containing the dominant allele; the parental phenotype that is expressed in a heterozygote. Similarly the homozygous pea plant with green wrinkled seeds contains the alleles yy and rr for the green colour and wrinkledness of seeds. 14.20. It is determined by a X-linked recessive allele B. coli bacteria (Fig. It has three sites on its extracytoplasmic band surface : two sites for K+ ions and one site for HCO3 the inhibitor ouabain. It probably arises from the folding of the nucleosome chain into a solenoid structure having about six nucleosomes per turn (Klug and coworkers, 1976, 1979 and 1985). In the modified classical method of symbolization, like classical method, capital and small letters are commonly used to designate dominant and recessive alleles, but in contrast to that, the genetic symbol corresponds to the first letter in the name of the abnormal, recessive or mutant trait. For participate in the generaevery molecule of ATP hydrolyzed inside the cell, 3 Na+ ions are tion of ATP from ADP. By the use of lectins, the carbohydrates can be specifically observed. as a light trap and is present in unstacked thylakoid membranes. In rodents and amphibians the sperm nucleus becomes scimitar-shaped with pointed tip. This has shown 50 17 that the real natural gene for yeast alanyl 77 46 tRNA was longer than the DNA duplex synthesized by Khorana. Further, because S-III and R-II colonies differed by a polysaccharide to transform was also tested, but no transformation was observed. 2.5). Some species may have special characteristics in their karyotypes; for example, the mouse has acrocentric chromosomes, many amphibians have only metacentric chromosomes and plants frequently have heterochromatic regions at the telomeres. 18S 16S (Dalton is the unit of molecular weight rRNA+30 30S rRNA+21 40S (MW); one dalton equals the weight of proteins hydrogen atom. Multicolour Edition CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY, EVOLUTION AND ECOLOGY [For B.Sc., Ph.D., F.E.S.I., F.A.Z. Reader Department of Zoology, Meerut V.K. AGARWAL M.Sc., Ph.D. Reader Department of Zoology, Meerut College, Meerut S. HCl production, thus, involves three types of transport proteins : 1. The essential feature of sexual reproduction, whether the individuals of a species are unisexual or bisexual reproduction, whether the individuals of a species are unisexual or bisexual reproduction. gametes to form a zygote. coli cells in a medium containing 3H-thymidine (tritiated thymidine) for various periods of times so that the radioactive thymidine was replicated in successive generations of cells. 8.10. Thus, cAMPCAP is a positive regulator, in contrast with the repressor, and lac operon is independently regulated both positively and negatively. (a) During mitotic phase of the cell cycle, chromatin is highly condensed to form chromosomes, and transcriptional activity of all genes is suspended. 12.5). Inbreeding in selffertilizing pea plants for his hybridization experiments. Nucleolus are the sites nucleolus. The transfer is catalyzed by a membrane-bound enzyme (i.e., glycosyl transferase) with its active site exposed on the luminal surface of the ER membrane. This defective enzyme or structural protein may adversely affect the trait controlled by the protein. Change in the gonad of the mollusc Crepidula experiencing consecutive sexuality. In recent years distinction between classical cytology and cell biology are used as the synonyms (Novikoff and Holtzmann, 1970). The cycles of adjacent cilia are almost but not quite in synchrony, creating a wave-like pattern. XXX male Fig. Vitamin D (Calciferol) Water Soluble Vitamins 5. It is secreted by the epithelial cells. While heterozygote in the intermediate section or por7 8 3 4 5 6 1 2 9 10 11 12 1 2 3 4 5 6 an intermediate section or por7 8 3 4 5 6 1 2 9 10 11 12 tion of chromosome is lost Translocation homozygote and it is caused by two breaks —one on either end of the 7 8 3 4 5 6 1 2 9 10 11 12 deleted region (Fig. A transposable element is not a replicate apart from the host chromosome the way that plasmids and phage can. The downstream promoters sequences of 5S rRNA and tRNA genes have subsequently been characterized more distinctly into box A, box B and box C. It is Schematic diagram of a generalized estimated that several hundred different enzymes plant cell wall. For example, if the female fertile male parent will deterF2 mine the phenotype of F1 progMM Mm mm eny. Intake of missing enzyme. Thymidine Deoxycytidylic acid (Deoxycytidylic acid Cytogenetics (Cytology and Genetics). 2.5. A classical experiment of Hershey and Chase, where DNA haploid cells of the same species as of T2 phage is labelled with 32P and the protein is labelled shown in the Table 2-1. This is also known as bleeder's disease. The endoplasmic membranes contain many enzymes which perform various synthetic and metabolic activities. 8.9. Chromatin reconstitution experiment demonstrating the positive role synthesis. (vi) Isogamy. In this process of chromosomes of salivary glands of Drosophila have been found very useful. The state of phosphorylation of H1 protein varies through the eukaryotic cell cycle, and after H1 phosphorylation, Contents 104 MOLECULAR BIOLOGY chromatin becomes much more strongly chromatin from bone marrow thymus condensed, as it does in mitotic chromosomes. Reciprocal crosses were also made, i.e., each of the crosses was made in two ways, depending on which phenotype is used as male or female. Sex-influenced trait. Because one parent (the tester) contributes gametes carrying only recessive alleles, the phenotypes of the offspring represent the gametic contribution of the other double heterozygote parent. Process of Meiosis Meiosis Superficially resembles two mitotic divisions without an intervening period of DNA replication. The structure and function of some important organelles are as follows: 1. Two types of granules fuse with the phagocytotic vacuoles and They are also called autophcontribute digestive enzymes and other components. (ii) Physiological polyspermy. DEF DEFGH. Write short notes on the following :chromosomal proteins ; nucleosome ; polytene chromosome, and lampbrush chromosomes. 1975 E.M. Southern developed a method, called Southern blotting technique for analysing the related genes in a DNA restriction fragment. 10.6. Method of formation of small mitochondrial vesicles having oxysomes on their surface. In non-muscle cells, microfilaments, being of actin composition, can bind mvosin (a contractile protein). The introduction of Marguis strain of wheat had opened up millions of square kilometres of fertile soil to cultivation in such northern countries as Canada, Sweden and the USSR. Many enzymes (e.g., dehydrogenases, isomerases and hydroxylases) are involved in the biosynthetic pathway of steroid hormones, some of which are located in SER membranes and some occur in the mitochondria. 5.6). A cell that is not destined to become a gamete; a "body cell", "whose genes will not be passed on to future generations. The five stages have been given Arabic numbers. 11.1. Interconversion of three kinds of plastids. Isolation Mitochondria can be easily isolated by cell fractionation brought about by differential centrifugation. For example, Janus green B selectively stains mitochondria; neutral red stains plant vacuoles and methylene blue stains plant vacuoles and also nuclear chromatin of dividing cells. Albinos illustrate pleiotropy. Coincidence is generally quite small for short map distance. It includes the study of mode of gene transmission from generation. Erythropoietin 11. Promotion of genetic research. Variegated branches of Mirabilis jalapa produce three kinds of eggs : some contain only white chloroplasts, some contain only green chloroplasts and some contain only green chloroplasts. correct specific defects. A gene whose phenotypic effect is sufficiently drastic to kill the bearer. Fifteen single-stranded oligonucleotides were used to prepare three duplex fragments, each containing a single stranded oligonucleotides were used to prepare three duplex fragments of Britten-Davidson's model for tranintegrator gene, which can scription regulation. Describe some main types of enzymes. 18.2. Here, we have a marriage between a polydactylous man and a normal woman (generation I). Replica reveals a natural-looking representation of the surface of the freeze-etched object and is the only way of seeing membrane interior and certain other features of the cells. lethality 0 Dies Fig. Yet This material acts much like a detergent to decrease the various metabolic activities produce small surface tension of the fluid layer lining the lungs. The microtubules of the spindle are attached with the centromere of the chromosomes. Contents 34 CELL BIOLOGY = 92 capsomeres; (6) Herpes virus = 162 capsomeres; (7) Adenovirus = 252 capsomeres; and (8) Tipula iridescent virus = 812 capsomeres. (a) The amount of heterosis is expressed by the excess of the F1 average over the midpoint between the two
parental means := $XF1 - \frac{1}{2}(XP1 - +XP2 -)$ Heterosis of F1 = $43.2 - \frac{1}{2}(47.8 + 28.7) = 43.2 - \frac{38.25}{2} = 4.95$ inches (b) As a general rule the F2 shows only about half the heterosis of the F1 : 1/2 (4.95) = 2.48. The rest of ATPase the energy is dissipated as heat or used for other H+ cell functions. When O2 is used by the enzyme, an unstable intermediate is formed which breaks down into 3-phosphoglycolate. This book can be used as a reference book by those students who are preparing for various competitive examinations/tests such as CPMT, CBSE (All India Medical Entrance Test), IFS, PCS, IAS and others. This type of mating is called full-sib mating and produces inbreeding (F2 of Mendel). These two Simple carbohydrates: sugarcanes store large different arrangements are known as quantities of sucrose in special cells. Likewise, the proteins at a replication fork cooperate to form a unit on the lagging strand called a primosome which moves with the fork, synthesizing RNA primers as it moves (Fig. basal body 6. The alcohol then can enter the cell and leach out the stain, whereas the cell walls of Gram positive bacteria form a barrier (i.e., peptidoglycan layers) that prevent the penetration of the solvent inside the cell. The cell plate develops as a membranedelimited structure enclosing a space in which new cellwall will form. Daily requirement Sources Functions Diseases and symptoms caused by lack of vitamin Stored in liver; maintain general health and vigour of epithelial cells. Further DNA synthesis within a given replication unit eye is initiated some where at a near the midpoint of the unit at a site termed as the origin (O); prokaryotes contain a solitary origin, while eukaryotes have multiple (up to several thousands) origins for DNA replication. Some mitochondria, particularly those from heart, kidney and skeletal muscles have more extensive cristae arrangements than liver mitochondria. Group G consists of the shortest acrocentric chromosomes. The spermatogenesis is a continuous process and for the sake of convenience this process can be studied in two different stages. These larvae tend to live under the bark of rotting logs and feed on fungus. Summarize the event of the first meiotic prophase. Mode of dominant epistasis. Got Nobel Prize for his studies on properties of colloids, especially proteins and for the development of analytical ultracentrifugation. Monoglyceride lipase 14. A phenotypic effect dependent on a change in position on the chromosome of a gene or group of genes. A—One spectrin molecule from human red blood cell; B— chains (90 per cent of which Schematic drawing of the spectrin based cytoskeleton on the is sialic acid). In many other crop plants translocations have been artificially induced by X-rays. Flower position : A, a; T, t Axial × Terminal 7. The concentration of various ions in the intracellular fluid (matrix) differs from that in the interstitial fluid. What is the difference between intragenic and intergenic suppression ? It should be noted that only in absence of the repressor, RNA polymerase enzyme can travel and transcribe lac operon as shown in B. Chand & Company Ltd., 7361, Ram Nagar, New Delhi-110 055. In many fungi, the cell wall is formed of chitin and in bacteria, the cell wall contains protein-lipid-polysaccharide complexes. For example, due to transamination amino acid glutamic acid --- α-Ketoglutaric acid + Aspartic acid (amino acid) (keto acid) (keto acid) (amino acid) In this case, the amino group is not lost completely but is transferred to one of the substrates of Krebs cycle. We have seen that glycolysis and H2O Krebs cycle can each generate 2 molecules of ATP per molecule of glucose by substrate level phos- Fig. The reticular fibres are embedded in a ground substance. Under aerobic condition nitrogen fixation is done principally in special type of cells called heterocysts, as in Nostoc (Donze, 1971; Carr, 1976). The proleptotene stage closely resembles with the early mitotic prophase. Initiation of Eukaryotic Transcription For the eukaryotic transcription the regulatory DNA sequences (such as promoters, enhancers and silencers) for genes transcribed by each of the three RNA polymerases differ. Nucleoproteins are of two types : 1. coli is composed of about 55 ribosomal proteins. Neither they mix nor they contaminate each other. Techniques in Cell Biology 16-31 Microscopy - light microscopy, methods of sample preparation for light microscopy, electron microscopy, the number of tRNA molecule C G l types discovered is much less than 61. Mitotic chromosome cycles is found to be regulated by the following three control factors (i.e., diffusible proteins) : 1. 9.9). 17.2). For the time being we may ignore left and right end alternatives. They are long fibres (of indefinite length) about 24 nm in diameter. The plasmid DNA carrying the foreign DNA fragment can be put back into a suitable recipient bacterium. A protein is translocated into the mitochondrial matrix space by passing through sites of adhesion between the outer and more reliable. 12.6. A cross between white-eyed female and red-eyed male produce white-eyed male. For example, a Golgi enzyme may add a "signal" or "tag" such as a carbohydrate or phosphate residues to certain proteins to direct them to their proper sites in the cell. their energy in part through the ejection of electrons) leaves atoms which are no longer neutral but are positively charged. (ii) Poky strain of Neurospora. Number of the chromosome Some linkage groups and chromosome Some linkage groups and chromosome assignment in human beings (Source : McKusick, 1987). Adaptations, Volant Adaptations, Volant Adaptations, Volant Adaptations, Volant Adaptations and Chromosome Some linkage groups and chromosome Some linkage adaptations, secondary aquatic adaptations; volant adaptations; volant adaptations; revision questions. SYNTHESIS OF GENE The genes can be synthesized by the following two methods : 1. phosphatidyl serine; and 4. (axial hole) of about 40A0 (4nm) diameter which runs the entire length of the rod and contains the RNA molecule. Most of these proteins are formed on membrane-bound ribosomes. Such an idea formed the very core of the theory of epigenesis. Thus, most of the cytoplasmic portion of the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the spermatid except the nucleus, acrosome, centriole, mitochondria and axial filament is discarded during the specime and axial filament is discarded during t mitosis. Membrane-bound enzymes catalyze Contents 60 CELL BIOLOGY reactions that would have occurred with difficulty in an aqueous environment. This movement of molecules is caused by moving water molecules has been redefined by Paul Berg (Nobel Laureate). Law of independent assortment. Besides the separate fibrous systems, cytoplasm is coursed by a multitude of internal membranous structures, the organelles (literally the word organelle means a tiny organ). The third arm indicates the separate fibrous systems, cytoplasm is coursed by a multitude of internal membranous structures. bacterial chromosome is permanently attached to the plasma membrane at one point, and when isolated often carries a number of membrane component with it. Cholesterol molecules (except those of several viruses) are capped. The inner compartment, inner chamber or matrix space, which is filled with a dense, homogeneous, gel-like proteinaceous material, called mitochondrial matrix. This is very common in variegated plants that carry more than one type of plastid (chloroplast) per cell. and two smaller identical L (Light) polypeptide chains (Fig. This example suggests an ephemeral type of maternal effect. of development (see Sheeler and Bianchi, 1987). The closed circles correspond to ER proteins that are removed from the rims of cis and middle Golgi cisternae ("refiners") and return to the ER (dashed arrow). The monospermic fertilization is common in the coelenterates, annelids, echinoderms, bony fishes, frogs and

mammals. Contents 268 CELL BIOLOGY Histores besides determining the structure of chromatin, play a regulatory role in the repression activity of genes. Deletion mutations. For example, when it is below 0.50, it would be intersex; when it is below 0.50, it would be metafemale or super female. RER contains two transmembrane glycoproteins (called ribophorins I and II of 65,000 and 64,000 dalton MW, respectively), to which are attached the ribosomes by their 60S subunits. For example, a large metagene expression centric chromosome is shortened by Growth control gene one-half in length to an acrocentric (oncogene) one, where as the small chromosome Tips of chromosome exchange becomes a large one (Fig. The plasma membrane of plant cells is surrounded by a rigid cell wall of cellulose. Inside an interphase nucleus, chromatin binds strongly to the inner part of the nuclear lamina which is believed to interfere with chromosome condensation. 1/2 D C 1/2 B 1/2 E C 1/2 B 1/2 2. Colour vision : Normal (Dominant) and Colour blind (Recessive). Type II collagen is present mainly in cartilage, intervertebral disc, embryonic notochord and vitreous collagen humour of eye. So long as persons are of genotype H-(i.e., HH or Hh), A persons of group A Unaffected male produce antigens A and H, group B persons Unaffected female produce antigens B and IA1iBHh iiHh H, and group AB persons Bombay phenotype (female) produce antigens A, B and H. As a result a larger fragment is produced upon enzyme digestion of DNA obtained from the amniotic fluid. The pea plant with rr alleles produces the gametes with the allele r. Double crossing over. Authors wish to express their thanks to Shri R.K. Gupta, the Managing Director, Mr Mr.. De Robertis, Jr., 1987). During the premeiotic interphase DNA duplication has occurred at the S phase. Dutrochet (1837) recognized that chlorophyll was essential to oxygen evolution by plants. Formation of the 70S initiation complex and translocation. Observations on the growth of a single E.coli cell have shown that the cell grows and divides into daughter cells after a unit time, which is a constant factor for each generation. A-DNA is more compact with 11 base pairs per turn of the helix and it is 23 angstroms in diameter. Facilitated difcell fusion is characterized by the followselectively carrier ing special feapermeable protein membrane tures: (1) the rate of transport of the Diffusion in the cell. This dry absorbent material pulls the buffer up through the gel from the lower layer (Fig. bacterium bacterium The sorting of proteins destined for various locations) (e.g., lysosomes, peroxisomes, etc.) in the cell. This type of light microscope takes advantage of the fact that different parts of a cell have different parts of a cell have different densities and, hence, different parts of a cell have different densities and hence different densities and hence different parts of a cell have different densities and hence densities and hen hymenopteran insects such as bees, wasps and ants. The gene-battery model assumes the presence of four classes of sequences : 1. Describe the process of autophagy. Prometaphase. Further, if the recessive X-linked gene is very rare, almost all observed cases will XAXa XAY XA y occur in males. Other alleles which are intermediate in A Wild type agouti or their degree of dominance between these two full colour extremes, are usually assigned the lower case Genotype = c+c+,c+cch letter with some suitable superscript. phage T4. Origin from the endoplasmic reticulum or plasma Contents MITOCHONDIRA 215 membrane. Once R R initated, RNA chains N N A A grow at a rapid O O rate—40 to 50 O base base O base base H C 2 H C nucleotides per sec2 ond in E. Describe two classical experiments which demonstrated that DNA is the genetic material. IFs are particularly prominent where cells are subjected to mechanical stress, such as in epithelia, where they are linked from cell to cell at desmosomal junctions, along the length of axons, and throughout the cytoplasm of smooth muscle cells. The fibre cells (i.e., sclerenchyma cells) of Manila hemp are over 100 cm in length. Ris had found that all cells of a shallow trough filled with water on which lipid substance can be spread to make a monomolecular film. In reactions 4 and 5, fructose -1-6-diphosphate molecules. Like the viruses and animal cells, they are resistant to antibiotics such as penicillin which kills bacteria by interfering with cell wall synthesis (see Ambrose and Easty, 1979). Because of the specificity of base pairing, the sequence of base along one chain automatically determines the base sequence along the other. 12.3. Pedigree chart showing how X-linked dominants are expressed in all the daughters of affected males (after Suzuki et al., 1986). The large ribosomal subunits have a slower RNA processing. (b) Does crossing over take place in the male Drosophila during spermatogenesis ? A number of "unusual" nucleotides are found in tRNA (e.g., pseudouridine ψ or psi), inosine (I), dihydroxyuridine (DHU), etc.). The extracellular coats of connective tissues contain the chemical compound hyaluronate which controls the diffusion. The shape of the nucleus also determines the shape of the sperm head which becomes fully adopted for the active propulsion through the water. When both the chromatids involved in the first chiasma, the chiasma is known as complimentary chiasma. Breeding data indicate 60 that a basic recessive gene is necessary for dwarf50 ing, but additional modifier genes have been posalfalfa 40 tulated to account for the different types of dwarfs (see Gardner, 1968). Now plasmid is used to include both episomes and plasmids. Structure of sex chromosomes. 8.11. Lyon's hypothesis. Small nuclear RNAs (sn RNAs) present in the sn RNP particles are designed as U1, U2, U4, U5 and U6. Therefore, these are of great importance in the determination of the phylogeny and taxonomy of the species. The oblique binary fission occurs in most dinoflagellates. For the continuous running of Calvin cycle, there must Contents 234 CELL BIOLOGY be a regular supply of 2NADPH2 2NADP ATP and NADPH and PGA H also sufficient amount of RuBP. Similarity in inner mitochondrial membrane and bacterial plasma membrane. 1953 J. synthesized by β-cells of the islets of Langerhans in the pancreas. There are about 100 isoenzymes in the cell, e.g., lactic dehydrogenase (LDH) occur in the form of five identical isoenzymes. Inheritance of A, B, AB and O blood types of man is determined by a series of three allelomorphic genes. The tRNAfMet charged with the first amino acid (N-formylmethionine), binds to the 30S subunit at the P site at three ribonucleotides. The light reacand other electromagnetic radiations travel in tion is catalyzed by chloroplast lamellae, especially in the grana. These stages reproduce sexually and help in dispersion. (b) A three dimensional model based on high resolution electron microscopy showing nuclear pore complex. However, in germ cells, the X chromosome is inactivated prior to spermatogenesis, otherwise, it may prevent sperm maturation and lead to sterility. Enzymes of mitochondrial matrix. 5.22). in membranes where lipids are actively synthesized, such as smooth ER, there is a rapid flip-flop of specific lipid molecules across the bilayer and there are present certain membrane-bound enzymes, called phospholipid translocators (e.g., flippase) to catalyze this activity (Bishop and Bell, 1988). Here, three blood groups are possible-M, N and MN-and these are determined by the genotypes LMLM, LNLN, and LM LN, respectively. Table 17.1. Major protein structures of the axoneme of the case of formation of new primary cell wall that separates two daughter cells after the karyokinesis. of mitosis. This technique is called gene therapy. of Golgi apparatus; (v) Enzymes of Golgi apparatus; (vi) Compartmentalization of Golgi apparatus; (vi) Compartmentalization of Golgi apparatus; (vi) Enzymes of Golgi apparatus. by the several repeated and organised mitotic divisions and cellular differentiation. In cytoplasmic petites, the mutation occurs in nuclear DNA. Schimper classified the plastids into following types according to their structure, pigments and the functions : 1. Coefficient is expression of the amount or degree of any quality possessed by a B D - substance. Describe the phase contrast microscopy. Initial or zygotic meiosis. However, eukaryotic ribosomes do not differ functionally from those in prokaryotes in a fundamental way; they perform the same functions, by the same set of chemical reactions. The process of activation of eggs is completed in following stages : (i) Movement of the sperm towards the egg. Translocation complexes and lethality. BASIS OF CRYPTOANALYSIS The basic problem of such a genetic code is to indicate how information written in a four letter language (four nucleotides or nitrogen bases of DNA) can be translated into a twenty letter language (twenty amino acids of proteins). operator Contents 96 MOLECULAR BIOLOGY When Jacob and Monod conducted their studies in 1960s, the existence of the promoter and the mechanism of repressor function were not known. The polysaccharides are composed of ten to many thousands monosacH O H O H H charides as the monomers in their macromolecules. Dna B helicase, Dna G primase and DNA poll III HE work together in strand elongation. Each pore complex has an estimated molecular weight of 50 to 100 million daltons. and bacteria in a mixture will remain 2. The Feulgen techniques host 35 have shown that DNA entirely S-labelled protein coat remains restricted to the chromosomes and it forms one of the major separation of viral particles some DNA components of chromosomes. Also, during the growth and celldivision phases of the organism, these cells are challenged less by the environment (in contrast to the bacteria), because the composition and concentration of their growth media do not change drastically with
time. coli can replace the homologous proteins in mammalian ribosomes. Its constancy, therefore, favoured Contents 40 GENETICS, HUMAN GENETICS and to Contents 10 MOLECULAR BIOLOGY DNA as the gene is interrupted by a small DNA sequence (0.8 kilobases) called transposon-like insertion, due to which aberrant SBEl enzyme is produced. However, there is at least one important difference that while mitochondria exploit the electrochemical gradient across their thylakoid but not their inner membrane) appear to employ only ATP hydrolysis to import across their double-membrane outer envelope. He proved that continuous variation are heritable, but he could not explain genetics of the quantitative traits. KINDS OF FERTILIZATION In the organisms following types of fertilization occur : 1. (b) What is the genotype of her husband ? In such cells there may be 15 or more plasmodesmata per square micrometer of wall surface, whereas there is often less than 1 per square micrometer in other cell wall (Gunning and Hughes, 1976). Plasmids are extra-chromosomal DNA elements found mostly in bacteria. The structure of collagen. The sarcoplasmic reticulum plays a role in releasing calcium when the muscle is stimulated and actively transporting calcium back into the same of chromosomes in a haploid set, lesser will be the frequency of all of them being included in the same gamete. The RNA molecule does not occupy the hole but is deeply embedded in the capsomeres. SIGNIFICANCE OF CROSSING OVER The phenomenon of crossing over is universal in its occurrence and it occurs in viruses, bacteria, moulds, plants and animals. as strong mutagens. This is our subject — to be examined in terms of its ultrastructure, composition and function." HISTORICAL Interphase nucleus. During β-oxidation process, the fatty acyl-CoA dehydrogenase into trans-2-enoyl-CoA. 4.4). Flavin adenine mononucleotide (FAM), 4. Contents 176 GENETICS, HUMAN GENETICS AND EUGENICS A. Gynogenesis. What is the genotype of the somatic cells of this branch? Sporopollenin is a lipoidal polymer forming tough wall (with species-specific patterns) of pollen grains. Biogenesis of 70S Ribosomes Smith et al., (1968) have sug5S site gested that in bacteria the RNA genes P site coding for the 5S, 23S, and 16S riboexit domain somal RNAs are tightly clustered in a peptidyl region of the chromosome and are transferase present in only few copies. The helix has two external grooves, a deep wide one, called major groove and a shallow narrow one, called minor groove : both of these grooves are large enough to allow protein molecules to come in contact with the bases. 5.20. Likewise, some of the NADH C C2 early steps in the adrenal cortex CO 2 NADH are also catalyzed by mitoNADH C3 chondrial enzymes. These mutants had high yields including several useful characters. The enzyme is drawn without the sigma factor (after Freifelder, 1985). Case III. Female human = 22 pairs of autosomes + 1 pair of beings : homomorphic X chromosomes = 22 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 autosomal linkage groups + 1 X chromosomes + 1 triangular seed capsules in Capsella. Which of the following would be likely to suffer the greatest, and which the least genetic damage from radiation exposure : (a) a haploid, (b) a diploid, (c) a polyploid ? The electron stain penetrates into all the Contents CELL BIOLOGY 24 empty spaces (i.e., openings and crevices) between the macromolecules. The biogenesis of new mitochondria and chloroplasts requires lipids in addition to nucleic acids and proteins. The sex chromosomes pass through the phenomenon of nondisjunction and present various interesting situations. Likewise corn meal of a tetraploid maize seed contain 40 per cent more vitamin A than cornmeal from a diploid plant. He established that the nucleus was the fundamental and constant component of the cells. Contents DETERMINATION OF SEX AND SEX DIFFERENTIATION 167 Further, identified in gorillas, monkeys, dogs, cattle, horses and goats, further suggesting that this is a common sex-determining mechanism in mammals. RNA viruses that replicate with reverse transcriptase. The F1 heterozygotes or hybrids were found to be pink or purple flowered, thus, showing the incomplete dominance of red colour. Many different methods have been used to classify proteins, no method of their classification being entirely satisfactory : (1) Classification based on biological functions. The flowers of pea plants are so constructed that the pollens of a flower normally fall on the stigma of the same flower and, thus, affects self-pollination or self-fertilization. GLYOXYSOMES Glyoxysomes are found to occur in the cells of yeast, Neurospora, and oil rich seeds of many higher plants. This is milder form of haemophilia. Further study demonstrated that CI allele had been lost through chromosome breakage. A-In the chromosome sare euchrowith tortoise-shell cats, where matic; B-In the early blastocyst the same is true as in A; C-In late the coat is a mosaic patchwork blastocyst 50% of the cells have a maternal heterochromatic X chromoof black and yellow hair. The nuclear lamina is a protein meshwork which is 50 to 80 nm thick (Alberts et al., 1987) or 10 to 20 nm thick (Alberts et al., 1987). Such phenotypic expressions of maternal genes (genotype) may be short-lived or may persist throughout the life-span of the individual. The organisms with only one cell in their body are called unicellular organisms (e.g., bacteria, blue green algae, some algae, protozoa, etc.). The child may then suffer from a disease called erythroblastosis fetalis, blue green algae, protozoa, etc.). photomicrograph : This photograph shows normal RBC's, damaged RBC's and immature RBCs that still contain nuclei. At such low temperature ice crystals are of the cylindrical plasma few distortions or artifacts arise. 18.9. XO female (Turner's (Klinefelter's syndrome). Between the outside of the desmotubule and the inner face of the cylindrical plasma membrane cellulose is an annulus of cytosol, which often hemicellulose microfibril appears to be constricted at each end of the molecule Fig. Lastly, phagocytic cells and cells of reticuloendothelial system (e.g., bone marrow, spleen and liver) are also rich in lysosomes. Some reverse mutations change only one nucleotide in the gene and are called single site mutations. 6.1. Pedigree exemplifying gosity within a diploid breeding population. Biogeography (Distribution of Animals and Plants) Descriptive phytogeography: major plant communities (biomes) of the world, phytogeography of the world, phytogeography of the world phytogeography (Distribution of Animals and Plants) Descriptive phytogeography of the world phytogeography of the wor India - vegetation of India, forest vegetation - moist tropical forests, dry tropical forests, montane (mountainous) subtropical forests, alpine forests, alpine forests, alpine forests, alpine forests, alpine forests, montane (mountainous) subtropical forests, alpine fo - palaearctic region, nearctic region, neotropical region, oriental region, oriental region, oriental region; revision questions. red blood cell formation, growth and nerve function. Tryptophan starvation is prevented by a modulating system in which the amount of transcription in the derepressed state is determined by the concentration of tryptophan. (b) Synaptonemal complex. Some transposons seem to be more likely to insert at certain positions (hot spots), but rarely at base-specific target sites. Structural levels of proteins. "in yeast") had been proposed by Kuhne in 1878. 10.17. nuclear envelope It is formed from two concentric unit membranes, each 5–10 nm thick. In such alkaptonuric persons, the disease is manifested by the darkenings of cartilaginous regions (such as ear pinna) and a proneness to arthritis (a condition called ochronosis). Thus, by a meiotic or maturation division a diploid spermatides. Pleiotropy of sickle cell allele. Nicotinamide adenine dinucleotide (NAD) or Diphosphopyridine nucleotide (DPN), 2. Missence mutations. Contents 234 GENETICS, HUMAN GENETICS, HUMAN GENETICS AND EUGENICS Anniocentesis involves removing amniotic fluid by the help of a hypodermic needle from the amnion
("the bag of water") surrounding the foetus in uterus; culturing the foetal cells contained within the fluid; and screening the cultured cells for karyotype, enzyme production and restriction site pattern analysis of its DNA (Fig. Short tt Tt Trihybrid. The phagosylation, i.e., addition of oligosaccharides containing the sugars such as galactose, fucose and/ or sialic acid, to the molecules of proteins and phospholipids of the plasma membrane) is completed at the level of Golgi apparatus. The ridges appear to ments belt be composed of two rows of protein particles, desmosome as in zipper, each one belonging to the adjaspot cent cells. of about 30 types (Table 5-2). Amylopectin is glycogen-like and is a branched polysaccharide containing many 1-4- and few 1-6linked glucosyl units. There are ample Jaundice infant-major symptom of erythroblastosis fetalis. In contrast, 16 rRNA stalk about 80 per cent of the RNA in an E. In fact, experimental smooth endoplasmic evidence has suggested that cytoplasm reticulum the plasmodesmata mediate desmotubule transport between adjacent primary plant cells, much as gap junccell wall tions of animal cells. The conversion of glucose into starch is a chief characteristic of amyloplasts. 10.11. Enzymes of inner membrane. Thiamine pyrophosphate (TPP), 14. P1 : F1 : F2 : X Albino 1 cc Agouti c+c + + 1 c c : 2c+c : 1 cc Agouti c+c+ P1 : Agouti c+c+ F1 : F2 : 3 Agouti : 1 Albino Fig 10.2. P1 : 3 Agouti A monohybrid cross between agouti and albino rabbits. Dna B (=helicase) is transferred to exposed single stranded DNA (Fig. How many sets are represented in the species with 156 chromosomes ? (d) Chitin. Thus, superior specimens for microscopic examination can be obtained by killing the cells and coagulating or fixing the protoplasm by preservatives, called fixatives such as alcohols, formaldehyde, mercuric chloride, picric acid, acetic acid and mixture of these. They do not code for any of the amino acids. Current evidence indicates that much of this DNA is never transcribed in any cell. Electron transfer in respiratory cascade or electron transport system. Histones H3 and H4 and involves the irreversible methylation of a few lysine residues which alters the hydrophobic nature of the side chain of these histones. Hill and Bendall (1960), proposed Z-sheme for electron transport from water to NADPH during photosynthesis which alters the hydrophobic nature of the side chain of these histones. The nitrogen bases are : (i) Purines—adenine and guanine. (ii) Alkaptonuria. Chand and Company Ltd., for their keen interest in the publication of two non-homologous DNA molecules. In most plants, cellulose is synthesized on the external surface of the cell by a plasma membrane bound enzyme complex, called cellulose synthetase which uses a sugar nucleotide precursor supplied from the cytosol, probably UDP- glucose (Delmer, 1987). (ii) Codon assignment by heteropolymers (Copolymers with random sequences). Crossing over in pericentric inversion. These bacterial cells may occur singly (micrococci); in gairs (diplococci, e.g., pneumonia causing bacterium, Diplococcus pneumoniae); in groups of four (tetracocci); in a cubical arrangement of eight or more (sarcinae); in groups of four (tetracocci); in gairs (diplococci, e.g., pneumonia causing bacterium, Diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in gairs (diplococcus pneumoniae); in groups of four (tetracocci); in gairs (diplococcus pneumoniae); in gair bacterium, Staphylococcus aureus or in a bead-like chain (streptococci, e.g., sore throat causing bacterium, Streptococcus pyogenes) (Fig. Got Nobel Prize for their contributions regarding the structure of nerve cells. 1.1. Diagram of homunculus. Thus, peroxisomes are unusually diverse organelles and even in different cells of a single organism may contain very different sets of enzymes. Contents 64 GENETICS, HUMAN GENETICS in contrast to qualitative traits, the quantitative traits may be modified variously by the environmental conditions and are usually governed by many factors or genes (perhaps 10 or 100 or more), each contributing such a small amount of phenotype that their individual effects cannot be detected by Mendelian methods. This theory states that in the crossing over breaks occur in the non-sister chromatids. However, there is some dispute over the number of H+ ions translocated out during two-electron transportation from NADH to oxygen. Mucus and synovial fluid are also glycoproteins with lubricative properties. The "dotted" gene in maize (Dt) is a "mutator" gene influencing the rate at which the gene for colourless aleurone (a) mutates to its dominant allele (A) for coloured aleurone. These are submitted to gene bank so that fellow researchers can have ready access to it. The term synteny refers to genes that are located on the same chromosome, whether or not they show recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci that have been shown by recombination; linkage refers only to genetic loci thave been shown by recombi DNA replication, an unusual nitrogen base, called 5- hydroxymethylcytosine is incorporated in place of cytosine in the phage DNA. American cytologist, Walter S. The chlorophyll contains an asymetrical molecule which has hydrophilic head of four rings of the pyrols and hydrophilic head of four rings of the phytol chain. 5.17. He also showed that sunlight caused chloroplasts to absorb carbon dioxide and that chlorophyll is formed in chloroplasts only in the presence of light. The modes of infection or HA, hemagglutinin NA, neuraminientry of animal viruses inside the dase glycoprotein glycoprotein glycoprotein host cells have been well investigated for the RNA-containing vimatrix lipid ruses such as influenza virus and protein bilayer Semliki forest virus. coli contains 900 to 1500 nucleotides in its molecule. Complete lethality, thus, is the case where no individuals of a certain genotype attain the age of reproduction. Under aerobic conditions, the end products of glycolysis are pyruvic acid and reduced coenzyme NAD (i.e., NADH). The open-promoter complex is a highly stable complex and is the active intermediate in chain initiation. (see W.S. Klug and M.R. Cummings 2003). The eyes are pigmented. In eukaryotic cells, growth rate depends on total number of cytoplasmic ribosomes per cell and these are controlled by the nucleolus, the seat of ribosome synthesis. Chargaff demonstrated that in DNA the numbers of adenine and thymine groups are always equal and so are the numbers of guanine and cytosine groups. The following evidences suggested that poky trait may be due to lack of ATP energy and source of this energy is mitochondria; (ii) slow growth may be due to lack of ATP energy and source of this energy is mitochondria. type in quality and quantity and these cytochromes are found in mitochondria. Give an account of the mechanism of protein synthesis; compare it with prokaryotes and eukaryotes. In the heterozygous bar (B+B+) flies the number of facets is reduced to 358, whereas in the homozygous recessive ones (BB) this number goes down to 68. If a heterozygous individual undergoes Fig. Mitochondria contain DNA and the machinery needed for protein
synthesis. Types of lipids. (4) In some groups there is no regularity between parthenogenetic and sexual generations. It involves the study of human traits, human disorders, betterment and correction of human disorders. Source Beef sperm Human thymus Human liver Human sperm Hen red cells Rat bone marrow Herring sperm Paracentrotus lividus (sea urchin) sperm Salmon Wheat germ Yeast Diplococcus pneumoniae K-12 Escherichia coli Mycobacterium tuberculosis Bacteriophage T2 Adenine Guanine Cytosine Thymine 28.7 30.9 30.3 30.7 28.8 28.6 27.8 32.8 22.2 19.9 19.5 of A, G, C, and T in different samples of DNA are suggesting that DNA rather than being a monotonous polymer, carries genetic information in the form of specific nucleotide base sequences. The technique of isolation of rRNA genes involved the following steps: (1) The rRNA was isolated from ribosomes of Xenopus and made radioactively labelled due to its replication in a medium having tritiated uridine. replication of phage chromosome in preference to DNA of E.coli (host cell). ognized by the gamma (g) subunit of the same polymerase. Under B Release of the C Re-extension dynein arm normal conditions, the attachment of the dynein arm of subfibre A of N to subfibre B of ADP + Pi N + 1 by dynein arms is not observed in an intact cilium. It can be noticed that fixation for plant height occurred after five generations of inbreeding. Night blindness or nyctalopia (inability to see in dimlight). The energy derived from oxidative deamination depends upon the amino acid involved. Forward genetics and reverse genetics. The hydrogen atoms position themselves to one side of the oxygen, leaving a relatively negative cloud of electrons 2. The resulting zygotes are of four types and one of these, the CIB male, fail to survive because such embryos contain a recessive lethal which expresses itself when hemizygous. This layer chromatography or TLC (used for rapid separation of unsaturated and saturated fatty acids, triglycerides, phospholipids, steroids, peptides, nucleotides, etc.). Likewise, in most eukaryotes the average life span of mRNA is one to four hours. Further, the chromosomes in a cell are never alike in size, some may be exceptionally large and others may be too small. are engaged in the assembly of the polysaccharide components needed to form a typical primary cell wall. These cells have different types of chromosomes due to the crossing over in the prophase I. Heterochromatin is characterized by its especially high content of repititive DNA sequences and contains very few, if any, structural genes (i.e., genes that encode proteins). The function of β-galactosidase enzyme in lactose metabolism is to form glucose by cleaving lactose. (c) With what enzyme? Discuss whether chiasmata are the genotypes of the male and female progeny ? Sarcoplasmic reticulum tends to concentrate and store Ca2+ ions by the help of following two types of reservoir proteins : (1) Calsequestrin (44,000 daltons M.W.; highly acidic protein) which tends to bind up to 43 Ca2+ ions with it. The chromosomes are short and thick. outer face transition vesicles rough endoplasmic reticulum A Fig. Tubules (30 to 50 nm diameter) surround the dictyosome and radiate from it. Table 4-7. The amount of the water inside the cell causes a pressure known as hydrostatic pressure. Coined the term plasmalemma. ATP and many protein factors are needed for ribosomes to engage the mRNA. The tendency of one crossover to interfere with the other crossover is called interference. In Tn 1681 transposon carries the gene for a heat-labile toxin. Monod received Nobel Prize for the discovery of protein synthesis mechanism in virus. Introduced the metal shadowing technique. (vii) Since bases get more length spread out in ZDNA and since the angle of tilt is 60°, they are more closer to the axis. About 400 entirely new figures and data-packed tables have been added in this edition. In 1882, he coined the term mitosis. It is the essential motile element of these organelles. The ciliary apparatus is composed of following basic components (1) the shaft or cilium, which is the slender cylindroid process that projects from the free surface of the cell; (2) the basal body or granule, a centriole like cellular organelle from which the cilium originates; and (3) in some cells fine fibrils—called ciliary rootlets. McCarthy; (iii) A.D. Hershey and M.J. Chase; (iv) Fraenkel and Conrat. INHERITANCE OF X-LINKED (SEX-LINKED) GENES Characteristics of Sex-linked Inheritance The X-linked genes exhibit following characteristic patterns of inheritance : 1. Meiotic configurations formed at metaphase I in different types of trisomics. Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 61 (x) The extra arm is variable in nucleotide composition and is lacking entirely in some tRNA. The aleurone grains are derived from Fig. Formation of double bridge during single crossing over in ring chromosomes (after Stansfield, 1986). This method is well demonstrated in mammalian systems. Symbiotic origin. The electrons liberated from P700 are passed through acceptor x, to an electron transport chain (ferredoxin, ferredoxin, ferredoxin, ferredoxin) acceptor x, to an electron transport chain (ferredoxin, ferredoxin, ferredoxin, ferredoxin) acceptor x, to an electron transport chain (ferredoxin, ferredoxin, ferredoxin, ferredoxin) acceptor x, to an electron transport chain (ferredoxin, ferredoxin, ferredoxin, ferredoxin) acceptor x, to an electron transport chain (ferredoxin, ferredoxin, ferredoxin) acceptor x, to an electron transport chain (ferredoxin, ferredoxin, ferredoxin) acceptor x, to an electron transport chain (ferredoxin, ferredoxin, ferredoxin, ferredoxin) acceptor x, to an electron transport chain (ferredoxin, ferredoxin, ferred However, in both bacteria and eukaryotes mRNAs are known that are apparently resistant to nucleases and survive for long period of time. The dominance hierarchy is as follows : AY >A>a. This process is incompletely understood. Ribosomal RNA synthesis inside nucleolus. Thus, membranes which are metabolically highly active, e.g., those of mitochondria and chloroplasts have a greater proportion of proteins and more granular appearance than those membranes which are relatively less active, e.g., myelin sheath of certain nerve fibres. Linkage of the dominant alleles of one pair of gene and the recessive of another on the same chromosome. Thus, Robertsonian translocation is an eucentric reciprocal translocation where the break in one chromosome is near the front of the centromere and the break in the other chromosomes is immediately behind its centromere. What are the major features of each mitotic phase ? This discrepancy between the number of tRNA genes and gene transcripts occurs because of the 3-dimensional structure of tRNA. (Auxesis = growth resulting from increase in cell size). Polyploid flies. Mesosomes are involved in cross-wall (septum) formation during the enzymes of the respiratory chain are localized on the inner mitochondrial membrane like the bacteria in which they remain localized in the plasma membrane. The organisms which have only RNA, is called genetic RNA. (1) Double-stranded DNA. (2) Single-stranded DNA. It also includes increase in amount of apoplasmatic substances such as the fibres and matrix of connective tissues of higher animals such as mammals. Nucleolar ribosomal subunit rRNA genes are transcribed by Fig. Submetacentric. are motile and contain one or more flagella for the cellular locomotion (swimming). The inbred pedigrees can be depicted as follows : Here, B and C are full sibs, i.e., have common parents. Ribosomes 280-292 Historical; occurrence and distribution; method of isolation; types of ribosomes, 80S ribosomes, ribosomes, 80S ribosomes, 80S ribosomes, 80S ribosomes, structure of ribosomes, 80S ribosomes, model of 80S ribosome, dissociation and reconstitution of ribosomes, comparison of 70S and 80S ribosomes; biogenesis of 70S ribosomes; biogenesis of 70S ribosomes, comparison of 70S and 80S ribosomes, biogenesis of 70S ribosomes, biogenes, biogenes indicating that the phage RNA can serve as a template for its self-replication. Formation of basal bodies and ultimately the cilia is the specialized function of the centrioles in the cell. 1941 G.W. Beadle and E.L.Tatum published their classical study on the biochemical genetics of Neurospora. Give a brief life sketch of Mendel and state why his name is so significant for geneticists ? Table 20-1. There are a large number of cytochromes in cells; most are found in mitochondria, although some also function for geneticists ? Table 20-1. There are a large number of cytochromes in cells; most are found in mitochondria, although some also function for geneticists ? It may act as a focal point for the convergence of microtubules. Haemorrhage or bleeding in new-born infants; scurvylike symptoms (blood takes longer to clot). Carrier proteins of membrane functioning as uniports, Lawson et al., 1975), so that, they symptoms (blood takes longer to clot). usually thymine (T). Post-transcriptional modification of processing of mRNA. Adenine (A) Deoxyadenosine dAMP 2. (c) What is the genotype of her mother ? 8.8. Production of paired tetrad in an ascus, due to linear an arrangement would be disturbed if meiosis and subsequent mitosis to produce eight spores. During mitosis, 4 to 40 microtubules of mitotic spindle become attached to the kinetochore and provide the force for chromosomal movement during anaphase. Desmosomes are abundantly found in tissues that have to withstand severe mechanical stress, such as skin epithelia, bladder, cardiac muscle, the neck of uterus and vagina. (Chironomus) become very large having high DNA content. In these molecules, the carbohydrate portion consists of much shorter chains which are often branched. The present understanding of molecular biology is that in most organisms the phenotype or the body structure and
function ultimately depend for their determination on the structural and functional (i.e., enzymatic) proteins or polypeptides. Dutch microscopist, Anton van Leeuwenhoek Fig. Once held in place on the parent template chain, the free mucleotides were sewn together by formation of the phosphate diester bonds that linked adjacent deoxyribose residues, forming a newenhoek Fig. Once held in place on the parent template chain, the free mucleotides were sewn together by formation of the phosphate diester bonds that linked adjacent deoxyribose residues, forming a new together by formation of the phosphate diester bonds that linked adjacent deoxyribose residues. polynucleotide molecule of predetermined base sequence. The prophase is of longer duration and it completes in six successive stages, viz., proleptotene, leptotene, and ribosomes an ATP synthetics are all thylakoid contained in a third distinct membrane membrane that forms a set Mitochondrion of flattened disc-like sacs, Chloroplast the thylakoids (Fig. Contents 156 CELL BIOLOGY 1. The releasing factor 1 or 2 with the help of peptidyl transferase releases the polypeptide from the P-tRNA. (a) F1 females : fa + / Y (facet). 10.4. A monohybrid cross between agouti and Himalayan (or Russian) rabbits. 2.1. Comparison of optical pathways in light and electron microscopes. (ii) Non-histone or Acidic proteins. Cell plate, at this stage, comprises following structures : (1) central middle lamella; (2) primary cell walls on both sides of middle lamella ; and (3) plasma mem- Golgi apparatus cell plate microtubules daughter nucleus chromosomes plasma membrane cell wall space vesicles from Golgi apparatus Fig. (iv) Some DNA is about five-to seven-fold, i.e., five to seven times more compact than free DNA. This type of regulation also occurs in mature unfertilized eggs. Extra-Nuclear Inheritance by Endosymbionts Certain intra-cellular parasites such as bacteria and virus particles maintain symbiotic relationship with host cells. 14.10. For example, unfertilized eggs of many animals lack functional centrioles and use the sperm centriole for the first mitotic division (for cleavage), however, under certain experimental conditions— such as extreme ionic imbalance or electrical stimulation—the unfertilized egg can produce a variable number of centrioles. Define the terms redox reactions and redox potential. Seeds lose large proportion of their water on maturation leading to shrinkage in volume. If so, which ones? The genes are arranged on the chromosomes in a linear fashion. Crossing over is a phenomenon in which exchange of chromosomes by breakage and union. MTOCs also protect the minus ends of the microtubules from the disassembly. Calcium and calmodulin (an acidic protein having four Ca2+ binding sites) are some other regulating factors in the embryonic cells the nucleus generally occupies the geometric centre of the cell but as the cells the nucleus generally occupies the geometric centre of the cell but as the cells the nucleus generally occupies the geometric centre of the cell but as the cells the nucleus generally occupies the geometric centre of the cell but as the cells the nucleus generally occupies the geometric centre of the cell but as the cells the nucleus generally occupies the geometric centre of the cell but as the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cell but as the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the geometric centre of the cells the nucleus generally occupies the general gener start to differentiate and the rate of the metabolic activities increases, the displacement in the position of the nucleus takes place. Glyoxysomes remain intimately associated with lipid bodies, the spherosomes and contain enzymes for fatty acid metabolic metabolic activities increases, the displacement in the position of the nucleus takes place. succinate in this case). Contents C H A P T E R 8 Regulation of Gene Action T Many invertebrate animals - and some vertebrates - change form as they mature. Recent, DNA-RNA hybridization experiments have rejected the spinning out and retraction hypothesis (see Grant, 1978). Since viruses are entirely dependent on living cells for their replication, they cannot be a precellular form in evolutionary terms, but should be viewed as pieces of cellular genetic material which have gained some degree of individual autonomy (see Bradbury et al., 1975). Mitosis starts at the culmination point of interphase (i.e., G2 phase). The individual polypeptide chains of the protein itself is called multimer. The term cell membrane was coined by C. The DNA comprising these U G U genes is called rDNA (=ribosomal DNA) which is repetitive U in nature. Lysosomes are also numerous in epithelial cells of absorptive, secretory and excretory organs (e.g., intestine, liver, kidney, etc.). The vitelline membrane is composed of mucoproteins and fibrous proteins. (b) If yellow onions are crossed to a pure white strain of a generations? Certain Examples of Phenomenon of Dominance After Mendel several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested the validity of the phenomenon of dominance on several geneticists tested t Gossypium hirsutum, the New world cotton plant, is another interesting example of allopolyploidy. A shock evievent formation in a single gene of the phage so that all the phage so that all the phage genes cell division can be expressed. Contents GENE MUTATION 201 C H A P T E R 16 Gene Mutation A A chance mutation in a single gene of the speckled moth Biston betularia produced a fortunate change from the normal speckled colouration, seen in the moth on the left, to the melanic form seen on the right. 4.35. MORPHOLOGY stroma strouture of a chloroplast. AA, Aa BB, Bb, bb bb BB, Bb Phenotypic expression of alleles } No Phenotype production Phenotype expression due to dominant alleles on both loci (complementation of gene action) Example When a pure line variety of white flowered sweet pea, in F1 purple or red flowered plants were produced (Table 4-8). 3. These protofilaments then associate in a staggered manner to form successively larger structures. At metaphase and anaphase most vimentin and cytokeratin appear as spheroid bodies, while at telophase the filamentous cytoskeleton become gradually reestablished. (ii) During the transformation of leucoplasts, certain fibrils appear which give rise to crystals filling up the whole plastids. For example, mitochondria in epithelial cells of carotid bodies (or glomus carotica which are chemoreceptors, sensitive to changes in blood chemistry and lie near the bifurcations of carotid arteries) have only four to five cristae and mitochondria from granule inner membrane non-myelinated axons of rabbit brain have only a single crista. S1/S2 × S1/S3 × S1 / S3 S1 / S2 S2 / S3 S2 / S respiratory tract, the ciliary movements help in the elimination of the solid particles from it. 3.5. cytosine (2-hydroxy6-aminopyrimidine, mw=111.10 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering
system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thymine (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thyline (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) CH3 2 3 H NH Old numbering system Chemical formula of thyline (2, 6-dihydroxy-5- methylpyrimidine, mw=126.12 daltons) chromosomes or genomes (AAA), and an autotriploid will have three similar genomes (AAA), and an autotetraploid, will have four such genomes (AAA). Contents CHROMOSOMES Table 13.2. DNA content and chromosome component (after De Robertis, Jr., 1987). Gene 1. Thus, DNA can be of the following types : The above described DNA molecule contains the right handed helical coiling and has been called B-form or B-DNA. The DNA template and the RNA strands are antiparallel as in double-stranded DNA (after thesis and the first Freifelder, 1985). Glycolysis Under anaerobic conditions (i.e., in the absence of oxygen) glucose is degraded into lactic acid or lactate by a process called glycolysis (i.e., lysis or splitting of glucose), e.g., it commonly occurs in vertebrate muscles when the energy demand in heavy exercise exceeds the available oxygen. Plasmalogens are a special class of phospholipids which are especially abundant in the membranes of nerve and A soap micelle. (iii) Enzymes. Some bacteria retain the blue colour while others lose it and stay colourless. The female sex either consists of single X chromosome or one X chromosome and one Y chromosome and one Y chromosome and one Y chromosome. RER usually exists as cisternae which occur in those cells of pancreas, notochord and brain. Retarded growth. There is no linkage involved. The mutations occurring in gamete cells (e.g., sperms and ova) are called gametic mutations. The X-linked recessive phenotype is usually found more frequently in the male than in the female. Nutrition in bacteria. Describe the molecular structure of the following proteins : collagens, haemoglobin and immunoglobulin. Further, the outer membrane inner membrane inner membrane toward the perimitochondrial space and an inner membrane toward matrix. ULTRASTRUCTURE The field of ultrastracture of the chromatin is still the area where electron microscope had failed to provide us a clear picture of the organization of DNA in the chromatin. The word enzyme (Greek. specific transport proteins (see Table 10-1) that regulate the passage of metabolites into and out of the matrix. 9.2 and Fig. Base Ribonucleoside Ribonucleoside 1. Adenine(A) Adenosine 2. However, they resemble ER in being self-replicating membrane bound organelle. The persons with autosomal homozygous recessive genes hh fail to produce the enzyme homogentisic acid or homogentisic acid). adenine and guanine and two pyrimidines, cytosine and uracil. (d) Quaternary protein structure. The individual chromosomes are cut out from the photograph. Contents 64 CELL BIOLOGY Microtubules uncell wall chromatin dergo reversible assembly (i.e., polymerization-depolymercarbohydrate ization), depending on the DNA need of the cell or organelles. Plasma membrane controls the entry of nutrientes and exit of waste products and generates differences in ion concentration between the interior and exterior of the cell. They are called suppressor T cells. Lipids. The preformed precursor oligosaccharide is transferred en bloc to the target asparagine residue in a single enzymatic step almost as soon as that residue emerges in the lumen of ER during protein translocation (Fig.6.5 B). Solenoid Models H1 is reported to be phosphorylated just before mitotic cell division to make possible the higher levels of coiling (see Mays, 1981). (ii) Meiotic parthenogenesis. A schematic diagram of typical Mycoplasmas are mostly free-living, saprophytes PPLO cell. A Case of Reverse Genetics in Mendel's Wrinkled Character In the year 1990, a group of scientists, working at the John Innes Institute of Norwich (U.K), cloned the pea gene r (rugosus; old name wrinkled, w) which determines whether the seed is round or wrinkled. In addition to improving crop varieties, geneticists have learned to change the genetic systems of insects to reduce their fertility. This is done in three consecutive steps : oxidative decarboxylation (removal of carboxyl or -COOH group), Krebs cycle and oxidative phosphorylation. Thus, the colloidal state is a condition in which one substance, such as protein or other macromolecule, is dispersed in another substance to form many small phases suspended in one continuous phase While the mitochondria represent the symbionts which respire aerobically and contain the enzymes of Krebs cycle and respiratory chain. Such a breeding coefficient. Vitamins are organic compounds of diverse chemical nature. Homozygous individuals normally die early in life due to severe anaemia caused by premature destruction of the sickled red blood cells. Calling ΔpH the pH gradient and $\Delta \psi$ (delta psi) the resulting electrical gradient in volts, the energy produced ΔP is the proton motive force: $\Delta P = \Delta \psi + 2.3 \text{ RT/F} \Delta pH$ where R is the universal gas constant, T the absolute temperature, and F the Faraday constant. Acid phosphatase 4. When F1 males (b+vg/bvg+), were backcrossed (i.e., test crossed) to double recessive females (bvg/bvg or black vestigial), only two types of progeny (one with gray bodies and normal wings, to bvg+/bvg instead of four types of phenotypes were obtained (see Sinha and Sinha, 1990) : Parents : Gametes : F1 : Test cross : Gametes : Gray, Vestigial b+vg/bvg+ (b+vg) F1 male Gray, Long b+vg/bvg+ (b+vg) (bvg+) (only two types of gametes due to complete linkage × Black, Long bvg+/bvg+ (b+vg) (bvg+) (long b+vg/bvg+ × Female Black, Vestigial bvg/bvg+ × Female Black, Vestigial bvg/bvg+ (b+vg) (bvg+) (only two types of gametes due to complete linkage × Black, Long bvg+/bvg+ (b+vg) (bvg+) (long bvg+/bvg+ (bvg+) (long bvg+/bvg+) (long bvg+/bvg+ (bvg+) (long bvg+/bvg+ (bvg+) (long bvg+/bvg+) (long bvg+/bvg+/bvg+ (bvg+) (long bvg+/bvg+) (long bvg+/bvg+) (long bvg+/bvg+/bvg+) (long bvg+/bvg+) (long bvg+/bvg+/bvg+) (long bvg+/bvg+) (long bvg Drosophila) Test cross ratio : ½ Gray, Vestigial : b+vg/bvg ½ Black, Long bvg+/bvg 89 or 1 : 1. Deletion Fig. Diseases and symptoms caused by lack of vitamin Pellagra, a disease characterised by three D'sdermatitis, diarrhoea and dementia (psychological disturbance). Both autoploidy and allopolyploidy can result in a species with double the original chromosome number. Are the genetic effects the same in both cross and self-fertilizing organisms? Desmosomes are of following three types : (i) Belt desmosomes (Zonula adherens). Contents 288 CELL BIOLOGY In similar manner, reconstitution of 50S ribosomal subunit is achieved. In the last three decades several hybrid DNA models have been proposed to explain the mechanism of recombination. comparable to a structural gene of prokaryotic operon; 2. Each peptide bond is severed with the introduction of a water molecule, a hydrolytic Contents MITOCHONDIRA 213 - - - - reaction. Such mice are called 'waltzing mice'. The stroma also contains ribosomes and DNA molecules (i.e., 80 DNA molecules per chloroplast per cell of Chlamydomonas; 20 to 40 DNA molecules per chloroplast. Contents GENETIC ENGINEERING sis of complementary strands in the usual manner. For better type of development both good heredity and suitable environment are necessary. 16A/16A Normal 779 2. Maps of the location of genes (genetic maps) have been made in several chloroplast DNAs by the help of restriction enzymes. Immunology 11. Mitochondrial DNA (mt DNA) molecule is relatively small, simple, double-stranded and except for the DNA of some algae and protozoans, it is circular. Thus, an AT pair becomes and remains A-BU. Each bacterium has its own unique restriction enzymes and each enzyme recognizes only one type of sequence. (4) Labelled rRNA was added on filter paper carrying single stranded DNA. The central idea of pangenesis theory has been given first of all by Hippocrates. consist of two identical pairs : two alpha chains (141 amino acids each) and two beta chains (146 amino acids each). Contents GENE MUTATION 215 REVISION QUESTIONS AND PROBLEMS 1. The phaeoplasts occur in the diatoms, dinoflagellates and brown algae. Dark field microscope or Ultramicroscope. Asexual reproduction cannot produce segregation of nuclear or chromosomal genes, but cytoplasmic constituents can be differentially distributed to fission products. As stated in the cell theory, cells arise only from other cells. The significance of X body was not immediately understood, but in 1902 an American geneticist Clarance McClung who had made extensive observations of gametogenesis in grasshoppers, suggested that the X body was involved in some way with the determination of sex. The non-protein portion of haemoglobin consists of four iron-containing
haem groups, one associated with each of the four globin chains. So the genetical analyst can concentrate on one meiosis and forget the other. It is based on the fact that the DNA of each individual is interrupted by a series of identical DNA sequences called repetitive DNA or tandem repeats. Contents GENETICS, HUMAN GENETICS AND PROBLEMS 1. In angiosperms (flowering plants) monoploids may also originate spontaneously due to parthenogenetic development of egg. 1977 P.A. Sharp and R.J. Roberts discovered split genes of adenovirus. Specifically exchange α-ketoglutarate for malate across membrane. The existence of a mem- Contents 244 CELL BIOLOGY brane delimiting the nucleus was first demonstrated by O.Hertwig in 1893. 10.3) produce all agouti individuals in the F1 and a 3 agouti : 1 chinchilla ratio in the F2. It can act as a storage organelle for both nutrients and waste products ; as a lysosomal compartment (Boller and Kende, 1979), as a economical way of increasing the size of the cells, and as a con-Vacuole (b) (a) Plant cell vacuoles (a) Vacuoles seen in Elodea leaf (b) TEM of a cell showing vacuole. Such rare monoploids have been obtained in tomatoes and cotton under cultivation. Most of the proteins of the mitochondrion, however, result from the activity of the nuclear genes and are synthesized on ribosomes of the cytosol (cytoplasmic matrix). Certain drugs such as colchicine and vinblastin, are found to block the polymerization of tubulin. 3.1. B A-A self-fertilizing flower of Pisum sativum. These constrictions may connections between the two major components regulate the flux of molecules through the of the primary cell wall : the cellulose microfibrils annulus that joins the two cytosols (Gunning, 1976, 1983). The term semiautonomous organelles was applied to the two structures in the recognition of these findings. Th region of the matrix containing granular type of endoplasmic reticulum takes basiophilic stain and is named as ergastoplasm, basiophilic substances or Nissl bodies, chromophilic substances or Nissl bodies, chromophilic substances or Nissl bodies by early cytologists. It is a major compoCH2 nent of cell walls of plants and is named as ergastoplasm, basiophilic substances or Nissl bodies by early cytologists. It is a major compoCH2 nent of cell walls of plants and is named as ergastoplasm, basiophilic substances or Nissl bodies by early cytologists. It is a major compoCH2 nent of cell walls of plants and is named as ergastoplasm, basiophilic substances or Nissl bodies by early cytologists. thought that the semen of man has some "vitalizing" effect and he considered it as the highly purified blood. At this phase the chromatids of each tetrad are usually clearly visible, but the synaptonemal complex appears to be dissolved, leaving participating chromatids of the paired homologous chromosome physically joined at one or more discrete points called chiasmata (singular, chiasma; Gr., chiasma= cross piece). Generally, they are smaller and "hairy" in invertebrates than in vertebrates than in vertebrates. In fact, among the higher plants, there are eight types of sex phenotype expression (Table 13-1). The technique was discovered in England by Alec Jeffreys. 4.28% A, 28% A, 28% G, 15% C. (v) Metalloproteins. 4.42. A person with extra one X and Y chromosome display true hermaphroditism having both ovarian and testicular tissues and variable degrees of intersexual development of the genitalia. Cis-aconitic acid Then, each pyruMalic acid C 6H6O 6 C6H6O 5 vic acid molecule Aconitase is broken into +H2O three carbon dioxFumarase H O ide fragments: One 2 Iso-citric acid CO2 molecule is Fumaric acid C6H8O 7 C4H4O4 given off during + NADP Iso-citric oxidative decardehydrogenase FAD conversion of Oxalo-succinic acid pyruvic acid into acid C 4H6O 4 acetyl-CoA) and two CO 2 molSuccinyl CoA CO 2 ecules are given synthetase + Mg++ off in the Krebs a-Ketoglutaric acid C5H6O5 Succinyl-CoA + CO2 cycle. In Drosophila and other animals, translocations have also been induced by X-rays. Other plasmids may be separated parts of the normal genome from the same or a foreign cell, and may recombine with the main chromosome. Approximately and other animals, translocations have also been induced by X-rays. one-fifth of the 120 chloroplast genes are regulated in a light-dependent manner. Each amino acid before its attachment with its specific tRNA is activated by a specific activating enzyme known as the aminoacyl synthetase and ATP. The other gonad remains rudimentary. The chemiosmotic theory. (ii) Anaphase B. C-form of DNA is found at 66 per cent relative humidity in the presence of lithium (Li+) ions. Diagram and label the first and second anaphase figures. Certain enzymes known as kinases to perform catalytic activities. More than 500 human genetic diseases are known to be caused by single-gene defects (Albert et al., 1989). It may be static, unchanging in length and constantly exposing the same stretch of chromosome fibre. Note the lum takes basiophilic stain due to its top of the photo. Stages of Polypeptide Synthesis in Eukaryotes Fig. be linked together. coli chromosome, so the presA ence of loops may be a general feature of chromosomes. Genomic library. This DNA amount is utilized in the repairing of broken DNA molecule of the chromatids during the chiasmata formation and crossing over. For example, yeast cells grown on sugar have tiny peroxisomes. Contents RIBOSOMES 283 40S unit 40S 60S mRNA tRNA NH2 membrane of the endoplasmic reticulum 60S unit new protein molecule NH2 A B Fig. Model of molecular structure of F0 alpha (α), beta (β), gamma (γ), delta (δ) and epsilon and F1 partilces in the bacterial (ϵ), with the probable composition of α 3 β 3 γ δ ϵ . These are spiral-shaped and motile bacteria (Fig. For example, according to Boveri in sea urchin egg the fertilization of the egg (activation) takes place by the sperm aster. malformations; and various deformaties of skull, face and feet. Table 6.1. Manifestation of heterosis (in terms of quantitative inheritance) in F1 hybrids as suggested by Powers. envelope (i.e., to nuclear lamina) via the specialized structure, called attachment plaques (see Suzuki et al., 1986). 6.2. Various components of the endoplasmic reticulum. (c) - lys - thr - (nonsense), chain terminates prematurely. Frequently, the PS IIs are associated with the lightharvesting complex and are involved in light induced release of O2 from H2O (i.e., photolysis of water). 1964 K.A. Marcker and F. Therefore, the cells with little or no synthetic activities, e.g., sperm cells, blastomeres, muscle cell, etc., are found to contain smaller or no nucleoli, while the oocytes, neurons and secretory cells which synthesize the proteins or other substances contain comparatively large-sized nucleoli. For instance, the elephant will prove entirely useless material for genetical experiments than the Drosophila, pea plants, tomato, rats, guinea pigs, etc., which have been generally used and are still used in hybridization experiments. One of his female associates Rosalind Franklin obtained a superior X-ray diffraction photograph of DNA which confirmed Astbury's earlier inference of 3.4 internucleotide distance, helical scheme. Tubular form of ER is often found in SER and is dynamic in nature, i.e., it is associated with membrane movements, fission and fusion between membranes of cytocavity network (see Thorpe, 1984). These structures were long and sausage-shaped and marked by swellings and cross striations (transverse bands). Chromatin has three main components—DNA, histones and non-histones. C low pH value are known to affect depurination or loss of Fig. However, yield continued to decline for at least 20 generations until it reached one-third that of open-pollinated variety from which they were derived. The T4 genome or chromosome is a single DNA molecule which is 60 µm long, linear, double-stranded and tightlypacked within the head of the phage. This new individual of first generation (F1) contains two different genes (i.e., alleles) of a contrasting pair of characters, therefore, it is known as heterozygote or hybrid. The elongation site is then filled with a nucleoside of the phage. triphosphate that is selected strictly by its ability to form a hydrogen bond with the next base in the DNA strand. However, pore arrangement in other cell types is not random but rather range from rows (e.g., spores of Eqisetum) to Clusters (e.g., oocytes of Xenopus laevis) to hexagonal (e.g., Malpighian tubules of leaf hoppers) packing order (see Thorpe, 1984). AA, Aa bb 2. Further, due to subsidiary effect of abnormal haemoglo- Top red blood cell is normal, bottom cell bin (i.e., HbS), red blood cell of some persons suffered from this is sickled. By certain recent techniques, a flagellum can be severed from a cell by a laser beam and ciliary membrane can be peeled off by detergent treatments. 1967; Maden, 1977): (i) The first ribosomal RNA in HeLa cells is a large 45S molecule of 14,000 nucleotides. Various components cyclic AMP CRP RNA operator tra site B. DNA molecules 50S subunit 3.14) is about 2µm long and 1µm wide. At the time of such cross pollination, the pollen should be mature and stigma should be receptive. It is the characteristic of flowering plants. Likewise, lack of erythrolable pigment which is necessary for discrimination in red end of the spectrum results in protanopia or protan colour-blindness. 15.13. The bride is the (including phenylalanine) are excreted in younger of the two. In the revision of the book, the simplicity and clarity of the language has been maintained. 14.19. Seikevitz and Palade (1960) have reported that the granular type of ER has originated first and later it synthesizes the agranular or smooth type of endoplasmic reticulum. In fact, most genes occupy fixed sites on the chromosomes, and the overall
structure of the genetic map is practically invariant. of the fine structure of these organelles. When changes involving more than one nucleotide pair, or entire gene, then such mutations are called gross mutations. Virus studies then showed that many sites were present in a particular locus (e.g., rII locus in T4 phase). (a) F1 : all walnut comb; F2 : 9/16 walnut : 3/16 rose : 3/16 pea : 1/16 about various human diseases and metabolic disorders which are generally related with the genes. Due to these reasons Altmann suggested the name "bioblasts" to the mitochondria and he also hinted about their self-duplicating nature. Proteins Of all the macromolecules found in the cell, the proteins are chemically and physically more diverse. characteristic fibrous proteins found in all multicellular animals (e.g., in connective tissues). The xanthophylls contain many hydroxy groups in their molecules. The common examples of the sterols are cholesterol found in animals and Fig. When a plant with triangular seed capsule is crossed with one having top-shaped capsule, in F1 only triangular, character appears. 5.9. Cholesterol molecule (schematic) interacting with B. In most animals and many plants the haploid number are the same. Such types of microscopes were called "flea glasses", since they were primarily used to examine small whole organisms such as fleas and other insects. From these monoploid strains have also been developed pure breeding strains which are resistant for the insecticides and also for toxic compounds normally produced by the parasites of these plants. the strobilation occurs during the formation of ephyra larva. CHARACTERISTICS OF TRANSPOSABLE ELEMENTS Some salient features of the transposable elements are the following: 1. Many types of vacuoles and storage granules of plants are found to contain certain digestive enzymes and these granules are considered as lysosomes of plant cell (Gahan, 1972). In DNA transcription a different enzyme, called DNA-dependent RNA polymerase mediates a similar process, except that complementary ribonucleosidetriphosphates are matched with the DNA template and RNA polymers are formed. Glycero-phosphatidyl Transfer of phosphatidyl group transferase C. The characteristic feature of collagen (or tropocollagen) molecules is their stiff, triple-stranded helical structure (which was discovered by Rich, Crick and Rama-chandran). Both types of gametes differ from each other in their shape, size and behaviour and are collectively known as the anisogametes or heterogametes. In this case, an Photographs show two accentric fragment (without a cen-Fig. The mutations which arise from the insertion or deletion of individual nucleotides and cause the rest of the message downstream of the mutation to be read out of phase, are called frameshift mutations. Viral genetics. Revision questions (and problems) have been given at the end of each chapter to test the learning capacity of the readers. Homologous chromosomes (Homolog). egg. Bar eye in Drosophila. Glycoproteins are proteins that contain various amounts (1 to 85 per cent) of carbohydrates. For example, Brenner (1957) showed that the overlapping one. + + v v P1 Vestigial Long winged (Homozygous) (Homozygous) female F1 + v v Long winged (Heterozygous) male + v v Lon space. It was demon- Drumstick nuclear appendage Leukocyte A 165 Leukocyte B Fig. Contents 198 CELL BIOLOGY 2. Extensive experimentation of different organisms have revealed the fact that most organisms generally have inherent potentialities for both sexes and each individual is found to be more or less intermediate be- 2n + XX 2n + XY n+X 2n + XY 2W Type Chicken 2n+ZZ Fig 13.3. The XX-XY and ZW-ZZ type determination of sex in man and chicken. The space between and 1 immediately around the triplet is filled with an 2 amorphous, electron-dense material. OXIDATION OF PROTEINS Before proteins can be introduced into the mainstream of metabolism (catabolism) they must be split into amino acids. Granular theory was propounded by Altmann in 1893. Synge Manton et al. Types of junctions between animal cells (Source : Maclean and Hall, 1987). Corn (Zea mays) has 10 pairs of chromosomes and 10 linkage groups. A woman of blood group A marries a man of blood group O. Unlike viruses, they are free living and do not require host cells for the inner ear are Contents 310 CELL BIOLOGY responsible for the transduction of sound. The cAMP activates a protein kinase (e.g., Akinase) which phosphorylates (activates) many specific enzymes. Chronological tabulation of certain important cell biological investigations of 20th century. b, cyt. CHEMICAL ORGANIZATION OF CYTOSOL (OR CYTOPLASMIC MATRIX) Chemically, the cytoplasmic matrix is composed of many chemical elements in the form of atoms, ions and molecules. (b) Girls suffering from Down's syndrome. This is normally accomplished by disrupting tissue in homogenizers wherein the clearance is such that nuclei are not broken but the plasma membrane and endoplasmic reticulum are severely disrupted. Ph : 2268048, 2354008 z 152, Anna Salai, Chennai-600 002. The repressor protein is a diffusible tetramer i mRNA lac mRNA protein having 152,000 dalton M.W. B - galactosidase To clarify the repermease spective roles of these eletransacetylase inducer ments. F. Contents CHROMOSOMAL MUTATION-I 1 2 3 break 4 2 3 3 2 Reciprocal translocation heterozygote 4 2 1-4 2-3 2 4 Alternate disjunction Synapsis 2 B 1 1 1 1 1 1 4 1-2 4 4 2 2 1-4 3-4 4 -3 2-3 3 3 C 1-2 3-4 3 3 1 1 A 1 1 4 Standard 4 chromosome arrangement 3 3 181 Adjacent disjunction II 2 2 1-2 2-3 3 3 Fig. They are structurally and functionally related to lysosomes in animal cells and may contain a wide range of hydrolytic enzymes. Moreover, it is extremely difA : BUK BUe = 5-Bromouracil A:T enol form ficult to recognize transveretc. These protofilaments have a centre-to-centre spacing of 4.5 nm. The point mutations. Holandric gene. One member of the heteromorphic pair appears identical to the member of a pair in the female; she called this the X chromosome. The nutrient medium. Since, the two embryos have arisen by mitosis, they have the same chromosome sets in their body cells. The phenomenon of dosage compensation in Drosophila has been shown to be due to hyperactivity of one X chromosome in male Drosophila. The low pH in endosome activates a fusogenic protein or fusogen in the viral envelope that catalyzes the fusion of F2 results of of genetic information from DNA to RNA molecules and then from RNA. The autopolyploids, which consist of same basic set of chromosomes multiplied. A narrow, but important, distinction is, thus, made between a molecule that can generate only its own kind and a molecule that can also generate new kinds of molecules. The changes in the genome involving chromosome parts, whole chromosome sets are called chromosome mutations. for more than 100 different "species" of tRNA. Role of Lipid Molecules in Maintaining Fluid Property of Membrane (i) Types of movements of lipid molecules. 11.3. Unequal crossing over and production of ultrabar and triple bar Drosophila. Contents 246 GENETICS, HUMAN GENETICS, HUMAN GENETICS, HUMAN GENETICS AND EUGENICS C H A P T E R 19 Eugenics, Euphenics and Genetic Engineering E ugenics deals with the application of the laws of genetics to the improvement of humen race. crossing over is not actual reduction a e A in cytological crossing over, but it is the paracentric result of lack of recovery of the products of A B C D E F A B E D C F single crossing over (see Burns and Bottino, 1989). Enzymes such as exonucleases, restriction endonucleases, restriction endonucleases), SI enzymes (to change cohesive ends

of single stranded DNA fragments into blunt ends), DNA ligases, alkaline phosphatase, reverse transcriptase, DNA polymerases. The complimentary chiasma produces D four single cross overs but no non-cross over. with 35S. The children's blood types are O, A and AB. Likewise, some lipids of outer surface are glycolipids. These ions act as a buffering system and tend to stabilize pH of blood and cellular fluids. The enucleated part loses the regeneration capacity after a few decapitations, but the nucleated portion always maintains this ability. However, when excess H2O2 accumulates in the cell, catalase converts H2O2 to H2O + O2 H2O2 and aging. For instance, hormone-protein complex or a transcription factor may bind to a sensor site and cause the transcription of integrator. Physical action, i.e., physical action, i.e., physical stress exerted by microtubules which become attached to the nuclear envelope (see Burns and Bottino, 1989). Sometimes breaks occur at each end of the chromosome and broken ends are joined to form a ring chromosome. Table 10-3. following clues : Contents 136 GENETICS, HUMAN GENETICS (a) It is more frequently found in the female than in the male of the species. IA1 is dominant to all other IA alleles, IA2 is recessive to IA1 but dominant to all other IA2 but dominant to all other IA2 but dominant to all still unexplained. It is here that almost all of the cell's DNA is confined, replicated and transcribed. Segregation patterns of ascospores in asci as a result of crossing over involving different structure. The chromosomes of each species of water are found in its molecular structure. has a characteristic morphology (structure) and number. biochemical genetics. 3.2) between tall and dwarf pea plants then only tall pea plants appeared in the following way (Fig. A Studies have shown that ordinarily ~ 30 AAA AAA per cent of hn RNA and ~ 70 per cent of A AAUAA mRNA are poly-adenylated. Moreover, the mitochondrial matrix contains different choline deh. Contents FINE STRUCTURE OF GENE 127 C H A P T E R 11 Fine Structure of Gene T Some of what this boy will be as an adult will be influenced by what he learns from his grandfather, but much will reflect the genes he has inherited from his grandfather. The lipase too has no effect. Adjacent to the TrpE gene are the promoter, the operator and two regions called the leader and the attenuator, which are designated TrpL and TrpA) respectively (Fig. Contents MITOCHONDIRA precursor protein insertion into membrane driven by electrochemical gradient signal peptide outer mitochondrial membrane inner mitochondrial membrane recogination postulated receptor cleavage by matrix protease membrane contact site translocation into matrix requiring ATP-dependent protein unfolding A cleavage site signal peptide (a) cleavage site signal peptide (b) cleavage site signal peptide (b) cleavage site signal peptide (c) cleavage site signal cleavage mitochondrial protein synthesis B (b) Fig. What is an oxidative decarboxylation ? Deparaffinized in xylol for staining. The transferred gene replicates normally and is handed over to next progeny. (i) Meselson and Stahl's experiment. It was shown that an isoform of starch branching enzyme (SBEI) is present in round (RR or WW and Rr or Ww) seeds, but absent in wrinkled (rr or ww) seeds. Consequently, the presence of X XXXX G X X hese bases forces the model builder Me X X to construct several non-base-paired Di X X X loops in the tRNA molecule. Similarly, two Renner complexes in Oenothera muricata are called rigens (R) and curvans (C). Diatoms. Presumably the condensation prevents RNA polymerase from gaining Contents CELL BIOLOGY 272 5 6 1 6 4 1 2 5 3 3 4 2 30nm A B Fig. Contents CYTOPLASMIC MATRIX 103 The enzymes are specific in action and many factors such as pH, temperature and concentration of the substrate affect the rate of the activity of enzymes. Photosynthetic enzymes 15. DDDD. Moreover, at the other temperature extreme, large amounts of energy (335 joules or 80 cal per gram) must be lost for water to be converted from the liquid to the solid state. Growth. Nucleosomes and Solenoid Model of Chromatin In eukaryotes, DNA is tightly bound to an equal mass of histories, which serve to form a repeating array of DNA-protein particles, called nucleosomes. In order to become saturated or balanced the chromosomes must pair. Literally hundreds of mistaken hypotheses and wild guesses were proposed before 1900 in vain attempts to find out a solution to the problem of determination of sex. Animal tissues B. A The egg, travels down the oviduct towards the uterus. Cytology versus Cell Biology The cell biology the cell; cell physiology studied biochemistry, biophysics, and functions of the cell; and cell biology interpreted the cell in terms of molecules (macromolecules such as nucleic acids and proteins). (iii) Band 3 protein. If a glyFig. The artificial insemination is already widely practiced to permit those women whose husbands are sterile or have some serious hereditary afflictions to bear children. Previously the mitochondria have been known by various names such as fuchsinophilic granules, plasmosomes, plastosomes, plastoso fila, vermicules, bioblasts and chondriosomes. The 60S ribosomal subunit is generally rounder in shape than the small subunit, although its one side is flattened; this is the side that becomes confluent with the small subunit during the formation of the monomer or monosome (i.e., functional 80S ribosome). The embryoid may be grown on agar to form a monoploid plantlet, which can then be potted in soil to mature. Under favourable conditions winged males and females are produced. How is this trait inherited ? The auria plants have the genotype Cc because they are heterozygotes of green and white plants. A woman whose father was of blood group AB and whose mother was A marries a man of blood group B. The genotype of F1 hybrid is $\nu + \nu$ and in it the allele $\nu +$ is dominant over the alleles ν which is recessive. 5.2. The original Danielli-Davson model (1935) of membrane struce. Self membrane. For example, in Chlamydomonas a set of genes that encode proteins involved in basal body structure and flagellar assembly is carried on a separate genetic element that segregate independently of the major chromosomes. The portions of specimen that exclude stain transmit electrons readily, so their images can be seen. The cooperation of two genomes has been greatly clarified by studies on the molecular assembly of cytochrome oxidase (Saltzgaber et al., 1977). Coated-pits are depressions of plasma membrane having a coat of bristle-like structure towards their cytosolic side. The perinuclear space is a 10 to 50 nm wide fluid-filled compartment which is continuous with the ER lumen and may contain fibres, crystalline deposits, lipid droplets or electrondense material (see Thorpe 1984). In humans, unequal crossing over between homologous chromosomes bearing σ (sigma) and β (beta) genes for σ and β subunits of adult haemoglobin (HbA), results in deletions and duplications of these genes. As a result in an albino patient melanocytes are present in normal number in their skin, hair, iris of eyes, etc., but lack in melanin pigment. Characteristic Ig A Ig D Ig E Ig G Ig M 1. In eukaryotic systems, only one release factor is known, i.e., eRFI. (b) bimolecular layer of phospholipids. but occasionally show yellow spots on their body. In electron microscopy, spacers have acted as sinks or storage areas for gene-specific binding proteins. Recessive phenotype. In salivary glands the appearance of some puffs has been correlated with the production of specific proteins which are secreted in large amounts in the larval saliva (Grossbach, 1977). amino Non-ambiguous code means that a par- acids 1 2 ticular codon will always code for the C A T G A T same amino acid. 3.3. A bacteriophage. 3.4. Certain abnormal recessive and dominant characters of man. It is well established now that the mitochondrial mass grows by the integrated activity of both genetic RNA The genetic RNA of viruses is self-replicating, that is, it can produce its own replica by itself. Davidson studied split genes for 28 S rRNA in Drosophila. The electrons are
passed through four carriers successively at lower energy levels, so that at each step energy is released, which is harvested in the production of two ATP molecules (from ADP + Pi). Got Nobel Prize for their studies of the metabolism of glycogen. (iii) Cytology of monoploids. The outer studies of the metabolism of glycogen. membrane which consists of a lipid bilayer traversed by channels of porin polypeptide. Messenger RNA is complementary to chromosomal DNA; it forms RNA-DNA hybrids after separation of the two DNA strands. But the plastids of an albino mutant of barley, fail to develop beyond a particular stage and there occurs no differentiation of grana and stroma. Homogametic sex. Often, it is difficult to define, because, it is. For example, the affected individuals secrete excessive quantity of amino acids that are found in the cell wall of the bacteria. A—At metaphase, subunits are added to the plus end of a microtubule at the kinetochore and are removed from the minus end at the spindle pole. A-Microtubule-walking proteins that resemble dynein or kinesin are part of the kinetochore, and they use the energy of ATP hydrolysis to pull the chromosome along its bound microtubules; B-Chromosome movement is driven by microtubule disassembly : as tubulin subunits dissociate, the kinetochore tends to slide poleward in order to restore its binding to the walls of the microtubule (After Alberts et al., 1989). Direct Evidences of Evolution : Fossils 18-33 Palaeontological evidences o group types of different persons, an agglutination test is performed. 7.3. A-Diagram of the segregation of two pairs of allelomorphic genes localized on the same pair of chromosomes without crossing over. Contents 52 CELL BIOLOGY which the double helix is itself twisted (Schmid, 1988). Recently following two models have been suggested to explain the three-dimensional structure of prokaryotic or 70S ribosomes : 1. Phytochrome is known to mediate many light-activated responses, including chloroplast rotation, stem elongation, leaf initiation and flowering. The Y chromosome is smaller in size with one end slightly curved or bent to one side in Drosophila; in man and Melandrium no such curvature of Y Heterochromatin chromosome occurs. Horse myoglobin 6. Define the following terms : genotype; phenotype; hybrid; gene; allele; mutation; linkage and eugenics. A married couple, both of whom had normal vision, produced a colour blind son. Generation AA Aa aa 100 0 100 0 50 50 25 25 75 37.5 12.5 87.5 6.25 93.75 1/4 1/4 Per cent heterozygosity Per cent homozygosity Genotypes 1/2 25 1 1/4 50 1/4 25 1/2 12.5 25 1/4 3 37.5 6.25 1/4 4 43.75 3.125 25 1/4 3 37.5 6.25 1/4 4 43.75 3.125 25 1/4 3 37.5 6.25 1/4 3 37.5 6.25 1/4 4 43.75 3.125 25 1/2 12.5 1/4 6.25 1/4 3 37.5 6.25 1/4 4 43.75 Fig. tems are coupled chemically rather than through direct energy transfer. Viruses that parasitize the bacterial cells, are called bacteriophages or phages (phage means 'to eat'). The four levels of structural organization in protein molecules (after Stansfield, 1969). Cleavage ring composed mainly of a clin filaments. Wildtype eye colour (+) is dull red and sex-linked. Structure of Mature egg has a cell-like structure and composed of the following parts (Fig. In patient therapy, cells with healthy genes may be introduced in the affected tissue, so that the healthy genes may be introduced in the affected tissue, so that the healthy gene overcomes the defect without affecting the inheritance of the patient. As for instance the plasma membrane of mammalian erythrocytes is found to contain some specific, genetically determined substances (carbohydrates and proteins) corresponding to the A, B and O blood groups. There are certain cases where centrioles seem to arise de novo. Table 11-1. When the detailed structure of a gene becomes procurable, then such a gene becomes procurable, then such a gene can be synthesized by a purely chemical method. Hormones may exert their phenotypic effects by derepressing gen-es preRegular gene viously repressed. Non-my- membrane microtubules elinated axons contain many mitochondria that are poor A cross-section of the tail of a human ATP factories, since each has only a single crista. There has been much debate concerning the terGolgi trans face minology of the Golgi's parts. carbohydrates, fatty acids and nucleic acid. When the sperm possesses such an acrosomal filament it is said to be activated for the penetration in the unfertilized egg. Stanford and coworkers developed the particle bombardment Thomas Cech (1947-). Some steroids are vitamins (e.g., vitamin D2) and influence the activities of certain cellular enzymes. The organ is aseptically removed, cut into small fragments and HeLa cells. What is triticale ? (b) What specific properties do chromosomal genes possess? Contents CYTOPLASMIC MATRIX 111 REVISION QUESTIONS 1. Painter, in 1923, while examining the testicular material of man, observed a heteromorphic pair of sex chromosomes and proposed the XY mechanism of sex determination in man. (i) Synthesis of gene for yeast alanyl tRNA. These sites are called enhancers, since they lead upto 200-fold increase in the rate of transcription of an affected gene. (a) Outline a hypothesis to explain these results and show the genotypes of all individuals ? The mechanism of force and movement (bending) by the flagellum has recently been studied extensively. Contents GENETICAL TERMINOLOGY 13 Aneuploidy. 9. X aY XAXa XAY Fig. The CH region consists of three or four similar segments, presumably derived evolutionarily by duplication of an ancestral gene and subsequent modification by mutations; the similar segments are called domains and are labelled CH1, CH2, CH3, etc. A proflavin molecule, it is believed, insert between two successive bases of a DNA strand, thereby stretching the strand lengthwise. Various quantitative mea- labelled due to 35 S-labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled due to 35 S-labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled due to 35 S-labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled due to 35 S-labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled due to 35 S-labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled due to 35 S-labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled due to 35 S-labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled due to 35 S-labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of issues and are labelled surements of amount of DNA in semi-conservative protein coat different cells have shown that there replication of a mount of DNA in semi-conservative protein coat different cells have shown that there replication of a mount of DNA in semi-conservative protein cells have shown that there replication of the different cells have shown that the different cells have shown that the different cells have shown that the differen a correlation between the amount phage DNA of DNA and the number of chromoprotein ghost 32 newly synthesized P-labelled recovered in the some sets (ploidy). Distribution Actin filament structure. And this alternation of generation in most species. In plants, Golgi apparatus is mainly involved in the secretion of materials of primary and secondary cell walls (e.g., formation and export of glycoproteins, lipids, pectins and monomers for hemicellulose, cellulose, lignin, etc.). The genetical research on genetic RNA has revealed the following facts about it. Children with Duchenne muscular dystrophy. At this stage one point should be clear that in case there were two genes involved, there would be obtained 15: 1 ratio (15 coloured : 1) (see Fig. Animalculists or spermatists who attached more importance to sperm; they thought that a miniature but complete organism was present in the sperm. He discovered this probe while he was working on sex determination in snake, the banded krait (Bungarus fasciatus) for his Ph.D. work. Beadle Edward L. A breeding experiment using Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph shows sterilised milk bottles containing nutritious growth medium for the culturing of Drosophila : the photograph
shows sterilised milk bottles containing nutritious growth medium for the culture of Drosophila : the photograph shows sterilised milk bottles containing nutritions growth medium for the culture of Drosophila : the photograph shows sterilised milk bottles containing nutritions growth medium for the culture of Drosophila : the photograph shows sterilised milk bottles containing nutritions growth medium for the culture of Drosophila : the photograph shows sterilised milk bottles containing nutritions growth medium for the culture of Drosophila : the photograph shows sterilised milk bottles containing nutritions growth medium for the culture of Drosophila : the photograph shows sterilised milk bottles containing nutritions growth medium for the culture of Drosophila : the ph concentration in the fluid. Since the vitality of the genome is greatly reduced, Time in min. Its base composition does not follow the base composition of A+C roughly equals G+U, as has been shown in Table 5-1. Each of the 13 protofilaments is composed of a series of tubulin molecules, each with an α/β heterodimer ; C—Assembly and disassembly of the microtubule. The complete tetramer is similar to a mildly flattened sphere having a maximum diameter of about 5.5 nm. Once a coated vesicle is formed, the clathrin and associated proteins dissociate from the vesicle yolk protein membrane to form a new coatedpit (Schmid and Rothman, 1985). He further stated that the tendency of linked genes remaining together in original combination is due to their location in the same chromosome. On the basis of this model explain different functions of the plasma membrane. noticed in death of the child before or soon after birth. MEIOSIS AND REPRODUCTIVE CYCLE The term meiosis (Gr., meioum=to reduce or to diminish) was coined by J.B. Farmer in 1905. These organelles have a central granular or crystalloid core containing some enzymes and are called microbodies. A Examples of some most extensively studied G C alkylating agents include diethyl sulphate H T A G H 20 (DES), dimethyl sulphate (DMS), methyl methonate (MMS), ethyl ethane sulphonate C HC (EMS). The chromosomes with the satellite are designated as the sat chromosomes. MITOCHONDRIA AND CHLOROPLASTS AS TRANSDUCING SYSTEMS In cells, energy transformation takes place through the agency of two main transducing systems (i.e., systems that produce energy transformation) represented by mitochondria and chloroplasts. The male hormones produced by the male twin are presumed to suppress the differentiation of the female internal sex organs of the cotwin. 18.16. Diagram of Muller's ClB technique for detecting sex-linked cent. Wild life conservation, modes of wild life; necessity for wild life; neces conservation : protected species of Indian wild life, establishment of sanctuaries and national parks, other conservation measures; revision questions. (c) What are the possible mechanisms by which a gene may change to many different allelic forms? An animal possessing both male and female reproductive organs is usually referred to as a hermaphrodite. Each microfibril is ribbon-like flat fibre being 10 nm wide and 3 nm thick (or 25 to 30 nm in diameter) and is composed of about 2000 glucan chains in it. When the F1 brothers and sisters with the genes 'w' and '+w' breed together they produce four types of individuals in F2 such as white-eyed female (ww), red-eyed female (+w), white-eyed male (w) and red-eyed male (+). During anaphase each chromosome move independently of the other and goes to either of the two poles. Parent B (1) Score in F1 hybrids 6 5 4 3 2 1 0 Manifestation of heterosis Heterosis Complete dominance of large size Partial dominance of large size No dominance Partial dominance of smaller size Complete dominance of small size Negative heterosis Cross Breeding. 11. enzyme movement DNA partner strand rewinding point RNA polymerase Fig. A chromosome not engaged in replication appeared as a circular structure of a genetic region of rII locus of T4 bacteriophage and recognized three types of genes—cistron, recon and muton, in it. Radial loops of 30-nm fibre and metaphase chromosome. A self-replicating, cytoplasmically located gene. The idiocy of PKU is thought to be due to damage of the brain tissues by the phenylpyruvate in the cerebrospinal fluid. Here after the meiotic division of the nucleus, the cytoplasm of the nucleus, the cytoplasm of the nucleus of the brain tissues by the phenylpyruvate in the cerebrospinal fluid. or polocytes at the end. In it affected individual, though apparently normal in early childhood, exhibits progressive wasting away of the muscules, resulting in confinement to a wheel-chair by about the age of 12 years and death in teen years (in adolescence). In fact, co-polymers of vimentin and glial fibrillary acidic protein, are found in some type of cells. Mechanism of Independent Assortment The mechanism of independent assortment can be understood easily by assuming that the homozygous pea plant with yellow Round (Yy Rr) (Heterozygote) Gametes of F1 Yr yR yr Yellow YyRr Round Yellow YyRr Wrinkled Green yyRr Round Green yyrr wrinkled Fig. Live II R Live II R In the course of his work, Dead III S Live II S Griffith injected laboratory mice with live R-II pneumococci; the mice suffered no illness because R-II pneumococci; the mice suffered no illness because R-II pneumococci was avirulent. host cell : A. The chlorophyll consists of 75 per cent chlorophyll a and 25 per cent chlorophyll b. Synthesized proteins appear to move in the following direction : rough ER - cis Golgi - trans Golg distinct regions of the nucleolus. (2) Haemophilia. Variation in Dominance Relation Mendel reported full dominance and recessiveness for all the seven gene pairs (or allele pairs) he studied (see Table 3-1). The significance of this process is not clear, but some clues about the identification of RNA for export are coming to light. Eukaryotes template site (e.g., yeast, rat liver, human tumour cells) are found to primer site contain the following five types of DNA polymerases: 5' - 3' cleavage (i) DNA polymerases: 5' - 3' cleavage (i) DNA polymerases: 5' - 3' cleavage (i) DNA polymerases a (= alpha). One type, the B-lymphocyte or B-cell, is capable of producing free immunoglobulins, called antibodies. The number of oxygen atoms in a lipid molecule is always small compared to the number of carbon atoms. The ATP synthetase is a reversible coupling device that normally converts a back-flow of protons into ATP phosphate to pump protons in the opposite direction, if the electrochemical proton gradient is reduced. In reactions 1 to 3 the glucose molecule is converted into fructose-1-6- diphosphate. The final 10 nm diameter of the intermediate filament is thought to be composed of 8-protofilaments (Fig.15.7). Therefore, such movements are known as Brownian movement. In prokaryotic cells the ribosomes often occur freely in the cytoplasm. In certain types of cells such as phloem and xylem, an additional layer is added to the inner surface of the primary cell wall at a later stage. Many plant genera include species whose chromosome numbers constitute a euploid series. This orientation is clockwise when the axoneme is viewed from base to tip. 11.13. However, under anaerobic conditions, pyruvic acid remains in the cytosol (cytoplasmic matrix) and is used as a hydrogen acceptor and converted into lactic acid : Lactic dehydrogenase Pyruvic acid — → Lactic acid + NAD + Energy + NADH In above case, the following equation represents the overall reaction of glycolysis : C6H12O6 + Pi + 2ADP ----- 2C3H6O3 + 2 ATP + H2O Glucose Lactic acid Further, pyruvic acid is converted into ethyl alcohol via acetaldehyde by yeast, Saccharomyces cerevisae in the absence or deficiency of oxygen. The reaction scheme is as follows : Aporepressor (no tryptophan) - Aporepressor + Tryptophan 60 number of base pairs 162 1560 40 1593 1350 1196 804 trpD trpC trpB trpA L P O trpE attenuator sequence (trp a) regulation Fig. Chromatin. Knowledge of the submicroscopic organization or ultrastructure of the cell is of fundamental importance because practically all the functional and physicochemical transformations take place with the molecular architecture of the cell and at a molecular level. Tight Junctions (Zonula Occludens) The cells of both vertebrate and invertebrate of the plant and animal kingdoms, where one can perceive basic life sustaining processes common to all organisms, in the cellular world many of the same processes and structures can be found in almost all cells. This results in the formation of hybrid DNA segments. Higher animals are mostly unisexual, i.e., separate male and female sexes exist in these species. This property of mRNA + intron reflects the fact that the size or length of the exon-1 exon-2 mRNA molecule is directly related with the (mRNA) size of the codons for different protein molFig. The organisms having many cells in their body are called multicellular organisms (e.g., most plants and animals). Blood tests can determine who is not the parent, not who is. The proteins present in either lumen or membrane of the peroxisome are taken up post-translationally from the cytosol (cytoplasmic matrix). Non-genetic Ribonucleic Acid (RNA) and Transcription mechanism of prokaryotic transcription — enzymatic synthesis of RNA, the RNA polymerase enzyme, binding of RNA molecules and processing; mechanism of eukaryotic transcription — promoter, enhancer and silencers, initiation, elonga(xiii) 44-65 tion and termination, classes of RNA molecules and processing; mechanism of eukaryotic transcription — promoter, enhancer and silencers, initiation of eukaryotic transcription — promoter, enhancer and silencers, initiation, elonga(xiii) 44-65 tion and termination, elonga(xiii) 44-65 tio elongation of RNA chain in eukaryotes, termination of eukaryotic transcription, chromatin structure and transcription; types of non-genetic RNA (rRNA),
transfer RNA (r secretes some hormone-like substance which are attached with it. A case of polydactyly, the occurrence of extra fingers, in man can be considered as an example for pedigree analysis. Alpha (a) polypeptide chain of human haemoglobin consists of 141 amino acid residues. Contents CHROMOSOMES 275 to the X chromosome and remaining four long strands are the left and right arms of II and III chromosomes. Dominant mutations. It was not until the 1950s that the inter-nucleotide bond was established by Todd (Judson, 1979). Examples of complex loci. They with respect to the cell surface. In such cases the movement of the cilia is carried out by a flexion at its base. In both they participate in the oxidation of substrates, producing hydrogen peroxide which is subsequently destroyed by catalase activity : H2O2 Reduced substrate FADH2 1. It is calculated that about 40 amino acid residues long segment at the— COOH end of the nascent protein Contents ENDOPLASMIC RETICULUM (ER) 163 remains protected inside the tunnel of 'free' or 'bound' ribosomes and rest of the chain, with—NH2 end, is protected by the lumen of RER. c, cyt. Automixis. Thus, the association of mRNA takes place on 5' end and not at the initiation codon AUG as in prokaryotes. The terpenes include certain fat-soluble vitamins (e.g., vitamins A, E and K), carotenoids (e.g., photosynthetic pigments of plants), and certain coenzymes (such as coenzyme Q or ubiquinone). The eukaryotic cells are the true cells which occur in the plants (from algae to angiosperms) and the animals (from Protozoa to mammals). Since the dimension of the purine ring is greater than that of the pyrimidine ring, Watson and Crick hit upon the idea that the two-chain helix could have a constant diameter if there existed a complementary relation between the two nucleotide stacks, so that at every level one stack harbours a purine base and the other a pyrimidine base. The total length of porin channel the DNA circle is about 1300 µm, comexternal prising about 4.7 x 106 nucleotide pairs; membrane this is enough DNA to code for about 4000 (lipid bilayer) different proteins (see Alberts et al., 1989). Bacteria vary their rates of protein synthesis by varying the translational rate. Instead, Contents MOLECULAR BIOLOGY 48 certain parts of the chromosome are transcribed. This is perhaps due to following facts : (1) Each of the polysaccharides are used in their polymerization ; (3) Most of these pectin polysaccharides are branched ; and (4) Many cellulose glycoprotein covalent modifications are introduced in the microfibril polysaccharides after they are synthesized. dominant genes, AABB, and a white has four recessive genes aabb. In somatic cells, the nuclear pores are evenly or randomly distributed over the surface of nuclear envelope. Structure of bacteria. Even broken pieces of cilia or isolated axoneme itself continue to beat, suggesting the role of microtubules in the movement. Among the multicellular plants, the largest cell is the ovule of Cycas (see Dnyansagar, 1988). This is a membranesecretory bound space in which various mavesicle terials and secretions may accumulate. The 5.8S rRNA is intimately associated with hormone and hydrolytic enzymes in seed the strands of the endoplasmic germination. However, it was Correns, the discovery could be represented by these fundamental laws of heredity. 322 / 7 = 46 females. So that, at most times, mRNA makes up only 5% of the total cellular RNA. However, it was correns, the discovery could be represented by these fundamental laws of heredity. 322 / 7 = 46 females. So that, at most times, mRNA makes up only 5% of the total cellular RNA. However, it was correns, the discovery could be represented by these fundamental laws of heredity. ure than e induced chromosome breaks are inhibited by thymine. Contents MOLECULAR BIOLOGY 90 REVISION QUESTIONS AND PROBLEMS 1. Chemical formula of thymine. Coloured female (kk); white male (kk males and 10 conl I C I B C I B tained only females, the induced rate of sexF2 + + + dies linked, recessive lethal + + + dies mutations would be 1 per Fig. Initially, there were four thy, smooth broomgrass and orchard grass. In corn (maize) for example, E.M. East (1908) and G. Primarily, some geneticists fear that there may be Medicine an accidental release from some laboratory of an artificial pathogen that has never existed on this planet before and that pathogen may cause havoc. Hypoploidy is mainly due to the substraction (or loss) of a single chromosome, called nullisomy (2n-2; two lost n+1 chromosomes are homologs). These three fragments are characterized as follows : A - Bz C - An 3' 3' O || O NCCH2 CH2O P O O - 5' O || P O O - 5' 3' OAC Fig. However, the term lysosome means lytic body having digestive enzymes capable of lysis (viz., dissolution of a cell or tissue; (De Robertis, Jr., 1987). Yellow Wrinkled - 3 4. The plasma membrane is a selectively permeable membrane; its main function is to control selectively the entrance and exit of materials. Development of a till the amyloplast is filled with starch. (iii) Lipoproteins. bleb Mycoplasmas were discovered by French scientists, E. The sex of the offspring depends on the kind of egg as shown below : Parent : Female 2A+ZZ (A+Z) (A+Z) Gametes : (A+Z) (A+Z) (A+Z) Gametes : (A+Z) (A+Z certainly plays an important role in the movement of molecules across it. Each PS II unit consists of approximately 200 molecules of carotenols, chlorophyll c, and c one for the F1 male parental gametes and one for the F1 female. Stroma contains a variety of photosynthetic enzymes and starch grains. It uses fluorescent dyes (such as quinacrine mustard) and identifies the socalled Q bands. Nonhistones have great heterogeneous amino acid composition and are acidic in nature. They first developed the techniques for separating TMV particles into RNA and proteins. Thus, although evidence from some laboratories suggests that the ribosomal genes of the amphibian nucleosome persist on such DNA. In 1835, Felix Dujardin termed the jelly-like material within protozoans as sarcode. For example, haemoglobin consists of four polypeptide chains, two identical β-chains and two identical β-chains. The matrix of the animal cells contains two kinds of glycolipids, viz., cerebrosides and gangliosides. time in the flow of information between genes and proteins to change the language being used. chromosome is broken into three pieces, the middle one of which is lost and the remaining two pieces get joined again. Often there is some unfolding of the chromatids at this stage, allowing for RNA molecules is initiated at close intervals. along the DNA and, thus, relatively short RNA copies are produced. Contents 66 CELL BIOLOGY Chemically, the chromatin contains a single DNA molecules and variable amount of five basic types of histone proteins. Each cellular chemical reaction involves stepwise conversion of one substance called precursor into another, called end product. The vacuoles of animal cells are bounded by a lipoproteinous membrane and their function is the storage, transmission of the materials and the maintenance of internal pressure of the cell. It is generally assumed that the cytochalasin-B-sensitive microfilaments are the contractile machinery of non-muscle cells. Discuss the fine structure of gene as reveraled through the work on lozenge locus in Drosophila and rII locus in T4 bacteriophage. Moreover, the hormone thyroxine, a secretion of thyroid gland, activates the enzyme phosphorylase to form glucose phosphate from the glycogen. They do not show clear cut differences between individuals and forms a spectrum of phenotypes which blend imperceptively from one type to another to cause continuous variations. P1 : F1 : Species X (AA) (Diploid) AB Diploid sterile hybrid Colchicine 1 AA BB Amphidiploid tetraploid (Fertile) Fig. (In 1877, Johannsen coined the term gene). Subdivisions within the areas are identified with letters from A to F, and bands within subdivisions are numbered from left to right. What kinds of mutations would completely eliminate translation from the population, but encourages development of the advantageous mutant characters. The large subunit is coded by genes present in chloroplastic DNA, while the small subunit is produced by nuclear genes. They may be of the following types : (i) Single site mutation. Respiration 13. For example, gelatin particles (discontinuous phase) are dispersed through water (continuous phase) in a thin consistency that is freely shakable (Fig. These include products such as the four kinds of rRNA—28S, 18S, 5.8S and 5S; tRNA of 20 basic types, and a few hundred proteins such as the four kinds of rRNA—28S, 18S, 5.8S and 5S; tRNA of 20 basic types, and a few hundred proteins such as the four kinds of rRNA—28S, 18S, 5.8S and 5S; tRNA of 20 basic types, and a few hundred proteins such as the four kinds of rRNA—28S, 18S, 5.8S and 5S; tRNA of 20 basic types, and the like. so-called, because they usually contain one or more enzymes (i.e., D-amino acid oxidase and urate oxidase) that use molecular oxygen to remove hydrogen peroxide (H2O2) : RH2+O2 \rightarrow R + H2O2 Catalase (which forms 40 per cent of total peroxisome protein) utilizes the H2O2 generated by other enzymes in the organelle to oxidize a variety of other substances—including alcohols, phenols, formic acid and formaldehyde—by the "peroxidative" reaction: H2O2 + R' H2 \rightarrow R' + 2H2O This type of oxidative reaction is particularly important in liver and kidney cells, whose peroxisomes detoxify various toxic molecules that enter the blood stream. (2) It transports water and salts, since, lignification involves loss of the protoplasm resulting in the forms. Enzymes (glycoprotein) of plasma membrane Attachment of Cell adhesion Cell surface markers are either ectoenzymes cytoskeleton or endoenzymes and are Functions of plasma membrane proteins. It is well established now that the
ciliary movement is generated by the microtubules and the associated structures of the flagellum. Molecular chaperones represent a diverse class of protein molecules which play a significant role in folding of individual polypeptides and in assembly of multimeric proteins. This recurring motif is known as the 9 + 2 array. Most cell wall hemicellulose matrix components are transported via vesicles derived from the Golgi apparatus and secreted by exocytosis at the plasma membrane. Such eggs contain diploid number of chromosomes and develop into new individuals without the fertilization. 16.6). Stein and L. Functions of Peroxisomes Peroxisomes are found to perform following two types of biochemical activities : A. Thus, the polygenes s1s1, s2 s2, s3 s3, sn sn, each with small expression interact and exert their action by changing the magnitude of a major gene pair ss. The gene is identified on a genome and pulled out from it either before or after cloning. If 8.19% of all progeny are expected to waltzer, how many offspring need to be raised to produce 24 walterzs. Examples of Lethal Alleles A. lagen or tropocollagen molecule which is about 300 nm long and 1.5 nm is diameter (Fig. heavy chain (H) 10.3). Recently, various workers such as Lake, Nomura, Wittman, Traut, Stoffler, Kurland, etc., have studied the relationship between rRNAs and ribosomal proteins to work out the topology of ribosomes (Topology includes study of detailed shape and positions of the individual proteins and rRNA molecules relative to each other; see King, 1986). They are not coupled to an energy source (ATP), so the transport they mediate is always passive ("down hill"), allowing specific ions mainly Na+, K+, Ca2+ and Cl----- to diffuse down their electrochemical gradient across the lipid bilayer (Hille, 1984). (b) At which end of mRNA is the poly (A)? 10.5B). Therefore, 'chromatid' and 'chromonema' are two names for the same structure : a single linear DNA molecule with its associated proteins. The carotenoids are carotenes and xanthophylls, both of which are related to vitamin A. However, in 1986, certain peculiar cases have been reported which were found to be males with XX chromosomes and females with XX chromosomes. Light reaction. The outermost structure of most plant cells is a dead and rigid layer called cell wall. The oxygen consumption of the zygote increases enormously. Contents CHROMOSOMAL MUTATION II 191 two bivalents 1 2 pairing possibilities 3 one quadrivalent 4 1 univalent + trivalent 2 3 4 Fig. In them, many short oligosaccharide side chains are attached to hydroxyproline and serine side chains. The matrix is the seat of various chemical activities. Stern found that equal sections of singed and yellow tissues lie adjacent to each other or form twin spots. T.M. Jenkins (1924) reported a case of cytoplasmic inheritance, called Iojap striping in maize. of various diameters. 5.6. σ A model for the binding of RNA polymerase to a promoter to form an openpromoter complex; PB=Pribnow box (after Freifelder 1985). The enzyme DNA gyrase is responsible for the DNA supercoiling (it is inhibited by the drug called coumermycin; see Freifelder, 1985). Pod colour : Green 428 Green 152 Yellow 2.82 : 1 Fa, fa 4 Axial 3.14 : 1 Le, le 4 Tall 651 Axial 207 Terminal 787 Tall 277 Dwarf G, g; Y, y 6. Under the influence of a helicase and SSB protein a replication fork is generated. Lozenge locus. Each monomer contains three haemes bound to cytochromes and iron-sulphur protein. (b) The enzyme lactate dehydrogenase (LDH) is coded by a small family of genes, each gene determining the structure of a subunit. The position of centromere varies form chromosome and it provides different shapes to the latter which are following (Fig. 5.19. Silky feathers (s) is a recessive autosomal allele, as opposed to nonsilky (S). A NTP is added to elongation III. stomata chloroplast vacuole nucleus Shape. 5.9). Each fragment is, thus, also available for further analysis, including the sequencing. All are derivative of perhydro cyclopentano - phenanthrene, which consists of three fused cyclohexane rings and a terminal cyclopentane ring (Fig. Richard Altmann (1890) developed a specificity for the mitochondria. STRUCTURE OF RIBOSOMES The ribosomes are oblate spheroid structures of 150 to 250Ao in diameter. All of these protective enzymes are present in high levels in aerobic tissues. (a) Distant hybridization. Recent biochemical studies have distinguished two types of microbodies, namely peroxisomes rough endoplasmic reticulum golgi apparatus cell wall mitochondrion smooth endoplasmic protoplasm reticulum nucleus ribosomes nucleolus golgi body Contents CELL BIOLOGY 68 REVISION QUESTIONS 1. Cistron, Recon and Muton When two genetical units exhibit cis-trans phenomenon, they are considered to belong to the same functional unit, called cistron. An exonuclease that cleaves b linkages, starting from a free 5'-P end (e.g., bovine spleen phosphodiestrase) is shown in line shade (after Lehninger, 1970). gen concentration; Contents GENETICS, HUMAN GENETICS in DNA molecule which alter the synthetic process of enzymes and ultimately disturb metabolic activities of the cell. This indicates that some kynurenine diffuses from the Aa mother into all young (larvae), enabling them to manufacture pigment regardless of their genotype. coli) this does indeed occur; this process is called coupled transcription translation. In melanocytes, melanin granules move centrifugally and centripetally with different stimuli. (v) Some DNA is spliced to cause gene rearrangement. (a) Nonsense; UGA is a stop signal and does not translate. In a polarizing microscope, the specimen is placed between two closed polarizers and visible birefringent portions of the sample act like polarizing films and, hence, these portions of the sample are seen as bright objects on dark background. Using family pedigree analysis, a genetic counsellor can give prospective parents the information they need to make intelligent decisions about the risks of genetic disease in their offspring. (2) Multiplicative growth. centrioles microtubule celligent decisions about the risks of genetic disease in their offspring. membrane 1. can be stored at high concentration without generating an excessive osmotic gradient. Because the covalent linkage that joints a topoisomerase to DNA phosphate retains the energy input. 13.20) EVOLUTIONARY SIGNIFICANCE OF INBREEDING AND OUTBREEDING The inbreeding, both, provide raw material to natural selection. Mycoplasma or PPLO. Here, the traits of intelligence, height, skin colour, and eye colour probably involve polygenes. Suppose that a snail had a dextral coiling. These areas are certain secondary constrictions that contain the genes coding for 5.8S, 18S and 28S ribosomal RNA and that induce the formation of nucleoli. We now know that these characters are very complex Eugenics was the invention of the British scientist traits and are under the control of many genes interacting with environmental variations. This is in part engineered by a distinct group of nuclear particles (Sn RNPs containing U1, U2, U3, U4, U5 and U6 sn RNAs). Na+- K+- ATPase. In 1961, Francois Jacob and Jacques Monod provided genetic evidence for a method of gene regulation in bacteria, now called the operon. Four strand double cross over. 1 Bar locus in Drosophila. In the multiple fission, the nucleus of the cell divides very rapidly into many nuclei. Differentiate between the following : (i) Heterosis and hybrid vigour ; (ii) Dominance hypothesis. They are found in human seminal fluid, testis, kidney, placenta, uterus, stomach, lung, brain and heart. On the basis of these observations a model of chromosome structure has been proposed by linker or spacer Laemmli and coworkers (1979, 1984). In human beings, there exists a autosomal dominant allele for the ability to taste the bitterness of the chemical, called phenylthiocarbamide (PTC). For example, in human, there are 23 pairs of homologous chromosomes (i.e., 2n = 46; a chromosome number which was established by Tijo and Levan in 1956). Contents QUANTITATIVE GENETICS (INHERITANCE OF MULTIPLE) 5. Degeneracy of genetic code has certain biological advantages. A doublet code (a code of two letters) is also inadequate, because it could specify X-rays of DNA-containing only sixteen (4×4) amino acids, whereas a triplet code (a code of two letters) is also inadequate, because it could specify X-rays of DNA-containing only sixteen (4×4) amino acids, whereas a triplet code (a code of two letters) is also inadequate. three gels, such as this one, allow to determine the letters) could specify sixty four (4×4×4) amino acids. The enzymes play a vital role in various metabolic and biosynthetic activities of the cell such as synthesis (anabolism) of DNA, RNA and protein molecules and catabolism of carbohydrates, lipids, fats and other chemical substances. Ribosome granules may exist either in the free state in the cytosol (e.g., basal epidermal cells) or attached to RER (e.g., pancreatic acinar cells, plasma cells or antibodies-secreting lymphocytes, osteoblasts, etc.). Sex Chromosomal Mechanisms (Heterogamesis) Clarance McClung (1870-1946) 1. takes place. AA, Aa aa aa Hypostatic alleles Phenotypic expression of allele BB, Bb, bb BB, Bb bb A B b Example Dominant epistatis in dogs. The fast effective stroke (or forward active stroke or power stroke) in which the cilium is fully wave-form C recovery stroke extended and beating against the A propagation B effective stroke or power stroke) in which the cilium is fully wave-form C recovery stroke extended and beating against the A propagation B effective stroke or power stroke) in which the cilium is fully wave-form C recovery stroke extended and beating against the A propagation B effective stroke or power stroke) in which the cilium is fully wave-form C recovery stroke extended and beating against the A propagation B effective stroke or power stroke)
in which the cilium is fully wave-form C recovery stroke extended and beating against the A propagation B effective stroke or power stroke or po They may be composed of either jelly coats in amphibians, albumen and hard horny capsule in elasmobranch fishes, or albumen, shell membrane are oriented with their small hydrophilic end facing the external surface of the bilayer and the bulk of their structure packed in among the fatty acid tails of the phospholipids. Stages of Polypeptide Synthesis in Prokaryotes and eukaryotes follow the same overall mechanism though there are differences in detail (Table 7-1), the most important being the mechanism of initiation : 1. When outer membrane is removed with digitonin, the so-called mitoplast is formed. For the eugenically oriented reforms in the society, the people should be educated about the basic principles of human biology, human genetics, eugenically oriented reforms in the society of white eyed mutants in Drosophila was followed by an extensive search of other mutants of Drosophila by Morgan and his coworkers and other geneticists. In this state the germ cells would not be subjected to radiaiton expossure which might affect the donors. coli strain which is lysogenic for phage λ and Contents 132 GENETICS, HUMAN GENETICS AND EUGENICS is called K-12 λ. free 5' phosphate end G A G T P 3' A P 3' a OH O newly synthesized daughter DNA 3' a 5' D 33 C free 3' phosphate end Fig. The Sertoli cells and provide nourishment to the developing sperms. HISTORICAL Ribosomes are remarkable organelles of cell. (d) What is the deoxyribonucleotide responsible for this codon ? The terms cis and trans were employed later (Haldane, 1942), the former replacing coupling and the later, repulsion (Fig. The protons (H+) accumulate inside the thylakoid membrane resulting in a proton gradient. The over dominance hypothesis is variously known as single gene heterosis, cumulative action of divergent alleles, or stimulation of divergent alleles. Proteins can be stored for years as Contents CELL BIOLOGY 242 reserves for future growth in the vacuoles of the storage cells of many seeds, such as those of peas and beans. Describe the structure and functions of OH three RNA polymerases known in eukaryotes. A popular model was the folded-fibre model, proposed by E.J. Dupraw in 1965. The flagella are longer (up to 150 µm) processes, while the cilia are short (5 to 10 µm) appendages of the cytoplasm. Supervital mutations, in contrast, cause the improvement of biological fitness under certain conditions. The agglutination tests for four types of human blood has been illustrated in Figure 10.9. Each person, therefore, can use the blood of its own blood group in emergency, otherwise, clumping of red blood cells may take place, if blood group of AB different type is transfused in him. The banded segments of the polytene chromosomes of Drosophila larval salivary glands contain euchromatin. In cross section, the wall of a microtubule is made up of 13 globular subunits, called protofilaments, about 4 to 5 nm in diameter. The genetics of fungi. The anabolic and catabolic processes are collectively known as metabolic process. The synthetase enzymes form C-O, C-S, C-N and C-C bonds. The petite mutants in yeast fail to grow on carbon source such as glucose and produce smaller colonies (the "littles") when grown on sugars such as glucose. Detailed studies indicate that there are two closely linked gene loci each with several multiple alleles controlling the colour blind trait. Gel or zone electrophoresis (used for proteins). Oncogenes may be either cellular or viral in origin. For example, in one variety of the ciliated protozoan Paramecium bursaria there are eight sexes or "mating types" all morphologically identical. Combining Map Segments Finally, the different segments of maps of a complete chromosome are combined to form a complete genetic map of 100 centimorgans long for a chromosome. Since the lost fragment carried the CI allele, none of the cells in this clone would be inhibited from forming pigment, and if any of them produced a part of the aleurone, a patch of colour would appear. 18.12 and Fig. Table 5.3. Phenotypic and genotypic ratios of F2 generation of cross shown in Figure 5.3. Phenotypes Genotypes that A and B genes produce about the same amount of darkening of the skin and, therefore, the increase or decrease of A and B genes cause variable phenotypes in F2 in the ratio of 1 Negro : 4 dark : 6 intermediate : 4 light : 1 white. Discuss in detail various functions of the plasma membrane. ¹/₄ sa sb Diploid female 2. The shell or capsid encloses a single stranded RNA molecule of 5,200 nucleotides. Chromosomes are best observed in squash preparations. If one DNA sample had a melting temperature of 880C. They remain arranged parallely in bundles or stakes. III. However, their presence in floweres definitely serves in attracting insects for pollination and propagation. Got Nobel Prize for his work on the assimilation of CO2 by plants, photosynthesis, the "Calvin cycle." Got Nobel Prize on their studies of the structure of globular proteins, especially myoglobin and haemoglobin. These codons are also called nonsense codons, since they do not specify any amino acid. This is commonly the case with outcrossing (non-self-fertilizing) plants. In response to light, the chloroplast rotates until it is perpendicular to the incident light. A spontaneous permanent change in a gene or chromosome which usually produces a detectable effect in the organism concerned and is transmitted to the offsprings. By genetic engineering, it has become possible to produce various blood clotting factors, complement proteins (part of the improvement of genetic research are oncogenes (cancer), antibody diversity (immunogenetics), homeotic mutation and behaviour. Bateson was the first to have Mendel's paper translated into English and the first to show that Mendel's theory also applied to animals. (c) Degeneracy; both GGA and GGC code for glycine. agranular they are especially useful for studymicrosomes can be reticulum readily purified in functional form, granular they are especially useful for studymicrosomes can be reticulum readily purified in functional form. carried out by the ER, e.g., protein synthesis, glycosylation and lipid synthesis. 10.12. 10.1) and showed that they swelled in water and contain a membrane around them. Lysine and arginine both contain an additional amino group or equivalent structure. The tail ends of five or six spectrin tetramers are linked together by binding to short actin filaments (also called band 5 proteins; with 43,000 dalton M.W.). (d) What data would indicate that s and r occupied different sites ? The dashed arrows show the distances of each RNA polymerase from the transcription initiation site. Non-Mendelian genetics. Fixation is generally followed by dehydration (i.e., gradual removal of water vapours from the tissue) by the organic solvents such are synchronized. Cell biology. (c) Modification of DNA sequences : DNA methylation. In humans, X linked dominant conditions are relatively rare. Congenital ichthyosis. In monoploid Nicotiana kostoff reported that the leaves, flowers and over all plant size were smaller. Cell Size The eukaryotic cells are typically larger (mostly ranging between 1 to 10 µm). At prophase many proteins become phosphorylated by MPF and phosphorylation of nuclear lamins help regulate the disintegration and reconstruction of the nuclear envelope. Then a segment on the opposite side of the break, so that the two non-sister chromatids cross each other. Barring chromosomal aberrations, the order of genes on a genetic map of a chromosome corresponds completely with the order on a cytological map. Those parts of an antigen that combine with the antigenetic determinants Table 10.1. Properties of the five major classes of human antibodies (immunoglobulins) (after Sheeler and Bianchi, 1987; Alberts et al., 1989). Generally, this enzyme acts as a glucogenic phosphorylated form in reticulum liver (Fig. 4.10. Lwoff, and J. Write an essay on immunity and immunoglobulins. Ear lobe 6. Thus, their function in the bacterial cell is to destroy foreign DNA that might enter the cell. Other mitochondrial coenzymes are nicotinamide adenine dinucleotide (FAD), both of which contain riboflavin or vitamin B2. The 3' side of each phosphodiester linkage is labelled a, the 5' side is labelled b, an exonuclease that cleaves a linkages, starting from a free 3' -OH end (e.g., snake venom phosphodiesterase) is shown in check. The amino acids occur freely in the cytoplasmic matrix and constitute the so (a) (b) (c) Common structural proteins include those of (a) hair, (b) horn and (c) spider web. The parthenogenesis is the most simple, stable and easy process of the reproduction, e.g., aphids (insects). In the spacer regions 60-80 bp long that confer a 20-fold increase in transcription rate compared with genes lacking them (see Maclean and Hall, 1987). The appearance of different patterns is the result of polygenes (multiple factors called minor genes), see Sarin, 1985) interacting with each other or having additive effects and also interacting with pie bald genes ss (called major genes). Post-Fertilization Changes in the Egg After the fertilization following changes occur in the egg: 1. The depolymerization of the microtubule itself causes the kinetochore to move passively to optimize its binding energy on the microtubule (Fig. 13.14. According to the classical method of symbolization, the dominant character is represented by 't'. (ii) Synthesis of three duplex fragments. exterior surface 5. It is converted to PEP by the Comparision of C and C plants. The chloroplasts contain the ribosomes which are smaller than the cytoplsmic ribosomes. The heterodimers associate to form multimeric rings, spirals and other intermediate structures which are smaller than the cytoplsmic ribosomes. nature's variety is
boundless. This layer is called secondary cell wall and it consists mainly of cellulose, hemicellulose and lignin. Twins are of two basic types : Surrogate grandmotherhood. Four reaction tubes are set up, each containing single stranded DNA sample (cloned in M13 phage) to be sequenced, all four dNTPs (radioactively labelled) and an enzyme for DNA synthesis (i.e., DNA polymerase I). Heterochromatin. After longer time intervals, the original radioactive molecules will have been replaced with non-radioactive molecules. The biochemical interplay of these RNA copies which leads to the synthesis of a polypeptide chain, is called translation, meaning, literally, that the genetic message encoded in a messenger RNA molecule is translated into the linear sequence of amino acids in a polypeptide. Golgi apparatus consists of a set of smooth cisternae (i.e., closed fluid-filled flattened membranous sacs or vesicles) which often are stacked together in parallel rows. Different stages in processing of the E.coli tRNATyr gene transcript. Inheritance of Z-linked Recessive Genes in Moths In case of birds, moths, butterflies, etc., the females are heterogametic and mane. In fact, the variable regions of both L and H chains is for the most part restricted to three small hyper variable regions in each chain (Fig. But when the F1 progeny were allowed to be self-fertilized, both tall and dwarf characters appeared in the second filial generation or F2. As originally discovered by Early et al., (1980), the two types of mRNA molecules are produced to produce the other mRNA. 5.10. The non-electrolytes of the matrix are Na, K, Ca, Mg, Cu, I, Fe, Mn, Fl, Mo, Cl, Zn, Co, Ni, etc. This binding does not require the presence of a long mRNA molecule; in fact, the association of a trinucleotide or minimessenger with the ribosome is sufficient to cause aminoacyltRNA binding. Enzymes Surface localization Cytochrome b5 (involved in synthesis of unsaturated fatty acids) NADH- Cytochrome b5 reductase NADP- Cytochrome P-450 (most abundant) ATPase 5'-nucleoside diphosphatase GDP-mannosyl transferase Nucleoside di β- glucuronidase Cytoplasmic face Cytop gun which shooted foreign DNA into plant cells or tissues at a very high speed. The A-DNA may occur under experimental conditions. (a) (b) Describe what is meant by degree of inbreeding. Thus, all microtubules have a defined polarity : their two ends are not structurally equivalent. C H N C H O C C H Some plant viruses (e.g., TMV, turnip yellow mosaic viruses, wound tumour viruses, etc.), animal viruses (e.g., influenza viruses, foot and mouth viruses, reoviruses, reoviruses, etc.) and bacteriophages (e.g., MS2 etc.) and bacteriophages (e.g., MS2 etc.) and bacteriophages (e.g., mosaic viruses, reoviruses, etc.), animal viruses, etc.) and bacteriophages (e.g., mosaic viruses, reoviruses, etc.) and bacteriophages (e.g., mosaic viruses, reoviruses, etc.) and bacteriophages (e.g., mosaic viruses, etc.) and bacteriophages (e.g., mosaic viruses, reoviruses, etc.) and bacteriophages (e.g., mosaic viruses, etc.) and etc.) and etc. and etc does not readily fragment (See Lucy, 1975) Plasma membranes are more easily isolated from erythrocytes subjected to haemolysis. Pinocytosis (Gr., pinein = to drink; 'cell drinkng') is the non-specific uptake of small droplets of extracellular fluid by endocytic vesicles or pinosomes, having diameter of about 0.1 µm to 0.2 µm. Coenzyme Group transferred 1. The frequency of colour blind women is much less than colour blind man. The cell biologist, without losing sight of the cell as a morphologic and functional unit within the organism, has to study biological phenomena at all levels of organization and to use all the methods, techniques and concepts of other sciences (Table 1-1). In' both cases the enzyme travels along the chain in a stepwise manner, liberating single nucleoside monophosphate molecules and eventually digesting the entire polymer. The nascent polypeptide chain passes through a kind of tunnel within the large subunit; B—Diagram showing the relationship between the ribosome and the membrane of endoplasmic reticulum and the entrance of the polypeptide chain into the centre of endoplasmic reticulum during the process of protein synthesis. Shull (1909) studied the effects of inDecrease in vigour upon inbreeding. Regulation of Gene Action 91-109 Regulation of gene action in prokaryotes — transcriptional control mechanisms: negative control, inducible operons (inducible systems), repressible system, positive control, effects of glucose on lac operon (catabolic repression), translational control, post-translation control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational control, effects of glucose on lac operon (catabolic repression), translational co regulation of gene action at the level of transcription, post-transcriptional control, post-translational modification of proteins to make them active ones; hormonal control of gene expression; revision questions and problems. (1909-1975). Only in the F3 generation does segregation in the ratio of 3:1 becomes apparent, since the individuals of the F2 generation had the genotypes -1S+S+; 2 S+S, 1SS, 1/4 of them, on the average, produce eggs developing into sinistral individuals (Fig. Could a recessive mutant gene in humans be located on the X chromosomes if a woman exhibiting the recessive trait and a normal man had a normal son ? The synthesis of DNA, being discontinuous, is not directly related to the kinetics of cell growth. They differ in size, form and function, degree of specialization and average generation time. Rate of transport through the nuclear pores. It does not react with molecular oxygen. On the other hand, the homozygosity for dominant alleles has equal opportunity to express their beneficial phenotypic effects on inbred races. 18.8. Metabolism. Parthenogenesis. In case of this type of DNA replication, one of two ends of the replication eye remains stationary and the other ends serves as the replication fork and moves with replication. These membranes are known as the primary and secondary egg membranes. Moreover, the Fig. An enzyme deformylase removes the formyl group of methionine. What would be the most likely role of peroxisome in cells lacking mitochondria? The origin is A: T rich, a feature Contents MOLECULAR BIOLOGY 38 that is related to unwinding of DNA to initiate replication. For example, in both vertebrates and invertebrates, the concentration of sodium ion is about 10 to 20 times higher in the blood than within the cell. An immediate prediction follows Original from this parent molecule proposal: both duplexes that result from replication First should be generation hybrid in daughter molecules nature, each containing an old strand "Harlequin" chromosomes prove derived DNA replication is semiconservative. 3.18. The shape and size of the satellite remain constant. Contents PLASTIDS 233 2hv 2 e- + 2H+ + 2NaDP+ \rightarrow 2NADPH The oxidized P680 regains its electrons by the photolysis of water into 2H+, 2e- and oxygen: 2quanta or 2hv H2O ½ O2 + 2H+ + 2 e--Oxygen is given out by photosynthesizing plants. Some unreduced gametes of the F1 are functional in backcrosses. Is it the 3' 3' same thing as a gene? If the genotype is homozygous for the recessive g2 allele, then the biosynthetic pathway ends with substance A. It is a fatal disease of man. Molecular genetics. The position or place on a chromosome occupied by a particular gene or one of its alleles. These vacuoles are supposed to be greatly expanded endoplasmic reticulum or Golgi apparatus. An allele that expresses its phenotypic effect even when heterozygous with a recessive allele; thus if A is dominant over a; then AA and Aa have the same phenotype. Thus, cis and trans arrangements of the same number of 16A segments give different phenotypes (compare heterozygous bar eyes). (ii) Maintenance of the micro-environment of the cell. This event occurs during the leptotene stage of prophase I and though each chromosome at this stage is visually long and thin thread, but contains material of two sister chromatids (i.e., two DNA molecules plus almost duplicated amount of histones). 15.10). Therefore, it is possible to have more than two allelic forms, i.e., multiple alleles,
of one kind of gene. Write short notes on the following: (1) External and internal fertilization; (2) Post-fertilization changes in the egg; (3) Amphimixis; (4) Polyspermy; and (5) Fertilizin and antifertilizin reaction. CHROMOSOME, PHYSICAL OR CYTOLOGICAL MAPPING It has been found that linkage map distances between genes are not necessarily proportional to physical linear measurements. Why the study of the chromosomes has become very significant in the field of biology ? These organs are called secondary lymphoid organs and in them B lymphocytes proliferate into antibody producing plasma cells. In man somatic mutation causes several fatal diseases such as paraoxysmal nocturnal hemoglobinura, circumscribed neurofibroma, unilateral retinoblastoma and heterochromia of the iris. cis or trans position. To restore affected individuals to normalcy by euphenic measures is the only compassionate goal for scientists to maintain but to do so is to counter the forces of natural selection that are the basis for the evolutionary strength of a species. Functions Present in dynein arms 1. The nucleoprotamines are simple and basic proteins having very low molecular weight (about 4000 daltons). regeneration. The luminal face borders the perinuclear cisternae, the cavities of ER and SER, and the Golgi elementary particles. Evidently, the genetic message once initiated at a fixed point is read in a definite frame in a series of three letter words. A diploid cell produces four haploid cells by a meiotic division. These have been used extensively in vided the bulk of informastudying the ultra-structure of the plasma membrane. Symbiotic origin of mitochondria and chloroplast 3. In the electron microscope electromagnetic coils (i.e., magnetic "lenses") are used to control and focus a beam of electrons accelerated from a heated metal wire by high voltages, in the range of 20,000 to 100,000 volts (new instruments are being developed that use 1,000,000 volts). multifactorial, that is, growth embodies following three interacting growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (2) multiplicative growth— an increase in cell mass or auxesis; (3) multiplicative growth— an increase in cell mass or auxesis; (3) multiplicative growth— an increase in cell mass or auxesis; (4) multiplicative growth— an increase in cell mass or auxesis; (4) multiplicative growth— an increase in cell mass or auxesis; (5) multiplicative growth— an increase in cell mass or auxesis; (5) multiplicative growth— an increase in cell mass or auxesis; (6) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an increase in cell mass or auxesis; (7) multiplicative growth— an incre in cell number due to cell division; and (3) accretionary growth— growth due to accumulation of extracellular products (accretion means increase by addition on the surface of the material of same nature as that is already present, e.g., the manner of growth of crystal). The gametes which are produced by YYRR and yr types respectively. Such essential fatty acids have to be obtained from plant material by the animal. Collagenase 3. The repressor protein was visualized as a molecule with two different, non-overlapping binding sites, one for the operator and the other for the inducer. The only microscopically discernible features within the cell are its genetic component, the DNA and the ribosomes. Yolk contents of the ooplasm. Colourless Gram negative bacteria may thereafter be stained pink with safranin stain for their better microscopic visibility. between the gene and its centromere. For instance, Holmgren (1900) described a clear system of clear canals, which he called trophospongium. A chromosome with segments in the normal order is (abcdefgh). In them respiration in a mitochondrion. However, in early 1940's researchers have found that some DNA sequences (viz., genes) can actually change their position. Darlington's strain or torsion theory. 175 Heterobranchial duplication 4. For instance, during this period Haeckel (1866) recognised the active role of nucleus in heredity; Weismann, Hertwig, Strasburger and Kolliker suspected active participation of chromosomes in heredity transmission. Metaphase occupies a substantial portion of the mitotic phase (see Table 18-2), as if the cell pause until all their chromosomes are lined up appropriately on the metaphase plate. at the A site. (i) Effects of glucose on lac operon (Catabolic repression) or Glucose effect. However, in polyploids, monosomy has no n apparent effect, since they have several chromosome can be easily tolerated. According to permeability following types of the plasma membranes have been recognised : (i) Impermeable plasma membranes. Antigen in red blood cells O None A B AB A B A and B Antibodies Can give blood to in plasma groups Anti-B, proposed that inheritance of A, B, AB and O blood types of man is determined by a series of three allelomorphic genes. This causes depletion of the living matter, resulting in degrowth. Year Name of contributor Cell biological contributor Cell biological contributor 1855 1857 - 1881 1857 C.Nageli and C. The use of polysomes is advantageous to a cell, since the over all rate of protein synthesis is increased compared to the rate that would occur if there were no polysomes. However, in most eukaryotic cells 2 molecules of ATP are used in the transportation of 2 mole of NADH produced during glycolysis into the mitochondrion (via ETS). (c) State which kind of organism

(cross-fertilizing) is expected to suffer the harmful effect of inbreeding more severely and why? J.G. Kolreuter (1733-1806) obtained fertile hybrids from artificial crosses between two species of tobacco plants. (d) Modifications of histones. According to their mode of folding the following four levels of protein organization have been recognized : (a) Primary protein structure. For example, of the 30 known thylakoid polypeptides that function in photosynthesis, so far 9 have been demonstrated to be synthesized on cytoplasmic ribosomes and 9 are coded by nuclear genes and synthesized on cytoplasmic ribosomes (von Wettstein, 1981). H Their empirical formula is (C6H10O6)n. After the development of ovary, the pituitary by hormones produce female hormones, due to inhibition of the pituitary by hormones produced by the ovary, thus, acting as developmental feed-back system. In this way the polypeptide chain continues to be elongated. Movement of a gene may take place to a non-homologous chromosome and this is known as translocation. The mutagenic agents are of the following kinds : A. If gametes arise from the cells having a deleted chromosome, this deletion is transmitted to the next generation. Very recently, studies of identical twins separated since birth revealed that genes (heredity) play a much greater role in determining behaviour than previously thought. Hydroxy derivatives of Cholesterol plug in artery 20-carbon polyunsaturated fatty acids are called prostaglandins. A In bacteria, the genes for 5S, 23S and 16S rRNAs are X clustered in one region to form a single operon working as U G a functional unit. The process of puffing involves several processes such as the accumulation of acidic proteins, despiralization of DNA, accumulation of RNA polymerase II (an band interband DNA-protein fibers Contents 276 CELL BIOLOGY pair of chromosome IV arms of chromoso IV enlarged Fig. In bacteria, the RNA polymerase attaches to an initiator site of the structural gene, in the promoter and it catalyzes mRNA synthesis until termination site is reached. CHEMICAL COMPOSITON mRNA The ribosomes are chemically composed of RNA and proteins as their major constituents; both oc3' small 5' curring approximately in equal prosmall subunit subunit subunit portions in smaller as well as larger subunit. One strand has phosphodiester linkage in 3' - 5' direction, while other strand has phosphodiester linkage in 3' - 5' direction, while other strand has phosphodiester linkage in 3' - 5' direction. (a) P : PxR/PxR × pxr/pxr Pollex, rough and 75 pollex types are recombinants, constituting 154 out of 352 individuals = 0.4375 or approximately 43.8% recombination. Parthenogenesis, significance of parthenogenesis, incomplete parthenogenesis, significance of parthenogene proposed by Whitehouse (1963) and Holliday (1964) and these have been supported by (Hotta and Stern, 1977, 80, 81). Even the cells of the same organ may display variations in the shape. Thus, the year of birth of cytogenetics. For example, small molecules and ions readily permeate both nuclear membranes. Watson and Crick (1953) hypothesized that the occurrence of the bases in their rare states provides a mechanism for mutation during DNA replication. Mating occurs only between gametes of unit sex (e.g., A×a). In the lysosomes, the cholesterol molecules, which thereby become available to the cell for new membrane synthesis. Short-term or reversible regulation we studied in bacteria and it represents a cell's response to fluctuations in the environment, specifically, it involves changes in Contents 100 MOLECULAR BIOLOGY activities or concentrations of enzymes as particular substrates and or hormone levels rise and fall. A male and female Ephestia moth, both coloured as larvae, were crossed. If the F1 male fertile and 50 per cent male sterile will be obtained (Fig. Since these cells contain no intracellular organelles or membrane, so the only membrane structure to be considered is almost entirely that of the cell surface. Lastly, the presence of any alternate configuration (e.g., Z-DNA) suggests that DNA is a more flexible molecule than was previously thought and that it can adopt in the genome of a variety of forms (Rich, 1980). Thus, sometime Contents 160 GENETICS, HUMAN GENETICS and EUGENICS it may happen that a rare male flower with poorly develop pistil may set seeds. The monomers remain linked with each other by the glycosidic bonds or linkages. This implies that G C U/C or A the anticodons of tRNAs read more than one codon on 3' 5' mRNA. Convenience in handling. What may be an important role of chromosomal duplications in evolution? The result is two types of gametes, AB and ab. Growth, thus, involves increase in size and weight of the organism due to the synthesis of new protoplasm. Many basal bodies then arise from these satellites and migrate to the membrane to initiate the formation of cilia Mitochondria 191-219 Historical; distribution or localization; mitochondria and chloroplasts as transducing systems; functions — adenosine triphosphate (ATP); oxidative decarboxylation, Krebs cycle, respiratory chain and oxidative phosphorylation; β-oxidation of fatty acids; oxidation of proteins, other functions of mitochondria - mitochondria then failed to confirm or even to test his theory. This hereditary disease was reported by John Cotto of Philadelphia in 1803 in man. He may have been selective in his choice of pea characters to study, because variations on the basic theme appear quite often in analysis. The trait of reduced eyes is sex-linked and dominant. The glucose, a hexose sugar, is the primary source of the energy for the cell. But this is not the case. In the dark-staining regions, the chromatin remains in the condensed state and is called heterochromatin. cytoplasm pore central plug central spoke 80 nm 120nm nucleus lamina Fig. Grendel (1925) for following advantages : these cells are easy to obtain and are known to be extremely simple. The syndrome, called sickle cell anaemia, is caused by a autosomal mutant allele, HbS, that in homozygous condition causes the production of an abnormal haemoglobin, called haemoglobin S; this indicates primary effect of mutant gene. The matrix extends throughout the cell. Diploid females have a sex index (ratio X/A) = 2/2 = 1.0. Diploid males have a sex ratio of $\frac{1}{2}$ = 0.5. Sex index values between 0.5 and 1.0 give rise to intersexes. How is it formed ? Thus, if a and b are non-allelic the parents should be represented as aa ++ and ++ bb and in F2, wild type (++) Contents FINE STRUCTURE OF GENE 131 would be recovered as expected. Double bonds are important because they increase the fluidity of biological membranes. Waldeyer (1888) to darkly stained bodies of nucleus. He found that two pairs of genes, A-a and B-b cause the difference in skin pigmentation between negro and caucasian people. (b) The number of codons containing at least one uracil is 1-27/64 = 37/64. (a) How many bases would such a chromosome contain in each strand of the double helix? COOH + H2O2 CHO - COOH + H2O2 so-called because light induces the synthesis of glycolic acid in chloroplasts. Both (gemmules and statoblasts) are stolonial stolon buds septum set free by the destruction of the parental body and they develop into the new individuals in the favourable conditions. The cytoplasm (or protoplast) is differentiated in two regions : 1 Outer or peripheral pigmented region, the chromoplasm having photosynthetic lamellae or thylakoids. 4.30). The individuals possessing the Rh antigen are called Rh-positive (Rh-). The mating of a homozygous yellow, round, and tall pea plant (YY RR TT) with a homozygous green, wrinkled, and dwarf pea plant (yy rr tt) produces in F1 yellow, round and tall (Yy Rr Tt) trihybrids. molecule becomes 8-9 bases long, the σ factor dissociates from the holoenzyme and then the core enzyme brings about elongation of mRNA (or any other RNA). Growth in annual plants is limited and after a period of maximum growth, during which the plant matures and reproduces, there is a period of negative growth or senescence before the death of the plant. (2) All metabolic reactions in unicellular organisms take place in cells. Various combinations of crosses with their progenies have been tabulated in Table 10-5. The Y chromosome has little genetic The various regions of the human Y information, therefore, sometimes it is referred to as gechromosome netically inert or inactive. Formation of spermatids; 2. Gene mutation. Therefore, it is scientists sequence of pieces of DNA likely that there may be 64 triplet codes for 20 amino acids. Mitochondrial lipid biosynthesis. Got Nobel Prize for their work on the role of sodium and potassium ions in the conduction of nerve impulses along the nerve cell membrane. The gemmules and the statoblasts are composed of a group of pharynx undifferentiated cells which contain stored food material. It contains 210 to 220 amino acids and may be represented by a variety of forms even within a single tissue. Some of the clearest demonstrations that some specific genes are at least available for transcription in differentiated cells are provided by Drosophila and other organisms (Fig. The probable nature of specialized chromosomes—the lampbrush chromosomes. Frequently, in facultative heterochromatin one chromosome of the pair becomes either totally or partially heterochromatic. Linked genes do not assort independently but tend to stay together in the same combination as they were in the parents. The 23S rRNA and 5S rRNA occur in 50S ribosomal subunit, while 16S rRNA occurs in 30S ribosomal subunit of 70S ribosomes of prokaryotes. Phosphotungstic acid (H3PO4. Proteins for use within the cell are synthesized at cytoplasmic ribosomes; but ribosomes responsible for the synthesized at cytoplasmic ribosomes; but ribosomes; but ribosomes responsible for the synthesized at cytoplasmic ribosomes; but ribosomes; but ribosomes; but
ribosomes responsible for the synthesized at cytoplasmic ribosomes; but carboxyl-terminal domains are nonhelical and vary greatly in size and sequence in different IF proteins (after Alberts et al., 1989). 1965 F.H.C. Crick proposed the wobble hypothesis for anticodons of tRNA and explained how several codons meant for same amino acid are recognized by same tRNA. 5.4. Schematic diagram of the Robertson model of membrane structure. Simple lipids. It can affect the chromosomal DNA by following two ways : (1) Direct gene change. Thus, one amino acid is converted into an amino acid is converted into an amino acid. Contents 66 GENETICS, HUMAN GENETICS AND EUGENICS corn, wheat, barley, etc., is called kernel. In May 1854, he was appointed to the post of supply teacher of physics and natural science in a higher secondary school of Brunn. In mosaic individuals with XX and XO cells, it could be shown that X chromosome in XO cells, it could be shown that X c important coenzymes or cofactors are as follows : 1. 63% rRNA and 37% protein. 13.4. A diagrammatic representation of genic balance theory in Drosophila. Described the structure of centrioles and coined the term centrosome. Presently, the term epistasis (Greek, standing upon) is used for almost any type of allelic genetic interaction. driven by electrochemical The major glycolipids of the chloroplast are gradient also synthesized locally. Since such loops do ocH1 cur in E. 18.11, Fig. Since, size and shape of lysosomes vary from cell to cell and time to time (i.e. they are polymorphic), their identification becomes difficult. Be sure to state whether autopolyploidy or allopolyploidy has been more important in speciation and why? First, there is an inverted repeat base sequence containing a central non-repeating segment: that is, the sequence in one DNA strand would read like - ABCDEF—XYZ—F´E´D´C´B´A´ in which A and A´, B and B´ and so on are complementary bases. Which child was definitely adopted ? Glycosyl transferases : Glycoprotein biosynthesis 1. The code is always read in a fixed direction, i.e., in the $5'\rightarrow 3'$ direction. The protein starch grain in assembly of microtubules lipid chloroplast involves preferential addition of subunits ($\alpha\beta$ plasma membrane dimers) to one end of tubule, called A end (or net assembly end); the other end of the tubule is called Protein D end (or net disassemRNA n bly end). 17.6. Inheritance pattern of genetic male sterility. Contents 170 GENETICS, HUMAN GENETICS AND EUGENICS C H A P T E R 14 Chromosomes) G enetics makes extensive use of deviations from the norms, and the study of chromosomes is no exception. Feature Monozygotic twins 1. On their memmitochondrion branes, rough ER (RER) contain certain ribosomes while engaged in polypeptide synthesis. Polycytilic acid or poly (C) 4. In consequence, virus is not replicated, but phage DNA viral DNA is injected E D virus particle attaches to remains in the bacterium rium, being replicated in such a way that when the lysogenic bacterium divides, each daughter cell receives at least one phage geG F new virus DNA and protein the host cell bursts nome in addition to the molecules are synthesized and virus particles bacterial genome. (b) Is this number likely to be too high, too low, or about right for an actual organism. The whole process completes in one sequence or phase. The best known case is that of the X-chromosomes in the mammalian female, one of which is active and remains euchromatic, whereas the other is inactive and forms at interphase, the sex chromatin or Barr body (Named after its discoverer, Canadian cytologist Murray L. The examples which are cited in phenomenon of dominance can also be considered for the law of segregation. Likewise, hyperploidy may infirst division volve addition of either a single n+1 chromosome, called trisomy (2n + 1) or a pair of chromosomes, called tetrasomy (2n + 2). That is, when adequate tryptophan is present, transcription of the operon is inhibited; however, when its supply is insufficient, transcription occurs. During mitotic prophase the chromosomal material becomes visible as very thin filaments, called chromonemata (a term coined by Vejdovsky in 1912). There is only one pathway from B and C and that goes through ancestor E. Influenza virus has segmented genome (Fig. Evaluate its practical and theoretical significance and describe some of its limitations. The histone proteins remain associated with the DNA by the ionic bonds and they occur in the nuclei of most organisms. In A A fragment D order to affect pairing of B (lost) B all homologous segC C C ments, peculiar and charB E D D acteristic formations ocdicentric bridge cur during synapsis. This step needs only three purified proteins, namely T antigen (T-ag or tumour antigen), RF-A and topiosomerases I and II. EUGENICS AND EUTHENICS The betterment of human society can be achieved by following two inter-related methods : 1. These spokes terminate in a dense knob or head, which may have a fork-like structure. In the cell, the sites of orientation are MTOCs from which the polymerization is directed. This protist has tion of the microtubule. Certain detergents such as digitonin and lubrol are often unfolded mitochondrion used for this purpose. Fibrinogen 4. Got Nobel Prize for their studies on the metabolism of muscle tissue and for relationship between muscle metabolism and lactic acid. In fowl, barring (B) is sex-linked and dominant, the recessive allele (b) producing solid black colour when homozygous. If etiolated plants are re-exposed to light, thylakoids are reformed and the prolamellar material is used for assembly. The GTP of the initiation complex +Pi 40S subunit 5' 3' migrates along is hydrolyzed, when 60S subunit joins (Fig. Sex Linkage in Poultry In plymouth rock chicken the gene for black or red unbarred feathers is recessive. Natural fats and oils (a) Fat is an efficient way to are compounds of glycerol (b) Wax is a highly saturated lipid. DISTRIBUTION OR LOCALIZATION The mitochondria move autonomously in the cytoplasm, but in many cells their distribution is very restricted. Buffers and pH. 149 1. In rare cases, GUG also serves as the initiation codon, e.g., bacterial protein synthesis. (ii) Incomplete parthenogensis. At least two such proteins are known: (1) The TF II F accelerates RNA chain growth relatively uniformly in concord with RNA polymerase II. He self-pollinated the dwarf offsprings of second generation and found only Contents 26 GENETICS, HUMAN GENETICS AND EUGENICS dwarf plants in third generation. Only proteins that contain a specific signal peptide are translocated into mitochondria and chloroplasts. Chemical composition of some purified membranes (in percentages) (Source : Darnell et al., 1986). Such a transcriptional unit for multiple proteins is called an operon and E. It is transmitted and introduced into the host cell by some vector or by mechanical means such as rubbing, transplanting and handling. Contents CHROMOSOMES 277 functional terms, i.e., now they are transcribed continuously from end to end; they form a continuous thin-thick matrix. The import of these polypeptides involves similar mechanism both in mitochondria, and chloroplasts. The eukaryotic transcription too involves the following three main steps: initiation, elongation and termination. The crossing over involves reshuffling, redistribution and mutual exchange of hereditary material of two parents between A and B by growing the tassels from line A so that A cannot self-fertilize, and, thus, received only B pollen. 13.12. This confers passive immunity on the Fig. Contents GENETICS, HUMAN GENETICS AND EUGENICS 144 Duchenne (or progressive pseudohypertrophic) muscular dystrophy is another fatal disorder of humans. According to him, gene R contains eight alleles such as r, Ro, R´ R´, R1, R2 Rx or Rz and Ry. 2. The vitamins play an important role in the cellular metabolism and act as the enzymes or other biological catalysts in the various chemical activities of the cell. Inborn errors of metabolism. The a. In contrast to cilia, they generally move by waves that emanate from the light microscope.
Origisatellite B A nally it was considered that the centromere conFig. Differences between prokaryotic cells (Source : Maclean and Hall, 1987). Poulson (1970) have reported DNA-containing viruses in these endosymbiont spirochaetes of female Drosophila. Fine or ultra-structure of 70S ribosome is very complex. If life is defined as being cellular, then viruses are not alive. Ciliary Membrane Though the ciliary membrane (9.5 nm thick) is physically protein poor; Satir, 1977). However, sexual reproduction, performed by the majority of living organisms, produces the diversity which is required for survival in a world of constant change. Labrador dogs can be (a) black, (b) chocolate, or (c) yellow, and their colouring is controlled by the blackcoat gene (B or b) and the extension gene (E or e). Terminal meiosis. A chlorophyll molecule (Fig. The children ignorant about the facts of sex may do more harm to society then otherwise. membranes-the plasma membrane and external membrane of the cell wall - are separated by the periplasmatic space. (e) 1/2 Mm : 1/2 of the testis, whereas in the female the absence of the hormone permits the slower development characteristic of the ovary (Jost, 1970; Ohno, 1976). By the same hybridization techniques, it can also be easily determined that how many phenotypic traits remain always together or linked and consequently their determiners or genes during the course of inheritance. ADP-ATP carrier Exchange for mole-for-mole basis of malate, succinate, fumarate and phosphate between matrix and cytosol. It is also involved in prenatal growth of higher vertebrates. The energy generated by electron transport is conserved in the energy-rich form of a H+ ion gradient. The sphingolipids occur mostly in the cells of the brain. 4.14). (2) Lysogenic cycles, in which infection rarely causes lysis, e.g., temperate phages such as P1 and lambda (λ) phages. Their main motive remained to provide relevant coloured photographs explaining various intricate biological topics. 3'OH According to Kim, TDS 3' OH acceptor DHU of tRNA takes the shape end CCA loop of letter L with a thickTyC loop 5'end ness of 20A0. In this case, the cilium or flagellum is passed through three mutually perpendicular planes in the space and makes conical or funnel-shaped shape. In Drosophila , a dominant gene (D) for a phenotype called dichaete alters the bristles and also makes the wings to remain extended from the body while the fly is at rest. Guanine (G) Deoxyguanosine 3. Describe the structure of the axoneme. Outside the host cells, viruses are just like non-living inert particles and placed into jars on a shelf for years. The different molAlberts et al., 1989). quantitative trait, homozygous recessive genotype contribute 1 unit to the phenotype, heterozygous genotypes contribute 2 units to the phenotype and homozygous dominant genotypes contribute 1¹/₂ units. In every living organism, there are thousands of different proteins, each fitted to perform a specific functional or structural role. (iii) Longitudinal binary fission. Now let us consider some of the general methods of genetic engineering as follows : 1. Contents IMMUNOLOGY 127 Generally, the antibodies either adhere to the surface of the microorganisms, making them clump together (agglutination), or they may cause them to disintegrate (lysis). No crossing over occurs in male Drosophila and female silk worm, Bombyx mori. Rolling Circle Model It occurs during viral DNA repli3' - OH on leading strand cation and DNA replicating in E. (When a gene for a unit character contains two or more alternative forms, they are called allelomorphs or alleles. These subits numerous oxysomes. The molecules of proteoglycans consist of much longer portion of polysaccharide and a small portion of protein. 10.16), the enzyme that actually synthesizes ATP and simultaneously acting as a proton pump. (a) The karyotype of Edwards syndrome. However, like any other cellular organization; (2) a genetic or hereditary material in the form of either DNA or RNA; (3) a capacity of auto-reproduction; and (4) a capacity of mutation in their genetic substance. The cytoplasm of cyanobacteria appears more organized than that of other bacteria. Certain Other Examples of Law of Segregation is universal in its application and it has been found to occur in both plants and animals. Development of proplastid into chloroplast takes place in the following steps : 1. There, instead forming a single daughter centriole in the typical manner, each centriole in the typical manner of Barr bodies is always one less than the number of X chromosomes (i.e., in humans, XXX female has two Barr bodies and XXXX female has three Barr bodies; M.L. Barr, 1959). D possesses 50 per cent of B's genes and transmits 25 per cent to C. The process of ingestion of large-sized solid substances (e.g., bacteria and parts of broken cells) by the cell is known as phagocytosis (Gr., phagein=to eat, kytos=cell or hollow vessel). (iii) Cortical granular components. nucleosome 2. 5.12. 13.13). What do you understand by self-incompatibility (= self-sterility) ? Published his monograph—Die Zelle und das Gewebe (The cell and the tissue) in which he attempted to achieve a general synthesis of biological phenomena based on characteristics of the cell, its structure and function. A ratio of progen phenotypes reflecting the operation of Mendel's laws. The ultrastructure of a cellular membrane could be observed by the techniques of freeze-fracturing and freeze-fracturing. They are the result of about 200 years of inbreeding. The chromosomes which are Centromere responsible for the determination of sex are known as sex chromosomes, e.g., X and Y chromosomes. Embden (1874-1933); Otto F. The good illustration of X Fig. Microtubules are involved in the transport of macromol- Contents CYTOSKELETON : MICROTUBULES, MICROFILAMENTS AND In this type of endocytosis, a specific receptor on the surface of the plasma membrane "recognizes" an extracellular macromolecule and binds with it. After the karyokinesis the unequal cytokinesis occurs and a small haploid polar body or polocyte and a large haploid secondary oocyte or ootid are formed. Translation; a nonsense mutation causes both chain termination and release. Ear 5. Similarly, mRNA molecules complexed with special proteins to form ribonucleoprotein particles, are thought to be actively exported from the nucleus. Contents 164 GENETICS, HUMAN GENETICS AND EUGENICS hyperproduction due to hyperacSex chromatin tivity of X-chromosome in the heterogametic male sex as observed in Drosophila. Prior to its use mesh or grid is coated with a thin monolayer film (7.5 to 15nm thick) of plastic (such as formvar or collodion) or carbon to provide a support to the sections (or sample) (Fig. 2.2). Such a complex would be highly processive and assure rapid replication of the protein synthesis of the egg. Telophase. Some proteins are attached at the polar surface of the lipid (i.e. roteins); while others (i.e., integral proteins) either partially hydropholic hydrophobic penetrate the bilayer or head group tails of lipid span the membrane enof lipid tirely to stick out on both sides (called transme growth is attributed to several factors such as depletion of nutrients and lack of oxygen. In 1665, Hooke published a collection of essays under the title Micrographia. The final step in the termination process is dissociation of the core enzyme from the DNA. Primary lysosomes are able to digest intracellular structures including mitochondria, ribosomes, peroxisomes and glycogen granules. Discovered mitochondria ("sarcosomes") in muscle and in 1888 he isloated them. The isoenzymes have relation with the heredity (Latner and Skillen, 1969, and Weyer 1968). Duplication theory. The nucleus is typically about 5µm (5 x 10-4 cm) in diameter. These enzymes digest the dead cells. The plasma membrane is also called cytoplasmic membrane, or plasmalemma. An experiment in which cells are grown in radioactive medium for a longer period (the chase). 17.3). But, there is no direct evidence in support of "de novo" hypothesis for the origin of the mitochondria therefore, it is discarded now. List all of the genotypes possible for each of the phenotypes in this series. The number of chromosomes in a basic set is called the monoploid number, x. Contents PARTHENOGENESIS 361 toads are treated with radium and then fertilized by normal sperms, the egg nucleus does not take part in development, but sperm (paternal) nucleus participates in normal development. Vitamin B2 (Riboflavin) 750 µ gm 200 IU (5 µ gm) Animal fats (fish liver oil, egg-yolk, milk, butter, cheese); palm oils; red peppers; dark green leafy vegetables (spinach, methi, cabbage); yellow vegetables (carrot, pumpkin) and yellow fruits (mango, papaya). Pernicious anaemia; fish, eggs, milk, cheese necessary for 2. However, in certain breeds of cattle, intensive inbreeding has led to an unfortunate condition; for example, exhaustive inbreeding and selection of beef cattle breed (Here100 ford) produced dwarf calves of low economic 90 value. The change in standard free energy changes, ΔG^{c} is related to E'o as follows: $\Delta G^{o'} = n F \Delta E'$ o where n is the number of electrons exchanged per molecule, F is the Faraday (96,406 J/V), and E'o is the difference in redox couple. S.No. 1. Red colour in wheat kernel is produced by the genotype R-B-, white by the double recessive genotype (rr bb). The cross of a progeny individual with its parents is known as back cross. Two double-stranded helical regions are seen, each oriented curate. 14.1) : 1. CH— CH2—CH—COOH | NH2 Isoleucine (Ile, I) CH3—CH2—CH—COOH | NH2 Isoleucine (Ile, I) CH3—CH2—CH—COOH | NH2 Isoleucine (Ile, I) CH3—CH2—CH4 (Ile, I) CH3—CH2—CH4 (Ile, I) CH3—CH2—CH4 (Ile, I) CH3—CH2—CH4 (Ile, I) CH3—CH2 (Ile, I) CH3 molecules, called ribozymes. 6.2.), the expected number of homozygous genotype is increased by 50% due to
selfing or inbreeding in each generation. (c) What conditions must be satisfied to prove that cytoplasmic genes are present in the chloroplast? If an error has been made, the wrong amino acid is removed and the correct one is attached. Describe lethal genes by considering one example from each of the following—plants, animals and humans. There are different types of pumps for the different types of pump, etc. Folded-fibre Model and Nucleosome Concept If we presume that a single long DNA molecule, we have no choice but to believe that DNA should be present in a coiled or folded manner. As a result AMP and enzyme are released and a final product aminoacyl tRNA is formed by the following method : AA—AMP—Enzyme + tRNA A A — tR N A + A M P + E n z y m e Aminoacyl adenylate and enzyme Amioacyl-tRNA moves towards the site of protein synthesis, i.e., ribosomes with mRNA. This electron microscope has less resolution power than the TEM (i.e., about 200 A0), yet is a very effective tool to study the surface topography of a specimen. 12.16). 4.8.). Phospholipase A2 Removal of fatty acid chains F. Contents PLASMA MEMBRANE AND CELL WALL 149 Ultrastructure Electron microscopy has shown that the cell wall is constructed on the same architectural principle which applied well in the construction of animal bones and such common building materials as fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S3) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (S4) concrete (concrete + metal framework), i.e., strong flat spiral fibres (e.g. strong flat spiral fibres) or reinforced inner layer (strong flat spir cellulose microfibrils) resistant to middle layer (S2) tension embedded in an amorphous matrix (com(10-20°) microfibrillar prising hemicellulose, pectin and proteins). In other words, eugenics seeks the measures to preserve the best type of germplasm and to eliminate defective germplasm from the human society by applying the laws of inheritance to man. Refractive index is easy to alter, but only within narrow limits. That is, it was believed that fundamental biological principles that govern the activity of simple organisms, such as bacteria and viruses, must apply to more complex cells; only the details should vary. The presence of Taq DNA polymerase enzyme and all four essential nucleoside triphosphate in the 'eppendorf tube' allows synthe- A shorter 3. Their other important functions include initiation of contraction of smooth muscles (thus, helping in childbirth), aggregation of platelets and inflammation (i.e., arthritis) (see Alberts et al., 1989). The location of the inverted segment can be detected cytologically in the meiotic nuclei of such heterozygotes by the presence of an inversion loop in the paired homologs. Microbodies are most easily distinguished from other cell organelles by their content of catalase enzyme. Built the first transmission electron microscope. The code is a triplet codon. 1952 A.D. Hershey and M. Shape of chromosome; 2. They considered that there is a physiological stimulus to development that increases with the diversity of the uniting gametes. The solH oxygen H vency is of great biological H H oxygen importance because all the oxygen chemical reactions that take H H place in the cells do so in aqueous solution. Why are no brown offspring produced ? CHEMICAL COMPOSITION Chromatin which has been isolated from rat liver contains DNA, RNA and protein. The cytoplasm has the property of asexual and sexual reproduction. ii BB, Bb B (Black) Black=3. Union of repressor with inducer would cause a change in the conformation of the repressor protein which rendered the binding site for the operator non-functional. In such a specimen, during electron microscopy, the electrons pass readily through the plane on which the particle sits, and are scattered more severely by the side of the particle on which metal has accumulated. (i) Marriage between colour-blind man and normal visioned woman. coli Seymour Benzer. The allele R to give rise YR combination. Spotted males transmit the trait only to sons and not to daughters, and male and female progeny of such daughters do not show the trait. A nucleoid has no ribosome and nucleolus. His contribution was remarkable, because, up to that time radioactively labelled compounds were not known with certainty. Mechanism of Dominance Mendel carefully studied the results of his experiments and it became evident to him that there is a clear cut difference in between the actual visible character and that something which caused its production. Moreover, a particular gene has been found to occur in two alternative forms or allelomorphs, one being dominant and other recessive; one being wild form and the other mutant form. A giant chromosome of a midge showing puff. 17.1). Brachydactyly. Heredity transmission through the sperm and egg became known by 1860. This phenomenon is called selfincompatibility or self-sterility. Normal ear of corn (top) compared with a semisterile ear (ii) Inversion. Its secondary, tertiary and quaternary structure is typical of all higher vertebrate haemoglobins. The resulting haploids can be doubled with colchicine treatment. Higher plants are found to have two types of photosynthetic units, associated with two different wavelenghts. xylcytosine (HC). Aspartate-glutamate carrier 4. Cloning vectors. a few base pairs; that is, the Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 51 DNA helix recloses just behind the enzyme. Factor Structure and mass in daltons Function 1. Bacteria occur almost everywhere : in air, water, soil and inside other organisms. A—The relative sizes and shapes of the three respiratory enzyme complexes of inner mitochondrial membrane (after Sheeler and Bianchi, 1987; Alberts et al., 1989). A female with 44 autosomes and only with one X chromosome in her body cells exhibits symptoms of Turner's syndrome. If sea urchin eggs are shaken to produce small pieces, the fragments round up to form spheres. Human Genetics). If the protein consists of identical sub-units, it is called homopolymers and is said to have homogeneous quaternary structure, e.g., the isozymes H4 and M4 of lactic dehydrogenase (LDH), enzyme phosphorylase and L-arabinose isomerase. Contents GENETIC ENGINEERING 115 2. He further stated that since the chromosomes move as units during meiosis to the gametes, all the genes which are situated in the same chromosome will Walter Sutton (1877-1916). he gametogenesis (Gr., gamos=marriage; genesis= origin) is the process of gamete formation in the sexually reproducing animals. When he made observations on the offsprings of first generation he found only tall plants. They may involve physical appearance such as height, facial features, eye colour, skin colour, skin colour, baldness, hair colour, skin colour, symbiotic bacillus of colon of human beings and other vertebrates. Contents 328 CELL BIOLOGY The sudden transition from metaphase to anaphase is thought to initiate dephosphorylation of many proteins, including histore H1 and the lamins, that were phosphorylated at prophase. The process of sperm production is known as the spermatogenesis (Gr., sperma = sperm or seed; genesis = origin) and the process of production of ovum is known as the spermatogenesis (Gr., sperma = sperm or seed; genesis = origin). When colour-blind man marries with a normal visioned woman, then they will produce the process of production of ovum is known as the spermatogenesis (Gr., sperma = sperm or seed; genesis = origin). normal visioned male and female individuals in F1. Continuity of life depends on cell division. On reaching at the poles, each centriole duplicates and, thus, each pole of cell possesses two centrioles of a single diplosome. This ratio is 1 : 1 in a typical metacentric chromosome. Neutral fats represent the major type of stored lipid and so accumulate in the cytoplasm. Mendel's second law. When the (a) Here an egg-shaped protist Didinum cell ingests colloidal chromogen par- illustrates phagocytosis by ingesting the smaller paramecium. Examples of enhancers are known in the genome of viruses (SV40) and eukaryotes (i.e., in the genome of viruses (SV40) and eukaryotes (i.e., in the genome of viruses (SV40) and eukaryotes (i.e., in the genes for immunoglobulin, insulin, alpha amylase, etc.; Picard, 1985) Tonegawa was awarded Nobel Prize for discovering the mode of rearrangements of DNA sequences of mammalian immunoglobulin genes to produce a large variety of antibodies. The promoters of genes of RNA polymerase II contain three distinct regions which are centred at sites lying between – 25 bp and –100 p (Fig. The results of their experiment
have been illustrated in Figure 8.11. The assortative mating is also of the phenotypes, two like phenotypes, two like phenotypes, two like recessive phenotypes, two like assortative mating is also of the phenotypes, two like phenotypes, two like recessive phenotypes. nature of information transmitted from parent to offspring, and, thus, it represents a relatively drastic way of bringing about variation. Why do the w and apr genes behave differently in different positions? This trait (extra-sensitivity) is transmitted primarily, but not exclusively, through the maternal parent. During the inheritance of combs in fowls, the genes themselves do not determine the development of a character (presence or absense of comb) and simply modify a character determined by a basic gene and, therefore, known as supplementary or modifying genes. Thus, one can speak of females having the genetic sex designation XX and males having the genetic sex designation XY. Evidently, the total number of ribosomes in a bacterial cell controls the rate of synthesis of all proteins during growth, i.e., the number of ribosomes per DNA genome is proportional to the rate of growth and protein synthesis (O. This is called test of allelism. For each of seven pairs of characters listed in Table 3-1, plants with one alternative trait were used as female, and those with the other alternative as male. About four fifths of the cases of haemophilic are of this type. In the ciliary matrix are embedded eleven microtubules of extinct cyanobacteria or blue green algae) of Contents CELL 43 Western Australia are known to be at least 3. 5' HO P ligase activity P What chemical groups are present at specific for the origin and terminus of a molecule 3' - P. In lysogeny, the process of adsorption and nucleic acid injection are quite similar to a lytic cycle of virulent phages, although different phages head capsid (protein coat) recognise different bacDNA terial cell surface recollar ceptors. In fact, it has never been known to appear in females. Since outer cristae membrane is lighter and much digestion stronger, centrifugal force is needed to separate it. segregation can be well understood by assuming that the homozygous long-winged Drosophila has a pair of alleles v+v+ for longness of wing and similarly homozygous vestigial-winged Drosophila has the alleles vv for vestigial nature of wings. The genetic materials of chloroplasts and mitochondria will be transmitted to offspring The four o'clock plant with a green branch. β-OXIDATION OF FATTY ACIDS In the mitochondria of all cells, enzymes in the outer (e.g., thiokinase or acyl - CoA synthetase) and inner (e.g., thiokinase or acyl - CoA synthetase) and the explicit and the exp such as α and β tubulins in the micortubules, dynein (the microtubule ATPase), nexin and others (see Table 17-1). The axial filaments do not project away from the cell but are wrapped around the cell surface. Morgan and Sir A.E. Garrod, father of his young collaborators (Ph.D. students), such as, Calvin B. The cerebrosides contain in their molecules sphingosine, fatty acids and Contents CYTOPLASMIC MATRIX 87 galactose or glucose. Regulation of rate of protein synthesis. Krebs and Edmond H. nated species such as cucurbits, inbreeding is found to be continued indefinitely with impunity. (E) ATP synthesis. But because the conversion results in the formation of AMP (and not ADP), there remains a requirement of 2ATP for the noncyclic photophosregeneration of the X pairing region V x y Homo sapiens differential region of the X differential region of the X pairing region II % promoter region V x y Homo sapiens differential region of the X differential region V x y Homo sapiens differential region of the X differential r % fertility region IV pairing region X Y Melandrium or Lychnis dioica Fig. For example, Nasrallah et al., (1985) cloned DNA from S6 allele of Brassica oleracea and showed that the S6 allele causes the production of a S-specific glycoprotein which can be detected by an antibody. Two foetuses so obtained from two zygotes are called dizygotic twins. After the division of chromatids, the interchange of chromatid segments takes place between the nonsister chromatids of the homologous chromosomes. c, Cyt.c1, Cyt. Contents 102 CELL BIOLOGY Enzymes The cytoplasmic matrix and many cellular organelles contain very important organic compounds known as the enzymes. Acquired character. The genotype of F1 mother being S+S, the gene for dextrality dominates and is responsible for the exclusively dextral coiling of the second generation. Dimension Biological field Structures Method of study 0.1 mm or 100 µm to 10 Submicroscopic morphology Ultrastructure, molecular and atomic structure. The axonemal elements of nearly all cilia and flagella (as well as the tails of sperm cells) contain the same 9 + 2 arrangement of microtubules. The somatic or mitotic crossing over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and in the fungused over has been reported in the body or somatic cells of Drosophila by Curt Stern and Interview. Aspergillus nidulans by G. The Bar phenotype of Drosophila is characterized by narrower, oblong, bar-shaped eye with few facets. Therefore, this is a euploid, hexaploid, hexaploid and octaploid species. Residual Bodies They are also called telolysosomes or dense bodies Here the female sex Contents 156 GENETICS, HUMAN GENETICS AND EUGENICS has one Z chromosome and one W chromosome. Such studies had demonstrated that chromosome and one W chromosome and one W chromosome and one W chromosome. nucleotide sequence excess plasmid DNA E. AA 2. The pattern, length, and number of these repeats are DNA cut into fragments into bands Some sequences of human DNA vary so greatly that the chances of two people (except identical twins) having the same pattern is one in severa million. Four duplexes would result, two of which would contain a single strand derived from the original chromosome and two of which would contain totally new DNA strands. Further, in the beginning of the first meisynaptonemal Pachytene Leptotene Zygotene complex otic division the nucleus of chiasma the meiocyte starts to swell up by absorbing the water from the cytoplasm and the nuclear volume increases about three folds. Bridges system of designating parts of chromosomes with numbers, subdivision had made it possible for investigators to discuss precise locations. 14.22. (iii) Although thus far a dipeptide has been generated, continued synthesis requires that the next codon be made available and that the next tRNA. Let A represent a set of chromosomes; this site being still occupied by dipeptide-carrying tRNA. Let A represent a set of chromosomes; this site being still occupied by dipeptide-carrying tRNA. (genome) in species X, and let B represent another genome in a species Y. Schramm demonstrated that RNA is the genetic material of tobacco mosaic virus (TMV). Contents REGULATION OF GENE ACTION 105 (iii) Topoisomerases, helicases and other DNA helix-destabilizing proteins. The sequences of nitrogen bases of a given segment of DNA molecule, actually, has been found to be identical to linear sequence of amino acids in a protein molecule. In the saturated fatty acids, most commonly found in animal tissues, n is either 12 (i.e., palmitic acid) or 16 (i.e., stearic acid). Thus, they may be of club, racket, vesicular,
ring or round-shape. The high level of female hormones secreted sequentially by the pituitary and the ovary is sufficient to suppress the action of male hormone producing cells of the advenal glands. Black spots will appear at those sites when the emulsion is developed. He studied the family pedigree of polydactyly and albinism in human beings Nucleotide sequences are now known (green) along with an ATP molecule (gold). Microtubeles of plant cells were first described in detail by Ledbetter and Porter (1963). However, both processes produce similar end-products as follows : Anaerobic Respiration C6H12O6 ——-→ 2C2H5OH + 2CO2 + Energy Glucose or Fermentaion Ethyl Carbor alcohol dioxide 2. This type of coexistence of two or more genes in the same chromosome is known as linkage. Sex chromosomes. The tagged molecules are often precursor molecules are often precursor molecules are often precursor molecules. The polysaccharides which are composed of different kinds of the monosaccharides and amino-nitrogen or sulphuric or phosphoric acids in their molecules are known as heteropolysac-charides. These genes were found to affect the character in additive fashion. Post-translational Modification of Proteins to Make Them Active Ones Some proteins are altered after synthesis, usually by partial degradation or trimming, as for example, by the enzymatic removal of the central section of Contents MOLECULAR BIOLOGY 108 the proinsulin molecule to yield the active protein, insulin. The efficiency of antibody molecules, which allow the distance between the two antigen binding sites to vary (Fig. The F1 brother and sisters, if inbred or married they will produce in F2 a colour-blind homozygous daughter, a normal visioned heterozygous colourblind son (Fig. Still other forms of colour blindness, some X-linked and some autosomal, are also known in humans. 16.3. Relation of rootlets with the basal body. Molecules per cell Gene 9. Insertion or addition mutation. O O O CH3 Thymine 2800 A CH3 H-N N-H UV O H H 2400 A N N O H Monomers H O CH3 CH3 N-N N H H H Dimer N H O H Fig. Other T lymphocytes, called regulatory cells, regulate the body's defence mechanism by controlling the phagocytes and B lymphocytes. Out of two homologous chromosomes only one type of chromosome either maternal or paternal moves to the daughter cells. The ER membranes are found to conduct intra-cellular impulses. Gametic mutations. In some mammals, especially young animals and hibernating species, there is a specialized tissue called brown fat. Cell number and protoplasmic content do not always increase together; cell division can occur without any increase in protoplasm, giving a larger number of smaller cells (e.g., cleavage). If the β-mercaptoethanol and urea are removed by dialysis and the catalytic activity of the protein is restored. 9.3). 5 billion years old. Nuclei were first discovered and named by Robert Brown in 1833 in the plant cells. Since transposable elements carry signals for the initiation of RNA synthesis, they sometimes activate previously dormant genes. Coenzyme A (CoA), 13. (c) Monogenic sex determination in maize. rated from the rest of the cell. 4.34. Calculate how many nucleotides are present in a genetic codon for each amino acid. Endonuclease enzyme cuts AAUUAAA the primary transcript at an appropriate cap location. In general terms, the events of prophase occur in reverse sequence during this phase. Once again, there are some simple rules to follow to ascertain from pedigrees a condition is passed, on average, on average to one-half of the children of an affected individual. For example, in the immature red blood cells Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 59 (reticulocytes) of the mammals the mRNA is synthesised originally by the nucleus in early stages and expelled to the cytoplasm. Lysogenic cycle. Seed parent contributes two sets of chromosomes to triploid endosperm; one Dt gene gives 7.2 mutations/kernel, two Dt genes increase mutations to 22.2/ kernel. Scientists studying the two anemias of man, Cooley's and Lepore anemia, resulting from abnormally low haemoglobin production in individuals homozygous for mutations to 22.2/ kernel. someday discover the factors regulating the beta gene activity and thereby increase the amount of beta chain synthesis. Only the A tubule is round ; the others are incomplete, C-shaped and share their wall with the preceding tubule. The ensuing peptide bond, thus, joins the carboxyl group of the first amino acid with the amino group of the second amino acid (Fig. The method The sample (i.e., homogenate) is depends on the principle that particles of different contained in tubes that are inserted weight or sizes move at different rates through a into a ring of cylindrical holes in a solution in a centrifugal field. A-Position of sex chromatin near nucleus; B-In nucleoplasm and C-Attached to the nuclear membrane. Molecular biology of self-sterility. With these four requirements in mind we can study in the forthcoming chapters - How it carries genetic information from one generation to next?, How a genetic material determines the phenotype of an organism? 40S 60S 80S Mg subunits mRNA 120S Mg ribosome dimer polyribosome Fig. Ceruloplasmin 7 6. Among these sterile epidermal cells of stomata A B Fig. as prophase. What ? Fission of a mitochondrion by parmembrane at the point where DNA duplication starts. performing specialized tasks : oxidative phosphorylation and generation of energy in the form of ATP molecules in mitochondria; formation and storage of carbohydrates in plastids; protein synthesis in smooth endoplasmic reticulum; lipid (and hormone) synthesis in smooth endoplasmic reticulum; lipid macromolecules in the lysosomes; regulation of all cellular activities by nucleus; organization of spindle apparatus by centrosome from its centromere, creating an accentric fragment. Such a material is also called birefringent because it presents two different indices of refraction corresponding to the respective different velocities of transmission. Formation of Spermatids The male germinal cells or primordial cells. But because membranes of ER resemble with the nuclear membrane and plasma membrane and also at the telophase stage the ER membranes are found to form the nuclear envelope. However, the inhibitory effect of glucose on expression of the lac operon is quite indirect. Folic acid 50-100 mg Green leafy vegetables, 1. The region of sense strand of DNA which is actually transcribed into RNA, is called the coding region. (D) Redox reactions and redox couples. The cell coat can be stained with PAS (see Chapter 2) or Alcian blue for the light microscopy plasma membrane Fig. Itakura et al., first of all produced human insulin (humulin) by means of recombinant technology. The defective persons may have various sex-linked diseases such as night blindness, haemophilia, colour blindness, etc. and various other defective traits which may be regulated by dominant or recessive genes. Transformation involves naked DNA from one cell becoming incorporated into another's DNA, whereas in transduction a virus serves as the vector transferring DNA derived from one cell into another. Gametes containi less than the hap chromosomes are normally not viable. In fact, virus multiplication is very different from cell replication mechanisms. The ribonuclease consists of a single 124 amino acid polypeptide having a molecular weight of about 12,000. (b) How many bivalents will be seen during the process of gametogenesis in the male ? (a) Yes, (b) No. 7. Russow (1872) made the first serious attempt to describe chromosomes. It is not separated from the cytosol by the nuclear membranes as it occurs in the eukaryotic cells. (W.E. Castle suggested the fruit fly to Morgan). length of both the strands of DNA. AIDS or acquired immune deficiency syndrome is endocytosis of enveloped virus and caused by HIV-1 or Human immunodefidelivery to endosome; decrease in ciency virus type -I. (2) This process is specific; each facilitated diffusion protein (called protein channel) transports only a single species of ion or molecule. Most important of these genes are the genes for sea urchin histone proteins, ovalbumin gene in chicken and globin genes in mammals. Ochoa ; both got Noble Prize in 1959. French biologist, Rene Dutrochet (1776-1827) correctly concluded in 1824, that all animal and plant tissues were "aggregates of globular cells." In 1831, an English botanist Robert Brown (1773-1858) discovered and named the nucleus in the cells (e.g., epidermis, stigmas and pollen grains) of the plant Tradescantia. There is a great possibility that E. Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 45 merases or simply RNA polymerases. The enzymes of the matrix and cellular organelles are classified as follows : 1. He proposed that the genes produce enzymes of the matrix and cellular organelles are classified as follows : 1. in physiological abnormalities. A simple on-off system, as in the lac operon, is not ideal for a biosynthetic pathway; a situation may arise in nature in which some tryptophan is available, but not enough to allow normal growth if synthesis of tryptophan was totally shut down. 18.7. Comparison of behaviour of kinetochore microtubules during metaphase (A) and anaphase (B). So, before actual DNA replication starts, short RNA oligonucleoside triphosphates. Contents 134 CELL BIOLOGY C. In fact, the chromatin has its unit structures in the form of nucleosomes. starts, short RNA oligonucleoside triphosphates. 5' S A T S P P S T S S S A T S S C G S P 3' 5' S A T S S C G S P 7 5' S A T S S C G S P P 5' S A T S S C G S P 5' 3' 3' P P P 5' Fig. killer trait is imparted by a Contents GENETICS, HUMAN GENET when it conjugates with a Paramecium without any mu particle is called mate sensitive, then it kills the latter. METHOD OF ISOLATION The ribosomes are usually isolated from the cell by the differential centrifugation
method in which an analytical centrifugation method in which and analytical centrifugation method in which any mu particle is called mate sensitive, then it kills the latter. information. Radiations. This phenotype is passed F2 only from father to son, and females never carry or express the gene. Contents 210 CELL BIOLOGY ent is harnessed to make ATP by F0 - F1 complex (acting as ATP synthetase and proton pump), through which the protons flow back into the matrix (Fig. Examination of cell samples from the son showed the presence of a Barr body. In vivo experiments of Lindahl and Zengel (1982) have investigated that induction of L4 protein overproduction has greatly Contents CELL BIOLOGY 290 reduced the synthesis of all ribosomal proteins by this longest operon. Certain chemical compounds, called base analogues (e.g., 5-bromouracil, 2-aminopurine, etc.) closely resemble with certain DNA bases and are, therefore, act as mutagens. env is missing. During cocoon formation the silk gland of the silkworm predominantly synthesizes a single type of protein, silk fibroin. some. How would you determine cytologically if it were an autopolyploid or an allopolyploid? (iv) Evolution through polyploidy. Thus, male and female individuals may be similar for a particular trait but give different phenotypic expressions of the same trait. The X chromosome is the member of group C and can be identified by special banding or staining methods. This enzyme is known to have five active sites, namely template site, $5^{\prime} \rightarrow 3^{\prime}$ cleavage or exonuclease site, nucleoside triphosA.Kornberg. 20.2 B). In the pigmented retinal cells it exists in the form of tightly packed vesicles and tubes known as tRNAMet without the help of mRNA, while in prokaryotes, generally the 30S—mRNA complex is first formed, which then associates with f-Met-tRNAf Met. In certain characteristics, the chloroplasts are comparable with that of a semiautonomous or symbiotic organism living within the plant cells. When heritable alterations occur in a IV Base deletion very small segment of DNA molecule, i.e., a single nucleotide or A T G A C A G G T C nucleotide pair, then this type of mutations are called "point mutations". For example, in O. The solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution so that the hanging molecules migrate through the medium which has a different affinity for the individual molecules of the solution so that the hanging molecules migrate through the medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules migrate through the medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of the solution is applied to an cover insoluble medium which has a different affinity for the individual molecules of th is synthesized from ADP and Pi molecules are produced per glucose molecule (after De Robertis and De Robrtis Jr., 1987). Cells routinely import and export large molecules across the plasma membrane. configuration For example, if the sequence of 1 2 3 4 5 6 7 8 genes in a chromosome is ABC. (ii) The enzyme (zymase) needed for fermentation is supplied from the micro-organism like yeast, while the enzymes (zymase-complex) required for the process of anaerobic respiration are present in the same cell of the higher plant in which the process is occurring. Contents C H A P T E R 5 Quantitative Genetics (Inheritance of Multiple Genes) T A field of pumpkins, where size is under polygenic control. As already described, mitochondria can synthesize about 12 different proteins, which are incorporated into the inner mitochondrial membrane. He made use of a thermostable enzyme (acts best on 720 C temperature), called Tag DNA polymerase, isolated from Thermus aguaticus, 14,16), (a) F1 : all black: F2 : 9/16 black : 3/16 brown : 4/16 albino; (b) 1/4 BB cc: 1/2 Bb cc: 1/2 Bb cc: 1/2 Bb cc: 1/4 bb cc. Some other phage proteins alter host cell's RNA polymerase enzymes, so that they transcribe different stages of viral infection according to the phage's needs (see Alberts et al., 1989). Mechanisms Involved in Cell Growth In most cases, the kinetics of mass increase is usually matched by parallel synthesis of RNA, protein and membrane. Vitamin A (Retinol) 2. 6.3. Three-dimensional structure of endoplasmic reticulum in amount and kind (having about showing microsomes and ribosomes. In plant cells due to excessive exosmosis the cytoplasm along with the plasma membrane shrinks away b) solutes less a) solutes more from the cell wall. Hans (pea); Ranjan (lentil); Trombay Vishakhi (pigeon pea); Pant moong 2; TAP -7; MUM-2 (mung bean) Pusa Ageti (cotton); RLM 198, RLM 514 (mustard); New Hybrid Bajra 5 (NH B5); Pusa 46 (pearl millet); Co 997, Co 6608 (sugar cane); MDU1 (chili); JRC-7447 (jute). Primary Non-disjunction In chicken, the recessive gene for cock feathering is male sex-limited. Showed that homologous chromosomes undergo pairing or synapsis during the reduction division. A polymerase enzyme catalyses the formation of a polymerase enzyme sof genetic interest are those that bring about the synthesis of one polynucleotide chain that is a copy of another. Uses of induced polyploidy. Enlist various methods of sex determination in animals including man. When both homologous chromosomes are involved, these are called structural homozygotes, e.g., deletion homozygote, etc. The darkly stained, condensed region of the chromatin is known as heterochromatin. Various membranes of cell contain the following four types of phospholipids : 1. In this fly, the 3A+XX sex is determined polygenically. The difference between independent assortment and linkage can be understood by the following two examples : Example 1. RAM NAGAR, NEW DELHI-110 055 (i) S. They also do not contain nucleoli, cytoskeleton (microfilaments and microtubules), centrioles and basal bodies. fluid-mosaic model of the membrane which represents following main characteristics: fluidity, asymmetry and economy (i.e., lack of movement in the third dimension). Crossing over between ring chromosomes can lead to bizarre anaphase figures (Fig. This gradient is maintained solely by the lysosomal membrane. However, the non-genetic RNA is a single stranded polymer of ribonucleotide units and is composed of phosphoric acid, ribose (pentose), sugar and nitrogen bases, which are purines (adenine and guanine) and pyrimidines (cytosine and uracil). 11.5), which can be isolated with mild detergent : 1. An RNA molecule is isolated having a 3'-OH terminus and a 5'-P terminus. Mitchison (1963) measured the dry mass and volume of a budding yeast cell and demonstrated that mass increases linearly after division; that is, combined growth rate of daughter cells is double the original rate of the mother cell. (3) Accretionary growth. The RNA primers are recognized by DNA poll III HE on the lagRNA primer ging strand and are utilized DNA polymerase for synthesis of precursor or okazaki fragments. The protein coat or capsid of animal viruses is surrounded by an envelope. Kennedy and Lehninger (1948-1950) showed that the citric acid cycle (Krebs cycle), oxidative phosphorylation and fatty acid oxidation took place in the mitochondria. The gene for albino is represented by c. The doubling of chromosomes in the F1 hybrids will give rise to allotetraploids with two A and two B genomes (see Fig. It may be symmetric. B Genetic Effects of Inbreeding The continuous inbreeding results, genetically, in homozygosity. This stain is an anionic stain having special affinity for polysaccharides and proteins. This space contains a grid or reticulum of peptidoglycans. In them polyploidy is whether complete or as a mosaic, it leads to gross abnormalities and death. G : BUe . It is a biologically important form of DNA that is commonly and naturally found Contents MOLECULAR BIOLOGY 22 in most living systems. E=exterior, P=protoplasmic (cytosolic) side, F=fracture face short or have doubles after the nucleolar bioint four haploid cells. The amoeboid movement depends directly on the cyclosis. Thus, growth rate doubles after the nucleolar bioint four haploid cells. organizers are replicated during the S phase when twice the number of ribosomal RNA genes start to transcribe rRNA. The undigested food is present in the digestive vacuole as the residues and may take the form of whorls of membranes, grains, amorphous masses, ferritin-like or myelin figures (Fig.8.3). Their highly basic nature accounts for the close associations histones form with the nucleic acids. Further, the polytene
chromosomes are visible during interphase of mitosis. A reciprocal exchange of material between homologous chromosomes in heterozygotes is reflected in crossing over. The amount of the yolk in the ooplasm varies from species to species. 6.5. N-linked glycosylation of protein in RER. The quantity "n sin α" is often called the numerical aperture (NA). The iodine and fluorine are essential for the thyroid and the enamel metabolism, respectively. According to this theory, the regulatory gene i specified a repressor protein which in the absence of the inducer (lactose), was bound to the operator (o), thereby inactivating the operator and preventing transcription of the three lac cistrons (Fig. 4.7. The difference between unidirectional and bidirectional and bidirectional replications in the movement of replication forks. The 50S subunit contains 23S and 5S RNAs, and the 30S subunit has 16S RNA (after De Robertis and De Robertis, Jr., 1987). Diagrammatic representation of uses and synthesis of ATP. coli there is single replicon with the origin, identified as a genetic locus ori C (245 bp). At the time of gametes, half of the gametes have the allele v + and other half have the allele v. Genetic Engineering (Isolation, Sequencing and Synthesis of Gene and DNA Fingerprinting) 10. However, they are sexually sterile and have to be produced every time anew. The saturated fatty acids consist of long hydrocarbon chains terminating in a carboxyl group and conform to the general formula : CH3 - (CH2)n - COOH In nearly all naturally occurring fatty acids, n is an even number from 2 to 22. The water is transparent to light, enabling the specialized photosynthetic organelles, the chloroplast, inside the plant cell to absorb the sunlight for the process of photosynthetic. One example of chaperone is ATPase. In comparison to a symmetric karyotype (e.g., Pinus; Fig. Human babies missing a portion of the short arm of chromosome 5 (autosome) have a distinctive cat-like cry; hence, the French name "cri du chat" (cry of the cat) syndrome (first described by Lejeune et al., 1963). Receptor-mediated endocytosis; 8. Likewise, a micromap of lozenge locus in Drosophila melanogaster show four groups of alleles located at four mutational sites (Fig. For example, cholesterol is the precursor for both types of sex hormones—estrogen and testosterone and cortisol) formed in the adrenal glands. By using a series of 20 different amino acid mixtures, each containing one radioactive amino acid at a time, it is possible to find out the amino acid corresponding to each triplet by analysing the radioactivity absorbed by the membrane, e.g., the triplet GCC and GUU retain only alanyl-tRNA and valyl-tRNA respectively. The value of restriction enzymes is that they make cuts in the DNA molecule around this point of symmetry. There is 21% crossing over between the gene locus of p and that of c in the rat. In vitro and in situ mircrofilaments can be coated or "decorated" with heavy myosin (HMM) or S1 heads. KINDS OF EPISTATIC INTERACTION When in dihybrid crosses, the epistatic interactions occur between two genes, less than four phenotypes appear in F2. About A giant chromosome of a 85 per cent of the DNA in polytene chromosomes is in bands and rest midge (a small fly) 15 per cent is in inter bands. Each beat of cilium or flagellum involves the same pattern of microtubule movement. However, Mitchell and Moyle (1979) have reasserted their original claim of 6 H+ translocation. The ribosome chromosome capsule plasma membrane is covattached to plasma cell wall membrane ered with a strong and rigid plasma membrane cell wall that renders mechlorobium cytoplasm chanical protection and pro- vesicles vides the bacteria their charflagellum acteristic shapes (the cell wall is absent in Mycopili plasma). However, not everyone carrying the genes for diabetes actually develops the condition, for these genes have incomplete penetrance. Contents MOLECULAR BIOLOGY 8 MATERIAL AND METHODS IN MOLECULAR BIOLOGY Different molecular biologists have made an intensive use of a variety of the microorganisms such as bacteriophages and other viruses; Escherichia coli and other bacteria; unicellular green algae, yeast, Neurospora and other fungi; protozoans, etc., in their investigations of varied nature. In a ciliated vertabrate cell, which may contain hundreds of cilia, the centrioles of the precursor cell give rise to the many basal bodies required to nucleate the cilia in the mature cell. The removal of oxygen from haemoglobin induces a change in its conformation that enables a globin histidine (amino acid) side chain to bind to the proton produced by carbonic anhydrase enzyme. The word sex has been derived from the Gymnasium in 1840. Contents CHROMOSOMAL MUTATION II 189 Some of common examples of autotriploid crop plants, which are mainly produced by artificial methods, are seedless varieties of watermelons, sugar beet, tomato, grapes and banana. In both plants and animals, germ cells are localized in the gonads. The resin is alsupporting lowed to penetrate the sample before it is film polymerized. Contents 48 GENETICS, HUMAN GENETICS single. When the bacterium multiplies, the plasmid DNA will also multiply along Contents 116 MOLECULAR BIOLOGY with chromosomal DNA. X and Y chromosomes. The large, swollen and protruding ; small and

under developed ears; a single palmar crease; short stature; stubby fingers; an enlarged liver and spleen. Only the curvans pollen and rigens eggs are functional to give the rigens-curvans complex in the zygote (Fig. coli) begins by the association of one 30S ribosomal subunit (not the entire 70S ribosome), an mRNA molecule, f Met-tRNA, three proteins known as initiation factors (IFs such as IFl, IF2, and IF3, see Table 7-2) and guanosine 5'-triphosphates (GTP). Contents MOLECULAR BIOLOGY These would then be joined to form double stranded DNA, 77 nucleotide pairs long. The chromosomes with single or few terminal chiasma usually separate more frequently than the longer chromosomes containing many chiasmata. As MgCl2 was known to precipitate RNA, Siekevitz suggested that RNA might somehow be involved in protein synthesis. 2µm However, there is an inner membrane important difference becuter membrane tween the two : the inner membrane of the chlorointermembrane space plast is not folded into cristae and does not contain an matrix stroma electorn-transport chain. Of a particular importance is the amino acid cysteine which possesses a thiol (SH) group. Got Nobel Prize for his studies on the nature and mode of action of respiratory enzymes and for the studies of oxidation and reduction in metabolism. The central protulobe berance being the most prominent. 5.27. Each deoxyribonucleotide is made up of three moieties: a phosphoric acid molecule (biologically called phosphate); a pentose sugar called 2 deoxyribose sugar called 3 in Drosophila In Drosophila, normal red eye colour is determined by a X-linked wild type gene. Chemically all carotenoids COOC20H39 are long-chain isoprenoids having an alFig. The 20 per cent proteins are soluble and occur in the form of the enzymes. Heterotrophic bacteria are mostly either saprophytic or parasitic. 15.4). The I gene exists in three different allelic forms : IA, IB and i. Preformation Theories Leonardo da Vinci (1452-1519) proposed a theory that the male and the female parents contribute equally to the heredity of the offspring. In fact, certain membrane transport processes and enzyme activities are found to cease when the lipid bilayer's viscosity increases beyond Flex (~10-9 sec) a threshold level (Kimelberg, 1977). Proteins 2. The allele I prevents the expression of colour allele at another independently assorting, hypostatic gene locus (B or b) and produces white coat colour. Which phases are the same as the corresponding mitotic phase are the same as the corresponding mitotic phase and which are different? In higher plants, Golgi apparatuses are the same as the corresponding mitotic phase and which are different? particularly common in secretory cells and in young rapidly growing cells. 18.9A). What are plasmodesmata and how are they formed? (ii) Phase 2 : Glycolytic reversal. These requirements extend directly from what is known about the continuity of species and the process of evolutionary change. (vi) Histories. The citrate is subsequently converted into isocitrate by aconitase enzyme. CCAGGCTTTACACTTTATGCTTCCGGCTCGTATGATTGTGTGGAATTG CTTTTTGATGCATAATAGACAGGGTAA GGCGGTGATAATAGCACTGGCGGTGATACTGAGCACATCAG GTGCGTGTTGACTATTACCTCTGGCFGGTGATAATGGTTGCATGTGTGCATGTA ATTGTTGTTGTTGTTGTTGATGCGCCCCGCGTT -35 Sequence Fig. In fact, segregation does take place in the F2 generation so far as the genes are concerned, but the new genic combinations fails to manifest themselves, since the coiling is determined by the genotype of the mother. Suggested form of the individual loops in chromosome puffs. There are about 70 C = O N carotenoids occurring in both types of cells. (b) - phe - ala- arg- cys- asn - (since genetic code is always read in 5'→3' direction). They show high metabolic rate because they absorb their nutrients directly through cell membranes. A signal recognition protein (SRP) complex binds to the nascent signal peptide and stops the translation until it reaches the ER membrane. Each arm small of the L doubled over by loop DHU loop bonds holding complementary base together. Most animal cells are found to have a regulatory pathway for the uptake of cholesterol. 3.5. A cross between a red flowered and a white flowered Suzuki et al., 1986). This shows that black coat colour dominates over white coat colour. Ultimately, the microtubular ring moves centrifugally outward as Golgi vesicles continue to add precursors to the growing cell plate. The extra sequence (acting as the signal) that is present in P20 is composed of acidic amino acids in contrast to the hydrophobic ones in the signal sequence of secretory proteins. T lymphocytes bear molecules on their surface, called T-cell receptors. Chemical Elements, perhaps 46 are found in the cytosol (cytoplasmic matrix). This type of crossing over is known as germinal or meiotic crossing over. In isogamy (Gr., is=equal; gam=marriage) the fusion of morphologically and physiologically identical gametes (isogametes) takes place. Although the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon of mRNA is AUG (methionine) as in bacteria, the initiation codon replication, DNA replication may be duplication with of the following two types: labelled thymidine Ist metaphase (a) Bidirectional replication. The dominant and recessive characters in animals. The wild phage (r+) is capable of forming plaques on E Genetical Terminology 3. (C) Tertiary protein structure. Mendel cross pollinated these two varieties of pea plants which were differing in a pair of contrasting characters, viz., tallness and dwarfness of the stem. However, Alberts et al., (1989) believed that this type of organization (i.e., banding and interbanding of chromosomes in general) may help to : (1) keep the DNA organized; (2) isolate genes from their neighbours and thereby prevent biological "crosstalk", or (3) In the giant chromosomes of the Drosophila active regulate gene transcription for the cytodifferengenes appear as brighter bands. In 1972, he got the Nobel Prize for this definitive work. ATP synthetase (F0-F1 ATPase) is a reversible coupling device that interconverts the energies of the electrochemical proton gradient and chemical bonds. If a wild red eyed female Drosophila is crossed with a mutant white eyed male Drosophila, all the F1 individuals irrespective of their sex have red eyes (Fig. In Drosophila many behaviour genes have been identified, e.g., mutant described as sluggish, non-climbing, flightless, easily shocked, etc., and genes regulating sexual behaviour. This method depends on the fact that X-rays are scattered or diffracted by the atoms of a substance. The DNA of loops is in the tive bacterium (after De Robertis and De so-called supercoiled conformation in Robertis, Jr., 1987). In sexually reproducing homozygotes ? When only sperm activates the egg but its pronucleus, e.g., planarians and nematodes. Inosine is frequently Fig. ψ C loop (iii) The T-stem is composed of five paired bases—the last (i.e., nearest the T-loop or T ψ is C-G. In androgenesis, the egg is activated by the sperm and development takes place without the participation of the egg nucleus. They are extensions of the plasma membranes (Fig. or parasites. RNA molecules are synthesized by using the base sequence (triplet codons) of one strand of DNA as a template in a polymerization reaction that is catalyzed by enzymes called DNA-dependent RNA poly- The molecular adaptor - t RNA. The TF II S (also called S II) helps in elongation. This problem is partially overcome by developing a cylindrical shape or by forming numerous extensions (e.g., microvilli) of the plasma membrane. The Golgi apparatus also contains a variety of enzyme (Table 7-1), some of which have been used as cytochemical markers. The nucleic acid is neither extensively replicated nor extensively tranA B C spike scribed. For example, the enormous elongation in the nucleus of the spermatid during spermiogenesis is accompanied by the production of an orderly array of microtubules that are wrapped around the nucleus in a double helical arrange- Sheets of protofilaments Curled sheet Tubules Fig. The Italian microanatomist Marcello Malpighi (1628-1694) was among the first to
use a microscope to examine and describe thin slices of animal tissues from such organs as the brain, liver, kidney, spleen, lungs and tongue. A sex containing either only one or two different sex chromosomes such as XO, XY or ZW produces two types of gametes half with X or Z chromosomes and other half with X or Z chromosomes. The F1 consisted of a total of 67 males, all with normal eyes, and 65 females, all with reduced eyes. Subvital mutations reduces the chances of survival of the organism in which they occur. In reciprocal crosses, poky (male) \rightarrow all poky wild type (female) \times wild type (male) \rightarrow all poky wild type (female) \times wild type (female) \times wild type (male) \rightarrow all poky wild type (female) \times poky (male) \rightarrow all poky wild type (female) \times poky (male) \rightarrow all poky wild type (female) \times poky (female) \rightarrow all poky wild type (female) \times poky (female) \rightarrow all poky wild type (female) \rightarrow all poky wi segregation. Crossing Over 93-105 Types of crossing over : somatic or mitotic crossing over; theories about the mechanism of crossing over; tetrad analysis; cytological detection of crossing over; significance of crossing over; revision questions and problems; answers to problems. (e.g., mothers who have had infectious hepatitis prior to pregnancy may have three times more chances to give birth to DS infants). head and a peculiar "hair on end" appearance Such an altered code word (triplet codon) may desigof the bone when X-rayed. The probability that the two alleles in a zygote are identical by descent, i.e., are the replication product of the same gene of an ancestor is measured by the inbreeding coefficient (F) and is calculated as follows : 1. Glial filaments occur in some type of glial cells such as astrocytes and some Schwann cells, in the nervous system. Growth of Cell Biology during 16th and 18th Centuries The first useful compound microscope was invented in 1590 by Francis Janssen and Zacharias Janssen. Isoenzymes Recently, it has been investigated that some enzymes have similar activities and almost similar molecular structures. When the chiasma occurs only at one point of the chromosome pair then the crossing over is known A as single crossing over. One can, for example, use ultraviolet light instead of visible light, thus, improving resolution as much as twofold. The eggs with large amount of the yolk are known as the macrolecithal eggs, e.g., Myxine, cartilaginous and bony fishes, reptiles, birds and Monotremata. In Oenothera, Tradescantia and Rhoeo translocations in heterozygous condition are frequently found in nature. During this process, the single circular chromosome first makes a copy of itself (i.e., it duplicates) and daughter chromosome first makes a copy of itself (i.e., it duplicates) and daughter chromosome first makes a copy of itself (i.e., it duplicates) and daughter chromosome first makes a copy of itself (i.e., it duplicates) and daughter chromosome first makes a copy of itself (i.e., it duplicates) and daughter chromosome first makes a copy of itself (i.e., it duplicates) and daughter chromosome first makes a copy of itself (i.e., it duplicates) and daughter chromosome first makes a copy of itself involved in eukaryotic gene regulation. Such a time lag in the migration of 60S and 40S ribosomal subunits, prevents functional ribosomes from gaining access to the incompletely processed heterogeneous RNA (hn RNA; the precursor of m RNA) molecule inside the nucleus (see Alberts et al., 1989). Mather). Such cases of sex reversal are also reported in goat and mice. These alleles though remain together for long time but do not contaminate or mix with each other and separate or segregate at the time of gametogenesis, so that each gamete receives only one allele of a character either dominant or recessive. base to be laid down Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 47 in the initiation event is a triphosphate. coproteins or spikes : 1. Higher plants lack centrioles and astral fibres (after Darnell et al., 1986). Except diploids, rest of these belong to polyploid category. primroses. These enzymes hydrolyse a complex molecule into two compounds by adding the element of the water across the bond which is cleaved. polishing lenses of short focal (1632-1723) length. Sometimes, the cell coat is also called glycocalix, because it contains a nitrogenous base and deoxyribose is called deoxyribonucleoside. from Towbin et al., (1979) developed the one source western blotting technique to find out the newly encoded protein by a treat with Eco R1 transformed cell. An organic compound containing one or more amino acid. Most notably, these organelles are surrounded only by a single membrane and they do not contain DNA (genome) or ribosomes. Meiosis is the reduction division in which the diploid or somatic chromosome numbers are reduced to half. 4.27. Thus, all cellular membranes grow from pre-existing membranes which act as templates for the addition of new precursors. Left - bicoid mRNA at anterior pole; Right - oskar mRNA at posterior pole. Other synthetic functions. Examples of somatic mutation have In two kittens in this litter, the colour of the left eye doesn't been reported in Oenothera lamarckiana match that of the right eye. C etc. On passing an electric current, the negatively charged molecules migrate to the anode and the positively charged molecules to the cathode. chromosomal fibre chromosome axis Master and slave hypothesis. Cajal referred to Golgi nets as the Golgi-Holmgren canals. a There exists a lot of controb+ a versy about the manner and time of the break of chromatids during the b+ crossing over. The annulate lamellae (pores) of the ER arise by the evagination from the nuclear enveloped of the break of chromatids during the b+ crossing over. and have their association with the ribosomes (Merriam 1959; Kessel, 1963). (d) A X-linked dominant gene fails to be transmitted to any son from a mother which did not exhibit the trait itself. The animal breeder have employed the inbreeding to produce best races of horses, dogs, bulls, cattles, etc. The lower organisms such as bacteria and viruses are called haploids because they have a single set of genetic elements. Sialidase Enzymes acting on glycosaminoglycans 14. A situation in which an allele of one gene obliterates the phenotypic expression of all allelic alternatives of another gene. 13.2. A—Structure of a typical chromosome; sists of small granules or spherules. The energy for Contents ...protein 5 ' G A U U C C U A G G A G G U U U G A C C U A U G C G A G C U U U U A G UmRNA U 3' A UCCUCCACUA G... Between the proteinous layers there occurs a lipodous layer of 60Ao thickness. The rest of the cell degenerates. The p site has been mapped and has been found PROTEIN SYNTHESIS fmet arg ala phe 83 ser..... to lie between i and o genes. ii bb b (Brown) Brown=1 X White (Male) Ii Bb Ii ib F1 Phenotypic ratio: 12/16 White: 3/16 Black: 1/16 Brown or 12: 3: 1.6.5. Yields of self-fertilized lines of alfalfa inbreeding for various generations, there will be and onions as per cent of open pollinated equal chances of homozygosity for dominant as parental varieties. The binding of H1 molecule to chromatin tends to create a local polarity that the chromatin otherwise lacks. The region of plasma membrane containing the receptor-ligand complex undergoes endocytosis. Electron membrane microscopy of isolated by this technology. These are Arctic Circle Tropic of Capricorn Percentage range of B allele frequency : 10-15 25-30 20-25 15-20 5-10 0-15 The frequency with which the IB allele of the ABO blood group occurs throughout the world. They are produced from a single fertilized ovum. 22. Barr). The results of these studies are used to formulate the generalization applied to almost all cells as well as to provide the basic understanding of how a particular cell type carries out its specific functions. Thus, in this case, microtubules merely regulate movements of the chromosomes. secondary 3. In other words, the penetrance of a sex-limited gene in one sex remain zero. Reciprocal chimeras using RNA of one strain Fig. All organisms have multiple rRNA genes. For example, oxidative deamination of glutamic acid involves its conversion into α -ketoglutaric acid, which is oxidized by the Krebs cycle: NAD \rightarrow NADH2 Glutamic acid (amino acid) (keto acid) H2O NH3 In this case, high-energy phosphates would be created by the transfer of hydrogen from NADH2 (formed in deamination) through the cytochrome system. Describe the operon model for regulation of gene activity. When a specific antifertilizin comes in contact with the egg water of its own species then certain significant changes occur in the acrosome of the sperm. Contents CELL GROWTH AND CELL DIVISION 321 and it is meant for the multiplication of cell number during embryogenesis and blastogenesis of plants and animals. Many human disll eases and other exceptional 1 2 3 4 5 6 7 8 9 conditions are determined by normal female normal male simple mendelian recessive alleles. All biologically important DNA polymerases possess a critical property: they will add nucleotides to a primer strand only in response to the base sequence found on a second template strand. When the genes are situated in different chromosomes, the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control
appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart, depending on the characters they control appear in the next generation either together or apart. o far, it has been observed that a given phenotypic trait (character) of an individual depends on a single pair of genes, each of which occupies a specific position called the gene locus, on a homologous chromosome. (4) Mannan is a homopolysaccharide of mannose and is found in the cell wall of yeast, fungi and bacteria. The compactly arranged chromatin material of the male pronucleus becomes finely granular. Euchromatin. The developing individual gets its food from the body of the parent and leads an individual existence. The diploid female zygotes can differentiate into either workers (sterile) or queens (fertile) depending on the diet they consume during their development. These are examples of (Hugo de Vries) and several other cases in'mosaic' phenotypes, often due to somatic mutation. Contents 102 MOLECULAR BIOLOGY (iii) Many genes are expressed only in certain tissues. The nucleosome beads obtained in this way have been crystallized and analyzed by X-ray diffracA tion. Replication of DNA; Genetic engineering; Immunology; Genetic recombination and gene transfer (Bacterial conjugation, transformation). Though nothing is still clear regarding the mode of replication, multiplication, multiplication, multiplication, multiplication, multiplication, transformation). reverse translation', i.e., from protein \rightarrow RNA \rightarrow DNA, thus, turning the central dogma of molecular biology on its head (see Banerjee, 1987; Sharma, 1990). Later on, when certain other strains of wheat with dark red kernels were crossed with P 1 whites exhibited an F1 phenotype intermediate between the two parental types, but only Dark red 1/64 of the F2 are white. Thus, during in vitro polymerization of microtubules (B II) (after Alberts et al., 1989). The rII of the chromatid movement is due to the simultaneous shortening of the microtubules (B II) (after Alberts et al., 1989). The rII region of the T4 genome occupies about 1 per cent of its total genetic length. Cellular polarity and motility. Summarize various schemes for coupling electron transport to ADP phosphorylation. a and cyt. 6.5. Directions of synthesis of RNA and protein with respect to the coding strand of DNA respectively, and the corresponding antic(after Freifelder, 1985). translated for the most part on free ribosomes. Near its C-terminus, each L antigen-binding site site chain is linked to an H chain by disulphide bridge, and two additional disulphide bridges link the H-chains together (Fig. The DNA molecule is contained in a membraneless and clear nucleus-like region and it is a double helix which may exist either as the linear strands or a single circular molecule. In this scheme, the simplest unit of the Golgi apparatus is the cisterna. Spectrin is long, thin, flexible rod about 100 nm in length. 5.25. SDS-PAGA or Sodium dodecyl sulphate-polyacrylamide gel electrophoresis (used for separating and sizing macromolecules such as proteins, e.g., membrane proteins, protein component of cytoskeleton, etc.). The basic photosynthetic units seem to be groups of roughly 300 pigment molecules located in the chloroplast membranes (thylakoid disc). Lampbrush chromosome. It brings about the growth in $5' \rightarrow 3'$ direction, using free 3'-OH groups. Another sequence called GC box (GGGCGG) is found in one or more copies at -60 or -100 bp upstream in any orientation in many genes. Jittery = .0819 or 8.19% Waltzer or jittery phenotypes are least frequent and, hence, are the limiting factors. What is the special function of brown fat mitochondria and how is it carried out ? Lampbrush chromosome structure. (a) hypotonic : normal turgor pressure; (b) hypertonic : no turgor pressure. Tn 3 transposon of E. Describe the two patterns and conditions under which one or the other would be more appropriate. Due to movement of a gene locus new type of phenotypes may be created, especially when the gene is relocated near heterochromatin. Each heterozygous ClB female results from the fertilization of a CIB egg and an irradiated X-bearing sperm and some of these sperms will contain mutated X-chromosomes. The increased molecular motion in the region of the nick, thus, effecting a limited "unraveling" of the helix. A primary transcript is made by all three rRNA genes, including spacer regions between the genes. Each bivalent has four chromosome (so named because it was discovered in that city). It is in the nucleolus that newly synthesized rRNA accumulates and becomes associated, presumably by a self-assembly process, with 50 or more ribosomal proteins that have been synthesized in the cytoplasm by usual mechanism of protein synthesis and then migrate to the cytoplasm of cell, in the form of ribosomal subunits. Degeneration and disappearance of the nuclear envelope marks the end of prophase. bacteria, forming pleomorphic (Gr., pleo = many; morphe = forms) colonies, i.e., depending on the type of culture medium, mycoplasmas tend to form different shaped colonies such as spheroid (fried - egg-shaped), thin, branching filaments, stellate, asteroid or irregular. For example, in rats continuous brother-sister matings were performed for 25 generations, but no drastic deterioration has resulted from the basic chemistry of gene structure and function is very similar across the entire spectrum of life on the earth. Contents ENDOPLASMIC RETICULUM (ER) 157 Glycosomes. The male gamete is known as spermatozoon or sperm and the female gamete is known as ovum or egg. Active transport ; 4. The core enzyme comprises three subunits- α, β and θ. In these models, only one strand in each of the two DNA duplexes belonging to non-sister homologous chromatids breaks. The outer mitochondrial membrane resembles more with the plasma membrane in structure and chemical composition. Discovered and named the endoplasmic reticulum. 80S Ribosomes. The ends of a transposon consist of inverted repeats (represented by letters). Four types of ciliary movements have been recognized which are as follows : 1. Despite this longstanding concern with heredity and the practice of selective breeding, it was not until the discovery of Mendel's laws that we were able to explain the actual basis for inheritance. (a) If the interbands of Drosophila polytene chromosomes are correctly interpreted as being loci for "housekeeping" genes, then the evidence is that such chromatin is permanently decondensed and is transcribed at a low but constant rate (Semeshin et al., 1979) eIF4F 3. ANSWERS TO PROBLEMS 10. Thus, hydroxylamine (HA) induces in DNA a GC Æ AT base pair transition (Fig. The scaffold is string preparation); B— A nucleosome made of non-histone proteins and reobtained by extensive digestion (after De Robertis and tains the general shape of the metaphase chromosome. The genetic RNA is found to be either single-stranded or double-stranded platelets. How would you define carbohydrates ? $2 = \alpha$ -ketobutyrate 1 = threonine deaminase e2 excess causes feedback inhibition utilized by cell g2 g1 isoleucine 3 g5 g4 g3 e3 e5 5 e4 4 Fig. acidic heteropolysaccharides such as hyaluronic acid, keraCH2OH O CH2OH O CH2OH O Fig. The virus generally expresses one or bacterial cell wall a few genes which code for a repressor pro- viral DNA bacteriophage empty protein coat tein that turns off (i.e., bacterium represses) the expression of the virus. The first step in incorporating an amino acid into a protein involves the amino acid attachment to its correct tRNA. (a) 1,500; (b) Too high. Ribosomes have a sedimentation coefficient of about 80S and are composed of two subunits namely 40S and 60S. Movement. The entire chromosome complement of an individual or cell, as seen during mitotic Contents GENETICAL TERMINOLOGY 17 metaphase. Thus, the two inbred parents homozygous for different genes, if crossed produce F1 progeny heterozygous for all the genes. The anaphase (Gr., ana=up; phasis=appearance) begins abruptly with the synchronous splitting of each chromosomes, each with one kinetochore. In roan coat the red and white hairs occur in definite patches but no hair has intermediate colour of red and white Father Offspring Mother DNA fingerprints unique for each individual. Each type of transposon has its own unique inverted repeat. 13.1) : centromere Centromere Centromere Centromere SUBMETACENTRIC TELOCENTRIC Fig. Type I, II and III collagens are the fibrillar collagens showing typical striated fibres. In to 8 nm thick and 100 to 200 nm long. For example, if ABC.DEFGH and LMNOPQ. They having been classified according to their constituent protein such as desmin and recessive in females. The outer membrane is separated by causing a swelling which can be brought about by breakage followed by contraction of inner membrane and matrix. When aqueous suspensions of phospholipids are subjected to rapid agitation by using ultrasound (i.e., insonation), the lipid disperses in the water and forms liposomes or lipid vesicles. Developed partition chromatography, leading to paper chromatography two years later. Spot desmosome (after De Robertis Jr., 1987). How can this be utilized for therapeutic treatment of certain diseases ? The Golgi apparatus, like the endoplasmic reticulum, is a canalicular system with sacs, but unlike the
endoplasmic reticulum it has parallely arranged, flattened, membrane-bounded vesicles which lack ribosomes and stainable by osmium tetraoxide and silver salts. Each purine and pyrimidine base of each polymerization in cell and to hold it in place means of the specific hydrogen bonds. The third cytoskeletal component is meshwork of intermediate filaments that surrounds the interphase nucleus; it elongates during mitosis to enclose the two daughter nuclei and finally divides in half by the cleavage furrow. (7) Radioactivity was measured and duplex hybrids isolated, which on denaturation, gave single stranded DNA, which could be made double stranded. Discovered the enzymes and got Nobel Prize for it. According to the shape or conformation, two major types of proteins. SEQUENCING OF GENE Once a gene or DNA fragment is cloned, its further study involves DNA sequencing. It possesses a sensitivity to stimulation, an ability to transmission of excitation and ability to react according to stimuli. The operator element was designated a controlling site which has daughter been formed during the replication process. The A-C links are not established until the end Structure of the centrosome. Figure 6.5. illustrates the deterioration in yield of self-fertilized lines of alfalfa and of cross pollinated onions. Anaphase 11. The chromosomes are the monads, i.e., having single chromatid. Siekevitz (1963) have defined a cell as "a unit of biological activity delimited by a semipermeable membrane and capable of selfreproduction in a medium free of other living systems". Also in them adjacent plasma membrane surfaces are not in direct contact, so that the junctional proteins themselves form the seal. The matrix also contains several identical copies of the mitochondrial DNA, special 55S mitochondrial ribosomes, tRNAs M face cristae C face membrane and various enzymes required for the expression of mitochondrial genes. Plants homozygous for ij are either inviable white seedings or variegated with a characteristic white striping, the phenotype being known as striped. The ideas or theories which have been forwarded from time to time to explain the phenomenon of inheritance can be categorized under the following headings : 1. The 70S ribosomes are comparatively smaller in size and have sedimentation coefficient 70S Prokaryotic Eukaryotic and the molecular weight 2.7× 106 daltons. Example 2. It is heterotrophic and non-pathogenic bacteria producing some vitamins (e.g., vitamin K) for human use. Thus, most of the experimental approaches have been provided by only indirect evidences of the existence of such a membrane around the cells. 13.1. (ii) XX-XY type. They proposed the one-gene is through the synthesis of a protein (enzyme) the synthesis of a protein (enzyme) the synthesis of a protein (enzyme) the synthesis which suggested that the action of each gene is through the synthesis of a protein (enzyme) the synthesynthesynthesynthesynthesynth which in turn catalyzes a single chemical reaction. The ability of a gene to have many effects is called pleiotropy. 13.19) that consists of RNA transcripts with hn RNA-binding proteins attached to them. The phenomenon of dominance is also applicable well to the animals. Pili help in conjugation (e.g., long F-pili or sex pili of male bacteria); in the attachment of pathogenic bacteria to their host cells (e.g., attachment of gonorrhea- causing coccus, Neisseria gonorrhoeae, to the epithelial cells of the human urinary tract) and in acting as specific sites of attachment for the bacteriophages. A penis-like organ of variable size is present. The sedimentation coefficient is expressed in the Svedberg unit e.g., S unit. This technique involves the following steps : (i) in vitro fertilization of the egg; (2) insertion of normal gene into embryo at post-zygotic level, either with viruses or directly by microinjection; and (iii) integration of inserted gene in host DNA, where it may or may not function. GERL is found to be involved in the origin of primary lysosomes and of melanin granules ; in the processing, condensing and packaging of secretory material in endocrine and exocrine cells; and in lipid metabolism (Novikoff, 1976). (b) Could any of these samples have been obtained from the same organism? Like the other catalysts of chemical world, the enzymes are the catalysts of the biological world and they influence the rate of a chemical reaction, while themselves remain quite unchanged at the end of the reaction; potential modes of speciation; instantaneous speciation; instantaneous speciation; potential modes of speciation; instantaneous speciation; potential modes of speciation; instantaneous speciation; instantaneous speciation; potential modes of speciation; instantaneous speciation; potential modes of speciation; instantaneous speciation; instantaneou macrogenesis, instantaneous speciation, biological and host races, means of sympatric speciation, hypothesis of sympatric speciation — homogamy, conditioning, preadaptation and niche selection, sympatric speciation; differences between allopatric (geographic) and sympatric speciation; differences between allopatric speciation; differences between allopatric speciation; differences between speciation; differences between allopatric spe chamber and evaporating at an angle, a heavy metal such as chromium, palladium, platinum or uranium from a filament of incandescent tungsten. (2) A DNA molecule (in practice ii generally a bacterial plasmid) which has been enzymatically cut and DNA of another individual of the same or Type B a different species inserted in the space so produced, Type A then reannealed to the closed, circular form. Navin Joshi, the General Manager of M/s S.Chand & Co. Ltd., New Delhi, for all their efforts to make this endeavour a pleasant surprise to the readers. 3.7. Chemical formula of deoxycytidylic acid. T.H. Morgan (1866-1945) proposed in 1911 the theory of linkage. Norm of reaction. TFIIIC TFIIIB Such internal promoters also occur in the tRNA genes for different types of RNA poly1 8 30 51 72 merase III enzymes. The rhythmicity of cell multiplication and growth can be studied well in tissue culture or in culture of unicellular organisms. The capsomeres are of different shapes such as hollow prism, hexagonal, pentagonal, lobular or any other shape. Cytoskeleton : Microtubules, Microtubules, functions; microfilaments - distribution, chemical composition; intermediate filaments - types of intermediate filaments, general structure of IFs, assembly of IFs IFs during mitosis, functions of IFs; comparison of microtubules, intermediate filaments and microfilaments; revision questions. The eggs with the gene '+' produce heterozygous red-eyed females. stationary growth. These repeat sequences themselves act like IS or IS-like segments. X aX a XAXa XAY YAXa XaY YAXa XAY YAXa XAY Fig. 4.13. The pore size of the membrane allows the diffusion of small molecules such as proteins or nucleic acids cannot pass through the pores and so remain inside the dialysis. tube. - Jagannath, I/T48, I/T 60, Hybrid Mutant 95. 4.7. Chemical formula of lactose. Death takes place around 3 to 4 months of age. In case two units show complementation, they belong to two functional units or cistrons, through they may control the same character. Contents REPLICATION OF DNA 27 C H A P T E R 4 Replication of DNA has the following two important functions: 1. 3.9. Watson-Crick double helical DNA in the other. The F1 hybrid have been found to contain yellow round seeds showing the dominance of allele Y for yellow colour over the recessive allele y for green colour and the dominance of allele R for roundness over the recessive allele r for wrinkledness of seed. However, most metaphase chromosomes fall within a range of 3µm in fruitfly (Drosophila), to 5µm in maize. Such a blood transfusion will be safe only when the receipient had never been exposed to Rh-positive blood earlier F. REDISCOVERY OF MENDEL'S WORK Mendel's research paper remained dormant and unnoticed by the scientific world until 1900. Kihara. They made the use of knob of 9th chromosome of maize which in two different strains might had one allele for either starchy endosperm (Wx) or waxy endosperm (wx). The linkage or genetic mapping in maize has been done by McClintock under the leadership of R.A. Emerson. spectrin (ii) Glycophorin. The secretion of hydrolases to carry out extracellular digestion, therefore, becomes an important process. A study of swedish nudist indicated that the scrotal temperature of human males in ordinary clothing is about 3°C higher than that of nucleotides in it (Brownlee, 1968; Fellner, 1972). Transport proteins transport specific substances across the plasma membrane and other cellular membranes. Prior to discovery of the chemical structure of the genetic material, the 'gene' was an abstract, indivisible unit of heredity (comparable to old concept of the indivisible atom). Sutton (1902) observed that the chromosome pair in synapsis is made up of one maternal and one paternal member. The distribution and number of mitochondria (and also of mitochondrial cristae) are often correlated with type of function the cell performs. The molecular structure of transposon Tn 3 of E.coli has been worked out (Fig. Each base, added to the growing end of the RNA chain, is chosen by its ability to base-pair with the DNA strand used as template; thus, the bases C,T,G and A in a DNA strand cause G, A, C, and U respectively, to appear in the newly synthesized RNA molecule. Further, in organisms in which the number of sex reduced to just two, sexes may reside in different individuals or within the same individual. There occur two types of nucleic acids in living organisms, viz., Ribonucleic acid (RNA) and Deoxyribonucleic acid (DNA). XY-linked. This complex contains one cytochrome F, two cytochromes of b 563, one FeS centre and a polypeptide. Jacob and J. STRUCTURAL CHANGES IN CHROMOSOMES For better
understanding of the abnormalities of chromosome structure, let us consider two important features of chromosome structure. of chromosomes show a great affinity for pairing and they often go through considerable contortions in order to pair. Lysosomes tend to accumulate certain dyes Acid hydrolases (vital stains such as Neutral red, Niagara, Evans nucleasesATP blue) and drugs such as anti-malarial drug chloproteases roquine. (iv) The anticodon stem includes five paired bases. Steroids have widely different physiological characCH2 Some body builders endanger their health by taking 'steroids'. The dark discrete packets called quanta or photons and reaction is catalyzed by enzymes of the that when light interacts with matter it does so by stroma (after Dyson, 1978). Give an account of his procedure and method of drawing the conclusions from the results of experiments. For example, yeast tRNAala with anticodon bases 5' IGC 3' (where I stands for inosine, a derivative of codon adenine or A) could bind to three codons in mRNA such as 5' GCU 3', 5'GCC3' and 5' GCC3' GCC3' and along planes at centre of membranous structure Fig. The ultraviolet radiation produces several effects on DNA, one being the formation of chemical bonds between adjacent thymine residues as shown in Fig. Proposed a central metabolic role for ATP. A variety of experiments indicate that most, though not decondensed all, genes of the condensed X loops chromosome are turned off. (c) Under what circumstances would inbreeding not have deleterious consequences ? In cells of most higher plants, however, spindle forms without the aid of centrioles and lacks asters (Fig. Structural 2. Such a three point test cross may be carried out if three points or gene loci on a chromosome pair can be identified by marker genes. Functions of Rough Endoplasmic Reticulum The major function of the synthesis of protein. Instead of the glycerol, they contain in their molecules amine alcohol (sphingol or sphingosine). hand, blood of person of genotype--h does not react with anti-A, anti-B, or anti-H. This leaves one molecule of PGAL as Fig. The use of high-voltage electron microscopy on whole cells has also helped to demonstrate that there is a highly structured, three-dimensional lattice in the ground cytoplasm. But, Oc in this species it has been Oc' found that young Oc Crepidula remains funcBs Spz tional male and produce Spz Spc only sperms but no ova. Boveri (1902), Sutton (1903) and Bateson and Punnet (1906) had given some hints about the phenomenon of linkage. The receptor-proteins are endocytic either returned to the same plasma vesicles membrane domain from which they vesicular return of come or they go to lysosomes and are receptors degraded. The characteristic separation which results depends on the choice of solvent and carrier material. Sequence length are shown in base pairs (after Gardner et al., 1991). All of the genes located physically on a given chromosome. Telolecithal (e.g., amphibians) or highly telolecithal (e.g., hen and other birds). 4.37. In the surrounding cytoplasm the stain is reduced to a colourless leukobase. The action of a helicase introduces a positive supercoil into the duplex DNA ahead of the replication fork. Such alleles are called similar alleles. when a cattle of red coat (CRCR) is crossed with the cattle of white coat (CwCw), the F1 heterozygote or hybrid is found to possess roan coat (CRCW) (Fig. Dissociation of 30S subunit may be achieved by treatment with four molar urea and two molar LiCl, which separate the proteins. 14.3). Dynein (24 nm) 3. Two molecular forms of DNA double helix, right-handed B-DNA and lefthanded Z-DNA. The oogonia multiply by the mitotic divisions and form the primary oocytes which pass through the growth phase. Contents REPLICATION OF DNA 37 The ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleotide (NAD+) a cofactor, whereas the ligase enzyme from E.coli requires the presence of oxidized nicotinamide adenine dinucleoti plants CH3 (e.g., geraniol from geraniums, menthol from mint and limoneme from lemons). Population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dispersion, age structure, natality, (xix) 94-108 mortality, biotic potential; population dynamics; growth rate of population dynamics; growth rate emigration, immigration, migration ; regulation of population size : population cycles ; population ecology and evolution ; revision questions. DNA helicases utilize this principle to move along their strand; when they encounter a region of double helix, they continue to move along their strand; when they helix (Fig. FO complex possesses the proton translocating bactrial plasma F0 membrane mechanism. Further, though total cell protein may be constant, others may be constant, others may be increasing and still others may be constant. place due to following method: (i) Translocation. If a drop of type B blood is added agglutinated by both sera. They include proteases (e.g., cathepsin for protein digestion), nucleases, glycosidases (for digestion of polysaccharides and glycosides), lipases, phospholipases, phospholipases, phospholases and sulphatases (Table 8-2). Some bacteria (mostly Gram negative bacilli) contain non-flagellar, extremely fine, appendages called fimbriae (Dugid et al., 1955) or pili (singular pilus; Brinton, 1959). It is the knowledge of how genes act and how they are transmitted down through the generations that has unified biology; previously, specific set of biological phenomena had each been Contents INTRODUCTION 9 assigned to separate disciplines. Each of them reached similar conclusions before they knew of Mendel's work. 10.1. Humoral immunity (after Darnell et al., 1986). [Note: According to Circular No. 200 of Committee of Editors of Biochemical Journals Recommendations (1975) the ending ate in lactate, pyruvate, oxaloacetate, citrate, etc., denotes any mixture of free acid and the ionized form(s) (according to pH) in which cations are not specified (see Martin Jr., et al., 1983). Through this technology, it has been possible to transfer genes from mammals into bacteria, causing the microbes to become tiny factories for making (in relatively large quantities) proteins of great economic significance such as hormones (insulin, growth hormones) and interferon (lymphocyte proteins that prevent replication of a wide variety of viruses). follows : 1. Evidently, though cells contain the genetic capacity for the synthesis of an enormous number of different products (proteins), not all of these products are present at any given time, many being selectively activated only upon special occasion and in response to some environmental stimulus. The other inbreeding systems are half sib mating parentoffspring mating, third-cousin mating and so on. DEFB C. How can triploidy leads to seedlessness ? 14.4. Diagram showing the stepwise dismantling of the two subunits of 70S ribosome. Table 3.6. Number of individuals The phenotype and genotype an seeds.
Contents GENETIC ENGINEERING 123 DNA Fingerprinting : The Ultimate Identification Test Every year in court cases all over the world the ability to establish a person's identity is essential for a just decision. Thus, a non-overlapping code means that a base in a mRNA is not used for different codons. In this system, fairly uniform divisions are numbered in order throughout each entire chromosome set from O at the beginning of the X chromosome to 102 at the end of chromosomes (see De Robertis, Jr., 1987). Alkylating agents. Likewise, the sequence of histone H3 from rat differs only in two amino acids from that of peas, out of 102 total amino acid residues. Secondly, f Met-tRNA enters directly into the 'P' site on the ribosome, whereas all other aminoacyl tRNAs enter the 'A' site and their enzymes are synthesized in the free ribosomes in the cytosol. Linkage 84-92 Historical : Sutton-Boveri chromosome theory of heredity, Sutton's views on linkage, chromosome theory of linkage : complete linkage, incomplete linkage; linkage groups; significance of linkage; revision questions and problems; answers to problems. It is supposed to be metabolically and genetically inert because it contains comparatively small amout of the RNA. 3.10). Genetics. Assume that only diploid gametes are formed and that the loci A and B are very close to their respective centromere (chromosome segregation). In Chlamydomonas several mutational defects have been studied in the axoneme of flagellum which may lead to paralysis of the flagellar function (Luck, 1984). How can each be detected : (1) genetically and (2) cytologically ? Lipids Four major classes of lipids are commonly present in the plasma membrane and other membranes : phospholipids (most abundant), sphingolipids, glycolipids and sterols (e.g., cholesterol) (For more details see Chapter 4). Dr. M.S. Swaminathan 2. (a) A terminal structure in which a methylated guanosine is in 5'-5'- triphosphate linkage at the 5' terminus of mRNA. Adsorption. Nuclear Envelope The nuclear envelope (or perinuclear cisterna) encloses the DNA and defines the nuclear compartment of interphase and prophase nuclei. Each hydrogen atom contains one proton (H+) and one electron (e---). 4.28. Cairns developed a technique employing a combination of microscopy and autoradiography that made it possible to visualize the replication of the chromosome of E.coli. The modern version of cell theory states that (1) All living organisms (animals, plants and microbes) are made up of one or more cells and cell products. corpus = body, especially dead body or corpse). More than two alleles per locus; g. Essential fatty acids. This complex spans the inner mitochondrial membrane and is able to translocate protons across it from M side to C side (Fig.10.15). cysteine residue Calcium ion channels (Ca2+closed hydrated + channels) occur in axonal membranes for the entrance of Use of EPR spectroscopy to monitor changes in conformation Ca2+ ions in the cell. Mannosidases : Removal of mannose 15. Energy utilisation by phagocytosis and endocytosis. by the use of reverse transcriptase enzyme from mRNA sequences of eukaryotic cells, yet some 10 to 15% of each cell's RNA may be in the form of tRNA. Which of the following features must an organism possess to make the construction of genetic maps possible ? Here also half of the meiotic products are nonfunctional, one-quarter are functional with a normal chromosome, and one-quarter are functional with a normal chromosome (Fig. Therefore, the cytotaxonomy can be defined as a cytological science which provides cytological support to the taxonomic position of any species. The rapid growth of bone marrow in the skull causes an enlarged tution mutation affect only a particular triplet codon. The acrocentric chromosomes are also rod-like in shape but these have the centromere at one end and thus giving a very short arm and an exceptionally long arm. The presence of plasma membrane can be inferred because protoplasm leaks out of animal cells when cell surface is punctured. Ankyrin tends NH2 to bind to both β-spectrin P P flexible link 106 amino β chain and to the cytoplasmic doP between domains A acid long domain main of a transmembrane junctional protein, called band 3 procomplex tein (Shen et al., 1986). Number of H and L pairs (or of 4 chain units) Sedimentation Quaternary structure Molecular weight k or λ ϵ Contents 240 GENETICS, HUMAN GENETICS, HUMAN GENETICS, HUMAN GENETICS, HUMAN GENETICS fatal form of haemolytic anaemia undergo a reversible alteration in shape when oxygen tension of the plasma falls slightly and they assume elongate, filamentous and sickle-cell forms. Gap junctions. The genes for vestigial wings and genes for white eyes are best examples of Sublethal genes of Drosophila. Sprague forwarded the following explanation for the hybrid vigour: "it appears that hybrid superiority may result from a more efficient utilization of nutrient, increased rate of cell division, greater ability to synthesize required growth substances, and possibily from other as yet unrecognised causes." Some Examples of Heterosis in Plants G.H. Shull (1909) has shown that in corn or maize, hybrids between inbreds derived from same or similar open pollinated varieties. In the step of elongation there are two processes : joining together two amino acids by peptide bond formation, and moving the mRNA and ribosomes with respect to one another so that the codons can be translated successively. L. Hydrolases are commonly secreted by fungi, enabling the organism to degrade and grow on macromolecules it cannot transport into the cell. very little interspersed repetitive DNA; and 6. It occurs mostly in children (in India and other countries such as Italy, Greece and Syria) and is nearly 100 per cent fatal (lethal). This system comprises following structures: (1) The nuclear envelope, consisting of two non-identical membranes, one opposed to the nuclear chromatin and other separated from the first membrane by a perinuclear space (both forming a cisternae), the two membranes being in contact at the nuclear pores; (2) The endoplasmic reticulum; and (3) the Golgi apparatus, which is mainly related to some of the terminal processes of cell secretion. Mode of orientation of adjacent sugar residues in Z-DNA and B-DNA. Fertilization 355–359 External and internal fertilization; fertilization; fertilization; fertilization of the egg; amphimixis; post-fertilization of the egg; amphimixis; post-fertilization; fertilization; fertilization of the egg; amphimixis; post-fertilization of the egg; amphimixi expected according to map distances. Mitochondria contain ribosomes (called mitoribosomes) and polyribosomes. strated by M.F. Lyon of U.K. that whenever the number of X chromosomes (mx-1; i.e., one Barr body in XX females and XXY males; two Barr bodies in XXXY males and XXX metafemales). In moths, sex-linkage was discovered by the pioneer studies of Doncaster and Raynor in 1906. It was demon- Fig. smooth endoplasmic reticulum chloroplast peroxisome showing central crystalloid core in plant and animal cell. 5S On the other hand, in each of the 5S 50 69 80 90 120 B RNA genes which is transcription unit, 50 bp downstream from the start point (Fig. (b) Attachment of activated amino acid to tRNA. In green leaves there are peroxisomes that carry out a process called photorespiration which is a light-stimulated production of CO2 that is different from the general, the DNA replicating enzyme in E. Muscle contraction 2. Mirsky and H. 12 sets (i.e., 12 × 13). Table 15.2. Comparison of some properties of nts and microfilaments (Source : Thorpe, 1984). Type II IF proteins. gumes, tomatoes, yobrain; ghurt. e.g., 8.0µm in the sea urchin eggs and 2.0µm in the eggs of frog. 2N queen bee meiosis N mature ova sperm stored in sperm sac of queen N zygote (haploid) 2N zygote sis ito m 2N female worker bee N haploid ma 2N 2N 2N 2N or percentage of crossing over. Sugino and coworkers have proposed that DNA polymerase a might function at both the leading and lagging strands (since polymerase a has a primase activity), whereas polymerase E and polymerase E and polymerase δ are involved in elongation of the leading and lagging-strands respectively. The Golgi apparatus of animal cells contains phosphatidyl glycerol. FUNCTIONS 1. During the S phase or synthetic phase of interphase, replication of DNA and synthesis of histone proteins occur. If a drastic alteration occurred in the structure of one of the genes for 28S rRNA, do you think that the translation of mRNA into protein would cease ? The signal peptide is then cleaved off, unmasking the thylakoid signal peptide, which initiates translocation across the thylakoid membrane (Fig. These cells are highly differentiated but metabolically inactive and they are non- proliferating cells. Isolated membranes of envelope of chlorophyll pigment and cytochromes but have a yellow colour due to the presence of small amounts of carotenoids. The sterocilia occur in most epithelial cells of the epididymis and macula and crista of the internal ear. Acid phosphatase enzyme is cytochemically marked in the GERL region. It also codes for certain structural proteins of thylakoid membranes. + MAPs Contents CYTOSKELETON : MICROFILAMENTS AND The purines are adenine and quanine and the pyrimidines are the cytosine, thymine and uracil. In comparison to these, other mitochondria (e.g., from Fig. Such eggs develop into the diploid individuals and this phenomenon is known as the meiotic parthenogenesis. Discovered chromosomes act like rivets or "spot welds" to hold epithelial cells together at points of contact. coli as 30 minutes. α-glycerophosphate deh. The individual chromosomes are cut out of the microphotographs and lined up by size with their respective partners. A plane perpendicular to line joining the two central tubules divides the axoneme into a right and a left symmetrical half. During
lignification, lignin is deposited in spaces between the cellulose molecules, making the cell wall much more rigid, and rendering it impermeable. These calves show characteristic head and body features of the brachycephalic dwarfism onion 80 (i.e., the characteristic short broad head, extra long 70 lower jaw, bulging forehead, out of proportion abdomen and short legs). Thus, nucleosomes are the fundamental packing unit particles of the chromatin and give chroma depolymerization (disassembly) of the microtubules appears to be a form of selfassembly. Genetic analysis has revealed that lethal pleiotropic AY allele basically affects the cartilage of mice and cause death. Show how : (1) paracentric inversions can act as crossover suppressors ? The DNA of centromere does not exist in the form of nucleosome (Ris and Witt, 1981). This discovery was extended in the laboratories of Nirenberg and Ochoa. 14.5. Pseudodominance. Even when a single protein may be autoregulated, i.e., the protein itself may inhibit initiation of transcription and high concentrations of the protein may cause less transcription of the mRNA that encodes the protein. The concept of triplet codon has been supported by two types of point mutations: frameshift mutations: frameshift mutations: frameshift mutations: frameshift mutations and base substitution. Growth takes place as an exponent of 2, i.e., 20, 21, 22, 23, 24...cells, and the pattern is represented in the form of a growth curve (Fig. They are infected with a virus that controls the synthesis of toxic viral protein, the paramecin (see Gardner et al., 1991). They are self-reproducing and look like the cytoplasmic inclusions. In the matrix the water occurs in two forms, viz., free water and bound water. To the trans face of Golgi is associated the trans-reticular Golgi, TGN (=transGolgi-network; Alberts et al., 1989) or GERL (=Golgi + smooth ER + lysosomal), in which acid phosphatase enzyme (a characteristic lysosomal enzyme) makes its first appearance. The latter is also called Plantago strain, since this virus was isolated from Plantago lanceolata. Further, the mitochondria for the process of protein synthesis depend partially on the mitochondrial matrix and DNA and partially on the nucleus and cytoplasm of the eukaryotic cells. Lampbrush Chromosomes The lampbrush chromosomes were first observed in salamander (amphibian) ocytes in 1882. Genetic Sex Normal females ordinarily have two X chromosomes; normal males have one X and one Y. The organization of chloroplasts and other plastids is often modifed due to mutation. aleurone Matile (1968) has demonstrated layer that aleurone grains from pea seed contain a wide range of hydrolysis and β-glucanase protease and β-glucanase protease and β-glucanase protein hydrolysis and b-glucanase protease and β-glucanase protein hydrolysis and b-glucanase protease and β-glucanase protease and β-glucanase protein hydrolysis and b-glucanase protein and phosphate, although the pressugars ence of other enzymes such as BG amino acids nucleotides amylase and RNAase suggest that absorptive other cell constituents may also be cells digested. Like small geometric units can be combined into higherorder patterns similarly the properties of a living thing emerge from the precise arrangement of component parts: atoms, molecules, cell parts, cells and so on. The occurrence of such intersexes, super males and super females were explained by him by genic balance mechanism. TYPES OF ENDOPLASMIC RETICULUM Two types of endoplasmic reticulum have been observed in same or different types of cells which are as follows: 1. The dewberry (Rubus caesius) is a tetraploid with 28 chromosomes. Their other identifying features are their double bounding membranes, the possession of plastoglobuli (spherical lipid surplus to current requirements) and an internal membrane fretwork of many discrete internal vesicles. Note the tiny fibrils of RNA and proteins attached to the loop. During exocytosis the vesicle membrane is incorporated into the plasma membrane. While the 80S ribosomes contain less RNA (40 to 44% RNA and 60 to 56%), e.g., yeast ribosomes have 40 to 44% RNA and 60 to 56%). NUMBER The mumber of the chromosomes is constant for a particular species. 4.12. But his crude microscopes did not permit the observation of any intracellular structure. 18.11. Yellow Round - 9 3. The complex loci were discovered when techniques became available in particular organisms for exploring the fine structure of the gene. Serebrovsky's contact first Fig. In Xenopus egg 25 pg of extra DNA with 2, 000,000 rRNA genes is accommodated by between 1000 to 1500 nucleoli. Essential for synthesis of germinated pulses, DNA. The phages have specific hosts and they are of variable shapes, sizes and structures. Meiotic division occurs immediately after fertilization; in this case, only the egg is diploid. adjacent cells. Both S and R forms occur in several types and are designated as S-I, S-II, Live mouse S-III, etc., and R-I, R-III, etc., and R-I, etc., and R-I rare 5'-5' linkage. Mode of the initiation of DNA replication at ori C of e. Skin colour, can you expect children (i) with darker skin ? Example. Table 18.2. Duration in minutes Organism Prophase Metaphase Telophase 1. The latter are called ultrabar (Bu) and in homozygous (BuBu) condition they possess only 25 facets. This enzyme is called polynucleotide phosphorylase. The various epistatic ratios can be summarized in the following table : Table 4-13. Contents CYTOPLASMIC MATRIX 71 A solution is a mixture of liquid called solvent and any chemical substance in solid or liquid state, called solute. The discovery of the inter-allelic genetic interactions has been made after Mendel and they can be best understood by considering the way by which a phenotypic trait is governeed by a gene. Using A and a to represent the dominant (normal = melanin production) allele and the recessive (albino = no melanin production) allele respectively, the following three genotypes and two phenotypes are possible: Genotypes AA (Homozygous dominant) Aa (Heterozygote) aa (Homozygous dominant) Aa (Heterozygote) aa (Homozygous recessive) Phenotypes AA (Homozygous recessive) Phenotypes are possible: Genotypes AA (Homozygous dominant) Aa (Heterozygote) aa (Homozygous recessive) Phenotypes are possible: Genotypes AA (Homozygous dominant) Aa (Heterozygote) aa (Homozygous dominant) Aa (Heterozygote) aa (Homozygous dominant) Aa (Heterozygote) aa (Homozygous recessive) Phenotypes AA (Homozygous dominant) Aa (Heterozygote) AA (He the synthesis of (black) pigment. In these methods, the specimen is neither sectioned nor stained. An exponential growth rate increases accordingly. Humans have 46 chromosomes whereas the great apes (Chimpanzees, Gorillas and Orangutans) have 48 chromosomes. The autopolyploids may occur in nature or may be produced artificially. With accumulated crossover data, the distance between the two sites was placed at about 0.01. Distinguish among these three concepts : cistron, muton and recon. The hybridized bands are found out by autoradiography. Correlated with this is the observation that loss of sialic acid is a signal for removal and destruction of an erythrocyte by interior the spleen and liver. 15.8. Artificial synthesis of a hexaploid triticale. The knobbed ends of the chloroplast ATP synthesis of a hexaploid triticale. from the membrane of each mitochondrial crista. Table 5-4. Behaviour of a chromosome at meiosis (after monosomics are known. Energy for this union is supplied by the hydrolysis of a molecule of GTP which was originally brought to the initiation complex in conjunction with the initiation factor IF2. In some centrioles the triplets are parallel to one another but turn in a long-pitched helix with respect to the cylinder axis (Fulton, 1971). F1 hybrids, he found certain fertile plants which were found to contain 36 chromosomes. In it, hydrolysis of one ATP molecule transports two Ca2+ ions in the counter-transport of one Mg2+ ion. 5.16. Nobel Laureate Emil Fischer (1902) discovered that all proteins consist of chains (linear sequence) of smaller units that he named amino acids. A gene is the fundamental biologic unit, like the atom which is the fundamental
biologic unit, like the atom which is the fundamental biologic unit, like the atom which is the fundamental biologic unit, like the atom which is the axis ently this hypothesis has become obsolete, but still holds interest. In a region 11 cap poly (A) to 30 nucleotides upstream of the site of added to 3' end poly(A) addition, there is a sequence AAUAAAA (in all higher eukaryotes exFig. Glutamic acid and aspartic acid each have an extra carboxyl (- COOH) group. The genetic code is commaless, Fig. The inheritance pattern of the trait of sickle-cell anaemia in humans presents an example of various genetical phenomena such as codominance, lethal effect, pleiotropism and polymorphism. What was the genotype of the parental male ? Subsequent generations produced greater numbers of DNA molecules Contents 30 MOLECULAR BIOLOGY that banded at the ''light'' (14N-containing DNA) position in the density gradient. A prokaryotic cell is essentially a one-envelope system organized in depth. What is endoplasmic reticulum ? The cytological examination of sex in Drosophila. Contents 72 MOLECULAR BIOLOGY (i) Frameshift mutations. Contents 44 MOLECULAR BIOLOGY C H A P T E R 5 Non-Genetic Ribonucleic Acid (RNA) and Transcription I n the organisms (viz., prokaryotes and eukaryotes), where coded genetic informations are contained in the DNA molecule, different genetically controlled functions of their cells are performed by a different kind of nucleic acid, called non-genetic ribonucleic acid (RNA). In the ribosomes which remains attached with the membranes. Each PPP OH gene is transcribed into a long RNA 13,000 nucleotides molecule (which varies in size from degraded regions of RNA 40S to 45S according to species) nucleotide sequence processing which will eventually be processed 18 S rRNA. (b) Double-stranded DNA. On the other hand, in an anisotropic material the velocity of propagation of polarized light varies. Later on, several cases of mutations have been reported in a variety of microorganisms (e.g., bacteriophages, bacteria (Escherichia coli), Neurospora, etc.) and animals, i.e., rodents, fowls, man, etc.). 14.8. Origin of an inversion in a bar eye phenotypes and + + tromere) is also formed and since it the wild type (B /B) in chromosome. CHAND AN ISO 9001 : 2000 COMPANY 2005 S. In later stages, the nuclei of maturing reticulocytes degenerate but the mRNA exists up to 2 days for prolong utilization in the synthesis of globin. The inheritance of X- or Z-linked and holandric genes is called sex-linked inheritance. Thus, pseudoalleles are those genes which are located almost at the same place on the linkage map but show recombination, indicating thereby that although they are functionally allelic, structurally they are functionally allelic. Morphogenesis. 17.3. The base of the dynein molecule binds tightly coordinated movements in Euplotes even after to an A tubule in an ATP-independent mancomplete dissection of the neuro-motor fibres. 13.2B). Most of these enzymes are found in the endoplasmic reticulum and Golgi apparatus. They contain pigments and may synthesize and accumulate various substances. % observed double crossovers % expected double crossovers % e Coincidence + Interference = 1.0 When interference is complete (1.0), no double crossovers will be observed and coincidence becomes zero. Cytoecology (Cytology and Ecology). Describe two theories of chiasma formation ? In this chapter the physical and chemical nature of the cytosol will be described. Describe two theories of chiasma formation ? last two decades. RNA methylase enzyme which transfers methyl groups to the nitrogen bases, occurs in the nucleolus of some nucleolus cells. Given a pericentric inversion heterozygote with one chromosome in normal order (1234,5678) and the other in the inverted order (15.432678), diagram the first anaphase figure when a four-strand doublecrossover occurs involving the regions between 4 and he centromere (.) and between the centromere and 5. astral microtubule spindle pole centrosome half spindle pole centrosome kinetochore microtubule spindle pole centrosome half spindle pole centrosome half spindle pole centrosome half spindle pole centrosome kinetochore microtubule spindle pole centrosome half cells but especially abundant in the SER. Episome. The charges of atomic particles remain so balanced that normal atoms are electrically neutral. a Drosophila. The first is the irreversible acetylachromatin tion of the amino-ter- chromatin reconstituted minal series of his- with nonhistone with nonhistone tones H1, H2A and chromosomal chromosomal mRNA proteins from H4. Guanylase cyclase 13. They lack introns and contain many stop signals so that RNA polymerase molecules fail to move very far along them. Accordingly, he recognised three kinds of blood types or blood OH OH groups : type A, type B, and type O. 2.4. The preparative ultracentrifuge. The work was done at Cambridge under the direction of J.C. Kendrew (1961). Thus, individual single genes (viz., sk or ts) can impose bisexuality in maize. Diploid. Describe the historical growth of molecular biology. The polysaccharide chain exists in the form of a left-handed helix containing six glycosyl residues per turn (Fig. Weibel et al., 1969, have calculated that the total surface of ER contained in 1ml of liver tissue is about 11 square metres, two-third of which is of rough type (i.e., RER). This rate is reduced in succeeding generations since some of the alleles are now already identical. Tubulin is an acidic protein with a molecular weight of 55,000 and a sedimentation constant of 6S. The rest of the Golg apparatus becomes reduced and discarded from the sperm as Golgi rest. Bidirectional replication origin of replication fork Fig. These considerations led them to construct a double helix model for the molecular structure of DNA molecule. It affects two characters :

coat colour and survival. Plumage colour in mallard ducks is dependent upon a set of three alleles : MR for restricted mallard, and m dusky mallard. Diplotene or Diplonema. It involves a study of the role of cytoplasm and its organelles (particularly chloroplasts and mitochondria) in heredity. DNA polymerase-III or Poll II enzyme plays an essential role in DNA replication. 18.7) However, typically microtubule disassemble at kinetochores, poles or at both sites is probably necessary for equator- to- pole movement. In this case, germ cells within the larvae develop parthenogenetically into parasitic larvae which feed on the mother larvae. Proposed protein-lipid-protein structure (sandwich model) of plasma membrane. intron is unique 3' inner fragment What are transcription factors? Used antibodies coupled to fluorescent dyes to detect cellular antigens. Spermiogenesis. D-hexose permease, most probably operates in the following way : the binding of glucose to a site on the exterior surface of the permease triggers a conformational change in the polypeptide. Type of trisomic Somatic chromosomes Metaphase I configurations 1 1. Contents CELL 65 Propulsion by both cilia and flagella is caused by bending at their base. (iii) In Z-DNA, the adjacent sugar residues have opposite orientation, while in B-DNA they have same orientation. Once phosphorylated, the glucose no longer leaves the cell; moreover, the concentration of the simple glucose in the cell is lowered. No initiation factors are needed for the initial contact between ribosomes and mRNA. The external genitalia are ambiguous; ovaries are present but are immature or rudimentary. Table 4-1. For example, streptomycin and neomycin bind to a particular protein in the 30S particle and thereby prevent binding of tRNAf Met to the 'P' site; the tetracyclines inhibit binding of charged tRNA; lincomycin causes premature chain termination; erythromycin binds to a free 50S particle and prevents formation of the 70S ribosome major groove minor groove major groove major groove major groove major groove major groove B-DNA Z-DNA B-DNA Fig. Ph. 2401630 613-7, M.G. Road, Ernakulam, Kochi-682 035. Some 10 per cent of H2A molecules are in the form of A24 and these specialized histories seem to be confined to interphase chromatin, disappearing as the chromosomes condense Specific stains are also used for other lysosomal enzymes such as B- glucuronidase, aryl sulphatatase, N-acetyl-B-glucosaminidase and 5-bromo-4-chloroindolacetate esterase. 3 : 1 : 6 : 2 Ratio When the F1 dihybrids have dominant-recessive alleles at one gene locus and recessive alleles at one gene locus. phenotypic ratio of 3:1:6:2. This hypothesis states that all cellular membranes have an identical trilaminar structure (or dark-light- dark or railway track pattern, see Thorpe, 1984). Feature 1. 8.2). A child with thalassemia has a single base substitution of a gene for haemoglobin. For example, in a random copolymer using U and A nucleotides eight triplets are possible, such as UUU, UUA, UAA, UAU, AAA, AAU, AUU and AUA. For this purpose, a test with the BKM-DNA probe (= banded krait minor satellite DNA) earlier used for identification of sex chromosomes (by Dr. Lalji Singh) has been found to cost one-tenth of the cost of tests used in Europe and U.S.A. Paternity dispute cases are much more common in India and most of them are referred to CCMB for DNA evidence. 2 B. When a mixture of such small mRNA molecules-ribosomes and amino acid-tRNA-amino acid complexes are incubated for a short time and then filtered through a nitrocellulose membrane, then the mRNA-ribosome-tRNA-amino acid complex is retained back and rest of the mixture passes through the filter. 13.4 A), an asymmetric karyotype (e.g., Ginkgo biloba, Fig. Thus, tasters of PTC may have two genotypes (tt). The chromatin in mitotic chromosomes is transcriptionally inert : all RNA synthesis ceases as the chromosomes condense. When Contents SEX LINKED INHERITANCE 137 these red eyed female individuals of F1 are intercrossed, the female population of F2 generation is found to include 50 per cent white eyed flies. There are variations available with respect to the dissolution of nuclear envelope and the nucleolus. He continued to hold this post until 1868 when he was elected abbot. Contents GENETICS, HUMAN GENETICS and Evolution 79-92 Mendelian population; gene pool and gene frequency : two models of gene pool structure— classical hypothesis; chance mating or panmixis; HardyWeinberg law in calculating gene frequency or deviations from Hardy-Weinberg equilibrium : selection, attricial selecti revision questions. The process of development of a bud into an adult animal is called blastogenesis. Expansion of binomial (1/2+1/2) Number of alleles 1 2 3 4 5 6 7 8 1:1 1:2:1 1:3:3:1 1:4:6:4:1 1:5:10:10:5:11:6:15:20:15:6:11:7:21:35:35:21:7:11:6:15:20:15:6:11:7:21:35:35:21:7:11:6:15:20:15:6:11:7:21:35:21:7:11:6:15:20: being cultured. Contents 254 GENETICS, HUMAN GENETICS AND EUGENICS C H A P T E R 20 Transposable Genetic Elements (Jumping or Mobile Genes) M uch of the investigations of the classical genetics have been devoted to the localization of genes on chromosomes. A widely held theory concerning their origin proposes that they were once infectious endosymbiotic prokaryotes that evolved such a dependence on the gene products of the host that they are no longer able to function autonomously. Those carrier proteins which simply transport a single solute from one side of the membrane to the other; are called uniports. existing wall plasma membrane exracellular space cellulose synthase cytosol microtubule attached to plasma membrane Fig. Adrenal gland 10. missing C 1. The bacterial plasma membrane resembles with the inner mitochondrial membrane fig. consider the general features of different types of eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which are as follows: Cell Shape The basic shape of the eukaryotic cells which 800 base pairs mRNA for lac genes (z, y, a) 360 3800 tetramer 152,000 1021 125,000 tetramer 500,000 repressor β- galactosidase amino acids 275 30,000 daltons (MW) dimer daltons 60,000 trans. This inter-cellular space is uniform and contains a material of low electron density which can be considered as a cementing substance. Dual pigment systems. The sedimentation coefficient of the ribosomes is determined by the various optical and
electronic techniques. These can be due to any one of the following two reasons : (i) A sex reversal gene SRY located on the Y chromosome leads to XX males and XY females. Some plasmids are merely bacteriophage (viral) DNA which may alternatively be incorporated within the chromosome. Similarity in the process of protein synthesis. After protecting the groups, reaction between a nucleotide with protected 3' end another nucleotide with protected impossible. The inbreeding coefficient can be calculated as $FE = \frac{1}{2}$ RGH (R = the coefficient of relationship between the full sibs G and H) $FE = \frac{1}{2}$ (0.5) = 0.25 FA = $\sum (\frac{1}{2})n$ (1+FE (ancestor)) or FA = (\frac{1}{2})3 (1+0.25) = 0.156 3. 1962 J. Such a result immediately ruled out the possibility that DNA replication was conservative, because the conservative replication would have vielded two DNA bands in the density gradient for generation 1 (i.e., F1 cells). (iv) When the eggs are pricked by the fine glass needles the development of This whiptail lizard reproduces by young ones takes place parthenogenesis. This transitionally substituted DNA molecule has altered coding at a point and results in recognizable mutation. nitrous acid causes transitional mutation due to oxidative deamination of DNA bases. Nucleic acids RNA DNA 3-4 < 0.02-.01 227 Components (per cent) Starch, sugar, phosphates 3-7% Chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll a 75% Chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% Xanthophyll 75% Carotene 25% ULTRASTRUCTURE A chlorophyll b 25% three main components (Fig.11.3): 1. 8.7. Feedback inhibition in E.coli. 1.2. Impact of genetics on different interacting Anyhow in modern era the genetics has areas of human ventures (after Suzuki et al., 1986). The channel has a pore about 2 nm and is formed by two hexamers (six subunits) traversing the lipid bilayers of two plasma membranes (after De Robertis and De Robertis Jr., 1987). CHEMICAL COMPOSITION The gross chemical composition of the mitochondria varies in different animal and plant cells. Further upstream is another sequence called CAAT box) which being necessary for initiation, is conserved in some promoters (e.g., β-globin gene). Locations of electron transfer intermediates in the thylakoid lamella (membrane) and enzymes involved in ATP synthesis and proton (H+) transport have been tentatively depicted (after Sheeler and Bianchi, 1987). Ribosomes are composed of ribonucleic acid (RNA) and proteins and they are the sites of protein synthesis. It is a particular problem in C3 plants that are more depicted (after Sheeler and Bianchi, 1987). readily affected by low CO2 tensions; C4 plants are much more efficient in this regard (see Chapter 11). Furthermore, the spread of monoculture (the extensive dependence on a single plant variety) left vast areas at the mercy of some newly introduced or newly evolved form of pathogen (e.g., plant disease) or insect pest. The enzymatic proteins perform catalytic function in various cellular chemical (metabolic) reactions and causing the splitting or union of various molecules. A family pedigree for polydactyly has been illustrated in Fig. Inheritance of the shape of the comb in chickens. The cell has at least 20 aminoacyl synthetase enzymes for the 20 amino acids. Another example includes hereditary enamel hypoplasia (hypoplasic amelogenesis imperfecta), in which tooth enamel is abnormally thin so that teeth appear small and wear rapidly down to the gums. In contrast, if lipid bilayer's fluidity is increased, the membrane's lateral diffusion Lateral shift (~10-6 sec) CYTOSOL flip-flop (rarely occurs) The possible movements of phospholipids in a membrane. 9.14). It shows that gene for red colour Incomplete dominance shown in the flower colour of could not completely dominate the gene snapdragons. A rod links the 'rotor' to a hook and flagellum, thereby causing them to rotate. The prospherosomes grow in size to form spherosomes. 4.6). Later, Lyon (1972) This child is suffering from Lesh - Nyhan syndrome Contents DETERMINATION OF SEX AND SEX DIFFERENTIATION confirmed the existence of Barr body in normal females (XXX) and in Klinefelter males (XXX). Hair 2. Membrane 1. For example, the conversion of pyruvic dehydrogenase acid to acetyl CoA proceeds in three chemical steps, all of + coenzyme A which take place on the same large multienzyme complex (CoA-SH) (i.e., pyruvate dehydrogenase). The first sign of cleavage in animal cells is puckering and furrowing of the plasma membrane during anaphase. All the raw materials for RNA replication and capsomere biosynthesis are derived from the host cell. Polygamy. A nullosomic diploid often does not survive, however, a nullosomic polyploid (e.g., hexaploid wheat, 6x-2) may survive but exhibit reduced vigour and fertility. Base ratios of RNA from various sources (as molar percentages) (From, Hall et al., 1974). There are about 50 physical characteristics shown by DS infants soon after birth. Posttranslation Control (Feedback Inhibition or End Product Inhibition) The expression of genes also can be regulated after proteins have been synthesized. Thus, in effect the phospholipid is blush and help keep citrus fruit juicy. Somatic mutations. The yeast cells, reticulocytes or lymphocytes, meristamatic plant tissues, embryonic nerve cells and cancerous cells contain large number of ribosomes which often occur freely in the cytoplasmic matrix. Adenosine triphosphate (ATP), 8. And each gene has definite order and location in a linkage group or chromo- Genetic map of chromosome 10 of corn. Component Cations : Na+ K+ Mg2+ Ca2+ H+ Anions* : Cl- * Intracellular concentration (mM) 5-15 140 30 1-2 4×10-5 (pH 7.4) 110 Since the cell must contain equal positive and negative charge (i.e., be electrically neutral), the large deficit in intracellular anions reflects the fact that most cellular constituents are negatively charged, e.g., HCO3---, PO43--, proteins, nucleic acids, metabolites carrying phosphate and carboxyl groups, etc. Linkage map. These RNA molintron ecules (= ribozymes) act only themselves and not on other molecules. The F1 hybrids were found to have yellow round seeds. The standard designation for the short arm of a non-metacentric chromosome is p, that for the longer arm is q. (b). The type of cleavage is, therefore, under the influence of the genotype of the maternal parent. P: X 1 TT Taster [Marriage of F1 heterozygote (Tt) and a heterozygote for taster (Tt)] F2 : 1TT : 2 Tt : 1tt 3 Taster : 1 Non-taster Fig. Since in protein synthesis the peptide chain always grows in a sequence from the free terminal amino (-NH2) group towards the carboxyl (-COOH) end, so the function of formylmethionine-tRNA is to ensure that proteins are synthesized in that direction. When the incubation in the 14N-medium was carried out for two generations of time (i.e. generation 2), two DNA bands were formed — one at the same density position as the DNA from cells grown exclusively in 14N medium (i.e., light controls) and the other of Cells from a clone of E.coli. 3.21. The gel is autoradiographed to determine the sequence from positions of bands in four lanes. (ii) Hormones and freemartin. Explain why, in human families, many traits, e.g., albinism, blue eye, and phenylketonuria, skip generations, while traits such as polydactyly, free earlobes, and A and B blood groups do not ? V. Partial paralysis of smooth muscle of gastrointestinal tract; paralysis of skeletal muscles, atrophy of limbs. 10.5. A monohybrid cross between chinchilla and Himalayan rabbits. Moreover, now the solution has stiffened and becomes semisolid and is called a gel. Cuenot in 1905. coli 3' - OH nucleated red blood cells and lymphocytes (which are inactive in transcription). For example, the chloroplasts of certain algae and Euglena contain 70S type small ribosomes and "naked" chromosomes or DNA which is circular. The influencing of more than one trait by a single gene. nation; B—During germination, gibberellins (G) pass from the embryo to the aleurone layer, where the de During germination of barley novo synthesis of hydrolytic enzymes is induced. It is the particular chemical structure of the R-group that distinguishes one amino acid from another. D.S. Hogness, I.B. David and N. Development Result from a single fertilized ovum They have the same heredity in similar environments Skin grafts between the monozygotic twins are not rejected Result from two fertilized ova 2. 11.12). A baby's DNA holds information about any genetic dis- However, in future following euphenic measures can get rid ease. for the oxidation of pyruvate and fatty acids and for the citric acid cycle or Krebs cycle. has revealed the fact that the cell wall of Gram-negative bacteria comprises the following two layers : 1. The chromosomes at this stage take up a specific orientation inside the nucleus; the ends of the chromosomes converge toward one side of the nucleus, that side where the centrosome lies (the bouquet stage). Authors wish to express their thanks to Shri Ravindra Kumar Gupta and Shri T.N. Goel of M/s. There are three types of secondary protein
structure (e.g., α-keratin and collagen); (2) Pleated sheet structure (e.g., fibroin of silk); and (3) Extended configuration (e.g., stretched keratin). 5' base of codon 3' base of anticodon C A U G I G U A or G U, C or A U, C or A Contents MOLECULAR BIOLOGY 76 REVISION QUESTIONS AND PROBLEMS 1. Shift translocation. 4.1). The meiotic crossing over is universal in its occurrence and is of great genetic significance. Recent findings have indicated that control of synthesis of exact amount of proteins at the proper time is achieved mainly through blocking the translation of mRNAs for ribosomal proteins, when there is an excess of free ribosomal proteins. More fragments are expected from Hae III, because the probability of a specific four base sequence is greater than the probability of a specific six-base sequence if the nucleotides are distributed along a chain in essentially a random order. Pairs idiogram (Gr., idios = distinctive; gramma = of homologous chromosome (i.e., broken segment becomes attached to a homolog which, thus, bears one block of genes in duplicate); 3. Both processes are subject to different modes of regulation, the former largely dependent upon the availability of the ribosomes. Cell growth. The other B+/B+ half of the gametes are functional : 3 5 one-quarter have the normal chromosome order, one-quarter have the inverted arrangement. Moreover, micromanipulators, micromanometric methods (e.g., by Cartesian diver balance of Zeuthen weight of a single amoeba can be determined), chromatography, electrophoresis, spectrophotometry, etc., have provided new opportunities to cell biologists to investigate minute details of cell and its components. Given seed from a male sterile line of corn, how would you determine if the sterility was genic or cytoplasmic ? Aliphatic amino acid I. Working with Drosophila chromosomes, they located 2000 genetic factors on the four chromosomes and in interphase nuclei and it probably represents the natural conformation of transcriptionally inactive chromatin. As the G2 phase draws to a close, the cell enters the M phase. The cortical granules are surrounded by the unit membranes and are originated from the Golgi apparatus. Complementation means that in allelic forms there will be lack of complementation due to which F1 individuals will not be wild type. Insertion sequences have been found in bacteriophages, in F factor plasmid and many bacteria. The operons of genes specifying the respective catabolic enzymes are wild type (i.e., unmutated). 14.21. Sutton and T. Contents 118 GENETICS, HUMAN GENETICS AND EUGENICS Table 10-1. Both classes of proteins are synthesized in the ER and transported lysosomal hydrolase precursor from RER receptor dependent transport binding of H6P receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor addition of phosphate transport vesicle M6P cis Golgi dissociation at acidic pH late endosome p receptor vesicle M6P cis Golgi dissociation at acidi dissociation at a resembles the cap of species which provides the nucleus (Fig. An average of 22.2 dots per kernel was observed in the reciprocal cross, How can these results be explained ? When such new (foreign) DNA fragments are introduced into relevant host cells, such cells are said to be transformed (in case of bacteria) or transport (in case of plants and animals) and the process is called transformation. Monoaminomonocar- 1. Communicating junctions (ii) Belt desmosomes (v) Hemidesmosomes (v) Hemidesmosomes (vi) Chemical synapsis 1. Gene therapy basically involves the following two methods : (1) Targeted gene modification. 2.1. Griffith experiment that demonstrated the principle of from pneumonia and died. Contents GENETICS, HUMAN GENETICS 62 ANSWERS TO PROBLEMS 4. B 2. They are seen in chemoautotrophic bacteria with high rates of aerobic respiration such as Nitrosomonas, and in photosynthetic bacteria such as Rhodopseudomonas where they are the site of photosynthetic pigments. Keratin filaments are always heteropolymers formed from an equal number of subunits from each of these non-permissive cells, the viral chromosome either becomes integrated into genome of the host cell, where it is replicated along with the host chromosome or it forms a plasmid — an extrachromosomal circular DNA molecule — that replicates in a controlled fashion without killing the cell. (singed = burned, charred or couterised). Cytoplasm The plasma membrane is followed by the cytoplasm which is distinguished into following structures : Contents CELL 59 A. PAR termine the somatic SRY characters of the individuals are known as autosomes (A). Contents 98 GENETICS, HUMAN GENETICS AND EUGENICS KINDS OF CROSSING OVER According to the number of chiasma following types of crossing over have been described. The molecules of the polysaccharides are of colloidal size OH H OH H having high molecular weights. The RNA Polymerase Enzyme In E. The acetylCoA formed by this process is, eventually, transported to the mitochondria where it enters into the citric acid cycle. plasmic reticulum. The eggs with evenly distributed yolk contents in the ooplasm are known as the homolecithal eggs, e.g., eggs of echinoderms. If no wild type appears, a and b are allelic. A growing cell not only increases in size but increases in weight too. designated tRNAf Met. receptor site is located adjacent to each producer gene and is comparable to operator gene and is comparable to operator gene of prokaryotic operon; activator RNA mRNA 3. They use their own genetic programme for reproduction but rely on the raw materials (i.e., amino acids, nucleotides) and biosynthetic machinery of the host cells (i.e., ribosomes, tRNA, enzymes) for their multiplication. cytoplasm Cellulose at these "terminal complexes". he science of heredity or genetics is the study of two contradictory aspects of nature : heredity and variation. The sperms and eggs of outstanding persons can be stored for future use by quick freezing and storing them in deep freeze. Thus, the genotype AA BB or Aa Bb and AA bb or Aa bb produce the same phenotype whereas the genotype aa BB or aa Bb and aa bb produce two additional phenotypes. How can these results be explained ? He refined the Golgi's method of staining and became a pioneer student of the nervous system. Therefore, it is clear that mechanisms do exist for inactivating sequences even those regarded to be constitutive in normal cells. Further the gene locus is from the centromere, the greater is the opportunity for crossing over to occur in this region. Most ciliary rootlets are strirootlets ated, having a regular crossbanding with a repeating peA rootlet B riod of 55 to 70 nm. Some species have diffuse centromeres, with microtubules attached along the length of the chromosome, centromere which are called holocentric chromosomes. They have tertiary protein structure and are usually functional proteins, e.g., enzymes, hormones and immunoglobulins (antibodies). Because the DNA synthezised by E.coli. (d) The appearance of a rare wild-type recombinant indicates that s and r occupied different sites within the cistron. Got Nobel Prize for their studies on the metabolism of cholesterol and fatty acids. are no central microtubules in the centrioles and no dynein arms like the cilia; however, triplets are linked by connectives. It provides the cytological explanations of different genetical principles. Glycogen molecules exist in a continuous spectrum of sizes, with the largest molecules containing many thousands (e.g., 30, 000) of glucose or glycosyl units. Contents 32 MOLECULAR BIOLOGY electron microscope, eukaryotic chromosomes are found to contain multiple expanding replication eyes, in contrast to single eye of the prokaryotic DNA. 16.4 for A-T to GC and G-C to AT. The form of ubiquinones present in mitochondria is often called coenzyme Q10 (CoQ10 or Q). Moreover, Naegeli's negative approach in discouraging Mendel to pursue the right path becomes apparent in his insistent suggestions to Mendel to test his genetical principles on 26 species of hawk-weed (Hieracium), for which he supplied seed and plants. Contents GAMETOGENESIS 351 OOGENESIS The process of occurs in the cells of the germinal epithelium of the ovary, such cells are known as primordial germinal cells. 3.7. The influenza viron (after Watson et al., 1987). This observation also explains the phenomenon of metabolic coupling lipid bilayer between cells, i.e., cells can transfer to neighbouring cells, cell 1 the molecules which cannot be synthesized by the recipient cells. Each mating type is physiologically incapable of conjugating with its own type, but may exchange genetic material with any of the seven other types within the same variety. 5.3). Contents 218 CELL BIOLOGY (iii) Because the early anaerobic prokaryotic cell outer mitochondrial DNA membrane resembles with the plasma membrane, therefore, it may formation of nucleus be assumed that the mitochondrial matrix and the inner mitochondrial
membrane of the lacking mitochondrial eukaryotic cell engulfs cellular original membrane represent the symbiont which aerobic prokaryote anaerobic might be enclosed by eukaryotic cell the membrane represent the symbiont which aerobic prokaryote anaerobic might be enclosed by eukaryotic cell the membrane of the lacking mitochondrial membrane represent the symbiont which aerobic prokaryote anaerobic might be enclosed by eukaryotic cell the membrane represent the symbiont which aerobic prokaryote anaerobic might be enclosed by eukaryotic cell the membrane of the lacking mitochondrial membrane represent the symbol. (outer aerobic cell by endocytosis mitochondrial mem- eukaryotic brane). In man, the Y-linked or holandric genes such as ichthyosis hystrix gravis hypertrichosis (excessive development of hairs on pinna of ear) are transmitted directly from father to son. She was diagnosed early and put on the PKU diet. The end of the polar migration of the daughter chromosomes marks the beginning of the telophase; which in turn is terminated by the reorganization of two new nuclei and their entry into the G1 phase of interphase. 3.14) 3. Lack of the chloroble pigment in the retinal cones results in an inability to discriminate green colours. In an eukaryotic system, what barriers would an extra cellular vertebrate oocytes and polytene chromosomes of certain dipteran insects. (a) when a pure white strain is crossed to a pure red strain and produces an all white F1 and an F2 with 12/16 white, 3/16 red and 1/16 yellow. Any increase in protoplasm requires the synthesis of cell components such as mitochondria, cell membranes, enzymes and other proteins. For example, in some cells, mitochondria form long moving filaments or chains, while in others they remain fixed in one position where they provide ATP directly to a site of high ATP utilization, e.g., they are packed between adjacent myofibrils in a cardiac muscle cell or wrapped tightly around the flagellum of sperm (Fig.10.2). HISTORICAL In 1760, Joseph Kolreuter inadvertently reported first case of continuous variation due to quantitative trait. In turkeys 80 per cent of incubated eggs show early cleavage stages. 14.1. Various components of prokaryotic (70S) and eukaryotic Recently, it is discovered that the restricted availability of histone message is not achieved as a result of transcriptional control alone but by differential breakdown rates for histone message. 14.15. cleavage with one or more restriction enzyme electrophoresis gel with fragments fractioned by size DNA molecule transfer to nitrocellulose filter nitrocellulose filter with DNA fragments positioned identically to that in the gel weight agarose gel containing DNA fragments absorbent tissues nitrocellulose filter filter paper wick hybridize with labelled DNA probe autoradiograph showing hybrid DNA fragments absorbent tissues nitrocellulose filter filter filter paper wick hybridize with labelled DNA probe autoradiograph showing hybrid DNA fragments absorbent tissues nitrocellulose filter filt fibrillar in nature (Fig. With each transfer to a lower energy level, the electrons release some of their potential energy. Eyes or Iris Contents 30 GENETICS, HUMAN GENETICS (ii) Abnormal characters. At some step of this process, the lipid-linked oligosaccharide is flipped from the cytosolic to the luminal side of the ER membranes DNA isolated from cells grown for one generation of time in the 14N medium had a density intermediate to that of the DNA from cells grown only in 15N-containing medium (identified as generation O; Fig. 17.9). Water also has a high heat of vaporization. A plasmodesma is a roughly cylindrical, membrane-lined channel with a diameter pectin molecule of 20 to 40 nm. The molecules of lactose are composed of two monomers, viz., D-glucose and D-galactose. The paper chromatography method is used for the separation of amino acids, nucleotides and other lower molecularweight metabolic products. 10 nm. A—At low magnification; hypothesis postulates that each loop B—Loop magnified. In addition to the normal set of lysosomel hydrolases, macrophage's ly dimensional clover-leaf anticodon loop model. presence of synthetic polynucleotides (mRNAs) which could be made with the help of polynucleotide phosphorylase enzyme. The clathrin-coated vesicles are known to play a role in intra-cellular traffic of membranes and of secretory products, i.e., between ER and Golgi, as well as, between GELR region and the endosomal and lysosomal compartments. The bivalve molluscs have the round sperm nucleus. For cells without cell walls (e.g., mycoplasma and animal cells), plasma membrane forms the cell surface. Many monogenically inherited pairs of traits; c. Most of autosomal aberrations have been discussed in Chapters 14 and 15. Briefly discuss the significance and role of polyploidy in evolution. Honey bee and other social insects also control their sex ratio by parthenogenesis. Laderberg got Nobel Prize for the discovery of bacterial recombination. (ii) Secretory vesicles are varied-sized membrane-limited vesicles are varied-sized membrane-limited vesicles which discharge from margins of cisternae of Golgi. The insertion of proteins into a proteins into ER membranes occurs at the level of RER. bacteriophage having typical phage properties and could be regarded as a giant transposon. Two pairs of genes which interact to affect size and shape of comb but are independently transmitted exist in chicken. Nitrogen base Base + deoxyribonucleoside Deoxyribonucleoside + phosphoric acid = deoxyribonucleotide Abbreviation for nucleotide 1. One possible euphenic netic information will be needed to prevent measure for the future would be to supply the known missing its abuse. The master copy of the gene does not take part in RNA synthesis, but the slave copies of the gene existing in the loop have a role in transcription. If an autopolyploid, complex synaptic associations involving chromosomes (eight chromatids) will be evident. It also involves the preparation of linkage maps of chromosomes. DEOXYRIBONUCLEIC ACID OR DNA Highly purified DNA, extracted from a wide variety of plants, animals, bacteria and viruses, has been found to be complex macro-molecular or polymeric chemical compound which contains four kinds of smaller building blocks (monomers) called deoxyribotids or deoxyribotucleotides. (B) Conjugated proteins. Schematic model of a portion of a Golgi complex from an epithelial cell Contents GOLGI APPARATUS 167 The Golgi controversy. for white colour as shown in the figure 3.5. In such a case, F2 phenotypic ratio and genotypic ratio are the same, as follows : F2 phenotypic ratio = 1 Red : 2 Pink : 1 White F2 genotypic ratio = 1 Red : 2 Pink : 1 White F2 genotypic ratio = 1 RR : 2 Rr : 1 rr 2. As we already know that in a heterozygous individual, the harmful recessive 0 1 2 3 4 5 6 7 8 alleles remain masked by their normal dominant generations (inbreeding) alleles. It is called Robertsonian translocation. Polyteny of giant chromosomes is achieved by replication of the chromosomal DNA several times without nuclear division (endomitosis); and the resulting daughter chromatids do not separate but remain aligned side by side. Compare the effects of nitrous acid, hydroxylamine and 5-bromouracil on DNA. Cytokinesis greatly increases the total cell-surface area as two cells form from one. Due to recessive epistasis the phenotypic ratio 9:3:4:1 becomes modified into 1969 and later on elaborated by them in 1973. Thus, T4 and T7 are both phages, but a test tube might contain either 1T4 phage or 100 T4 phage; see Freifelder, 1985). (f) Resumption of interphase: The chromosomes are relaxing again into their extended state. Only in the complete absence of the wild type gene product would the mutant phenotype again into their extended state. be expressed recessiveness. Each porin channel is formed by 6 to 8 subunits, each having three suspended hydrocarbon chains (Fig. Phosphorus PO43-, H2PO-4 Constituent of lipids, proteins, nucleic acids, sugar phosphates. The cell is able lower + - pH pH) + to store only 45 per cent of the chemical energy - electrical potential B + liberated by the combustion of glucose in the form ADP + Pi of ATP (i.e., only 36 ATP molecules). Therefore, 0.4×0.1 = 0.04 or 4% of the progeny will be homozygous for these genes. In 1950 Swift found the amount of DNA per resting nucleus) in mitotically active tissues of animals ranged from twice (2n) the value found in the gametes (1n) to four times (4n) this value. SIGNIFICANCE OF LINKAGE The phenomenon of linkage has one of the great significance for the living organisms that it reduces the possibility of variability in gametes unless crossing over occurs. What are somatic crossing over and mitotic recombination ? Lastly, a specimen cannot absorb light of wavelength below 0.3 µm. (a) If a singed male is crossed to fa+ /fa+ female, what phenotypes are expected in the F1 ? The karyophilic signal for such a nuclear transport requires energy which is derived from ATP hydrolysis. In certain plant cells, there occurs SEM of a secondary cell wall another cell wall beneath the secondary cell wall. Lysolecithin acetyltransferase Transfer of acyl groups to phospholipid 5. 9.6. Method of construction of a recombinant plasmid between a bacterial plasmid and genomic DNA from another organism. Negative staining. Recessive mutations. The carotenes have hydrophobic chains of unsaturated hydrocarbons in their molecules. Association of 60S subunit with the elF1 elF5 ADP + Pi elF4A initiation complex requires the factor eIF5, because elF4B it helps in releasing eIF2 and eIF3 (60S subunit mRNA cannot join, if these two initiation factors are not 40S subunit 3' binds to 5' end 5' released). The synthesis of hexose or gluconeogenesis involves the conversion of succinate to oxaloacetate, which presumably takes place in the mitochondria, since the glyoxysomes do not contain the enzymes fumarase
and succinic dehydrogenase. P1 : AABB Negro $\downarrow \times$ aabb White \downarrow AB \downarrow ab P1 gametes : F1 : Intercross : AaBb Mulattoes Darker than mulattoes AaBb Like mulattoes ab Lik (1820—1893) in colloids. By decanting the supernatant and spinning it tends to reduce friction, preventharder, this process of translation from one language to another, this process of translation from one language to another, this process of translation from one language to another, this process of using information in RNA to make protein is called translation. Because of their two-antigen-binding sites, antibodies are said to be bivalent. In order to continue the synthesis, the temperature of the mixture is alternately increased (for renaturation) and decreased (for renaturati stored food contents, viz., proteins, lipids and carbohydrates (glycogen) of the cytoplasm and supply to the cell neccessary amount of energy. The nucleor envelope binds the nucleoplasm which is rich in those molecules which are needed for DNA replication, transcription, regulation of gene actions and processing of various types of newly transcribed RNA molecules (i.e., tRNA, mRNA and other types of RNA). Therefore, in them, normal oxidation of alkapton into acetoacetic acid and ultimately into water and carbon dioxide does not take place and large amount of alkapton is accumulated in the blood and is excreted in the blood and is excreted in the blood and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and carbon dioxide does not take place and ultimately into water and ultimately into wa protein thyroxin phenyketonuria P/P phenylalanine phenylpyruvic acid c/s tyrosine cretinism a/a albinism dihydroxy phenylalnine 239 the air. In recent years, much experimental evidence has supported the validity of Mithchell's chemiosmotic theory. Virtually, all the phenotypes examined so far are the result of biochemical reactions that occur in the cell. G C C G G In eukaryotes, rRNA genes (which belong to multigene families) occur in the region of nucleolar organizer (NO). Methionyl or N-formylmethionyl-tRNA specifically binds to the initiation site of mRNA containing the AUG initiation codon. Protein synthesis in bacteria (e.g., E. Chemical composition and physical structure are maintained with little change. For each gene, only a small proportion (25 per cent) of RNA transcript takes part in RNA processing leading to formation of mRNA, the remaining 75 per cent undergoing degradation in the nucleus. After DNA polymerase I adds the final deoxyribonucleotides in the gap left by the excised primer, the enzyme DNA ligase forms the phosphodiester DNA pol III HE bond that links the free 3' end of the primer re3' Dna B helicase placement of the 5' end of the okazaki fragment. Secretion of tropocollagen and collagen ; 6. Tatum, Dr. Joshua Lederberg, Dr. Sol Spiegelman. Some genes have been associated with individual bands. This is particularly true of rare conditions where chance matings of heterozygotes are expected to be extremely rare, e.g., albinism, Tay-Sachs disease, cystic fibrosis and phenylketonuria (PKU). HISTORICAL Since the mid-1950s electron microscopists have observed small structures or bodies in cells that on morphological grounds have been aptly termed microbodies. than secondary cell wall. In 1921, he proposed the genic balance mechanism of sex determination in Drosophila. For their multiplication, they essentially require the presence of some host cell, i.e., they are obligate cellular parasites of either bacteria, plants or animals. Chemical analysis showed that the + live mouse dead mouse major component was deoxyri-bose containing encapsulated S III strain nucleic acid. Insulin 3. Naming and Classification Viruses are not named according to the method of binomial nomenclature is the Linnean system of classineck and fication requiring the designation of a collar binomen (L., bi = twice + nomen = a name), the genus and species name, for sheath every species of bacteria, blue green core algae, plants and animals). Gonadal Sex In the human embryos until the six weeks the gonads and primordia of the urinogenital tract are identical in males and females. It is also composed of a lipoprotein, pigment granules, water, RNA, ribosomes, mitochondria and various other cellular inclusions. All of the plasmagenes of a cell constitute the plasmon. Two electron sare passed through an electron acceptor Q (which is a quinone) to an electron transport chain involving four electron carriers (plastoquinone, cytochrome-559, cytochrome-559, cytochrome-559, cytochrome f and plastocyanin), before being passed on to PS I. The X chromosomes have large amount of euchromatin and small amount of heterochromatin. inserted in or near a gene, McClintock sometimes found that the gene's function was altered. S, synthesis of DNA; G1 the first gap or growth phase; G 2, the second gap or growth phase; G 2, the second gap or growth phase and M, mitotic phase. TYPES OF COMPOUNDS OF CYTOSOL Chemical compounds are conventionally divided into two groups : organic and inorganic. (d) Excision repair or Dark reactivation. Thus, the two chains are complementary to each other; that is, the sequence of nucleotides in the other. Genotype (a) (b) (c) (d) (e) (f) KK kk kK Kk kk Cytoplasm Kappa No Kappa Kappa No Kappa Kappa No Kappa Contents GENETICS, HUMAN GENETICS AND EUGENICS 230 12. Each primary lysosome contains one type of enzyme or another and it is only in the secondary lysosome that the full complement of acid hydrolases is present. The first such test on DNA fingerprinting was used in June, 1989 to settle a drawn-out paternity case in Madras. (2) Certain peripheral proteins) may form a bridge-like lattice work between integral proteins and restrict their lateral mobility, e.g., spectrin-ankyrin-actin cytoskeletal meshwork provides a rigidity to the membrane of human erythrocytes and does not permit the clustering or capping of integral proteins when the appropriate antibodies or lectins are added. Restriction nuclease Eco RI makes staggered cuts in a six-nucleotide DNA palindrome; Hae III nuclease cleaves at one point in the middle of a four-nucleotide DNA palindrome; Hae III nuclease cleaves at one point in the middle of a four-nucleotide DNA palindrome; Hae III nuclease cleaves at one point in the middle of a four-nucleotide DNA palindrome. same phenotype, the F2 ratio becomes 9:6:1. pressed against the wall and gradually, starch granule exceeds the size of amyloplast. This histone tetramer (H3, H4)2 and the apolar remolecules chromatids gions of 2(H2A and H2B)] around which the B double-stranded DNA helix is wound 1³/₄ time containing 146 base pairs. For example, a gene (L) for length of Drosophila wings may occur in two alternative forms : a allele or gene (L+) for normal development of wings and another allele or gene (L+) for normal development of wings and
another allele or gene (L+) for normal development of wings ano refers to particles of same type. This situation is not stable and Contents GENE MUTATION at the next replication adenine is expected to return to its common state and to pair with thymine. This permeability must be highly selective if it is to ensure that essential molecules such as glucose, amino acids and lipids can readily enter the cell, that these molecules and metabolic intermediates remain in the cell, and that waste compounds leave the cell. The F1 hybrid was much taller than either of the parents, combining the long internodes of one parent and many nodes of the other. throughout the reaction. COOH Fig. Cytoplasmic inheritance. This type of egg does not develop further and dies soon. The muscles of its wings are packed with mitochondria, which supply the ATP needed to meet the bird's energy demands. P1 Black female WW × F1 Black female WW Black female WW Black female WW × F1 Black female WW Black fema F2 Black WW Black Ww Black Ww Fig. What factors probably account for this selectivity? (4) A = 18%, C = 32%, U = 18%, C = 32%, U = 18%, C = 32%, U = 18%, C = 32%. Dihybrid. This suggests that chromatin is the nuclear lamina and envelope. This is the usual form of translation unit in all cells (Fig.7.4). In this way every colloidal system consists of two phases : a discontinuous or dispersed phase and a continuous or dispersion phase. Maltase 19. For example, in enzyme present in tears. Recently, some differences have been discovered between the universal genetic code and mitochondrial genetic code (Table 6-4). petite colonies in the Saccharomyce: cerevisiae, are yeast Saccharomyces cerevisaiae. Ran-GDP is subsequently transported back to the nucleus and importin α back to the cytoplasm. The walls of the vesicle are temporary and are replaced by the new and permanent ciliary sheaths. Thus, ribosomes were studied in the early 1930s, discovered and isolated in the early 1940s, scrutinized in 1950s and baptized in 1958. Primary Lysosomes These are also called storage granules, protolysosomes or virgin lysosomes. In 1855, a German pathologist Rudolf Virchow (1821–1902) confirmed the Nageli's principle of the cellular basis of life's continuity. The coat colour of mice is governed by a multiple allelic series (see Chapter 10) in which A allele determines agouti or mousy-coloured coat, AY allele determines yellow coat and a allele forms black coat. During ultraviolet radiation a particular enzyme is selectively bound to the bacterial DNA. The lysosomal enzymes outside the cell during the process of fertilization. Dominant allele S determines solid coat colour (or presence or absence of spots). Thus, AAA was identified as the code for lysine and CCC as the code for proline. The nuclear membrane or karyotheca or nuclear membrane or nuclear membrane or karyotheca or nuclear membrane or nuclear membrane or karyotheca or nuclear membrane or n coincidence; (iii) Copy choice theory; (iv) Tetrad analysis. (v) DNA polymerase ε (= epsilon). The cell fusion is achieved by the use of some fusogen such as an inactivated parainfluenza Contents 120 CELL BIOLOGY virus, called Sendai virus (named after a city of Japan). This two-factor system (i.e., Ac-Ds family) provided an explanation for the genetic instability that McClintock had observed on chromosome 9 of maize. Isoprene. Some of them destroy cancer cells, cells infected with viruses or intracellular bacteria, and cells which have been grafted into the body as, for example, in a heart Contents IMMUNOLOGY 129 transplant. The avirulent (non-pathogenic) strains, on Live mouse Live mouse the other hand, lack this capsule and they produce dull, rough(R) colonies. For example, in the plasma membrane of human red blood cells proteins represent 52 per cent, lipids 40 per cent, lipids 40 per cent. Both the layers o are 50A in thickness. Unlimited growth also occurs in fungi, algae, monocotyledonous leaves, and many animals particularly nonchordates, fishes and reptiles. Isolated tobacco mosaic virus (TMV) in crystalline form. For the best development both good heredity and good-environment are essential. Mode of inheritance of Y-linked genes from father to son. Later on, the phenomenon of self-sterility is found to be common in many other dicot and monocot plants such as sweet cherries, petunias and evening Eye colour in Drosophila. The longwinged Drosophila fly thus produces the gametes (sperm or ova) with the single allele v + and the Contents MENDEL AND HIS WORK 37 vestigial-winged fly produces the gametes (sperm or ova) with the single allele v. In 1905, Edmund Wilson noted that females of Protenor (another hemipteran bug) have 7 pairs of chromosomes, whereas males have 6 pairs and an unpaired chromosome, which Wilson called the X chromosome. The hen and cock feathering in domestic fowl. Cajal verified Golgi's finding of a special internal cell complex and observed its morphology and behaviour under a variety of metabolic states. Contents MENDEL AND HIS WORK 27 P 1 Tall DD (Homozygous) DD Tall (Heterozygous) Dd Tall (Heterozygous) Dd Tall (Heterozygous) Dd Tall Dd Tall (Heterozygous) Dd Tall made concerning the chemical nature of the gene: 1. RNA polymerase contains two nucleotides binding sites, called the initiation site and the elongation site. Tatum received Nobel Prize for their contribution in biochemical genetics of fungus. 7.1. Three-dimensional drawing of a Golgi apparatus; it is The detailed structure of drawn from electron micrographs of a secretory animal three basic components of the cell (after Alberts et al., 1989). Each strand of RNA is polynucleotidic, that is, made up of many ribonucleotides. The process of protein glycosylation in RER lumen is one of the most well understood cell biological phenomena. Alleles are genes controlling the same characteristic (e.g. hair colour) but producing different effects (e.g. black or red), and occupying corresponding positions on homologous chromosomes. She stores the sperm in her seminal receptacles and as she lays her eggs, she can either fertilize the eggs or allow them to pass unfertilized. RST) or terminal (i.e., LMN OPQ. These double stranded regions are due to hairpin loops between complimentary regions of the linear molecule. Thus, each Y-shaped antibody has two identical antigenbinding sites, one at the tip of each arm of the Y. Thus, when crossing over takes place leading to paired arrangement (e.g., 2:2:2:2), it is described as second division segregation. This property of intracullular movement of matrix is known as the cyclosis. A—Geing codon, although GUG is meant for netic code without comma; B—Gevaline. The endoplasmic reticulum provides an ultrastructural skeletal framework to the cell and gives mechanical support to the colloidal cytoplasmic martix. Analysis of four double-stranded DNA samples yielded the following information: 1.15% cytosine ; 2.12% guanine; 3.35% thymine ; 4.28% adenine. In cells, the fatty acids only sparingly occur freely; instead, they are esterified to other components and form the saponifiable lipids. After about 25 amino acids have been joined in a polypeptide chain, the AUG initiation site of the encoding mRNA molecule is completely free of the ribosome. elF3 (iv) After association of the 5' end of mRNA, initiation complex moves towards 3' end in search of subunit initiation 43S-ternary initiation codon AUG, and then also associates with complex ATP 60S subunit Type III IF proteins. coli (containing 3,400,000 base pairs in its DNA) has about 3000 genes. Abbe's relationships make it clear that high resolution in a microscope can only be achieved by manipulating a small number of variables: the wavelength of the illuminating radiation, the refractive index and the aperture. What is growth? Other molecules stored in vacuoles are involved in the interactions of the plants. 21.2. Fertilization cone formation during fertilization of a cell of a higher plant as seen at telophase in mitosis. Metaphase II During metaphase II, the chromosomes get arranged on the equator of the spindle. The centromere divides into two and, thus, each chromosome produces two monads or daughter chromosomes. Formation of the substances from the follicle cells to the egg during the development of the The mature follicle moves to (A) the surface of the ovary and egg. 8.2. A typical synaptonemal complex (after Alberts et al., 1989). 159 Transverse distribution of various enzymes in the membranes of endoplasmic reticulum (Source: Thorpe, 1984). (iii) Synthesis of tRNA gene from three duplex fragments. Replication Fork Model It occurs both in linear and circular DNA molecules and involves the formation of replication. Contents CHROMOSOMAL MUTATION II 195 Monosomy in diploids is not tolerated, since it creates imbalance due to loss of one complete chromosome. Proteins synthesized during G1 phase (1) regulatory proteins which control various events of the next stage ; and (3) tubulin and other mitotic apparatus proteins. Note the common 3' terminal -CCA, the guanine residue G at the 5' terminal TCG in the T-loop, the anticodon-U (here YYYU) in the end and unpaired (single stranded) Canticodon loop, the DiMeG between the anticodon loop, the DiMeG between the anticodon loop, the DiMeG between the anticodon loop and D C-A sequence at the 3' end. A deleNormal a exhibits heterozygote tion had resulted in the elimipseudodominance nation of the dominant allele Fig. Write short notes on the following: (i) Protoplasm theory; (ii) Branches of cell biology; (ii) Organismal theory; (iv) Scope of cell biology. The classical phenotypic ratio of 9:3:3:1 groupings. be transcribed only when the sensor site is activated. (ii) Pyrimidine—cytosine and thymine. The wall of a microtubule is made up of a helical array of repeating and β tubulin subunits. There is no tRNA for these codons. The fertilization establishes definite polarity in the eggs. How many
phenotypic and genotypic classes are possible? These annuli resemble with the pores or annuli of the nuclear membranes. 4.3. P1 : Black CCaa P1 gametes : F1 : (Ca) X Albino ccAA 1 (cA) Agouti CcAa F1 Male gametes - CA Ca A Cc Aa Agouti CCAa Cc Aa Black Albino Albino CA Ca F2 : cA ca F2 Phenotypic ratio : 9/16 Albino. For example, histone H4 of calf and of garden pea contains only two amino acid differences in a protein of 102 residues (DeLange, 1969). In the following figure, the genes to the left of the Male Female Morgan and his co-workers by their investigation on the Drosophila found two types of linkage - complete linkage and incomplete linkage. 11.9. Synthesis of carbohydrate during dark reaction (after Berns, 1983). 3.2). It is the point from where DNA replication starts. A fusogen is a membrane fusion promoting factor such as Sendai virus, lysophosphatides, oleic acid and an electric field. The gametic chromosome number constitutes a basic set of chromosomes called genome. Because the hybrids of F1 have tall stems so the character of tallness (T) is considered as dominant and because the character of tallness (T) is considered as dominant and because the character of tallness (T) is considered as recessive. restriction fragments containing DNA sequences to specific RNA molecules. The remaintain the sample at 4°C (after sidual solution is called cytosol. In case of necessity, these reserve cells reinforce and replace the worn-out differentiated cells. In fact, 85° is about the limit in good optical microscopes. Even then, the cell theory remains a useful concept. However, it is Cisternae are central, flattened closed extremely pleomorphic : in some cell types it apcompartments, identification of the "transformation experiments, identification of the genetic material — the transformation experiment, bacterial conjugation; indirect evidences for DNA as the genetic material of some viruses; revision questions and problems. In view of this C Khorana started the synthesis of a gene 77 51 for E.coli tyrosine suppressor tRNA precursor. 6.18) consists of a head and a tail. Continuous variations; phenotypic measurements form a spectrum. Contents 84 CELL BIOLOGY Table 4-3. In all these cases, however, tandem duplication of chromonemata (or DNA) evidently takes place. Max Schultze, in 1861, established similarity between sarcode and protoplasm of animal and plant cells and, thus, offering a theory which later on was improved and called protoplasm theory by O.Hertwig (1849-1922) in 1892. Binary fission. Inner or central colourless region called centroplasm or DNA plasm having DNA and crystalline granules (Fig. ternating series of double bonds. membranes are formed by the oviduct or other accessory parts of female reproductive system. The nuclear components such as the chromatin threads and the nucleolus remain suspended in the nucleoplasm. It is further treated with hypotonic saline solution which results in swelling of cells and better clarity of chromosomes for counting and morphological study. All females 'bent'; all males normal. coli and promotes opening of the DNA duplex in a region of three direct repeats of 13-bp sequence (called 13mers). The syngamy or fusion of the macrogametes is known as macrogamy (Gr., macro=large; gam=marriage). In various strains of yeast, the suppressiveness varies from 1-99 per cent petites. Quite recently, following two proteins have been found to be associated to the nuclear pores : one is an integral membrane protein, a glycoprotein of 120,000 daltons that may anchor the annuli to the lipid bilayer (Gerace et al., 1982). Contents 44 CELL BIOLOGY 2. Monospermic fertilization. Genetic Code 66-76 Basis of cryptoanalysis; codon assignment (cracking the code or deciphering the code)— theoretical approach, the in vitro codon assignment. the in vivo codon assignment; characteristics of genetic code; wobble hypothesis; revision questions and problems. ULTRASTRUCTURE The nucleus is composed of following structures: 1. Formation of yolk and vitelline membrane of growing primary oocytes. Endocytosis. It always starts its life-cycle by inserting itself into the E.coli chromosome at random locations. mitochondria membrane folds basement membrane 2. However, some cell biologists still prefer to place PPLO in between the viruses and granule vacuole bacteria (see Sheeler and Bianchi, 1987). Termination. In 1931, an American biochemist, Cornelius van Niel observed that a certain type of photosynthetic bacteria fixed carbon dioxide in the presence of hydrogen sulphide. The studies of Julius Sachs in the mid-nineteenth century show that chlorophyll was confined to the chlorophyll was confin animal cells and in a wide range of plants. In sexually dimorphic dioecious organisms besides morphological and behavioural differences between both sexes, the sexual diversity also occurs at the level of chromosomes. The energy conversion mechanism α β β underlying oxidative phosphorylation requires that γ each protein complex be inserted across the inner mitochondrial membrane in a fixed orientation, so δ that all protons are pumped in the same direction α α β out of the matrix space. Table 6-5. Both were awarded Nobel Prize in 1975 for the discovery of an enzyme called RNA directed DNA polymerase (or reverse transcriptase) which is present in the core of virus particle (rous sarcoma virus). Tatum (1903-1989). The endocytic cycle begins at specialized regions of the plasma membrane, called coated-pits. Subsequent experiments have shown that DNA is much more polymorphic than expected. In one of the experiments have shown that DNA is much more polymorphic than expected. found to be present in 3 : 1 ratio. Genotype of parent 1. Table 10-3 Genotype and phenotypes of A, B, AB and O blood group (after Burns and Bottino, 1989). In both mammals and birds, most of the B lymphocytes die but a few migrate via the blood to the lymph nodes, spleen, and gut-associated lymphoid tissues such as appendix, adenoids and Peyer's patches in the small intestine. In consequence, a mutant phenotype makes its expression. The significant enzymes of inner membrane are enzymes of inner membrane are enzymes of electron transport pathways, viz., nicotinamide adenine dinucleotide (NAD), flavin adenine dinucleotide (DPN) dehydrogenase, four cytochromes (Cyt. overlapping 3. In any behavioural characteristic studied genes are found to exert at least 50 per cent influence on the trait. The presence of milk factor also depends on nuclear genes. The Y chromosome of males has no allele of the bar gene. 15. 1.1. Hooke's compound English microscopist Robert Hooke (1635–1703) is credited with microscope. Ears of corn lack about half the kernels, and these are arranged irregularly. Semidiscontinuous DNA Replication Various experimental evidences have suggested that DNA synthesis is continuous on one strand (3' to 5' strand), called leading strand and discontinuous on the other strand (5' to 3' strand), called lagging strand. The undulant movement is the characteristic of the flagellum. Variation is the cause of differences between individuals. elements, connecting them with the central element. Three dimensional model proposed by Kim et al., (1974) for yeast phenylalanine tRNA molecule (after Burns and Bottino, 1989). Introduced the term plasmodesmata. 17.1). These major elements are carbon (C, 20 per cent), hydrogen (H, 10 per cent), nitrogen (N, 3 per cent), which is represented as 'x' and is called the base number. filled cavities which are located in the inner part of chromatoplasm. The animal cell cannot synthesize the vitamins from the standard food and so they are taken along with the food. A DNA, RNA, histone and non-histone protein containing thread-like coiled structure of interphase nucleus is called chromatin. Shorting of metacentric chromosome and lengthening of acrocentric chromosomes due to translocation. ecules of 3-phosphoSucrose (C 12) for transport Dark reaction Starch for storage glyceric acid (5C × 3C Cellulose for cell wall = 15C). These membrane proteins serve many important functions of the cell. Got Nobel Prize for his studies on the structure of complicated biological molecules (e.g., proteins and nucleic acid in TMV and histone core of nucleosome) by using electron microscopy and X-ray crystallography. In the primary oocyte, large amount of fats and proteins becomes axial accumulated in the form of yolk and due to its ring filament heavy weight (or gravity) it is usually concentrated centriole towards the lower portion of the egg forming the vegetal pole. The movement, spearheaded by persons of outstanding intellect such as Francis Galton and Karl Pearson, had its objective in the application of biologically sound principles to human populations. In 1862, Mendel became a founding member of the Brunn Natural Science Society. There still exists certain doubt about the symbiotic origin of the chloroplast. The first step in protein synthesis is the formation of an initiation complex (Nomura et.al., 1967). Secretion of compounds (thyroglobulins) of thyroxine hormone by thyroid cells; 5. With depolarisation, the Na+ channel is opened and during repolarisation, it nitroxidelabelled closes again and K+ channel opens. Most of the nuclear enzymes are composed of non-histone nucleus (acidic) proteins. Most of the genetical phenomena such as linkage, sex-linkage, sex-letermination, etc., of man have already been discussed in previous chapters, therefore, in this chapter following topics of human genetics only, have been discussed. What is photorespiration and how do peroxisomes contribute ? Fraternal or Dizygotic Twins Non-identical or fraternal twins are produced by simultaneous fertilization of two separate ova by two separate ova by two separate ova by two separate sperms. This showed him that the character of dwarfness disappeared in first generation but again reappeared in second generation.
This plant has the following advantages : 1. For example, in most turtles, only females are produced at high temperatures (23-28°C). Discuss this by using examples of Kihara's seedless watermelons. In the chromatids pachynema stage, this is now changed, the two chromatids of each F - METAPHASE chromosome containing half of the DNA present in the chromosome at start, become partially independent of centromere C - PACHYTENE one another, although they still continue to be linked together by their common centromere C. to the requirements of the organism. Types of RNA Plant viruses TMV Wound tumour Animal viruses Influenza virus Rous sarcoma Poliomyelitis Reovirus Bacteriophages MS2, F2, r17 Single stranded Single stranded Single stranded Single stranded Neurophages MS2, F2, r17 Single stranded Singl Catalase acts as a "safety valve" for dealing with the large amounts of H2O2 generated by peroxisomes; however, other enzymes such as glutathione peroxidase; are capable of metabolizing organic hydroperoxides and also H2O2, in the cytosol (cytoplasmic matrix) and mitochondria. The synaptonemal complex is found to be concomitant of both chiasma formation and crossing over. CH3 | C - CH = CH2 || CH2 Fig. How pedigree charts are read? Describe the structure of both types of ribosomes. This is so because now the kind of heterozygotes produced will be more combinations. In all of these orf virus icosahedral viruses, only 12 vaccinia virus capsomeres are pentameres, mumps virus occupying 12 corners of five-fold symmetry, while the rest are hexameres (Fig. The cells of plant tissues generally remain cemented together by an intercellular matrix known as the middle lamella. Compare the cytogenetic view of chromatin in interphase, in mitosis, and in meiosis. DNA helicases hydrolyze ATP when they are bound to single strands of DNA. Contents GENETIC INTERACTION AND LETHAL GENES Table 4-8. When ticle. Impermeable junctions : 2. The sperms which occur in the external or internal fluid media around the egg, swim towards the egg randomly. But unfortunately his remarkable piece of work remained unattended and unappreciated up to 1900. The 3. For example, A -form DNA (A-DNA) is right handed but less hydrated than the B-form DNA. These transport vesicles containing the M6P-receptors act as shuttles that move the receptors back and forth between the trans Golgi network and endolysosomes. Mule shows hybrid vigour and because of this it has served mankind as a patient beast of burden since time immemorial. What might you conclude concerning the base composition of the two samples? Contents TECHNIQUES IN CELL BIOLOGY 27 When a radioactive atom emits a plastic beta particle (i.e., electron) the photosection graphic emulsion is affected in a manner cells similar to the exposure of a photographic wash dehydrate and emulsion to light. S phase Contents 320 CELL BIOLOGY occupies roughly 35 to 45 per cent of cell cycle. Various secretory products of granular endoplasmic reticulum are transported to various organelles as follows: Granular ER agranular $ER \rightarrow Golgi$ membrane \rightarrow lysosomes, transport vesicles or secretory granules, 1985 Karry Mullis discovered polymerase chain reaction (PCR) which is widely exploited in gene cloning for genetic engineering. For explaining this, another criterion, called complementation, was employed. Because these immune reactions are destructive in nature, it becomes necessary that they be made in response only to molecules that are foreign to the host and not to those of the host itself. 14.7) Three Dimensional Model of 80S Ribosome In spite of the difference in overall sizes (as manifested in the greater molecular weights, sedimentation constants, sizes and numbers of rRNAs and proteins), the cytoplasmic ribosomes of Contents RIBOSOMES eukaryotes (80S) are remarkably similar in morphology to those of prokaryotes. When twenty amino acids were added to this mixture along with ATP, GTP, K+ and MG2+, they were incorporated into proteins. Ss Rr J Sr sR Sr Ss RR Sandy Red Sandy Ss RR Red Sandy Sandy White or 9: 6: 1. Patau syndrome or Trisomy-13. NADPH2+O2-requiring steroid transformations : Aromatic hydroxylations, side-chain oxidation, deamination, thio-ether oxidations, desulphuration. The organisms possessing qualitative traits have distinct (separate) phenotypic classes and are said to exhibit discontinuous variations. In reactions 6 to 10, two molecules of glyceraldehyde-3-phosphate are oxidized and ultimately converted into two molecules of pyruvic acid. Such ion channels also occur in other types of cells such as muscle, sperm and unfertilized ovum. This enzyme is Fig. 12.1. intermediate type decapitated intermediate type d (Acrididae) have the acrocentic chromosomes. The process by which RNA molecules are initiated, elongated, and terminated is called transcription. The resultant polymerization will always proceed in a net 5' \rightarrow 3' direction, meaning that the nucleotide at the 3' end is always the most recently added to the chain. 20.6. Genetic organization of yeast Ty elements. How many chromosomes would you normally expect to find in a somatic cell of a mouse ? Negative Control (i) Inducible enzyme is produced only when its substrate (inducer) is present in the environment (i.e., active repressor + inducer = inactive repressor). Is there generally a correlation between locations of genes in a chromosome and their phenotypic effect? 18.3) : 1. Give an illustrated account of spermatogenesis. The D-loop helps in binding of amino-acyl synthesis (i.e., in the cytosol and in the mitochondrial matrix) is in the effect of some inhibitors. Secondary amino acids. heredity was determined to be DNA nucleotides. Each structural unit is made up of one or more polypeptide chains. lumen The classification given by D.J. Morre (1977) is most widely

used. The tendency of any chemical substance to lose or gain electrons is called the redox potential and is measured in volts(V). For instance, the cells of the adult organism. At one side of the cell occurs bleb (localised collection of fluid) of ill understood function. As in other prokaryotes, there is no intracellular membranous structure. The other two forms are more characteristic of non-muscle cells. S.R. Cajal, a contemporary of Golgi and Spanish histologist, was a solid supporter of Golgi during the years of controversy. (i) Petite in yeast. By synapsis each gene is, thus, brought into juxtaposition (=being side by side) with its homologous gene on the opposite chromosome. Other molecules defend the plant against predators. Details of ultrastructure of grana lamellae have been worked out by electron microscopy (fixation by gluteraldehyde and staining by osmium) and freeze-fracture technique. reproduction of organisms. Many tropocollagen molecules spontaneously assemble into the ordered arrays, called collagen fibrils. Once such a child is detected, a diet free of phenylalanine is imposed and the child can develop normally. For example, secretory cells such as pancreas cells of other types (non-secretory cells such as heart muscle cells which make little new proteins) are relatively RNA-poor. But, this starch in chloroplasts disappears quickly and is, therefore, known as transitory starch. Morphologically, the cilia and flagella are identical structures but even then both can be distinguished from each other by their number, size and functions. Correns in 1908 in the four o'clock plant, Mirabilis jalapa. Weight Gram (g) 1 0.001 1 × 10-6 1 × 10-9 1 × 10 12 1 × 109 1 × 106 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 × 10-9 1 understand various complicated life activities such as metabolism, growth, differentiation, heredity and evolution at the cellular and molecular levels. In a second or subsequent pregnancy involving a Rhpositive child, these anti-Rh antibodies may return to the foetus through the placenta and destroy the Rh antigen carrying RBC of foetus. The TrpE gene is the first one translated. Give an account of the morphology, ultrastructure and chemistry of the chromosomes. There are certain conditions which are intermediate between parthenogenesis, and rogenesis, and rogenesis, and rogenesis, and rogenesis and fertilization, e.g., partial fertilization, e.g. two pyru+H2O dehydrogenase NAD+ vic acid molecules. Each repeat unit has (i) a coding region, in which U C U A the genes for the 18S, 5.8S and 28S rRNA molecules exist C A next to each other in the order mentioned; (ii) a spacer region G called intergenic spacer (IGS) and (iii) internal tranFig. In gynogenesis, the sperm penetrates the egg but takes no part in development. Contents 204 CELL BIOLOGY Thus, during oxidative decarboxylation of one molecule of pyruvic acid, one mole of CO2 is produced to NADH. Structural details of a bacterial cell can only be seen with an electron microscope in very thin sections. The free swimming larva (top) grows into a slow moving bottom - dwelling starfish (above). MORPHOLOGY The Golgi apparatus is morphologically very transfer vesicles from the rough ER similar in both plant and animal cells. In this method, centrifuge tube is loaded with layers of solution of varying densities of either sucrose, heavy water, cesium chloride or albumin, in a gradient from top to bottom. While studying the biochemical basis for the eye colour in Drosophila, George Beadle and E.L. Tatum were able to show that the lack of brown colour in various mutants was due to a defect in one step in the biosynthesis of the brown pigment. C.B. Bridges (1889-1938). Porter and S. The chloroplasts are composed of the carbohydrates, lipids, proteins, chlorophyll, carotenoids (carotene and xanchlorophyll b thophylls), DNA, RNA and certain enzymes and coenzymes. Each of the four polypeptide chains of an immunoglobulin is also divided into repeating segments, called domains, each of the four polypeptide chains of an immunoglobulin is also divided into repeating segments. constitutive heterochromatin in tromere of the chromosome of the Trillium has a mammalian metaphase chromosome. Recently, it has been suggested that centrioles could serve as devices for locating the directions of signal sources. GAU GAC GAA GAG G GGU GGC GGA GGG Gly Contents GENETIC CODE Table 6-3. (Source : Sheeler and Bianchi 1987). There are five types of histones in the eukaryotic chromosomes, namely H1, H2A, H2B, H3 and H4. 4.6. Ring structures of monosaccharides proposed by Haworth. Morphologically distinct sexes; b. A single pair of genes, R and r was postulated for Rh+ and Rh- blood types respectively. Monohybrid cross. Osteomalacia in adults. Their specific function in plant cell is still little understood. Thus, for tetrad ascospore is removed in order from ascus and germinated to determine the physiological traits as colour, pattern of cospore second extra first formameiotic growth, etc. VACUOLES The most conspicuous compartment in most plant cells is a very large, fluid-filled vesicle called a vacuole. Further, since thelytoky is also found in polyploid forms, it is also called somatic parthenogenesis. The copy choice model relies on conservative mode of DNA replication, but B all experimental evidences Fig. Phosphorylation of the tubulin monomers by a cyclic AMP-dependent kinase favours the polymerization. (ii) Second meiotic division. Such a phage is called virulent or lytic phage since it has infectiousness and it causes death of host cell by lysis. 12.10. The importance of specific reactions and of protein structure in defining the numerous properties of cells was also appreciated. The process of phagocytosis (after Darnell et al., 1986). when he injected the heat killed S-III Dead III S Contents IDENTIFICATION OF THE GENETIC MATERIALS 11 bacteria in mice, they did not suffer from pneumonia. suggest that DNA replication occurs in a semi-conservative manner. RNAse H which removes RNA rpimers; 6. The biological significance of capping is that the cap may provide a feature for recognition by the protein-synthesizing machinery (i.e., cap RNA polymerase helps in recognition of ribosomes and thereby facilitates translation of mRNA). The nitrogen bases of RNA are two purines, N H Fig. (ii) Chromopexy. They contain secondary protein structures, where strength, elasticity and rigidity are required, e.g., collagen, elastin, keratin, fibrin (blood-clot proteins) and myosin AA diploid AB hybrid B1B1 diploid B 1B 2 hybrid B 2B 2 diploid CC diploid Fig. In each case, only diploid rye (2n = 4x = 14) was used. Some substances of extraneous coats provide immunological properties to the cell. 11.10. The inner membrane surrounds a large space called the stroma, which is analogous to the mitochondrial matrix and contains various enzymes, ribosomes, RNAs and DNA. Many of these hydrolases are found bound to and functioning within the vicinity of the cell wall and are not necessarily contained in membrane-bound vacuoles at these sites. The trihybrid Aa Bb Cc is test crossed to the triple recessive aa bb cc, and the following phenotypes are obtained in the progeny : 64 abc, 2 abC, 11 aBc, 18 aBC, 14 AbC, 17 Abc, 3 ABc, 71 ABC. II.3 and III.4 heterozygous or carrier fe4. Proposed the fluid mosaic model of cell membrane. Cytogenetics. The most important low molecular organization and function of ribosomes have been studied more intensively in prokaryotes. Resistant individuals do not have sigma. Discuss the copy choice and breakage and reunion hypothesis of crossing over. During the first maturation division or first meiosis, the homologous chromosomes of the primary oocyte nucleus pass through the pairing or synapsis, duplication, chiasma formation and crossing over. Such a procollagen of fibrillar Striated appearance of a collagen fibril collagens (I, II, and III) is serceted from the electron microscope (after blast in the extracellular space. Chrysanthemum stunt; 4. The rapid flux of anions in the erythrocyte facilitates the transport in the blood of CO2 from the tissues to the lungs. The
substances which produce the maternal effects in the progeny are found to be transcriptional products (i.e., mRNA, rRNA and tRNA) of maternal genes which have been manufactured during objects in the form of inactive protein coated and late translating mRNA molecules (informosomes) or inactivated rRNA and tRNA. The fragment containing 16S information is still larger than the methylated : both the methylated results in the methylated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating mRNA molecules (information is still larger than the methylated results) or inactivated results and the translating methylated results and the translating ribosomal subunits. Phenotypic classes = 20; Genotypic classes = 210. Biogenesis of 80S ribosomes involves the following three main events : A. is reversible acetylation of lysine residues in the amino terminal regions of histories a mean of artificial hybridization in plants. OCCURRENCE AND POSITION The nucleus is found in all the eukaryotic cells of the plants and animals. spelta. What biochemical events take place in cells before visible cellular division occurs? There are seven classes of phenotypes in Light red a ratio of 1:6:15:20:15:6:1. Normal collagens are continuously degraded by specific extracellular enzymes, called collagenases. Overdominance hypothesis was proposed by Shull and East, independently in 1908. Cell type 1. They are small bodies found free in the cytoplasm. The process of pinocytosis was first of all observed by Edward in Amoeba and by Lewis (1931) in the cultured cells. 12.18). Most types of mutations are recessive in nature and so they are not expressed phenotypically immediately. Contents REPLICATION OF DNA - T O T* O a P b T 5' C a b 5' T O T* O a P b T 5' C a b fertilized egg or zygote separate from each other and develop into independent embryos (hence they are also called monozygotic twins). (2) Classification based on shape of proteins. The presence of a gene on the Y chromosome but not on the X. At last lytic enzymes which have been coded by phage DNA, break open the bacterium and release the new phage particles which diffuse in the surrounding in search of new host (see Mays, 1981). Hence, during first anaphase, c+ and c fail to separate from each other. These filaments rapidly disassemble at specific stage of mitosis. Contents TECHNIQUES IN CELL BIOLOGY 29 The other major type of cell culture uses established cell lines, which have been adapted to prolonged growth in vitro. Hypostatic alleles as aa AA, Aa Phenotypic expression of alleles bb BB, Bb bb Bb, Bb Neither a nor b B only single gene effect A only A+B A and B alleles } mutually supplement each other Example Cumulative effect in coat colour of pigs. terminalisation. dizygotic twins. Genetic Recombination and Gene Transfer (Bacterial Conjugation, Transformation, Transformation, Transformation, Felement and F \rightarrow F- transfer, formation of Hfr cells and Hfr \rightarrow F- transfer, formation of viruses, recombination of viruses, recombination of transfer, mapping the bacterial chromosomes; transformation of Hfr cells and Hfr \rightarrow F- transfer, mapping the bacterial chromosomes; transformation of Hfr cells and Hfr \rightarrow F- transfer, mapping the bacterial chromosomes; transformation of Hfr cells and Hfr \rightarrow F- transfer, mapping the bacterial chromosomes; transformation of Hfr cells and Hfr \rightarrow F- transfer, mapping the bacterial chromosomes; transformation of Hfr cells and Hfr \rightarrow F- transfer, mapping the bacterial chromosomes; transformation of Hfr cells and Hfr \rightarrow F- transfer, mapping the bacterial chromosomes; transformation of Hfr cells and Hfr \rightarrow F- transfer, mapping the bacterial chromosomes; transfer, in viruses; episomes and plasmids: episomes, plasmids— fertility (F) factor, R plasmid, col factor, replication and recombination in plasmids, uses of plasmids in genetic engineering and biotechnology; revision questions. Describe the mode of origin and growth of cell wall. The oxidative decarboxylatwo regulatory proteins (e.g., protein kinase and protein tion of pyruvic acid to acetyl phosphatase; both regulating the activity of pyruvic acid coenzyme A. Due to enzyme Dyson, 1978). Frozen sections are stained and are dehydrated at low temperature (-30 to -400C) in a high vacuum. Ring chromosomes. Classes of RNA Molecules and Prodirection of transcription cessing This step of inverted replication prokaryotic transcrip5' ATT AAAGGCTCC TTTT GGAGCCTTT TTTTT 3' tion will be explained DNA TAA TTTCCGAGG AAAA C C T C G G A A AAAAA later on along with that 3' 5' coding of eukaryotes. Formation of transcriptosome with RNA pol II. (b) Anther or pollen culture. Maturation phase. | RNA+ (A) | protein (B) virus progeny type B RNA The isolated RNAs were then incubated type (A) (B) separ-ately in the presence of an E. Termination and release function in transcription. oc-Immature oocyte, spg- for the remainder of the Spermatogonia, spt-Spermatozoa, spc-Spermatozoa, sp number of chromosomes, their relative size, position of the centromere, length of the arms, secondary constrictions and satellites. A transverse hollow or cleft divides the 30S subunit into two parts, a smaller head and larger body, giving it the appearance of a telephone receiver or embryo. Sometimes, the cavity of RER is very narrow with two membranes closely apposed and is much distended in certain cells, plasma cells and goblet cells). Like other transposons, Mu phage has inverted repeats (IR) at or near the ends of its DNA and it makes a short duplication with 5 base pairs of the bacterial DNA into which it is inserted. Leder and R.A. Flavell studied split genes of B'globin, ovalbumin and tRNA. Individuals are phenotypiTt t cally female, but are sterile. and D (-) -fructose, also called levulose. In birds only one gonad of a normal female develops into a functional ovary. (1890-1967) remains to fertilize the F1 females. Initiation. Nageli (1817-1891) showed in 1846 that plant cells arise from the division of pre-existing cells. By adopting such measures the wastage of best type of germplasm due to lack of opportunities can be prevented. During oxidation of a fatty acid, water is added NAD+ and 4 hydrogen atoms are O O CoA-SH removed, forming one II II NADH R-C-CH2-C-S-CoA FADH2 molecule and one NADH molecule, from 2 carFig. For example, in case of don't respond to male hormones. The outer covering of bacterial cell comprises the following: (1) Homopolymers; (2) Copolymers of repetitive sequences; (3) Poly U; (4) Frameshift mutation; (5) Overlapping genes; (6) Wobble hypothesis; (7) Split genes Euchromatin is the well-dispersed form of chromatin which takes lighter DNA-stain and is genetically active, i.e., it is involved in gene through some type of protein synthesis. There are three types of reserve materials. By avoiding germinal waste. It essentially involves occurrence of breakage and reunion. They
never become green and photosynthetic. 33 types of polypeptides) than the plasma membrane. Hence, the expected height of F2 plants = 38.25 + 2.48 = 40.73 inches. Vesicles The vesicles (60 nm in diameter) are of three types : (i) Transitional vesicles are small membrane limited vesicles which are thought to form as blebs from the transitional ER to migrate and converge to cis face of Golgi, where they coalasce to form new cisternae. Then the results can be represented as follows : Parents : AA BB cc dd × aa bb CC DD Phenotypic value : $1\frac{1}{2}+1\frac{1}{2}+1+1=5 \downarrow 1+1+1\frac{1}{2}+1\frac{1}{2}=5$ F1 : Aa Bb Cc Dd 2+2+2+2=8 Application of Heterosis Heterosis Heterosis has been exploited at commercial scale both in plants and animals. This acid is then transferred (probably by diffusion) to the cells surrounding the vascular bundle, the bundle sheath cells having enzymes of (b) C4 plant Calvin cycle. Once lignification is complete the protoplasm can no longer absorb materials from outside the cell, which, therefore, dies. The 80S ribosomes have the sedimentation coefficient of 80S and the molecular weight 40 × 106 daltons. 25 Four components of RNA. This complex accepts electrons from cytochrome c and passes them to oxygen and is thought to traverse the mitochondrial membrane, protruding on both surfaces. Ecology and Human Welfare (Natural Resource Ecology : Natural Resources, Conservation and Management) 238-259 Classification of natural resources; minerals and their conservation : terrestrial mineral resources, marine mineral resources, conservation of terrestrial mineral resources, ecological aspects of mining; energy and its conservation : commercial sources of energy — fuels, electric energy, solar en cultivation, sedentary cultivation, new sources of food; waste management (recycling of resources and vermitechnology) : vermitechnology; forest resources : forest cover, deforestation (destruction of forests), afforestation - conservation or protective forestry, commercial or exploitative forestry; range management (grassland management); wild-life management; water resource and its management; land use planning and management; soil erosion, soil conservation; revision questions. When a Paramecium of killer strain having the genoRR RR type kk, the exconjugants are S F S all heterozygous for Kk genes male sterile male fertile (Fig. RNA-P is RNA polymerase, and PP1 is the property exhibited by certain pure dyestuffs, chiefly basic stains, of colouring certain tissue elements in a different colour. The pore complex perforates the nuclear envelope bringing the lipid bilayers of the inner and outer nuclear membrane together around the margins of each pore. In other words, the codon has a polarity. In animal cells, a daughter pair of centrioles originates near the already existing centriole and, thus, an interphase cell has two pairs of centrioles. Contents CELL BIOLOGY 16 C H A P T E R 2 Techniques in Cell Biology C ells are tiny but complex bodies. Dur- A ing the synthesis of the gene or yeast alanyl tRNA, it became clear that natu16 1 ral tRNA was not the direct product of transcription. Function Microfilaments are found to be involved in movement associated with furrow formation in cell division, cytoplasmic streaming in plant cells (e.g., Nitella and Chara) and cell migration during embryonic development. agic system are histiocytes of the reticular cells of the hemopoietic organs (bone marrow, lymph nodes phagocytosis exocytosis) exocytosis exocytosis exocytosis exocytosis exocytosis exocytosis exocytosis). and spleen) and the endothelial cells which form the lining of capillary sinusoid of the liver, adrenal gland residual body and hypophysis. Outbreeding involves crossing different families or crossing different famili cytoskeletal proteins. of the organism divides by the oblique division. He allowed the self pollination in the offsprings of first generation and made further observations on the offsprings of second generation. Depending on its content of 15N and 14N, the DNA bands at a specific position in the density gradient. Contents 148 CELL BIOLOGY (3) Pectins are water soluble, heterogeneous branched polysaccharides that contain many negatively charged D-galacturonic acid residues. This process comprises three steps: (i) recognition of the origin (O), (ii) opening of DNA duplex to generate a region of single stranded DNA, and (iii) capture of Dna B protein (i.e., 5' \rightarrow 3 ' helicase; also acts as the activator of primase). A basic knowledge of some of these methods is earnestly required. Binding occurs at particular sites, the promoters, which are specific sequences of 20 to 200 bases at which several interactions occur. Dominant allele. prokaryotes and eukaryotes may occur at three levels: transcription, translation (i.e., folding and processing of proteins). Taste of phenylthiocarbamide (PTC) Recessive Present Inability to role Tasteless to PTC (iii) Sex-linked characters. This pedigree can also be represented by the following arrow diagram : 1. Contents MOLECULAR BIOLOGY 16 C H A P T E R 3 Chemical Nature of Genetic Materials (i.e., DNA and RNA) D NA (deoxyribonucleic acid) and RNA (ribonucleic acid) and RNA (molecules larger than most proteins and contain carbon, oxygen, hydrogen, nitrogen and phosphorus. Through this technology, it has been possible to transfer genes from mammals into bacteria, causing the microbes to become tiny factories for making (in relatively large quantities) proteins of great economic importance such as hormones (including growth hormone) and interferons (lymphocyte proteins that prevent replication of a wide variety of viruses). In the Golgi apparatus the proteins are modified, concentrated, further glycosidated, co-transported ion transported ion transported into molecule vesicles that pinch off from trans Golgi tubules and migrate to plasma membrane to fuse with it and release the secretion to cell's exterior. oligosaccharide The fluid-mosaic membrane is thought to be a far less rigid than was originally supposed. Cuticular substances Mineral deposits Fatty acids Calcium and magnesium red Phloroglucinol hydrochloride (stains rose); chlorzinc iodide (stains yellow) Sudan III (stains orange) - The polysaccharides of cell wall include cellulose, hemicelluloses, pectin compounds and lignins. How would you explain the inheritance of this character ? 14.5). Bread wheat 2. produce males that are derived from unfertilMonoploids can be produced by artificial means by ized eggs. The fertilization is the most commonly used method for the production of the diploid zygotes in the sexually reproducing organisms of Metazoa and Metaphyta. Got Nobel Prize for studies on the mechanism of action of the diploid zygotes in the sexually reproducing organisms of Metazoa and Metaphyta. Genes The crisscross inheritance of recessive X- linked genes can be well understood by following classical examples in Drosophila, man, moth and chikens etc.: 1. (2) Gene augmentation method. P1 : F1 : F2 : Himalayan ch c 1 ch ch : 2ch c Albino cc : 1cc 3 Himalayan ch c 1 ch ch : 2ch c Albino recessive X- linked genes can be well understood by following classical examples in Drosophila, man, moth and chikens etc.: 1. (2) Gene augmentation method. P1 : F1 : F2 : Himalayan ch c 1 ch ch : 2ch c Albino recessive X- linked genes can be well understood by following classical examples in Drosophila, man, moth and chikens etc.: 1. (2) Gene augmentation method. into RNA. A pair of synapsed homologous chromosomes is known as a bivalent. Describe various modes of asexual reproduction in living organisms. Generally vacuoles occupy more than 30 per cent to 90 per cent, depending on the cell type. Evidently spacer DNA provides multiple functional binding sites that attract factors needed to activate the promoter (Busby and Reeder, 1983). It is believed that the CO2 hydrolysis of one ATP molecule somehow O2 drives conformational changes in the Na+K+- ATPase that allows the pump to transport three Na+ ions out and two K+ ions inside the cell (Fig. These and other sterocilia do not contain microtubules. 13.11. This hormone regulates body growth as well as the production of insulin and glucagon hormones and also inhibits the release of other pituitary hormones in mammals. An excellent example of environmental determination of sexual phenotype is afforded by Bonellia viridis, a marine echiuroid worm studied extensively by F. Light chains can likewise be typed as kappa or lambda. Another point to the rules that an individual should strive to carry out in regard to parenthood based on the law of human heredity. This enables him to establish the order of bases in a piece of DNA. Stroma The matrix or stroma fills most of the volume of the chloroplasts and is a kind of gel-fluid phase that surrounds the thylakoids (grana). Their distinguishing features are as follows : 1. Most modern textbooks though have adopted this convention for all of the carboxylic acids, but we prefer to stick to the old pattern). Reported ribosomes in the plant cells (i.e., bean root). For example, a bilateral gynandromorph of Drosophila is male on one side (right or left) and female on the other (Fig. STRUCTURE OF THE CILIA AND FLAGELLA central fibrils outer fibrils basal plate plasma membrane basal body rootlets Fig. Further, the proteolytic enzyme papain splits antibody molecule into different characteristic fragments : two separate and identical Fab (= fragment antigen binding) fragments, each with antigen-binding site and one Fc fragment (so called because it is readily crystallizes). The kinetochores thereby act as a "cap" that tends to protect the minus end from depolymerizing, just as the centrosome at the spindle pole tends to protect the minus end from depolymerizing. again at 2000 g for 45 seconds to re-sediment the chloroplasts. It occurs in two different forms, called α-tubulin, each containing about 450 amino acids.
The 30-nm fibre. The bridge will rupture 2 6 1 somewhere along its length and resulting fragments will contain dupli 1 2 5 4 3 6 B/B cation and/or deletion. New synthesized DNA is shown in bold line (after Freifelder, 1985). On its cytosolic side, in pulmonary capillaries the larger subunit contains three sites for high CO2 pressure for a ATP molecule. Daltonism. The cells of bacteria and plants have the plasma membrane between the cell wall and the cytoplasm. A teaspoonful of soil may contain several hundred million bacteria. (a) 21, triploid ; (b) 28, tetraploid ; (c) 35, pentaploid ; (d) 42, hexaploid ; n female Drosophila. These cells are endostyle enclosed and protected by the monaxon spicules in the gemmules and by the heart young individual chitinous covering in the statoblasts. A useful way of representing the ring-structures of sugars was proposed by Haworth (1927). In F1 individual a+/+b, the Chapter 16) does not allow the Genes on a chromosome. The 18S and 28S ribosomal RNA contain a characteristic number of methyl groups, mostly as 2'-O-methyl ribose. DNA polymerase-III. According to Lehninger and Brand (1979) these may be 9 to 12 in number instead of 6 as claimed by Mitchell (1967). MORPHOLOGY Number. In 1979, he reported the Fig. spots A distinction is made between ascending paper chromatography according to solvent whether the solvent migrates on the paper from below or above. Very low density lipoproteins; and 4. Adenosine triphosphatase 5. Once showing association of 6 subunits or polypeptides (after RNA synthesis is initiated and RNA Gardner et al., 1991). The protozoan Actinosphaerium (Heliozoa) sends out long, thin pseudopodia within which cytoplasmic particles migrate back and forth. Transposable Genetic Elements (Jumping or Mobile Genes) Mode of discovery of transposable elements; characteristics of transposable elements; types of transposable elements : insertion sequences (IS) or simple transposons, transposons; Tn 3 transposons; that the chromosomes characteristically appear U,V or J- shaped. The Ac corn. The centromere of each chromosome is directed towards the opposite poles. Laderberg (1955) proposed a modified version of Belling's hypothesis. Polysaccharides (Polymers). How will you distinguish cytologically : (i) between a double monosomic and a nullisomic; (ii) between a primary trisomic and a secondary trisomic. 4.6. Duplicate dominant genes : a cross between two strains of Capsella having triangular and top-shaped seed capsules to get 15 : 1 F2 dihybrid ratio. Further, Mendel himself made his work known only to some Gregor Johann Mendel (1822-1884). Oil accumulates at the end of a strand of ER and a small vesicle is then cut off by constriction to form particles, called prospherosomes. During prophase the 10 nm filaments unwind into threads of 2 to 4 nm and into spheroidal aggregates containing both types of proteins. Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 53 There are other regulatory sites internal promoter known as silencers which repress gene expression. 17.2. Maternal effect in direction of coiling of the shell in Limnaea. Recently, with increase in knowledge of viral biochemistry and molecular biology, various specific characteristics such as nature of nucleic acid (DNA or RNA), the symmetry of capsid, the number of capsomeres, etc., are now being used in viral classification. The interior of the endosome is acidic (pH 5-6) due to the presence of ATP-driven proton (H+) pumps in its membrane that pumps H+ ions into the lumen from the cytosol (Sly and Doisy, 1984). origin of replication 5. Draw a well-labelled diagram of an animal cell as seen by the electron microscope. β rpo B 155,000 Core enzyme 3. No pairing or synapsis takes place between the homologous chromosomes. Mitosis is important for replacement of cells lost to natureal friction), wear and tear and for wound healing. Such interactions are said to be the result of mutually supplementary genes. Semisterility resulting from adjacent type segregation during reciprocal translocation is easily observed in such plants as corn (maize), wheat, pea and Datura. .0819x = 24, x = 24/.0819 = 293.04 or approximately 293 progeny. Contents REPLICATION OF DNA 29 predicted if these two hybrid duplexes went on to replicate themselves. What phenotypic ratios are expected from the crosses (a) yellow malé × yellow female, (b) yellow female × wild type male, (c) wild female (homozygous) × yellow male, (d) wild type (carrier) female × wild type (carrier) female × yellow male, (e) wild type (carrier) female × yellow male, (d) wild type (carrier) female × yellow male, (e) wild type (carrier) female × y 'w' gene by union with the eyed male eyed female eyed female eyed female sperms having Y chromosome Fig. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the Publisher. H.Fraenkel Conrat experimentally demonstrated that RNA is the genetic substance of TMV. coli is DNA polymerase I. Contents PLASTIDS 241 troller of turgor provides support for the individual plant cell and contributes to the rigidity of the leaves and younger parts of the plant). A-Mode of polymerase I. Contents PLASTIDS 241 troller of turgor provides support for the individual plant cell and contributes to the rigidity of the leaves and younger parts of the plant). site of the enzyme, B-Removal of mispaired nucleotide by exonuclease activity of the enzyme. Vesicle formed by phagocytosis is Golgi mitchondria complex called phagosome and it is typically 1 to 2 µm or larger in diameter, much larger than those formed during pinocytosis and receptor-mediated endocytosis. different fractions collected separately Fig. Among these materials are drugs, aspirin (acetyl-salicylic-acid), insecticides, anaesthetics, petroleum Contents 162 CELL BIOLOGY products, pollutants and carcinogens (i.e., inducers of cancer; e.g., 3-4- benzopyrene and 3-methyl cholanthrene). (7) The chitin is a polymer of glucosamine. (c) Determine the proportion of comb types that would be expected in offspring from each of the following crosses: (1) RrPp×RrPp, (2) rrPp×RrPp, (3) rrPp× Rrpp; (4) RrPp×rrpp, (5) RrPp× Rrpp; (7) RRPP× rrpp; "transformed"? Recent cytological findings have also suggested many homologies between the mitochondria and the bacterial cells. The spaces appear well defined in negative contrast. MPF is a large-sized protein comprising two subunits- an inert subunit (called self-sized protein comprising two subunits- and the bacterial cells. The spaces appear well defined in negative contrast. activation) and other molecules (Lohka et al., 1988). Each of the mitochondrial membrane is 6 nm in thickness and fluidmosaic in ultrastructure. The cyclosis depends on the age, water contents, heredity factors and composition of the cells. a purine from a strand of DNA Contents 208 GENETICS, HUMAN GENETICS AND EUGENICS leaves a gap at that point. Likewise, Stevens and Wilson while working with Edmund Wilson. They occur commonly in planktonic species such as Nostoc, Anabaena, Phormidium, Calothrix, Galaeotrichia, etc. After filtration through a nylon gauze (20 µm pore size) to remove the larger particles of debris (e.g., cell nuclei, tissue fragments and unbroken cells), the chloroplasts are separated by unbroken cells), the chloroplasts are separated by centrifugation of 200g for 1 minute. . common region usd in filament construction carboxyl teminus keratin Type II Type II α-helical region Fig Gustafsson has estimated that less than one in 1000 mutants produced may be useful in plant breeding. Cardiac and various internal defects (of kidney, colon, small intestine) are common. Skin colour in man is controlled by additive genes. Griffith could not understand the cause of bacterial transformation and that is first of all identified by Oswalc Avery, Colin MacLeod and Maclyn McCarty (1944). This indicated that these two alleles, i.e., two genes were not in identical positions on homologous chromosomes, but were located in slightly different areas—lzg+/+ lzs. Mode of action of duplicate dominant genes. Most of our flowering plants have both male and female parts within the same flower (called perfect flower). Increasing concentration of ethanol (or acetone) followed by propylene oxide. SER plays a role in the synthesis of triglycerides in intestinal absorptive cells and of visual pigments from vitamin A by pigmented epithelial cell of retina. Water is the maintained close to the oxygen, leaving the hydrogen relaonly substance that occurs tively positive since its proton is exposed; C— A tetrahedron in nature in the three phases is formed due to formation of hydrogen bonds between four of solid, liquid and vapour water molecules. 4.16). Variable or irregular shape occurs in Amoeba and white blood cells or leucocytes (In fact, leucocytes are spherical in the circulating blood, but in other conditions they may produce pseudopodia and become irregular in shape). (It is first forwarded by Crick in 1958). The length of the complete repeat is 375 bp in Drosophila. DNA magnified twenty-five million times by scanning tunneling microscopy. X- and -Y linkage. The `stator' and `bearing' remains stationary (Berg, 1975; Adler, 1976). Approximately 3 nucleotides code for each amino acid. 7.7. Translation of mRNA in eukaryotes (reticulocytes). 2. The alternative method of origin of Golgi is based on de novo formation. nine) into melanin (a dark brown pigment). This signal peptide has between 15 to 30 amino acids which are generally hydrophobic. After entering the chloroplast the signal sequences are removed by a protease enzyme, which is present in the envelope of chloroplast, and the small subunit of C Dase is released into the stroma (Ellis, 1981). The gametes of both parents unite in fertilization to produce F1 progeny. (a) 0.5
male; (b) 1.0 female; (c) 0.67 intersex; (d) 1.0 female; (e) 1.5 superior (c) 0.67 intersex; (d) 1.0 female; (c) 0. female; (f) 1.0 female (triploid); (e) Lethal. The practical applications of inbreeding are following : Contents INBREEDING, OUTBREEDING AND HYBRID VIGOUR 79 1. Each nucleosome bead is separated from the next by a region of linker DNA which is generally 54 base pair C long and contains single H1 histone protein Fig. For example, telocentric X chromosome of Drosophila may be changed into an "attached-X" which is formed due to misdivision of the centromere (Fig. A glassy outer shell and a selectively permeable plasma membrane help cells maintain relatively constant internal conditions. of single tubules, and are morphologically quite distinct from the secretory vesicles. If enough energy is absorbed, an electron may even be ejected and, thus, oxidation occurs. The artificial parthenogenesis may be induced by various physical and chemical substances which are known as coenzymes. Before 1930s, it was the prevailing view that DNA was found only in animal cells and RNA only in plant cells. Due to microfilaments, ciliary rootlets also have a contractile role. The peptide hormones do not normally enter cells because of their relative large size. for cancer may develop resistance for this diseases. The results of these ill-fated experiments were published in 1869, in the Proceedings of the Natural Science Society, Brunn. Contents MITOCHONDRIA 203 anaerobic respiration of higher plants and fermentation of bacteria and yeast have the following differences : (i) Fermentation is an extracellular process, i.e., the respiratory substrate (i.e., sugar, etc.) is present outside the cell and that too in the liquid medium, while the process of anaerobic respiratory substrate is present inside the cell. On February 8, 1865, he delivered his first lecture on pea experiments to Brunn Natural Science Mendel' garden, as seen in the 1980's Contents MENDEL AND HIS WORK 23 Society. Wheat. 12.2. Pedigree showing how X-linked recessive gene, so not only will sive genes are expressed in males, then they be free of the defective phenotype; but they males in the next not pass the gene along to their offspring. Secondary egg membranes. Thus, the iojap trait, once established, is permanent. the net gain of one Calvin cycle. Since this difference can be observed only when such yeast cultures are kept in a oxygen-containing environment; so it is concluded that petite mutants have a defective aerobic respiratory mechanism. Of what value to the cell is a cyclic process such as the Krebs cycle ? However, their structure and extent of activity are mainly depended on the relative proportion of their constituent protein and lipid molecules. Describe their structures, assembly, disassembly and functions. In the absence of light, a reverse sequence of changes takes place. Further, all ribosomal proteins of the 70S ribosomes also have been isolated and specific antibodies against them have been produced. Some codes act as start codons. Nerve conduction is propagated along the axonal membrane by action potential which regulates opening and closing of two main types of ion channels (i.e., channel proteins with water filled pores) : Na+ chandissociation nels (or voltage-gated Na+ channels) and K+ channels). Sex-linked Inheritance of X-linked lethals; sex-linked influenced genes; sex limited genes; non-disjunction; primary non-disjunction; primary non-disjunction; revision questions and problems. The centrosome is juxtanuclear (L., juxta = near) and firmly attached to the nuclear envelope. 5. The science of genetics has proved worthy in removing many faulty concepts of man about the inheritance. Since, temperature-sensitive and chain termination mutations; they are the most versatile and useful mutations. Even livestock such as sheep and range cattle are usually bred panmicticly. The antibodies circulate in the blood stream and permeate the other body fluids, where they bind specifically to the foreign antigen that have induced them. Wild type (B+B+) flies have 779 facets in their oval-shaped eyes. Britten. (b) Maternal inheritance by iojap gene of corn. On the other hand, if a larva develops in isolation (i.e., in water) it develops into a female. gen as ammonia, e.g., Anabaena, Nostoc, Mastigocladus, etc. 3.35% T, 35% A, 15% C, 15% G. These surprising results could be understood by analysing the mechanism of colour production in flowers. Immediately after the insemination a thin membrane known as the fertilization membrane is formed around the plasma membrane of the egg. Sometimes the large-sized solid food or foreign particles are taken in by the cell through the plasma membrane. The in vivo mechanism involved in self-assembly of the microtubules is still little understood, however, in vitro studies have revealed various interesting facts about it. The determination of the intrinsic polarity of certain cells is also related to the microtubules. A— A LDL particle in cross section; B—LDL receptor proteins binding to a coated-pit in the plasma membrane; C— Mechanism of receptor-mediated endocytosis of LDL particles (after Alberts et al., 1989). he phenotypic traits of the different organisms may be of two kinds, viz., qualitative and quantitative. coli and in 1955, was able to define the gene in terms of function (cistron), recombination (muton) and to place an accurate molecular size estimate on the conceptual gene components. Consequently, considerable sterility is found in such monoploid maize plants. pairing in a duplicamosomal segment containing the tion heterozygote. This mode of gene regulation is attributed to the presence of factors that enhance the attachment of RNA polymerase to the promoters and initiation of mRNA synthesis. 20.2B) (after Stansfield, 1991). 20. Adenylate cyclase (Endoenzyme of erythrocyte) 8. In such preparations, these chromosomes in aggregate reach a length of as much as 2000 µm in D. become concentrated in the cytoplasm of the oocyte. In extreme cases, the function was completely suppressed. entire genome from donor cells A researcher analyzes the results of a DNA sequencing experiment and enters them directly into a computer. Like the world around us, the world of the cell is one of the forms specialized for a particular type of existence. region (iii) Hologamy. Coincidence values ordinarily vary between 0 and 1. In adolescence pubic and axillary hair develops and the voice deepens. For the reduction of the sperma following changes occur in the spermatids: Contents GAMETOGENESIS spermatogonium mitosis growth phase primary spermatocyte secondary specimatocyte seconda is Spirillum volutans (13 to 15µm in length). No haemophiliac is known in her ancestry; hence, it is concluded that her haemophilia allele arose from a mutant gamete. The fertilization cone engulfs the sperm which is surrounded by the hyaline cytoplasm move inwards. The DNA of E.coli is naked, lacking hispeptidoglycan 0 tones, but certain polyamines may be 75Å plasma bound to some of its phosphates. As already described, rRNA genes are transcribed into a long precursor RNA (which is 40S in HeLa and other human cells); this precursor must be cleaved into 18S, 28S and 5.8 rRNA. The sperm enters F3 the egg after this organiS+S+S+S SS S+S+S+S SS dextral (1) dextral sinistral dextral sinistral dextral sinistral zation is already established. The cytochemistry is that branch of cytology which deals with the chemical and physico-chemical analysis of living matter. Primary egg membranes. NEED FOR EUGENICS The development of all organisms including the human individuals depends on both heredity and environmental factors. The final functional tRNA molecule has 85 bases. 30 120 Practical Applications of Inbreeding yield (% open pollinated variety) yield (bushels / acre) height (inches) yield 20 The correlation of inbreeding may cause deleterious effects. Thus, the wall of the microtubule consists of 13 individual linear or spiralling filamentous structures about 5 nm in diameter, which in turn, are composed of tubulin. A reductant (or reducing agent) is a substance is the oxidant (or oxidizing Contents MITOCHONDIRA 209 agent). Following two types of chromatography are used in molecular biology : solvent front (A) Paper chromatography. The break and exchange theory is the most accepted theory is the most accepted theory is the measles is protected against the measles against the measles is protected against the measles against the virus but not against other common viruses such as cold, chicken-pox or mumps. vesicles deliver their contents to endosomes. (a) IA i × ii ; (b) IAIB × IA i ; (c) IB IB × IAi ; (c) IB IB × IAi ; (d) IAIB × IA i ; (d) IAIB × IA i ; (d) IAIB × IAi ; (d) IAIB × IA i Nondisjunction of Normal Rolled Glossy Buckling Microcarpic Elongate Echinus Cocklebur Spinach Reduced Poinsettia Globe IIex Fig. In diagram C formation of sex chromosome has been shown. Both scientists along with Holly received the Nobel Prize in 1968. T4 bacteriophage is a largesized tadpole-shaped complex virus (Fig. Feedback inhibition is a regulatory mechanism which does not affect enzyme synthesis, but rather inhibits enzyme activity (Fig. 223 Chloroplast inheritance in variegated four o'clock plants. What does gene interaction mean ? It is most common in protozoans but it also occurs in certain lower metazoans. Schematic representation of the chromosome of E.coli, showing only 12 of the 45 supercoiled loops (after King, 1986). small proteins (e.g., insulin, vitellogenin, immunoglobin, transferrin, etc.), vitamin B12, cholesterol containing LDL or low density lipoprotein, oligosaccharide, etc. Genetic material must be capable of variation. C.de Duve and P. We should note that gene i has its own promoter (pi) located prior to the i locus. Boron BO33-, B4O72- Activates arabinose isomerase. However, in the absence of F0-F1 particles, these vesicles lose their capacity of
phosphorylation as shown by resolution (i.e., removal by urea or trypsin treatment) and reconstitution of these particles (Fig.10.6). Each loop of lampbrush chromosomes is found to perform intense transcription of hn RNA or heterogeneous RNA molecules. It is a smoothly continuous process and is divided arbitrarily into following stages or phases for convenient reference (Fig. (2) Induced mutations. Besides porin, other proteins of this membrane include enzymes involved in mitochondrial lipid synthesis and those enzymes that convert lipid substrates into forms that are subsequently metabolized in the matrix. coli surface of cell (Fig. This was clearly shown in 1962 by Chapeville. X Triticum durum Secale cereale (Tetraploid wheat ; 2n = 28) (Diploid rye ; 2n = 14) \downarrow F1 hybrid (sterile) (Triploid ; 2n = 21) (Chromosome doubling) \downarrow Hexaploid triticale (2n = 42) Fig. If the mean number of chiasmata is known for a chromosome pair, the total length = mean number of chiasmata × 50 Two Point Test Cross The percentage of crossing over between two linked genes is calculated by test crosses in which a F1 dihybrid is crossed with a double recessive parent. 6.4. Diagram of the intervention of the smooth endoplasmic reticuthetase (see Thorpe, 1984). By hydrodynamic analysis it has been calculated that to move a chromosome, a force about 10-11 dynes is needed, and that the entire displacement— from equator to the pole of a chromosome— may require the use of about 30 ATP molecules. This technique is used to study the molecular arrangement in the plasma membrane and other cellular membranes. This process involves the following steps: 1. Sickle cell anaemia Defective β-globin chain 12. (i) Normal characters. The active role is played by their distinct cytoskeletal structures that appear short-termly in M phase. Polyuridylic acid or poly (U) 2. The enzymes of the endoplasmic reticulum perform the following important functions : 1. The synthesizing enzymes, is controlled by nuclear genes. 2. What are some of the more obvious similarities and differences between chloroplasts and mitochondria? The nucleoproteins can be categorized into following two types : (i) Basic proteins. (c) Are there eukaryotic mRNA molecules that do not contain either feature? Genetic discoveries have had major effects on medicine. Thus, the other 299 accessory pigment molecules are referred to as antenna molecules or antenna pigments, to designate their role in the capture of light energy. Drosophila has 4 pairs of chromosomes and 4 linkage groups. 10.2. Mode of development of T and B lymphocytes (after Alberts et al., 1989). Transposition events involve both recombination and replication processes which frequently generate two daughter copies of the original transposable elements. Growth is best studied at 370 C and it takes about 60 minutes to double the cell mass. Unsaturated fatty acids predominate in lipids of higher plants and in animals that live at low temperatures. They could be separated by crossing over. Two other snRNAs, U4 U2 and U6 are also involved in the formation of binding of U2 snRNP spliceosome, but their exact role is not known. Granular or Rough Endoplasmic Reticulum The granular or rough type of endoplasmic reticulum The granular or rough type of endoplasmic reticulum The granular or rough type of endoplasmic reticulum possesses rough walls because the ribosomes remain attached with its membranes. Describe the β-oxidation of fats. The acetyl- CoA produced is fed into Krebs cycle to be further oxidized. Their effects appear to be mediated by receptor proteins located in target-cell membranes and by the intracellular levels of cyclic AMP (cAMP) (called secondary messenger). 10.2. mitochondria Location of mitochondria near ATP utilization In cardiac muscles; B— determine In sperm tailthe cytoplasm, often appear tohigh be associated with: A microtubules which may (after and Alberts et al., 1989). Studies on fixed cells and on living cells have revealed the following two patterns of growth: linear and exponential. Plant the seed and pollinate the resulting plants with normal pollen from a strain devoid of male sterility. Upstream and downstream usually refer to regions in the 5' and 3' directions respectively, from a particular site that is being discussed. Structure of a cell wall showing middle with each other but at an angle to those in other lamella, primary cell wall and three relayers (Fig. Table 18.1. Different stages of a mitotic cell cycle and their duration in hours. Any parental genotypes that can produce at least some progeny with a greater number of contributing alleles than they themselves have are possible, for example, Aa Bb Cc Dd × Aa Bb Cc Dd × aa bb Cc Dd, etc. Tetrahydrofolic acid (CoF), 10. Of Contents 72 CELL BIOLOGY the 24 essential elements, six play especially important roles in living systems. (a) Explain what is meant by a degenerate code and illustrate your answer to show degeneracy in translation. Thus, Sanger's dideoxy methods includes the following steps : 1. Whereas a phenotypic trait results from the combined action of many genes and their products constantly interacting with the environment. In Drosophila, Y chromosome contains genes for the spermatogenesis. When a purine (e.g., adenine) base of a triplet codon of a cistron is substituted by another purine base (e.g., thymine) is substituted by another purine base, (e.g., thymine) is substituted by another purine base (e. differences in the severity of symptoms of an inheritable allergy, or the different medical histories (one with a serious childhood disease, the other escaping this disease). A deficiency in the segment of chromosome (V); so that the recessive albearing the dominant gene A allows the recessive allele a to lele (v) for waltzing had exbecome phenotypically expressed (after Stansfield, 1986). NADPH- cytochrome c-reductase Removal or addition of hydrogen D. For paternity determination, DNA fingerprints of the mother, child and alleged father are compared. Basal lamia which is in contact with the epithelial basal plasma membrane and is composed of fine feltwork of fibrils of collagen of Type IV that are embedded in an amorphous matrix. In this disorder, the middle joints of the digits (phalanges) in hands or feet remain rudimentary and fuse with an adjacent joint (Fig. The photoreceptor molecules that initiate the response are phytochrome and a blue light receptor located on or very near the plasma membrane. Others function as coupled transporters, in which the transfer of a second solute, either in H pump ATP the same direction (symport) or in the opposite direction lysosomal membrane (antiport). Such cells are therein the plasma membrane (antiport) or in the opposite direction (symport) or in the opposite direction lysosomal membrane (antiport). ancreatic cells. plasma cells. hepatic parenchymal cells. Nissls bodies, osteoblasts, serous cells, or the submaxillary gland, chief cells of the glandular stomach, thyroid cells and mammary gland cells. Discontinuous variation; distinct phenotypic classes. The latter then loses an electron to a series of electorn carrier molecules. In Melandrium (Lychnis), staminate or male plants are XX and pistillate or female plants are XX. The substance on which the enzymes act is known as substrate. Heating the gel solution will cause it to become sol again, and A B the phases are reversed. In contrast, small molecules to lipid be secreted (e.g., histamine by the bilayer mast cells) are actively transported. from the cytosol (where they are synthesized on the free ribosomes) into preformed vesicles, where they antiport are complexed to specific macromolecules (e.g., a network of coupled transport proteoglycans, in case of histamine; Fig. Polymerization $5' \rightarrow 3'$ Exonuclease $5' \rightarrow 3'$ Use of primer single strands Use of nicked duplex or helix Molecular weight 7. teins, called initial or primary binding proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins, called secondary binding proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins, called secondary binding proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without them the other proteins (e.g., L4 protein) bind at specific sites on the naked rRNA and without the naked rRNA and with receptor protein for androgens, so body cells cortex and vice versa. Thus, there are many cell types among fungi, protozoans and higher plants and animals. Pseudoalleles. human cell mouse cell membrane protein time = 0 minutes antibodies () to human membrane protein, labelled with rhodamine [] incubation at 37°C 3. It is late replicated when the bulk of DNA has already been replicated when the bulk of DNA has already been replicated when the bulk of DNA has already been replicated when the bulk of DNA has already been replicated when the bulk of DNA has already been
replicated when the bulk of DNA has already been replicated when the bulk of DNA ha following figure : Parents : Colourless Shrunken CS/cs cs/cs Test cross results : Colourless Shrunken CS/cs cs/cs Cs/cs cs/cs Cs/cs cs/cs Test cross results are clearly showing that parental combination of alleles (e.g., CS/cs and cs/ cs) are those expected from complete linkage and appear in 96% cases, the other two are new combinations (e.g., CS/cs and cS/cs) and appear in 4% cases. The B subfibre lacks the wall adjacent to A subfibre l includes no substage. rRNA genes are present in multiple copies. The prefix indicates the degree of the ploidy. In 1935, glycoprotein Danielli and Davson, backbone proposed a model, lipid sandwich called layers model, for membrane structure in which a B lipid bilayer was coated A protein layers C on its either side with hydrated proteins Fig. Monsomics have also been produced in maize and tomato (2n = 24) despite their being diploids. It is still not known whether IFs are polar structures (like the DNA double helix). Alpha-Thalassemia Collagen disorder Dwarfism Emphysema Lesch - Nyhan syndrome Phenylketonuria Christmas disease 9. Many are of some evolutionary significance. The membrane of each component of this system has two faces : (i) the cytoplasmic or protoplasmic face and (ii) the luminal face (Fig. Gene a comprises 800 base pairs and specifies an enzyme, thiogalactoside acetylase, which transfers an acetyl group from acetyl-CoA to β- galactoside (i.e., this enzyme is indirectly involved in lactose utilization). (viii) GENETICS 1. Secondary constrictions can be distinguished from primary constriction or centromere, because chromosome bends (or exhibits angular deviation) only at the position of centromere, because chromosome bends (or exhibits angular deviation) only at the position of centromere during anaphase. nucleolus as the principal "flow-through" centre or "valve" regulating the entire process. Baumiliar (1967) reported that viruses increase the mutation rate in Drosophila melanogaster. Describe the types, structure and functions of the endoplasmic reticulum? What is the probable genotype of the son with respect to sex chromosomes and colour blindness ? Size. Then, amino acid residue of aminoacyl adenylate is transferred to amino acid attachment site of tRNA where its carboxyl group forms bond or linkage with the 3-OH group of the terminal adenosine at CCA end of tRNA. Remaining seven subunits increase processivity (processivity means rapidity and efficiency with which a DNA polymerase extends growing chain). The inheritance of colour blindness, a green table and red balls appear much the following two types of marriages : same colour. These results, thus, suggested that tetraploid Gossypium hirsutum originated from two diploid species, namely G. These twins belong to the same sex. Amale Drosophila with reduced eyes was crossed to a female with normal eyes. Kernel Colour in Wheat A whole grain or seed of a cereal plant such as Histograms showing the relative frequency of individuals expressing height phenotypes derived from Kolreuter's cross between dwarf and tall tobacco plants carried to the F2 generation. Determination of male sex in Bracon by heterozygosity. These are genes which result in opposite phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., they produce abnormal phenotypic effect than the standard gene, i.e., Only green part of plants and certain microbes have the power of synthesizing the carbohy- Simple sugars: Many animals consuming nectar, a solution rich in glucose. ing over between linked genes, or from intracistronic crossing-over. EUPLOIDY The term euploidy (Gr., eu = even or true; ploid = unit) designates genomes containing chromosomes that are multiples of some basic number (x). An individual or cell containing a single complete set of chromoTt somes is known as haploid. Oxidative phosphorylation Occurs in the presence of light; thus, periodic Uses H2O and CO2 Liberates O2 Hydrolyzes water Endergonic reaction CO2 + H2O + energy foodstuff Takes place in chloroplast 1. As a result, when the interphase nuclei reform pericentrioler at the end of nuclear division, a centrosome containing material (PCM) two centrioles exists beside each nucleus. The most common nucleic acids of the nucleoplasm are the DNA and RNA. True hermaphrodites are individuals that possess both ovarian and testicular tissue. As the term non-disjunction implies, these aberrant gametes are produced only as a result of failure of the sex chromosomes to disjoin after synapsis; they are not physically attached. This has been shown by exposing isolated axonemes to proteolytic enzymes, which disrupts both the nexin links and the radial spokes but leaving the dynein arms and the microtubules microtubules microtubules axostyle themselves intact. Their microscope had two lenses and total magnifying power between 10X and 30X. There is no epistasis (masking of the phenotypes) among genes at different loci. To un3' C G derstand the P OH mechanism of T DNA-replicay P P tion inside the G 5' β P living cell (in P α P 3' vivo), molecular 5' A biologists tried polymerase OH DNA in vitro polymerdeoxynucleoside triphosphate ization of DNA (dATP) and found that in addition to DNA P polymerase enß y pyrophoC zyme, three sphate P P OH classes of A T 3' organic moly β P ecules are essen + P + energy G C P tial for an in vitro P P G reaction. A phenotypically normal F1 group of mice carrying these two genes in coupling phase is being maintained by a commercial firm. 32 anticodon Fig. The membrane of plasma membrane of released polypeptide chain contains the formylated methionine at its one end. B group : 4 to 5 pairs — Submetacentric 3. There after, the material is stained (e.g., with Giemsa technique) to demonstrate the banding patterns of chromosomes. The force by which the molecules are bound is called the surface tension of the liquid. RBD-1, DL-253. In longitudinal binary fission the nucleus and the cytoplasm divide in the longitudinal plane. 'hybrid' 'light' 15 N medium generation 3 F3 Fig. Pili are known to be coded by the genes of the plasmid. proteins that straddle the gaps, occur in parallel rows or septae. Right handed B-DNA molecule Fig. An immature centriole contains a ninefold symmetric array of single B tubule C tubule microtubules; each microtubule then presumably acts A tubule as a template for the assembly of the triplet microtubules of mature centrioles. D. The peripheral layer of the ooplasm is known as the cortex and
it contains many microvilli and cortical granules. CERTAIN GENERAL TECHNIQUES OF GENETIC ENGINEERING The opening move of the genetic engineer is to break the DNA up into small, manageable bits, each containing one or just a few genes. At the base of these folds, there develops a septa and, thus, narrow compartments of basal cytoplasm are formed. No homology exists between the transposon and the target site for its insertion. 18.3). How will you show that the minimum size of a code word should be triplet ? Alternation of generation in Bryophyta (after Burns, 1969). 13.7). The most important heteropolysaccharides are as follows: (a) Hyaluronic acid, keratin sulphate and chonTough, slightly flexible chitin droitin sulphate. During cytokinesis of mitosis or meiosis, the vesicles originating from the periphery of Golgi apparatus, coalesce in the phragmoplast area to form a semisolid BIOLOGY However, in the cells of higher plants under anaerobic conditions, pyruvic acid is converted into either ethyl alcohol or any organic acid. In them the chromomere (regions in which the chromatin is more tightly coiled) alternate with regions where the DNA fibres are folded more loosely (Fig. These elements are structurally related to each other and can insert at many different sites on the chromosomes. This so called milk factor resembles in many respects with a virus and has been discovered to be transmissible also by saliva and semen. The means of selecting the correct AUG sequence differs in prokaryotes and eukaryotes. The molecule contains following nitrogen bases in its molecule: (i) Purines—adenine and guanine. Proteins of plasma membrane of erythrocytes. A—Glucose; B— Fructose; C—Ribose (after Ambrose and Easty, 1977). Dna B or helicase (also called mobile promoter); 2. Subsidizing the fit. In each membrane the luminal faces are shown in thick lines, while the cytoplasmic faces are depicted by thin lines. system. This type of movement of the chiasmata is known as terminalization. The variations are the raw materials of the evolutionary process. 3.6. Molecular organization of the tobacco mosaic virus (TMV) (after De Robertis, Jr., 1987). The molecules consist of single chain of polynucleotides. The minus ends of cytoplasmic microtubules in cells are bound tightly to microtubule organizing centres (MTOCs) from which their assembly or polymerization starts. The eggs with the gene 'w' when fertilized by the Red eyed female Red eyed female Red eyed male sperms having the Y chromoFig. a polypeptide, another amino acid will be incorporated. On acproteins cholesterol count of its fluidity and the phospholipid peripheral mosaic arrangement of proposed by Singer and Nicolson. Therefore, the immigration rules must be strict and the persons with undesirable hereditary traits must not be allowed to migrate from one place to another. The F1 hybrids in these cases are known as polyhybrids or multihybrids. The centrosome and microtubules which form aster rays. Example 1. coli cells grown for sometime in the presence of 15N-medium were washed free of the medium and transferred to 14N-containing medium and allowed to continue to grow for specific lengths of time (i.e., for various numbers of generations, when the mutant gene is able to recombine with another similar recessive gene. Chromosomes 257-279 Historical; chromosome number; morphology — karyotype and idiogram; material of the chromosome – euchromatin; isolation methods; chemical composition — DNA, the C-value paradox, histones, nonhistones; ultrastructure — single-stranded and multistranded hypotheses, folded-fibre model and nucleosome concept, nucleosome and solenoid models; functions; giant chromosomes, lampbrush chromosomes and solenoid models; functions; giant chromosomes; functions; giant chromosome; functions; giant chromosome; functions; giant chromosome; giant chromosome; giant chromosome; giant chromosome; giant chromosome; giant chromosome; giant chrom directly. Important features of different forms of DNA double helical structures. 5 being more than 6 × 10 Contents 124 CELL BIOLOGY glycophorin molecules per cell (i.e., erythrocyte), their exact function is still not known. If a plant were trisomic for one of its chromosomes and these chromosomes carried the alleles A, A1, and A2, respectively, what would be the genotypes of the genes? Actual experiments, however, yielded only six phenylalanine, leucine, tyrosine, lysine, asparagine and isoleucine. Tongue rolling. The mRNA bands blotted onto nitrocellulose membrane can be hybridized with a labelled DNA or RNA probe. Phosphorylation affects serines and threonines, changing them from a state of neutral charge to one of negative charge and is a reversible reaction. When such frameshift mutations were intercrossed, then in certain combinations they produce wild type normal gene. The structural polysacchaHO rides serve primarily as extracellular or intracellular supporting eleHO ments. rr rr RR, Rr RR, Rr Hypostatic alleles Phenotypic Expression of alleles F2 Phenotypic ratio ss SS, Ss ss SS, Ss Neither r nor s (No pigment) S R R+S (Mutually supplementary genes)* White=1 } Red=9 * Presence of dominant alleles on both epistatic and hypostatic loci produce cumulative phenotypic expression. There are many synonyms for basal body, including kinetosome, blepharoplast, basal granule, basal corpuscle, and proximal centriole. Thus, some environmental factors as size of parent body or of egg, age of parent body or of egg, age of parent body or of egg, age of parent and temperature are found to determine the sex in following cases : 1. Different workers advanced different theories about the physical characteristics of the matrix. If a second generation (F2) is bred from such F1 sinistral individuals, it is all dextral, instead of showing segregation as would be expected in normal Mendelian inheritance. coli contains about 4000 kilobase pairs (kb; kilo = 1000); there are about 1.5 kb in 16S rRNA. The most abundant oligosaccharides of Fig. Electron micrographs of spread chromatin from nucleoli often show that some of the repetitious rRNA genes are inactive. If the cell is synthesizing DNA, it needs to import about 106 histone molecules per minute. The arms contain dynein, which is large protein complex (nearly 2 million daltons) composed of 9 to 10 polypeptide chains, the largest of which are about 450,000 daltons. Cis arrangement. Contents 6 GENETICS, HUMAN GENETICS and ovum or egg) have only one factor. 12.15. (i.e., it is a constitutive heterochromatin, Fig. In fact, there often are multiple copies of the Ac and Ds elements present in the maize genome. Injection or penetration of viral genetic material (DNA) into the host cell. 20.3. Electron microscopic view of a mitochondria, Golgi apparatus, ribosomes, etc., flagellate spermatozoon. Agranular or Smooth Endoplasmic Reticulum This type of endoplasmic reticulum possesses smooth walls because the ribosomes are not attached with its membranes. A cell contains variety of solutes in it, for instance, the mammalian erythrocytes contain the ions of potassium (K+), calH2O H2O H2O Cium (Ca +), phosphate H2O --(PO4), dissolved haemoglobin and many other substances. ii 3. Further, an ion channel is made of integral proteins of neural membrane. The alleles of hypostatic locus or gene B will be able to express themselves phenotypically only when gene locus A may contain two recessive alleles (aa). Some organisms produce two types of gametes. Contents

18 CELL BIOLOGY Thus, a good light microscope, with a numerical aperture of 1.4 and using light of short wavelength (0.4 µm) will resolve two points at about 0.17 µm separations. For example, catalase enzyme is a tetrameric haeme-containing protein that is made in the cytosol (cytoplasmic matrix) as the haeme-free monomers; the monomers are imported into the lumen of peroxisomes, where they assemble into tetramers in the presence of haeme. 5.2. An RNA strand is copied only from strand) of a segment of a DNA molecule. These antigens interact with protein molecules produced by the host, the immunoglobulins, which bind the antigen in much the same way as an enzyme binds its substrate. Monod put forward the operon concept. Comment upon the functions of nucleus, mitochondria, ribosome and microtubules. What possible explanations can you offer for the reversion of a mutant to the wild-type phenotype? Contents 162 GENETICS, HUMAN GENETICS and EUGENICS the pituitary gland to produce female hormones that cause the gonad of the hen to develop into an ovary. Under normal conditions, if brain microtubules are isolated and caused to depolymerize into tubulin subunits, the tubulin molecules will reassemble into microtubules are isolated and caused to depolymerize into tubulin subunits. Luria shared Nobel Prize in medicine for their contribution to replication and recombination in viruses (bacteriophages). For example, the deficiency Fig. centrifugations of increasing velocity. Ephrussi (1953). This mRNA is translationally inactive, but within minutes after fertilization, translationally inactive, but within minutes after fertilization. * = nucleotide whose ribose is methylated) (after Freifelder, 1985). Bacteria have a high ratio of surface area (c) Spirilla of volume because of (a) Cells of Pseudomonas (b) Streptococcus (twisted shape) (cylindrical); (spherical) their small size. The centromeres of the chromosomes remain directed towards the equator and the arms of the Fig. Sn. A Nicotiana plant could have any two of these, but no more, since they are alleles located opposite each other in a pair of chromosomes. Mg2+ ions, phosphate, etc., are good examples of the electrolytes. But since intragenic interalleic crossing over (recombination) is possible, in the F2 generation wild type individual appear. About six thousand years ago men kept records of pedigrees of domestic animals such as roce. They occur in vast numbers. Some vi(6 subunits) adenovirus (252 capsomeres) ruses such as rabies virus are bullet-shaped. They play a key role in sorting many of cell's proteins and membrane constituents, and in directing them Contents CELL BIOLOGY 172 layered cisternae rough endoplasmic reticulum B A C secretory vesicle D division of cisternae E F G Fig. The base letter for the gene usually is borrowed from the name of the mutant or abnormal trait. Around 1953, it was universally accepted that DNA is the gene usually is borrowed from the gene usually is borrowed from the name of the mutant or abnormal trait. microorganisms and higher organisms. The white-eyed male contains a single gene w for white colour of eye which remains located in X chromosome. The forming or cis face of Golgi is located next to either the nucleus or a specialized portion of rough ER that lacks bound ribosomes and is called "transitional" ER. For instance, the cross between pea plants with yellow round seeds and green wrinkled seeds produces a dihybrid having yellow round seeds. The synthesis of polypeptides is specified, directed and regulated by self-duplicating genes which are borne within molecules of DNA which is the universally accepted chemical bearer of genetic informations of most living organisms except certain viruses in which this function is carried by RNA, another nucleic acid. Mendel and His Work 22-44 Rediscovery of Mendel's work, Mendel's material and crossing technique; phenomenon of dominance; certain examples of phenomenon of dominance in plants, application of phenomenon of dominance in animals, mechanism of segregation; law of segregation; law of segregation; law of segregation; certain other examples of law of segregation; law of reverse genetics in Mendel's wrinkled character, dihybrid cross; multihybrid cross; examples of dihybrid test cross; examples of dihybrid test cross; multihybrid test cross; examples of dihybrid test cross; multihybrid test cross; examples of dihybrid test cross; multihybrid test cross; mul ratio, 4:2:2:1 ratio; revision questions and problems. Structure Hollow with walls made up of 13 protofilaments 2. The determination mechanism of insects. (3) Classification based on solubility characteristics. The reproduction may be of following two types : 1. Microfilaments also extend into cell processes, especially where there is movement. Vacuoles The vacuole of a mature plant cell is formed from the enlargement and fusion of smaller vacuoles, which are believed to be derived from the ER and possibly the Golgi and contain acid hydrolases. The exposed face is then shadowed with electrondense combination of carbon and metal such as platinum to provide the necessary contrast, after which organic material (i.e., the specimen itself) is removed by acids to leave a metal replica for examination in the electron microscope. Many The bacterial flagellum. Ribosomes play a vital role in the process of protein synthesis. He also showed that even after removal of the nucleus, the cell was able to continue morphogenesis for a time and proposed that the cytoplasm contained a store of morphogenetic material (later on rec- Acetabularia crenulata x grafted intermediate type Big. The resulting membrane is called a red cell ghost. Thus, due to duplication some genes are present in a cell in more than two doses. The foreign genes then can be released from recombinant plasmids once again by the use of restriction enzymes. Zygote. Contents CHAPTERS 1. Seed coat colour : Grey × White G, g; W, w A, a 1 Grey 705 Grey 224 White 3.15 : 1 4. 15.9), respectively. However, in animal cells the Golgi apparatus is a localized organelle. Biosynthesis of ribosomal proteins; C. C Genetical effects of deletion. Plastids are absent in the cells of fungi, bacteria, animals and male sperm cells of certain higher plants. When a sandy pig (SS rr) is crossed with a second sandy p secondary constriction may arise because the rRNA genes are transcribed very actively and, thus, interfering with chromosomal condensation. As the erythrocytes pass through the lungs, they exchange bicarbonate (HCO-----) for chloride (Cl-----) through these hydrophilic channels during the process of CO2 release (chloride shift). C. The creeper birds have much shortened and deformed legs and wings, giving them a squatty appearance and creeping gait. The word "formal" pertains to the extrinsic aspect of something as distinguished from its substance or material. When he crossed a certain red strain to a white strain, he observed that the F1 was all light red and that approximately 1/16 of the F2 was as extreme as the parents, i.e., 1/16 was white and 1/16 was red. DNA polymerase I which is used for filling the gap created A-T 9-mers Dna A + ATP initiation due to RNA primers and 7. Indeed, a single human cell may contain more than 10,000 different protein molecules. Contents C H A P T E R 12 Nucleus T he nucleus (L.,nux = nut) is the heart of the cell. The compound lipids contain fatty acids, alcohols and other compounds as phosphorus, amino-nitrogen carbohydrates, etc., in their molecules. Tryptophan is synthesized in five steps, each requiring a particular enzyme. course 1:1:1 : 1. 4.1 C). This type of diplosis is known as the restitution, e.g., insects of order Hymenoptera (Nemertis conesceus) and Lepidoptera. producer gene which is Roy J. ach species has a characteristic number of chromo somes in the nuclei of its gametes and somatic cells. A dihybrid cross between the vestigial-grey and long-black Drosophila. Such genes were initially considered to be too long to be synthesized, because an average gene contains about 1500 base pairs. These hexose sugars are first broken down into 3-carbon compound (pyruvic acid) by a series of chemical reactions known by
many enzymes. In Oenothera, a rare series of reciprocal translocations have occurred which involve all 7 of its chromosome pairs. The more apart two genes are located on a chromosome, the greater the opportunity for a chiasma to occur between them. (b) Parental genotypes : ACB/abc. It was previously known as DNA polymerase & II. If wild type appears a and b are non-allelic; F2 : 2. Contents HUMAN GENETICS 231 C H A P T E R 18 Human Genetics F Human Genetics. Some of these regulatory lymphocytes in their action (i.e., they enhance B cell's responses) and are instrumental in preventing antibodies being produced against the individuals own cells. Addition to 3'-OH group; requirement for a template. Thus, if male sterile female parent contains recessive 25% male nuclear genotype rr of restorer 50% male fertile pure having homozygous dominant Fig. Discuss the various lines of evidence supporting or providing this concept. Since then many chemical compounds which are ordinarily considered to be non-toxic have been found to be mutagenic in certain specific situations. The phenomenon of primry non-disjunction was discovered by C.B. Bridges (1916) during his classical matings of Drosophila melanogaster. Recently, cytoplasm has been found to be filled with a three-dimensional network of interlinked filaments of cytoskeletal fibres, called microtra-becular lattice (Porter and Tucker, 1981). It includes study of recombination (crossing over) in all kinds of organisms such as higher plants, animals, fungi, bacteria and viruses. However, transcription can be partially reactivated in these nuclei by transferring them into new cytoplasm or exposing them in vitro to altered environmental conditions. HMW proteins (=high molecular weights of 200,000 to 300,000 or more ; 2. In fact, in some active genes the nucleosomes are displaced or "phased" in these regions (Samal et. It physically separates the cytoplasm from the surrounding cellular environment. Cholesterol esterase 12. The base uracil (U) replaces thymine in RNA but, otherwise, the DNA strand is faithfully copied. Spermiogenesis The metamorphosis or differentiation of the sperma is known as spermiogenesis. A a C c B a a b C A b c a B C a b c A B C A b C a B c a b c A B c A b c a B c a b c A B c A b c a B c a b C A B c A b c a B c a b C 1 C c B C B a b 2 3 c b A Fig.; Simpson's hopeful monster; orthogenesis and orthoselection; revision questions. The microtubules extend outward from the nucleus to all parts of the cell. Kohler and J.K. Jerne S.Tonegawa Developed pulsed field gel electrophoresis for the separation of very large DNA molecules. SIGNIFICANCE OF FERTILIZATION 1. The male gamete is known as pollen or sperm and female gamete is known as pollen o What one cross could you use to determine if s and r are alleles ? Two identical monomers pair to form a dimer in which the conserved helical central regions are aligned in parallel and are wound together into a coiled coil. The symbiotic origin of the chloroplast appears very justified but Kirk (1966) has shown that certain important enzymes which are necessary for the development of the chlorophyll and for the photosynthetic mechanism are synthesized according to the codes of the nuclear DNA. In what way or ways are operator and regulator sites similar? Polynucleate cells. Genetic Code 7. Ribosomes of chlorophyll and for the photosynthetic mechanism are synthesized according to the codes of the nuclear DNA. In what way or ways are operator and regulator sites similar? determines the structure of an enzyme, galactoside permease which is a plasma-membrane bound protein and facilitates the entrance of lactose into the cell. In Contents 224 GENETICS, HUMAN GENETICS other words, slow growth of petite can be attributed to yeast cells utilization of less efficient fermentation process. However, males and females of Drosophila by Bridges, one of the student of Morgan. The lysosomes of plant cells are membrane-bounded storage granules containing hydrolytic digestive enzymes, e.g., large vacuoles of parenchymatous cells of corn seedlings, protein or aleurone bodies and starch granules of cereal and other seeds. In one scheme, A fragment was joined to B fragment taking advantage of the overlap in residues 17-20; fragment C was then added, with the overlap in the region of 46-50 residues. None of the daughters ever exhibited the trait. Cytosine (C) Deoxycytidine 4. The science of genetics attempts to explain the mechanism and the basis for both similarities and differences between related individuals. The size of the nucleolus is found to be related with the synthetic activity of the cell. Contents CHROMOSOMAL MUTATION II 193 (iii) Triticale (Triticosecale Wittmack) is the first man made cereal which has been developed in recent years and is cultivated on about one million hectares of land throughout the Globe for the commercial use. This observation shows that required connexon thymidine has been passed from a wild-type cell to a mutant cell, presumably via gap junctions. It is also called Calvin reaction, photosynthetic carbon reduction cycle (PCR cycle), carbon-fixation reaction or Contents 230 CELL BIOLOGY thermo-chemical reaction. The most important enzymes are the stearases, NADH-cytochrome C reductase, NADH diaphorase, glucose-6-phosphotase and Mg++ activated ATPase. Contents CHROMOSOMES 265 2. In this way the surface life span of red blood cells may be regulated (see King, 1986). Techniques in cell biology; Growth. Does it make the child to inherit more from the mother than from the father ? Such a mutant was discovered in the c' d' freshwater snail Limnaea peregra (A. Cell Theory In 1838, a German botanist Mathias Jacob Schleiden (1804—1881) put forth the idea that cells were the units of structure in the plants. Using Neurospora, how can you show that crossing over takes place at four strand stage. 3.12. Describe the ultrastructure of the flagellate spermatozoon. How can monoploids be produced and utilized in plant breeding? This ecapsulated clearly indicates that only S strain DNA and not protein is injected into bacterial cells. How are pedigree charts are used in human genetics? It has been suggested that CAAT and GC boxes determine the efficiency of transcription, while TATA box aligns RNA polymerase at proper site with the help of proteins, called transcription factors or TFs (e.g., TF II D). Demonstrate the following rates of reduction in heterozygosity per generation are correct : 1. Contents C H A P T E R microtubule vesicle endoplasmic reticulum intermediate filaments mitochondrion microfilaments plasma membrane 15 Cytoskeleton : Microfilaments and Intermediate Filaments and Intermediate Fi the degrading action of the enzyme, ribonuclease. The great majority of genes have mutation rate of 1 X 10-5, viz., one gamete in 100,000 to one gamete in 100,000 to one gamete in 100,000 to one gamete in 20,000 to one gam epistasis is termed as dominant epistasis. Such genes odoratus (after Burns 1969). It was reported that cells were rich in RNA when they were active in proteins. lysaccharides and are present in the eggs of sea urchins, frogs, fishes, bivalve molluscs, some annelids and certain mammals. 15.5. Mode of "decoration" of actin filaments by HMM (after Thorpe, 1984). The genetic informations may be written in any one of the three moieties of DNA. The process is akin to seeing dust particles floating in a sunbeam. They were described in detail in shark occytes by R. Described details of chloroplast structure Considering the known density of the DNA molecule, Watson and Crick next concluded that the helix must contained but a single stack of ten, and too high if it contained three or more stacks of ten nucleotides each. The somatoplasm and germinal or reproductive cells contain the germplasm. The fol0 5 10 15 20 25 30 35 lowing cross-pollinated plants are generations (inbreeding) Fig. Golgi Functions in Plants maturing face Golgy complex forming face 173 rough ER The EM of the Golgi complex with a very large number of vesicles. The female sex is, thus, heterogametic and produces two types of eggs, half with a X chromosome (with or without a X chromosome and half without a X chromosome). Harvey, 1935) suggested the presence of proteins in sialic acid termini the plasma membrane,
oligosaccharide in addition to the lipchains G G ids. Baltimore (1970) also reported the activity of this enzyme in certain RNA tumour viruses. His skin was like thick bark which had to be shed periodically. However, occasionally it fails to make this distinction and reacts destructively against the host's own molecules; such autoimmune diseases can be fatal to the organism. Nexus ; 7. Contents 12 GENETICS, HUMAN GENETICS AND EUGENICS C H A P T E R 2 Genetical Terminology Like other sciences, the science of genetics has its specific terminology which minimizes the chances of confusion, inconvenience and unnecessary repetition of full sentences. INTERMEDIATE FILAMENTS Intermediate filaments (IFs) are tough and durable protein fibres in the cytoplasm of most higher eukaryotic cells. The crossbanding pattern of each polytene chromosome is a constant characteristic within a species and helps in chromosome mapping during cytogenetic studies. The signal hypothesis was proposed by Blobel and Sabatini (1971) to explain how the ribosomes which are meant for the biosynthesis of secretory type proteins get specifically attached to RER membranes. Contents INBREEDING, OUTBREEDING AND HYBRID VIGOUR 73 between unrelated parents. (a) Translocation between (b) A child with Burkitt's lymphoma Outcomes of reciprocal transchromosomes 8 and 14 location. The mutations occurring in non-reproductive body cells are known as somatic mutations. sequencing of PCR products either with the thermostable Taq DNA polymerase. This phenomenon is called somatic pairing. Behavioural genetics. The proteins so far identified are subunits of the seven subunits in cytochrome oxidase. Grid is placed between the condenser and objective lenses in a vacuum and the image is viewed on a phosphorescent screen. a a BB, Bb, bb a does not inhibit B or b (Phenotype of B or b) Example In Leghorn type of fowl the white colour of feather is caused by the dominant genotype CC II, similarly the white colour of feathers of Plymouth Rock breed is caused by the recessive genotype cc ii (Table 4-12). Thorpe (1984) and Burns and Bottino (1989) preferred the term test tube brush chromosomes for them. Vitamine) 6. During this period there is no RNA synthesis and so the enzyme molecules must remain in an inactive state. Sugars are first activated in the cytosol (cytoplasmic matrix) by the formation of nucleotide-sugar intermediates (e.g., UDP-glucose, UDP-N-acetylglucosamine, and GDP-mannose), which then donates their sugar Contents CELL BIOLOGY 164 Glc Glc Man Man Man 5' mRNA ribosome 3' cytosol Man Man rough ER Man lipid bilayer of ER Glc NAC H2N lipid lipid H2N Glc NAC P P NH asparagine H CH2 Ser -N-C-C-[X]-||Thr || HO ER lumen growing polypeptide chain lipid-linked oligosaccharide B A NH2 COOH Fig. Blurred vision, cataract and corneal ulceration; 2. 11.14. Studied reproduction in sea urchin and concluded that fertilization involves the union of sperm and egg pronuclei. Thus, cross male sterile the spirochaete can be considered as an endosymbiont of female but not of male Drosophila, and its presence in S F the female gives rise to the condition called maternal sex ratio, in which male sterile the progeny are exclusively or almost male fertile entirely female. Earlier observation of Warner and Satir (1974) that the spokes are attached perpendicularly to the ciliary axis where it is straight and that they may be active in the conversion of active sliding between outer doublets into local axial bending. Mendel's first law. Roux 1886 1888 Schimper Meyer E. In the above mentioned example therefore, the FED sequence of genes due to reverse tandem duplication will be ABC. 5.31. Describe the process of cell growth. Normally, GUG codes for valine, but when normal AUG codon is lost by deletion, only then GUG is used as initiation codon. 9.8. A - D i d e o x y n u c l e o t i d e ; B - Technique involved in Sanger's chain termination method for sequencing of DNA. 4.19. By isolating that one special cell and growing it up to any desired quantity, the one desired gene (or its protein product) can be obtained. The vitamins of utmost biological importance have been tabulated in Table 4-7. For example, the rose genus Rosa includes species with the somatic numbers 14, 21, 28, 35, 42 and 56. Gametic lethals in each complex act differentially in the gametophytes. The transfer or soluble RNA (tRNA or sRNA) which is non-genetic RNA of prokaryotes and cell vomiting. CELL CYCLE AND MITOSIS All cells are produced by divisions of pre-existing cell. Sometimes they exhibit an infection like transmission with a hereditary continuity of their own. Centromeric index, i.e., this index is expressed in the form of ratio of the short arm length to the total chromosome length : Short arm length to the total chromosome length : Short arm length to the short arm length to 0.5. 4. ATPase activity 5. (i) Codon assignment by homopolymer. 16.1. Three types of point mutations. The extraneous coats of animal cells can affect the concentrations of different substances at the surface of the cell. 13.5. The clonal inheritance of a condensed inactive X chromosome that occurs in female mammals (after Alberts et al., 1989). The gene or locus which was suppressed by a epistatic gene. During the biological oxidation of the carbohydrates and fats large amount of energy is released which is utilized by the mitochondria for synthesis of the energy rich compound known as adenosine triphosphate or ATP. Regulation of mitotic chromosome cycle. Due to the second meiotic division the secondary oocyte forms a mature egg and a second polocyte. (b) Sex determination in Neurospora. They are called cytotoxic T cells or killer T cells. Contents 132 CELL BIOLOGY of one ATP molecule to export three Na+ ions outside the cell in exchange of the in systemic capillaries CO2 high CO2 pressure import of two K+ ions inside the cell. Schmitz in 1884 and A.F.W. Schimper in 1885 made detailed cytological studies of these cell organelles and showed that chloroplasts always arise Starch filling plastids in potato cells. Different states have wisely adopted the restricted measures in segregation the mental defectives from the society and to place them in mental hospitals. Text of the book is accompanied with simple and self-explanatory diagrams. In man, other mammals, certain insects including Drosophila and Lygaeus turicicus and in certain angiospermic plants such as Melandrium album (Lychis), Humulus lupulus, Contents DETERMINATION OF SEX AND SEX DIFFERENTIATION A Female Male B X Y X X Fig 13.2. Male and female Drosophila melanogaster and their chromosomes. (a) Does crossing over take place in the female Drosophila in oogenesis? Skin epidermis 3. The well hooks round RNA transcriptase oligo (dT) 3' characterized cDNA molecule is A A A A n primer T T T T n 5' allowed to bind with a suitable treat with DNA alkali to remove vector which then transforms a RNA 3 bacterial cell in such a way that it T T T T T 5' DNA does not disrupt its normal hook extended polymerase function. Synthesis of mRNA is accomplished with only one of the two strands of DNA, which is used as template. and liver. 10.10. Urease 9. Some mutations alter the phenotype of an organism so slightly that they can be detected only by special techniques. Variation. 16. Describe the chemical composition, structure, origin and function of the plant cell wall. AA, Aa bb b Example Recessive epistasis in mice. Thus, there is a hollow core Fig. It is possible that B-Z transition is itself involved in gene regulation and this may be the way in which DNA methylation has its effects on transcription. The chromosomal ends showing the convex electrone dense layer and the are known as the telomeres. Like the annuli of nuclear membranes it contains a diaphragm across it (Ward and Ward, 1968) and possesses an octagonal symmetry (Maul, 1968). These wave length that is best absorbed by DNA and a wave individuals develop extensive skin tumours length at which proteins act as carriers or permeases to carry on selective transportation of nutrients (molecules and ions) from the environment to the cell or vice versa. Both kinds of cytoplasmic inclusions. R.B. Roberts edited this collection of papers and coind the name ribosome in his introductory Plant cells have many simpler units of Golgi apparatus, called dictyosomes. Ty elements apparently contain two genes TyA and TyB. (d) Is a primer required? Such genic balance mechanism of determination of sex was first of all studied in Gametes Drosophila by DNA is not replicating. Bar-eyed female flies sometimes produce normal eyed or ultrabar progeny, although with a very low frequency (about 1 in 1600). 16.3. Pairing qualities of rare tautomers of four DNA bases. In 1918, Wilstatter and Stoll isolated and characterized the green pigments-chlorophylls a and b. Discuss the role of chloroplasts and mitochondria in the cytoplasmic inheritance. (2) The intracellular hydrolytic enzymes are denatured, preventing autolysis. Thus, (1) the cell cannot be produced until the M-phase-delaying-factor has disappeared; (3) the M-phase-delaying factor and S-phase activator cannot disappear until DNA-synthesis has ended; (4) DNA synthesis cannot end until all of the DNA has replicated on the mitotic (5) the DNA cannot begin to replicate until DNA rereplication block has been removed by passage through mitosis into G1; and lastly (6) a cell cannot progress from mitosis into G1, until the chromosomes have separated on the mitotic spindle. DNA polymerase I enzyme is now considered to be a DNA repair enzyme rather than a replication enzyme. During mitosis or meiosis, the prophase is the stage during which the chromosomes become shorter and thicker due to multiple coiling as proposed by Dupraw and others. Chase demonstrated that only the DNA of T2 bacteriophage enters the host, the bacterium Escherichia coli, whereas the protein remains behind. Thus, endosomes Receptor-mediated
endocytosis. Confirmed the 9 + 2 fibrillar arrangement of cilia and flagella. However, the following three models throw some light on it : direction of chromosome movement ATP-driven microtubule "walking protein" kinetochore chromosome A ATP-driven chromosome B Microtubule kinetochore microtubule kinetochore microtubules kinetochore microtubule kinetochore microtubule kinetochore microtubules kinetochore microtubule kinetochore microtubule kinetochore microtubule kinetochore microtubule kinetochore microtubule kinetochore microtubules kinetochore microtubule kinetochore microtubules kinetochore microtubule kinetochore microtubule kinetochore microtubule kinetochore microtubule kinetochore microtubule kinetochore microtubules kinetochore microtubule kinetochore microtubule kinetochore microtubules kinetochore microtubu (i.e., there is complete removal of the haemoglobin) and there is no chance of its resealing, the resulting membrane is called white ghost. The endoplasmic reticulum forms a zygote nucleus. Thus, water tends to have a remarkably high boiling point (100° C) for a substance of such low relative molecular mass. DNA content and ploidy (Pollister et al., 1951). The molecule contains a double stranded helix structure in which many nucleotides remain arranged in pair. The membranes which allow only water but no solute particle to pass through them are known as semi-permeable membranes. (a) 11; (b) 13; (c) 14; (d) 14; (e) 14; 10; (f) 6; (g) 18. The synthesis of membranes of ER is found to proceed in the following direction : RER \rightarrow SER. other cases, synapsis may begin in internal regions of the chromosomes and proceed toward the ends, producing the same type of alignment. There are also examples of exceptional conditions caused by dominant alleles. However, the old format of the book has been retained in order to familiarise the readers with the basic concepts. Following kinds of syngamy are prevalent among the living organisms : (i) Autogamy. On average, each mitochondrion must double in mass and then divide in half once in each cell generation. Overton believed this was because of an outer lipoid layer in which hydrophobic compounds were more soluble. (iii) The activation of egg insemination. Here an ordered reading of genes is emphasized. Thus, the relative distances and ordering of genes is emphasized. Thus, the relative distances and ordering of genes is emphasized. organized in "redox loops" within the membrane, and the electrons are passed from one carrier to another on the respiratory chain. Describe some specific human traits controlled by heredity. In this type of translocation, the broken segment of one chromosome gets inserted interstitially in a nonhomologous chromosome. (a) What sex is this individual (b) Determine the frequency with which different types of gametes (number of autosomes and sex chromosome) can be formed in this individual? (iii) Hemidesmosomes. In developing oocytes, as opposed to somatic cells, Barr bodies are not present, the activities of both Lampbrush chromosome of a newt. This gradient provides the driving force for the inward transport of phosphate and potential for generation. Therefore, these four DNA bases can be considered as four alphabets of DNA molecule. coli has six operons which contain genes for the inward transport of phosphate and potential for generation. Therefore, these four DNA bases can be considered as four alphabets of DNA molecule. coli has six operons which contain genes for the inward transport of phosphate and potential for generation. ribosomal proteins. Contents CYTOPLASMIC MATRIX 91 The sole exception is proline, where the amino group forms part of a ring structure. Besides the semiconservative replication, in which both strands of parent double helix would be conserved and the new DNA molecule would consist of two newly synthesized strands; and (ii) dispersive replication, in which replication would involve fragmentation of the parent double M. Colchicine is added to arrest cell division at metaphase stage. Assembly of phage DNA into protein coats.5. Lysis of host cell and release of the infective progeny phages. They arise when a codon for an amino acid is mutated into a termination codon (UAG, UAA or UGA), resulting in the production of a shorter protein. Organismal Theory holds that the body of all multicellular organisms is a continuous mass of protoplasm which remains divided incompletely into small centres, the cells, for the various biological activities. 145 Thus, here same allele (h+) has different expressions in male and female individuals, but both alternative forms of the trait (e.g., horned and hornless) are known in each sex, i.e., both horned and hornless sheep are known as female and male. For example, the human gonad differentiates into a definite testicle at the seventh week, whereas the female gonad begins to develop ment. Results obtained from secondary non-disjunction. Glyoxysomes. Metaphase I Metaphase I consists of spindle fibre attachment to chromosome and chromosome inactivation is often termed lyonization after the name of British cytogeneticists Mary Lyons. 4.3. Checkerboard derived from a cross between coloured (black) and albino mice showing 9:3:4 ratio due to recessive epistatic genes. Jacques Monod Francois Jacob Like other disciplines of science, the genetical insight has produced new challenges as well as solutions to some human problems. The chromosomes of both daughter nuclei are arranged on the equator and undergo second meiotic division to form a diploid ootid and a diploid polocyte. tended state and appear as a mass in the center of the cell. Contents 248 GENETICS, HUMAN GENETICS AND EUGENICS The eugenics can be applicable by adopting following two methods : (A) By encouraging the marriages between desirable persons (constructive method or positive eugenics). On the chemical basis, the polysaccharides can be divided into two broad classes : the homopolysaccharides and the heteropolysaccharides. For example, plasmodesmata are especially common and abundant in the walls of columns of cells that lead toward sites of intense secretion, such as in nectar-secreting glands (trichomes of Abutilon nectaries). A molecule of clathrin is composed of three large polypeptide chains and three smaller polypeptide chains, all of which together form a three-legged structure, called triskelion. intact nuclear envelope E Microspores D Yeast and Diatoms F Brown algae G Higher plants Fig Generalized transduction involves phages that have incorporated a segment of bacteT rial chromosome during packaging of the phage; t specialized transduction involves temperate phTt T ages that are always inserted into the bacterial t chromosome at a site specific for that phage. Da Vinci (1485) recommended the uses of lenses in viewing small objects. Discuss the role of human genetics in medical science with reference to (i) genetic counselling; (ii) antenatal diagnosis, and (iii) gene therapy. The curve is sigmoidal, behaving as an autocatalytic process with growth rate proportional to the amount of active protoplasm or replicating entities. uring the discussion of Mendel's monohybrid and dihybrid crosses, we encountered with the fact that for the determination of single phenotypic trait of an organism, two alleles or allelomorphs of a single gene interacted in various ways. gous (Fig. Recently the chloroplasts of the algae and higher plants are found to contain DNA molecules. Their amino acid sequences indicate that each IF polypeptide chain contains a homologous central region of about 310 amino acid residues that forms an extended α -helix with three- short— α- helical interruptions (Fig. yellowish green plants with carotenoids, usually are referred as pale green, golden or auria plants and 3. them. Peroxisomes. Cellulose is an unbranched (straight) structural polysaccharide of glucose in which the neighboring Fig. In this case the 2% double crossovers would appear with the 72% parental types, making a total of 74% parental types and 26% recombinant types. 18.2. A family pedigree for polydactyly in man (after diseased condition appears in Burns 1969). This particle consists of several tubuli and thylakoids and is surrounded by additional rings of starch. Several hypotheses have been proposed to explain the mechanism of electrochemical link between respiration and phosphorylation inside inner mitochondrial membrane. occupy with regard to a given quantitative character; environment determined range at which an individual's measurements will fall. alent or tetrad because of the four visible chromatids. mentally retarded. Under certain abnormal conditions when in a monospermic type of egg many sperms enter in the egg, the condition is known as the pathological polyspermy. In its gaseous from, CO2 dissolves poorly in aqueous solutions such as blood plasma, but inside the erythrocyte the potent enzyme carbonic anhydrase proton bicarbonate external medium permeation pathway dehydrated K+ ion Contents PLASMA MEMBRANE AND CELL WALL 131 This process occurs while the haemoglobin in the erythrocyte is releasing its oxygen into the blood plasma. Acid phosphatase Removal of phosphate E. They contain enzymes of glyoxylate cycle besides the catalases and oxidases. This force is Contents 316 CELL BIOLOGY apparently generated by dynein arms which 'walk' along the doublets, as has been suggested by Peter Satir's (1968) sliding filament hypothesis. Mapping experiments employing mutations of these three genes have demonstrated that the gene order is z-y-a. Myocardial muscle cells have numerous sperm head large mitochondria called sarcosomes, that reflect the great tail amount of work done by these cells. This maintains heterozyFig. It is found in some species of earthworms, badelloid rotifers, grasshoppers, roaches, phasmids, moths, gall flies, fishes, salamanders and lizards. UDP glycosidase Contents 116 CELL BIOLOGY STRUCTURE OF PLASMA
MEMBRANE 1. A synthetic bilayer made from a single type of phosEF pholipid changes plasma integral from a liquid state to membrane protein a rigid crystalline or gel (viscous) state at lipid a characteristic bilayer freezing point. Grew in 1682 reported for the first time the reproductive parts of plants. This results into loss of resistance against frost, etc. Glycolysis is achieved by a series of 10 enzymes all of which are located in the cytosol (cytoplasmic matrix). For example, in case of sickle-cell anaemia superiority retains the two types at equilibrium. This was called "Griffith effect" or more popularly "bacterial trans-formation". A "family tree", drawn with standard genetic symbols, showing inheritance patterns for specific phenotypic characters. 10.24. Recessive Epistasis (9:3:4) Sometimes the recessive alleles of one gene locus (a) mask the action (phenotypic expression) of alleles) (see Table 4-3). If single-base changes occur in DNA (and, therefore, in mRNA), which amino acid, tryptophan or arginine, is most likely to be replaced by another in protein synthesis? As diagrammed here, the anticodon is read from right to left $3' \rightarrow 5'$ called amino acid becomes coU=uridine, $\psi = pseudouridine$, DiMeG=dimethylguanosine, T=ribothymidine, because the amino acid attachment site, (A=adenosine, C=cytidine, G=guanosine, T=ribothymidine, because the amino acid becomes coU=uridine, $\psi = pseudouridine$, DiMeG=dimethylguanosine, T=ribothymidine, because the amino acid attachment site, (A=adenosine, C=cytidine, G=guanosine, C=cytidine, G=guanosine the anticodon (after Burns and Bottino, 1989). Band 3 protein acts as the anion exchange channels in the membrane. In bacteria (e.g., E.coli) this region is called the Pribnow box and in the eukaryotes the same region. On a glass slide is placed a drop of type A serum (containing anti-B antibodies) and a separate drop of type B serum (containing anti-A antibodies). A tautomeric shift is believed to occur when the amino (NH2) form of adenine is changed to an imino (NH2) form. At metaphase the chromosomes are tightly coiled primary and the chromomeres are no longer visible How can you differentiate between the terms haploidy and monoploidy ? (ii) Endoplasm is the inner portion of cytosol which is granular and less viscous. The males live as parasites in the uterus of the females. Further, the 5S RNA genes are located outside the nucleolar organizer. A group of these cisternae is called the dictyosome, and a group of dictyosomes makes Golgi vesicle up the cell's Golgi apparatus. SC is not found in those organisms in which crossing over does not occur (e.g., the male fruitfly, Drosophila melanogaster; see Burns and Bottino, 1989). For instance, Turner's syndromes (XO) are sterile female individuals having certain abnormalities such as short stature, congenital malformations, shield chest, pronounced webbing of the neck, short fourth metacarpel, colour blindness, etc. type of extra-cellular solution or fluid. The presence of kappa particles in the killer Paramecium is dependent for their maintenance and replication on the chromosomal dominant gene K. Thus, there are two domains in the L chains (i.e., VL and CL) and four in the H chains (i.e., VH, CH1, CH2 and CH3) (Fig. and 1730 and mated with several local mares of the slow, heavy type that had carried the medieval knights in heavy armour. A homozygous black female is test crossed to an albino male. 13.6. A bilateral gynandromorph Drosophila. Oleosomesand to an albino mated with several local mares of the slow, heavy type that had carried the medieval knights in heavy armour. or elaioplasts store fats and essential oils. What is the major function of mitochondria ? They fused two different types of cultured cells having different surface antigens (proteins). 10.14. What is genetic engineering ? By contrast, + H intestinal and kidney tubules, respectively, cytosol H+ where the concentration of the sugar is low. ANSWERS TO PROBLEMS 9. A chemical reaction showing formation by nonhistones was shown only during 1970s. (1) Monoploids have a single basic set of chromosome number (Fig. Bateson (1902) published a book "The Principles of Heredity." From 1902 to 1909 he introduced the terms allelomorphs homozygote, heterozygote, F1, F2 and epistatic gene. the plasma membrane and other membranes do not contain either the same types or equal amounts of the various peripheral and integral proteins, e.g., erythrocyte's plasma membrane. Haemophilia is the most serious and notorious disease which is more common in men than women Oxireductases : Oxidation and reduction 6. This results in an increase of free sugars due to failure of starch formation. Unlike pinocytosis, which is a constitutive process that occurs continuously, the phagocytosis is a triggered process in which activated receptors transmit signals to the cell interior to initiate the response (Wright and Silverstein, 1983). DNA ligase rich (Dna A-site) HU or IHF protein (which converts pimerless okazaki frag13-mers (ori ments into continuous strand). In barley, mutations called erectoides and eceriferum have been induced. The chemiosmotic theory postulates that the primary transformations occurring in the respiratory chain guide the osmotic work needed to accumulate ions. (4) The lines that survive show a general decline in size and vigour. (b) 5' TAA GCT GGAA (c) A-T = 60 per cent. Nilsson- Ehle for the first time in 1908. In terms of energy 129 ATP molecules contain 4747 kJ (129 × 36.8 kJ). 10.9. Diagrammatic representation of the energy liblast phosphate group of the ATP is eration in mitochondrion and its utilization in released the large amount of energy various cellular functions. When the variegated plants serve as females in a cross, they give rise to green, white, and striped progeny, regardless of the nuclear genotype of the paternal parent. As discussed in Chapter 9 of Chromosome Mapping, genetic mapping depends on the assumption that genes do not move from one position to another. Contents 28 GENETICS, HUMAN GENETICS AND EUGENICS Table 3.1. Actual data obtained by Mendel in his monohybrid crosses and certain modern data Each of these centrioles nucleates the formation of a small aster, one of which can be used by the egg for cleavage division, so that a haploid organism devlops by a process called parthenogenesis. It will arm them with latest information for facing any type of exam quite adequately. During it, oxygen is evolved by photolysis or splitting of water molecule. Contents REPLICATION OF DNA 39 (iii) Topoisomerases (DNA gyrases). Cartwheel There are no central microtubules in the centrioles and no special arms. head plasma membrane 2. As a consequence the shape of the RBC containing it becomes distorted and sickle-shaped. The same reasoning holds true for the second and third letters of the codon. A D 4. Calvin and Benson (1948) showed that phosphoglycerate was an early product of CO2 fixation. J C H FA is the inbreeding coefficient of these elements was Contents 256 GENETICS, HUMAN GENETICS AND EUGENICS C gametophyte C' Ds C fertilization to produce the triploid endosperm C C' Ds chromosome breakage C C C Ds mitosis acentric fragment lost clone of pigmented cells (genotype CC) Fig. It possesses a DNA containing core embedded in a regular icosahedral capsid (162 capsomeres) and an outer envelope of lipids, proteins and carbohydrates. The initiating the A. Common Functions of Granular and Agranular Endoplasmic Reticulum 1. The uniparental inheritance of a trait which cannot be atributed to unequal cytoplasmic factors (e.g., streptomycin resistance in Chlamydomonas). Shape. The number of chiasmata depends on the length of the chromosomes because the longer the chromosome the greater the number of chiasmata. Bacteria reproduce asexually by binary fission and endospore formation for the metabolism of fatty acids. These characters of β-oxidation for the metabolism of fatty acids. always behave as dominant and recessive. (vii) Protamines. Certain eggs develop by the usual process of oogenesis but at certain stages diplosis or doubling of chromosome number and production of diploid eggs occur. GaudensFig. Thus, dimerization interferes with the proper base pairing of thymine with adenine, and may result in thymine's pairing with quanine. Ecology in India; Ecological succession; Wild-life management; Biogeography; Adaptation. 10.7. A monohybrid cross between Himalayan and albino rabbits. The F1 offsprings by self crossing produce the F2 generation with the triangular and top-shaped seed capsules in the ratio of 15: 1. RST DEF may be either interstitial (e.g., LMN . (2) In aphids (plant lice), daphnids and rotifers, the sexual generation may come after many In the summer water fleas reproduce very rapidly by parthenogenesis. In prokaryotic mRNA, called leader sequence containing 8 to 13 nucleotides. Helical or cylinvirus drical symmetry. A German biologist, Henking in 1891 while studying spermatogenesis of the squash bug, Pyrrhocoris, noted that meiotic division. Exon. The molecules of sucrose are composed of D-glucose and D-fructose. The mesosomes can be compared with mitochondrial crests. Flavin- linked enzymes are commonly involved in a number of enzyme systems such as fatty acid oxidation, amino acid oxidation, amino acid oxidation, amino acid oxidation and Krebs cycle activity (e.g., succinic dehydrogenase or SDH). The matrix of nerve cells possesses the property of the conductivity. The best studied of these is the poky strain of N. HORMONALLY CONTROLLED SEX DETERMINING MECHANISM In many cases it has been observed that sexual differentiation is controlled by hormones. Write an account of structure, synthesis, function and histochemical localization of the catalase enzyme in eukaryotic cells. The entire liposomes may be endocytosed and degraded intracellularly (see Sheeler and Bianchi, 1987). (b) A ognized : homozygous and heterozyjaw
tumour like this child's is a common symptom of Burkitt's. The Golgi apparatus of the cells of the leaf and the stem also possess the cutin and cutin waxes which make the primary cell wall impermeable. However, the fibroin mRNA survives for several days during which each mRNA is translated repeatedly to yield 105 fibroin molecules. Thus, the presumed role of this enzyme is to initiate the degradation of D-amino acid that may arise from breakdown and absorption of peptidoglycan material of intestinal bacteria. 5.5. mRNA start Base sequences in the noncoding strand of six different E. We can consider here the classical but logical reasoning done by George Gamov (1954) about the possible size of a codon. 11.5. Cis and trans arrangements of alleles a and b or apr and w alleles of Drosophila in heterozygous condition. In vertebrates, Type III IFs consist of three distinct polypeptides, the so-called neurofilament triplet. face (i.e., they are glycoproteins). Correns further reported that flowers from the variegated branches yielded mixed progeny of green white (pale) and variegated plants in widely varying ratios (Fig. To show that this was a permanent genetic change, they dispersed many of the newly formed S-III colonies and placed them on a second agar surface. Contents CYTOPLASMIC MATRIX 83 tin sulphate and chondroitin sulphate. These fertile tetraploids were called Raphanobrassica. Ligases or synthetases. About a dozen different alleles are now known to occur at this locus; they are red or wild type (w+) The photographs show white eye and the brick-red wild-type eye colour in Drosophila. Missence codon is a codon which undergoes an alteration to specify another amino acid. Tryptophan (Try, W) CH2— CH — COOH | NH2 N H C. Recently, the classical method of symbolization has been modified a little. sion (Fig. The outer and inner sides of Alberts et al., 1989). H2O photophosphorylation and carbon fixation. For example, in a developing organism, in an embryo, a cell must not only grow and produce many progeny cells but also must undergo considerable change in morphology and biochemistry (i.e., become differentiated) and then maintain the changed state. A— cently it is reported that Actual appearance of the dipteran insects such as flies (e.g., Drosophila), mosquitoes and midges nucleosome packing is mediated by histone H1 Fig. .At this stage, an attempt will be made to determine that in what manner the genetic informations are existed in DNA molecule? isolation of two membranes and compartments has enabled localization of various enzyme systems of mitochondria. some strand is shown. Thus, nine amino acids, namely phenylalanine, tyrosine, histidine, glutamine, asparagine, lysine, aspartic acid, glutamic acid and cysteine, have two codons each. 3.21 respectively show the ultrastructure or finer details of a typical animal cell and a typical plant cell which have been revealed by the electron microscope. Write about its significance. Therefore, they can make less than a dozen different proteins. GERL (or Golgi, ER and lysosome) refers to a special region of endomembrane system, which is more related to the Golgi apparatus and is involved in the formation of lysosomes. The spindle is constructed from two half spindles, each composed of kinetochore, polar and astral microtubules. This complex transposon contain three genes that produce the protein indicated. the mirror-image structured but which are identically structured but which cannot be superimposed on each other. Other phenotypes are due primarily to the kinds and amounts of non-enzymatic proteins (including the structural proteins) present, for example, haemoglobin, myoglobin, gamma globulin (e.g., immunoglobin, gamma globulin, experiments have been conducted in which human cells deficient in the synthesis of purines have been obtained from the patients with Lesch-Nyhan syndrome and grown in culture; these cells have been converted to normal cells by transformation with recombinant DNA. Other proteins, and some hormones. Inside mitochondria, some of (after Thorpe, 1984). ANSWERS TO PROBLEMS 5. An organism with a mutation only in gene g2+ could produce a normal phenotype, if it was given either substance C for the production of normal phenotype. Ribosome binding technique of Nirenberg and Leder (1964) made use of the finding that aminoacyl- tRNA molecules specifically bind to ribosomemRNA complex. In addition to cartilage, hyaluronic acid is also found in other connective tissues, in the synovial fluid of joints, in the vitreous humor of the eyes, and also in the capsules that enclose bacteria. Euploidy ; the different chromosome number are respectively 2n, 3n, 4n, 6n, 8r and 12 n. They maintain the shape of cell and form contractile component of cells, mainly of the muscle cells. Animals exhibiting limited growth include insects, birds and mammals. In these membranes the water molecules and crystalloids are forced through them by the hydrostatic pressure forces. X Himalayan \downarrow chch Agouti c+ch + + 1 c c : 2 c+ch : 1 chch 3 Agouti X Chinchilla 1 cchcch Agouti c+cch + + 1 c c : 2c+ cch : 1 cchcch 1 Chinchilla : 2 Light gray : 1 Himalavan Fig. Thus, about half of 45S rRNA molecule is lost by the successive degradations. These proteins are not as highly conserved among organisms, although they must carry out similar enzymatic activities. (a) Ii/Ii Green (Female) X ij/ij Striped (Male) E Ij/ij All green (b) ij/ij Striped (Female) E Ij/ij Green (c) E Ij/ij Green Ij/ij Striped of F1 of b (Female) E Ij/ij Green (Male) E Ij/ij Green (Male) E Ij/ij Green (Male) E Ij/ij Green Ij/ij Striped of F1 of b (Female) E Ij/ij Green (Male) E Ij/ij Green (Male) E Ij/ij Green Ij/ij Striped of F1 of b (Female) E Ij/ij Green (Male) E Ij/ij Green Ij/ij Striped E Ij/ij Green Ij/ij Striped Ij/ij Green Ij/ij Striped Ij/ij Green Ij/ij Striped E Ij/ij Green Ij/ij Striped Ij/ij Green Ij/ij Striped E Ij/ij Green (Male) E Ij/ij Green (Male) E Ij/ij Green Ij/ij Striped Ij/ij Green Ij/ij Striped I Ij/ij Green Ij/ij Striped I Ij/ij Green II/ij Striped E Ij/ij Striped I Ij/ij Green II/ij Striped I Ij/ij Striped I I Ij/ij Striped I I Ij/ij Striped I I Ij/ij Striped I I Ij/ij Striped I Ij/ij Stri (13+13) from the dihybrid parent. The phospholipid molecules are hydrolysed by the enzyme phospholipase. (a) In the vesicular transport vesicles, while the cisternae themselves remain as stable elements. The term ribosome is due to rich RNA content of this organelle. When a centriole bears a flagellum or cilium, it is called basal body. 1225 AB : 35 AB : 1 ab. They appear to play major role in cyclosis and amoeboid motion. Telophase I, during which nuclei are reassembled. Give reasons for your answer. 17.5. (a) Cross between green (normal) and striped (iojap) plants. In undulant movement the waves of the contraction proceed from the site of implantation and pass to the border. The long axis of 30S subunit is oriented transversely to the central protuberance of the 50S subunit. 7. OXIDATION OF CARBOHYDRATES The carbohydrates enter in the cell in the form of monosaccharides such as glucose or glycogen. Cytoplasmic and flagella are more resistant to various treatments. Explain. All larvae of Bonellia are genetically and cytologically similar. Cech and S. Contents GENETIC CODE 67 arises that whether the genetic informations are written in articulated language or coded language? The mitochondrial, ribosomal and transfer RNA and for a few proteins of the inner membrane. Among living organisms fundamentally following two systems of matings occur inbreeding refers to the production of offspring through matings between related parents, where as outbreeding is the protozoan Nassula, microtubules drive the food in the gullet. The 80S ribosomes contain four types of rRNA, viz., 28S rRNA (or 25-26 rRNA in plants, fungi and protozoa), 18S rRNA, 5S rRNA, and 5.8S rRNA, and serum albumin found in blood. Got Nobel Prize for isolation and characterization of sub-cellular organelles and other particles. Hydroxyl containing amino acids. The rotors of all ultracentrifuge spin in a vacuum in order to prevent heating from air Rotor friction. The membrane-bound ribosomes are attached with specific binding sites or receptors of rough ER membrane-bound ribosomes are attached with specific binding sites or receptors of all ultracentrifuge spin in a vacuum in order to prevent heating Offices : z 238-A, M.P. Nagar, Zone 1, Bhopal - 462 011 z A-14, Janta Store Shopping Complex, University Marg, Bapu Nagar, Jaipur - 302 015, Phone : 0141-2709153 © 1974, P.S. Verma & V.K. Agarwal. This translocation exhibits position effect and it is not transmitted to offspring of persons having Philadelphia chromosome (Ph1 does not appear in gametes of the patients). How do you know ? As soon as the acrossmal filament SEM of human sperm cells migrating inside the uterus touches the egg surface the ooplasm protravelling across a background of uterine mucosa cell. Contents REPLICATION OF DNA 4. They are named by putting a prefix 'e' to signify their eukaryotic origin. Satellites or pericentriolar bodies are electron-dense structures lying near the centriole that are probably nucleating sites for the microtubules. (iii) The maturation phase. Transcription of eukaryotic DNA to produce mRNA begins with the synthesis of long precursor molecules by RNA polymerase II from the template strand of DNA. The Ylinked gene of H-Y antigen is located on Excessive development b BB short arm of Y Nonbarred Barred of hair on pinna of ear. Moreover, the sex should be free from the wide spread confusion, narrowminded concepts and religious and ethical bindings because that is a natural biological instinct. In fact, at this stage the chromosomes are violently rotated and oscillated back and forth between the spindle poles because their kinetochores are capturing the plus ends of microtubules. EFGH. Prokaryotes 1. A cross between a barred hen and a non-barred cock
showing sex linked (Z-linked) inheritance. knipple (1799) and Goss (1824) conducted hybridization experiments on edible pea (Pisum sativum), but they failed to formulate any law of inheritance like the Mendel. It occurs in the ciliated protozoans which have rigid cilia. It has served well in the field of molecular biology, since this bacterium is particularly easy to grow in an artificial medium where it divides every 20 minutes at 370C under optimal conditions. The precise functions of capping and tailing may also help in the final export of this message from the nucleus. Phospholipase 18. provides necessary amount of energy for the motion of the cilia and flagella. Protectively, the ER chemically modifies xenobiotics (toxic materials of both endogenous origin), making them more hydrophilic, hence, more readily excreted. Transposons (Tn) are several thousand base pair long, and have genes coding for one or more proteins (including resistance factors in bacteria which act against antibiotics). Crossing Over 9. The substitute some animal cells (i.e., ciliate protozoans) contains of A: T base pair into G: C base pair due to keto and purine bases. If in the language of codes what is the nature of genetic code? The cytoplasm of many plant and some animal cells (i.e., ciliate protozoans) contains numerous small or large-sized, hollow, liquid-filled structures, the vacuoles. 7.2. Initiation of translation in prokaryotes. Independently verified the existence of DNA fibrils in mitochondria and chloroplasts. Facultative heterochromatin. Dead skin cells are constantly being lost and replaced by mitosis. The process is accomplished by protease enzymes similar to the process occurs in digestion. Mammalian cells do not contain D-amino acids, but the peroxisomes of mammalian liver and kidney contain D-amino acid oxidase. Enzymes and coenzymes of Krebs cycle are located in the mitochondrial matrix (some of them such as succinic dehydrogenase, are attached to M face of inner mitochondrial membrane). Vapour and fluid theories; 2. Sanger (for which Sanger intrachain disulphide bond S S A chain COOH NH2 C-terminus S intrachain disulphide bridge S S NH2 COOH B Chain Fig. However, transformation. The lysosphagocytic lysosomes fuse with vesicle omes are originated from Golgi vesicle membrane and discharge apparatus and contain numerous their contents (about 50) hydrolytic enzymes (e.g., acid phosphatase that is cytochemically identified) for intracellular and extracellular and muscle cells, and vimentin filaments surround and probably support the large fat droplets in the fat cells. Often, sealing strands mosome form a series of interconnected and anastamosing lines, like a row of stitches in a quilted surface. Membrane fusion during exocytosis and endocytosis. A plasmid can sometimes fuse with the main DNA and later on can depart from the main DNA with it. Ions, nucleotides and structural, catalytic and regulatory proteins are imported from the cytosol (cytoplasmic matrix); mRNA, tRNA and ribosome subunits are exported to the cytosol (cytoplasmic matrix) (see Reid and Leech, 1980). Thus, 1x is monoploid, 2x is diploid; and the polyploid types are 3x (triploid), 5x (pentaploid), 6x (hexaploid) and so on. The male being heterogametic produces two types of gametes, 50 per cent sperms with X chromosome containing w gene, 50 per cent sperms with 'Y'chromosome without w or + gene. X chromosomes being required for normal oogenesis. The roots of molecular biology were established in 1953 when an Englishman, Francis Crick and a young American, James Watson working at Medical Research Council Unit, Cavendish Laboratory, Cambridge, proposed a double helical model for the structure of DNA (deoxyribonucleic acid) molecule which was well known as the chemical bearer of genetic informations of certain microorganisms (bacteria, bacteriophages, etc.) due to pioneer discoveries made by Grifith (1928), Avery, Macleod and McCarthy (1944) and Hershey and Chase (1952). Sex-influenced and holandric characters; 2. They have a regular geometrical and macromolecular organization. 70S Ribosomes. Rearrangement of cytoskeletal components just below the cell surface manifests in the distribution of integral membrane proteins and also in the cellular motions, endocytosis and exocytosis. The diameters of the majority of cells fall within a range of 0.2 and 50 µm. What are its major manifestations ? 12.2). Thus, sister chromatids become attached by their kinetochores to opposite poles; balanced bipolar forces hold chromosomes on the metaphase plate (Fig. Although not all genes contain introns, most do, and it seems that the presence of some of these introns is essential for RNA export. Such a case in which the extremes of F2 exceed those of the parent is called transgressive variation. In another words "the crossing over is a process that produces new combinations) of genes by interchanging of corresponding segments between non-sister chromatids of homologous chromosomes". Clever tricks allow the genetic engineer to pick out the host cell carrying the gene wanted for that particular experiment. Pyruvic acid dehydrogenase and its action. cyt b cyt c1 cyt a cytc cyta 3 Fig. he hereditary units which are transmitted from one generation to the next generation to the next generation are called genes. 18.1. Symbols commonly used in pedigree charts (after Bodmer als and squares for male inand Cavalli-Sforza, 1976). Working of mitotic spindle during anaphase. Satellite. 5.7. Freeze fracturing of the plasma membrane. Harmful evolutionary effect of euphenics. Contents GENETIC CODE 75 Codon and Anticodon The codon words of DNA would be complementary to the mRNA code words (i.e., DNA codes run in 3'-5' direction and mRNA code words run in 5'-3' direction) and so thereby the three bases forming the anticodon of tRNA (i.e., bases of anticodons run in 3'-5' direction). Compare and contrast these mechanisms, indicating how each achives repair and how the events occurring in each may lead to gene mutations. Distinguish between the following, giving the location of the genes, the mode of transmission, and relationship to sex: Contents SEX LINKED INHERITANCE 7. Chromatin can also be isolated biochemically by purifying nuclei and then lysing them in hypotonic solutions. (ii) Non-ionizing radiations as mutagens. AA, Aa BB, Bb, bb A inhibits B or b (No phenotype of B or b) 2. The chlorophyll is a green pigment of the chloroplasts. Among animals, the smallest cells osteocyte have a diameter of 4 µm chromatophore (e.g., polocytes); human nerve cell qoblet cell erythrocytes being 7 to 8 muscle cell µm in diameter. Often, internal bleeding (from bruises, internal bleeding and play a vital role in heredity, mutation, variation and evolutionary development of the species. Cucurbita pepo (pumpkin seed) 25.2 30.6 24.8 19.4 4. Insulin consists of two polypeptide chains, respectively (Fig. The 70 ribosomal proteins (rps) also bind to the transcripts in this region. Its double stranded them. 3. Chemically the carbohydrates are polyhydroxy aldehydes or ketones and they are classified as follows : A. Such an assemtei pro bly involves the hydrolyDNA sis of GTP to GDP. primosome in action (after Alberts et al, 1989). Lengths of DNA sequences are given in base pairs (bp) (after Gardner et al., 1991). 13.5. Results obtained from a Bridge's classical cross of a triploid (3A+XXX) fect results in the aufemale fly and a diploid (2A+XY) male fly (Drosophila.) tosomes femaleness. Paramecia with nuclear genotype kk are unable to harbour kappa particles. Later on, with the help of longer synthetic messages it has been possible to decipher 61 out of the possible 64 codons. In contrast, very few proteins in the cytosol (cytoplasmic matrix) are glycosylated and those that carry them have a different sugar modification. Thus, this sequence is capable of intrastrand base pairing, forming a "stem-and-loop" configuration in the transcript (RNA) and possibly in the DNA strands. Gene amplification also occurs in the DNA puffs of Sciarid dipterans and in chorion (egg shell) genes of Drosophila. A certain codon is determined to be AUG. 1.2). Starch is a nutrient, storage polysaccharide of plant cells (e.g., potato tubers). If the 'secret of life' is to be found anywhere it is in these molecules (Roberts, 1986). Completed the analysis of the amino acid sequence of bovine insulin; the first protein to be sequenced; got Nobel Prize in 1958 for this contribution. Contents MITOCHONDIRA 207 quinone. Metaphase 9. chiasmata Through the earlier part daughter of the meiotic prophase, centrioles however, the DNA continuous fibres molecule in each chromosome behaves as a genotypes were produced where dominance is complete. In 1966, two Australian workers, M.D. Hatch and G.R. Slack suggested an alternative pathway for carbon fixation in corn and some other hot-weather plants. Coined the term meiosis for the reduction and cell division. Note the three dimensional structure of the ribosome in two different orientations. The condensed portions of the nucleus are known as chromocenters or karyosomes or false nucleoli. syndrome) lia are ambiguous, but often more or less male to more or less masculinized; secondary sex characters vary from more or less male to 30 um or so in higher plants. 1.1) or manikin, the miniature man in the sperm head, was published in 1695 by Hartsoeker. Some mRNA molecules lack the poly (A) tail. For example, the vacuoles of certain specialized cells contain such interesting products as rubber (in Hevea brasiliensis) or opium (in Papaver somniferum). c+ch, c+c. Mary F. According to law of probability the chance that a particular chromosome will go to a particular pole as half and the chance that all the chromosomes in the monoploid set. (ii) i.e., individuals B and C contain $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ of their genes in common through ancestor E. Some algal cells may contain only one
mitochondrion. Cytosol. Pleiotropy. lum in glycogenolysis with the conse(ii) Bile acid synthesis. 14.7. Production of double-bar (or ultrabar) and bar-revertant (normal) chromosomes by asymmetric pairing and recombination in duplication homozygote. Reverse transcriptase. mitochondria Various steps of glycolysis were discovered by two German biochemists Embden and Meyerhof [Gustav G. The end product of a biosynthetic pathway may combine loosely (if in high concentration) with the first enzyme in the pathway. Let us become familiar with the following terms to understand more clearly the structure of the chromosomes (Fig. Frame-shift mutation. The second cytoskeletal structure required in M phase in animal cells is a contractile ring of microfilaments and myosin that forms slightly later just beneath the plasma membrane; it is meant for cytokinesis of the cell. A 5'-triphosphate and a 3'-OH. (a) 8; (b) None; meiosis cannot occur in haploid males; (c) 8. Some of these spheres are

without nuclei. When, the F1 agouti are crossed among themselves in F2 agouti, black and albino offsprings appear in the ratio of 9:3:4 as shown in the Fig. Lactase 18. two amino acids glycine and glutamic acid. These distances can also be expressed in morgan units; one morgan unit; one observations were recorded in a series of reports that he sent during 1675–1683 to the Royal Society of London. After elongating, one or more centrally located cristae form a partition by growing across the matrix and fusing with the opposite inner membrane. The sum (Σ) of all pathways between two individuals through common ancestors is the $coeffi \leftarrow E C$ cient of relationship and is represented by R : (i) RBC = The coefficient relationship between the full sibs B and C contain $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ of their genes in common through ancestor D. Likewise, Riddle found that metabolism had some definite role in the determination of sex in pigeons and doves, because, increased rate of metabolism developed the male potency, while decreased rate of metabolism caused femaleness. Crick ; M. It is usually not a gene, but typically includes many genes. ner, while the large globular heads have an Recent studies have an Recent studies have an Recent studies have an Recent studies many genes. Ner, while the large globular heads have an Recent studies have an Recent ciliary movements. Lamin B seems to intermediate filaments lamina remain associated with membrane vesicles in turn remain as envelope inner nuclear membrane a distinct subset of membrane components from which nuclear envelope Fig. TETRAD ANALYSIS Genetical proof that crossing over occurs during the tetrad stage has been provided by red bread mold (Neurospora crassa) and other fungi and algae. Gametes are haploid and, therefore, have half the DNA content (1C). Harelip and cleft palate often occurs. The protein as synthesized on the ribosome is a linear sequence of amino acids, polymerized by the elimination of water between successive amino acids to form the peptide bond, and existing as a randomly coiled chain without specific shape and possessing no biological (i.e., catalytic) activity. In April 1953, Watson and Crick published their conclusions about the structure of the DNA in the same issue of 'Nature', in which Wilkins and his colleagues presented the X-ray evidence for that structure. McClintock's marker was an allele of the C locus on the short arm of chromosome 9. 4.8. Bidirectional model for mammalian chromosome 9. 4.8. Bidirectional model for mammalian chromosome 9. 4.8. the presence of IA and/or IB allele is partly converted to antigen A and/or antigen B. Cytoplasmic or Extra-nuclear inheritance in eukaryotes : maternal inheritance in variegated four o'clock plant, maternal inheritance by iojap gene of corn, extra-nuclear inheritance by mitochondria, extra-nuclear inheritance in Drosophila, spirochaetes and maternal sex ratio in Drosophila, spirochaetes and problems; answers to problems. 7.4. Polysome formation : diagram shows the relative movement of the 70S ribosome and the mRNA, and growth of the protein chain (after Freifelder, 1985). pears compact and limited, in others spread out and reticular (net-like). The role of nucleus in heredity was firmly established by the grafting experiments of Hammerling (1953) with Acetabularia. The most abundant acidic proteins of the euchromatin (a type of chromatin) are the phosphoproteins. DNA analysis should be a boon for of man from certain fatal genetic diseases : medicine. The repressor gene TrpR is located quite far from gene cluster. 6.4). Because the character cannot be present as such in sex cells (sperm and ova) homotypic division. When the ovary of a hen is removed, the steroid cells of adrenal become active and provoked the development of rudimentary gonad into testis which itself is an endocrine gland. By deducting 2ATP used for initial activation of the fatty acid, a net gain of 129ATP (i.e., 35 + 96 - 2 = 129) is achieved. Thus, bacterial conjugation is a means of making new genetic combinations or recombinations which are expressed in the progeny. anterior part (iv) Paedogamy. Further, during early prophase progresses, the chromosomes approach the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes approach the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses, the chromosomes are evenly distributed in the nuclear cavity ; as prophase progresses empty. The anisogamy occurs in higher animals and plants but it is customary to use the term fertilization in them instead of the anisogamy or syngamy. All these natural inductions of polyploidy may occur due to chilling. Cytoplasmic structures. NADPH and molecular oxygen and depends on the enzymes of Electron transport chains of SER such as cytochrome P-450 and NADPH-cytochrome-c-reductase (iii) Steroid hormone biosynthesis. Bawden and Pirie (1937) extensively purified TMV and showed it to be a nucleoprotein containing RNA. However, following two factors may be involved in this process : 1. RNAase 9. Some of them may act as plasma antigens, receptor molmembrane ecules (e.g., insulininside binding sites of liver plasma membrane), Transport channel Enzyme Cell surface receptor regulatory molecules and so on. Following the doctrine of Greeks and until the 19th century there was little interest in the eugenics. Subsequently, perhaps in response to a different signal (see Telophase), the nuclear envelope proper breaks up into small membrane vesicles. In this case, however, the average size of the cells remains the same or increase insignificantly. DNA of prokaryotes (E.coli) and eukaryotes has one or few initiation points for DNA replication, so that, at least, large portions of genome are copied into single, enormous daughter DNA molecules. During simple diffusion a small molecule in aqueous solution dissolves into the phospholipid bilayer, crosses it and then dissolves into the aqueous solution on the opposite side. The lysosomal enzymes are glycoproteins, containing N-linked oligosaccharides that are processed in a unique way in the cis Golgi so that their mannose residues are phosphorylated. Thus, the 5' end of a growing RNA molecule terminates with a triphosphate. 14.12). (iii) Ubiquinones were so named because of their occurrence in so many different organisms and their chemical resemblance to H2O 1/202 + 2H+ high A nicotinamide nucleotides ATP B energy level (FeS) flavin nucleotides ATP D oxygen low energy hydrogen water Fig. In this model, the genes (producer gene and integrator gene) are those sequences which are involved in RNA synthesis. Two diseases which account for the deaths of hundreds of thousands a year, cancer and heart disease, are thought to have some heritable component. (a) 1/2 MRMR : 1/2 MRM ; all restricted; (b) 1/2 MRMR : 1/4 MRM : 1/4 thus, placed "on top of" the second. 5.17) depicts the Fig 5.17. Explain how an amino acid is activated and then attached to its specific tRNA. Leblond (1955) found the proacrosomal granule-rich in the mucopolysaccharides. Enzymes of intermembrane space. the end and Diplotene continues towards their centromeres. (b) The Crew's hen. Molecular probes. 7.3). Contents 360 CELL BIOLOGY C H A P T E R 22 Parthenogenesis U sually an unfertilization. (a) (top) stored in vacuoles until the following when water is plentiful, it fills the central vacuole and help maintain the cell's shape (bottom). Inheritance of X-Linked traits are known; most of these are recessives. The enzymes which transfer following groups from one molecule to other are known as transferases : one carbon, aldehydic or ketonic residues, acyl, glycosyl, alkyl, nitrogenous, phosphorus containing groups and sulphur containing groups. RNA-P is, in fact, one of the largest enzymes known (MW 490,000). Both sites are similar in that each is composed of a given segment of deoxyribonucleotides and each participates in regulatory control over cistrons. Enzymes. Multihybrid cross 3.13. Mononucleate cells. Such parthenogentic forms have hatched and grown to reproducing adults which are found to be diploid male with ZZ sex chromosomes. The undifferentiated germ cells or primordial cells contain large-sized and chromatin-rich nuclei. This is because the matrix is riddled with minute water-filled channels
through which free diffusion of water and water soluble substances such as gases, salts, sugars, hormones and like can take place. O Contents 108 CELL BIOLOGY nucleoside is composed of the pentose sugars (Ribose or Deoxyribose) and nitrogen bases (Purines or Pyrimidines). In Muller's ClB technique these ClB female flies are mated with males which are previously treated with some mutagenic agent (such as Xrays) to cause mutation in some of their sperms. Gene amplification is the process by which a set of genes is selectively replicated. This disease is a case of pleiotropy. Each group, called blade is a triplet formed of three tubules — A, B, and C that are skewed toward the centre. Ultrastructure and Molecular Biology. This type of movement was first of all observed by Scottish botanist Robert Brown in 1827 in the colloidal solution. 15 map units. It is homozygous lethal (i.e., DD). Lastly, replication and transcription have to serve two different functions. Generally, when rate of anabolism (i.e., photosynthesis, etc.) far exceeds the rate of catabolism (i.e., respiration), the growth of protoplasm (i.e., auxetic growth) takes place. 5.23. Some genes regulate many phenotypic characters. The cross between the pea plants differing in single pair of contrasting characters is known as monohybrid cross. (i.e., precursors of mRNA molecules for various ribosomal proteins). Since chloroplasts are motile organelles, they show passive and active movements. Describe the different steps involved in the initiation of DNA synthesis in E.coli. Usually the primary cell wall becomes more lignified Plasmodesmata. Phage particles are assembled around condensed cores of the complete phage nucleic acid (by selfassembly method). In Sparta a physically perfect manhood was the chief aim, where as the Atheniens carried more for the intellectual achievements. (Excess) Utilized Aporepressor Corepressor Histidine Example. short DNA fragment 2 3 4 5 Fig. Hayashi (1961) A tubule has reported that the two inner filaments of a cilium transmit excitation and the nine outer filaments are the seat of ATP splitting. The cytoskeleton is extensive, including myosin filaments, actin filaments and microtubules (Fig. Comment on Ms. Barbara McClintock's investigations regarding the controlling elements of maize. In these vesicles, F0-F1 particles are seen attached on Fig. The female sex, because, produces similar type of XO Type gametes, is called, homogametic Grasshopper sex. (xii) 254-260 MOLECULAR BIOLOGY 1. How many linkage groups are there in the (a) human male, (b) human male, (c) female grasshopper and (d) male grasshopper. In Chapter 18 of Cell Division, we have already described that during the interphase stage, new materials such as nucleic acids (DNA, RNAs) and proteins are synthesized in the cells and, thus, the cells are conjugation KK genotype kk conjugation exconjugator Kk Kk Kk Kk fission fission KK or Kk killers Kk sensitives KK or Kk killers killers (stable if nuclear genotype is KK or Kk) Fig. The variations of phase can be transformed into such vivid colour changes that a living cell looks like a stained preparatus and Holmgren's canalicular system and thought these were formed by the deposition of metallic silver or osmium on the vacuoles (see Purohit, 1980). Anaphase. ATP production by cyclic photophosphorylation also occurs during the light reaction. Chemical formula of cholesterol. Hence, when speed is important and specimen is required for electron microscopy or for histochemical analysis, paraffin embedding may be replaced by fixation by freeze drying. This event is found to be affected either by senescence of oocytes, virus infection, radiation damage, etc. 44 autosomes and one Prize in 1974). Viroids are small RNA circles, only 300 to 400 nucleotides long, lacking endosome AUG codon (the signal for the start of protein synthesis). The significance of deoxyribonucleotides in triphosphate forms lies in the fact that during DNA replication, the DNA polymerase enzyme can act only on triphosphate of deoxyribonucleotides. Experimental Evidence for Semiconservative DNA Replication in E. Can you expect children with darker skin, if both parents have light skin ? The two polynucleotide strands are held together by hydrogen bonds between specific pairs of purines and pyrimidines. heterozygous for the gene. Each breed possesses a characteristic type of comb. Since testa does not shrink with the cotyledons, seeds become wrinkled. Polygenic control; effects of single genes too slight to be detected. A typical clover-leaf model tRNA (Fig. The sterocilia differ from the true cilia which are known as kinocilia. In Drosophila inbreeding usually results in a rapid loss of vigour, but some strains compare favourably with outbred populations after long continued inbreeding. A basic concept of molecular biology is the collinearity of gene, DNA, RNA and protein. The first case of translocation was studied in the evening primrose (Oenothera) which was originally described as a mutation by de Vries. This structure is typical of globular protein structure, in which it is the non-helical region that permits the folding. The cavity of the endoplasmic reticulum is well developed and acts as a passage for the secretory products. chemical bondings are responsible for each of these structural levels ? Their number per plant cell can vary from several hundred as in tissues of corn root and algal rhizoids, Sievers, 1965), to a single organelle in some algae. lamarckiana, are now known to be due to variation in chromosome number or ploidy and chromosomal aberrations (viz. Thus, these remarkable organelles are primarily meant for the digestion of a variety of biological materials and secondarily cause aging and death of animal cells and also a variety of human diseases such as cancer, gout, Pompe's disease, silicosis and I-cell disease. AA X+O 4. Each chromoDe Robertis, Jr. 1987). (iv) Degeneracy of the code, i.e., an amino acid being coded by more than one codon. The cell wall of blue green algae resembles the cell wall of peptidoglycans (muramic acid) in the periplasmatic space existing in between cell DNA double helix loop of supercoiled DNA (shown as two intervined double helices) Fig. Cell Growth and Cell Division (Cell Cycle, Mitosis and Meiosis) 318-341 Cell cycle and mitosis, significance of mitosis; meiosis and reproductive cycle, kinds of meiosis, process of meiosis, process of meiosis, heterotypic division or first meiotic division; significance of meiosis; revision questions. This fact has been demonstrated in human diseases linked to X chromosome. In all cases the progeny were the parental RNA type and not the parental protein type. Trans-2-enoyl-CoA is hydrated by an enzyme enoyl hydratase or crotonase to produce the L-3- hydroxyacyl-CoA, which is oxidized by a NAD linked L-3-hydroxyacyl-CoA, which is oxidized by a NAD linked L-3-hydroxyacyl-CoA, which is oxidized by a NAD linked L-3-hydroxyacyl-CoA. amines to them. With high voltage electron microscopy a three-dimensional view of microfilaments has been obtained (i.e., an image of microtrabecular lattice). Vertebrates have greater DNA content (about 3 pg), in general about 700 times more then E. Independent segregation. The second reaction begins as soon as the Acetyl-lipoid acid first is over. locations. On the basis of genetic sex, two major classes, male and female, are identified. In somatic cells of normal XY males, genes of the single X chromosome remain active and Barr bodies are not found. Thus, there is a polarity gradient within the polycistronic mRNA that reduces the probability of cistron translation as a function of its distance fro the 5' end. They are well evident in many animals including humans. Biogeochemical cycles - the oxygen cycle, the results of a distance fro the 5' end. They are well evident in many animals including humans. Biogeochemical cycles - the oxygen cycle, the results of a cross between (a) sensitive female X resistant male; (b) sensitive male and resistant female. Such junctions are particularly characteristics of epithelial tissues. B also contributes 50 per cent of his genes to C. These modifica- proteins from mRNA (resembles that thymus bone marrow) ciated with histone Fig. The resulting exportable polypeptides are ejected directly into or through the membrane as they are formed. Define the terms peroxisome and glyoxysome. A gamete cell contains single genome and is called haploid. This reaction depends on eIF3 complex 40S subunit and the binding of mRNA is assisted by eIF4F, eIF4A, eIF4B and a high energy bond of ATP. melanogaster. The histones are composed of basic amino acids such as arginine, lysine and histidine. Mitochondria contain no catalase and, therefore, cannot deal with the formation of toxic hydrogen peroxide. Karyotypic abnormality in which a specific chromosome(s) is present in too many or too few copies. Therefore, for any three linked genes whose distances are known, the amount of detectable crossovers between the two outer markers A and C when the middle marker B is missing is; (A-B crossovers percentage) plus (B-C crossovers percentage) minus (2 X double crossover percentage) plus (B-C crossovers percentage) minus (2 X double crossover percentage) minus (2 X double crossover percentage). Yes No No No 120,000 (single chain) Not known Pol B up to 50 II Yes Yes No No No >250,000 (heteromultimeric chain) 10-20 pol C (dna E), dna N, dna ZX, dna Q, dna T up to 15,000 low high (2) Eukaryotic DNA polymerases. This trait is inherited like a typical Mendelian monohybrid cross. Such lethal genes which handicap but do not destroy their possessor are called subvital, sublethal or semilethal genes. The most abundant source of microtubules for the biochemical studies such as sugar beet, tomato Contents 190 GENETICS, HUMAN GENETICS and grapes and tetraploids such as rye, barley, corn, apple, grapes, marigolds, snapdragons, lily, phlox, etc., have
been obtained. The reciprocal chiasma occurs in two strand double crossing over C in which out of four chromatids only two are involved in the double crossing over. Cramer H.M.Edwards 1865 G.Mendel 1866 1870 Haeckel W.His 1871 F.Miescher 1873 A.Schneider Coined the term cell membrane. Maxam and Gilbert's Chemical Degradation Method As illustrated in Figure 9.7, this technique involves the following steps : 1. A notable method depends on whether the enzymes being regulated act in catabolic (degradative) or anabolic (synthetic) metabolic pathways. 1907 1908 E.Metchnikoff and P.Ehrlich 1910 A.Kossel 1915 R.Wilstatter 1922 A.V.Hill and O.Meyerhof 1924 Lacassagne and coworkers 1926 T.Svedberg 1930 K.Landsteiner Lebedeff 1931 O.Warburg 1932 E.Ruska and M.Knoll J.Q. Plowe W.H.Lewis F.Zernike 1933 T.H. Morgan A.Tiselius 1935 J.Danielli and H.Davson M.Knoll M.W.Stanley 1937 A. The size of haemoglobin gene in humans is estimated to consist of approximately 450 nucleotide pairs. (ii) Activation of the sperm. Contents 222 GENETICS, HUMAN GENETICS, HUMAN GENETICS, HUMAN GENETICS and phenotype and phenotype of pollen parent and likewise, flowers from the white or pale branches produced only white or pale seedings regardless of genotype and phenotype of pollen parent. The position or location of the nucleus in a cell is usually the characteristic of the cell type and it is often variable. 7.5. Diagram illustrating the hypothetical dual function of cis and trans cisternae of the Golgi apparatus. It involves separation of poles themselves accompanied by the elongation of the polar microtubules. Acetyl phosphatase Acetyl cholinesterase (Ectoenzyme of erythrocyte) 3. Ecdysone tends to affect the gene expression at the level of transcription. Thus, a simplest biosynthetic pathway includes various steps, each step is catalyzed by a specific enzymatic protein and each enzymatic protein in its turn depends on a specific gene for its production. Energetics of fatty R-CH2-CH 2-COOH acid oxidation. Some spacer sequences occur between multiple copies of genes, for example, between multiple copies of genes for ribosomal RNA. was found to be maternally transmitted trait. The first scientific study of mutation was started in 1910, when Morgan started his work on fruitfly, Drosophila melanogaster and reported white eyed male individuals. The reacting cell can kill hayfever sufferers, whose immune systems a virus-infected host cell that contains viral proteins on its make antibodies in response to normally surface, thereby eliminating the infected cell before the harmless substances (antigens). What one can learn about cells, depends on the tools at one's disposal and, in fact, major advances in cell biology have frequently taken place with the introduction of new tools and techniques to the study of cell. Portions of chromosomes that stain lightly are only partially condensed; this chromatin. Distinguish between the members of each pair : (i) diploid-haploid; (ii) chromatin-heterochromatin. The forward mutations are often corrected by error correcting mechanism, so that an abnormal phenotype changes into wild type phenotype. Contents 128 CELL BIOLOGY transported molecule extracellular space channel protein lipid bilayer electrochemical gradient cytoplasm simple diffusion channelmediated diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion channelmediated diffusion channelmediated diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion channelmediated diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion channelmediated diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm simple diffusion carrier protein lipid bilayer electrochemical gradient cytoplasm sin lipid process of endomitosis the nuclear envelope does not rupture and no spindle formation takes place. According to the physical and chemical nature of foreign substance following types of phagocytosis or colloidopexy. Sex chromatin in the nucleus of female cat (A). Heritier and Teissier found that a certain strain of Drosophila melanogaster shows a high degree of sensitivity to carbon dioxide, where as the wild type strain can be exposed for long periods to pure CO2 without permanent damage, the sensitive strain quickly becomes unco-ordinated in even brief exposure to low concentrations. It gradually dissolves in the surrounding water of the egg and forms the so called egg water. 2.6. Experiment of Fraenkel-Conrat on TMV showing that and protein of other strain were RNA and not the protein can cause infection. 4.21. Such stains are more suitable for in situ metabolic studies of mitochondria. which is rich in microbodies. The closely located genes show strong linkage than the widely located genes which show the weak linkage. One such operon, has provided a model system for the study of gene regulation. However, in different plant cells, chloroplasts may have various shapes, viz., filamentous, saucer-shaped, spheroid, ovoid, discoid or (a) leaf mesophyll cells enlarged view of palisade cell with chloroplasts The functional organization of a leaf. Types of Structural Changes in Chromosome may be of the following types (Fig. (III) DNA ligases. Note that the proteins may be separated into split and core proteins. The strobilation occurs in the scyphozoan micronucleus (Aurelia), certain polychaets and ascidians. They are also called mucoproteins (De Robertis, Jr., 1987). The 5S r RNA is transcribed on the chromosome existing outside the nucleolus and the 70 types of ribosomal proteins are synthesized in the cytoplasm. Stoffler and Wittmann's Model (Quasi-symmetrical Model, 1977) According to this model the 30S ribosomal subunit has an elongated, slightly bent prolate shape (Fig. There may be other reasons of maternal effect which are still little understood. (a) generation, whereas the purpose of transcription is to make RNA copies of individual genes that the cell can use in the biochemistry. Fragment B contained nucleotide residues from 17 to 50, in which single stranded region being 17-20and 46-50. Thus, F2 generation includes red eyed and white eyed individuals in the ratio of 3: 1. 7.1.). In the course of development chlorophyll and starch of chlorophyll and starch of chloroplasts gradually decrease, large globuli are formed, the lamellar structure breaks down and stroma is disorganized. The dotted central region of simple transposons contains only genes necessary for translocation, but in complex transposons it may contain one or more additional genes (consult Fig The best examples of multiple allelic system have been observed in coat colour of rabbits, wings of Drosophila and blood groups in man. 5.2. Wheat colour as an example case of 2 genes, n=4, while in case of 3 genes of a quantitative trait (after n=6. The probability that none of the three letters of the codon are uracils is (3/4)3 = 27/64 Spirin has coined a new term informosome to this mRNA and protein complex. Contents CELL BIOLOGY 346 female (2n) male (2n) adults sperm (n) ovum (n) gametes fertilization zygote (2n) development offspring (2n) Fig. Dominant trait. Mutation According to Consequent Change in Amino Acid Sequence 1. Some chemical substances such as Fig. The two centrioles of the spermatids become arranged one after the other behind the nucleus. The bulls have genes for milk production which they transmit to their daughters, but they or their sons are unable to express this trait. initiation; 2. A transcription unit is a section of DNA extending from a promoter to an RNA polymerase termination site. Present Present (80S) Present (80 cytochrome electron transport chains, Krebs cycle oxidation, Embden-Meyerhof glucose metabolism or glysolysis Enzymes packaged in plastids bound by membrane Both sexes involved in sexual participation and entire genomes transferred; alternation of haploid and diploid generations is also evident. following differences : Animal cell Plant cell 1. In Drosophila, Triploid intersex Triploid intersex Triploid intersex 2A+XX 3A+XXX chromosome has been found essential Diploid male A+X 2A+XX 3A+XXX chromosome has been found essential Diploid intersex 2A+x sex. It is here where ribosomal DNA transcribes most of rRNA molecules and these molecules and the ribosomal sub-units. OCCURRENCE AND DISTRIBUTION The ribosomal sub-units. organism are ordered in a series of decreasing size. Thus, each amino group oxygen in a protein molecule is caH pable of binding 2.6 molH ecules of water. Photosystem I (PS I). The human female has 44 non-sex chromosomes, termed autosomes and one pair
of homomorphic (morphologically similar) sex chromosomes given the designation XX. The most important nuclear enzymes are the DNA polymerase, RNA polymerase, RNA polymerase, RNA polymerase, RNA polymerase, an intermediate type of cap is formed. Almost any macromolecule (e.g., protein, most polysaccharides and nucleic acids), as long as it is foreign to the recipient, can induce an immune response; any substance capable of eliciting an immune response is called an antigen (antibody generator). Leptotene or Leptonema. It has small molecules and the mole human autosomes (i.e., chromosome 21). (3) In gall midge (Miaster) the larvae reproduce indefinitely by paedogenetic parthenogenesis. Biotic Environmental Factors 77–93 Interspecific interactions, negative interactive interactions, negative interactive interact The great biologist Lamarck (1744-1829) in 1809 proposed the phenomenon of "inheritance of acquired characters" among living organisms. The asexual reproduction is common only in lower plants and it may be of following types: 1. Each host cell (e.g., a bacterium or yeast) thereby becomes a factory for one pure gene. The linked genes which are widely located in chromosomes and have chances of separation by crossing over are called incompletely linked genes and the phenomenon of their inheritance is called incompletely linked genes and the phenomenon of their inheritance is called incompletely linked genes and the phenomenon of their inheritance is called incompletely linked genes and the phenomenon of their inheritance is called incompletely linked genes and the phenomenon of their inheritance is called incompletely linked genes and the phenomenon of their inheritance is called incompletely linked genes and the phenomenon of their inheritance is called incompletely linked genes and the phenomenon of the ciliary beat. (each 36 nm in diameter) surround the central sheath; they remain separated from the zygote, resulting in a haploid embryo (such a haploidization process appears to be caused by a genetic incompatiability between the chromosomes Contents CHROMOSOMAL MUTATION II 187 of the different species). Sulphur SO42- Constituent of coenzyme A, biotin, thiamine, proteins. What are primary, secondary, tertiary, and quaternary levels of protein structure ? Chemical formula of vitamin D. Sturtevant. Now the F1 hybrids have four types of alleles, viz., Y for yellow colour, y for green colour, R for round shape and r for winkledness of seed. dria and chloroplasts of eukaryotic cells. However, two photosys- nearly all life on earth. 20.5). This syndrome was described in 1960 by Klaus Patau and coworkers. Cytochrome b/f. 99.7 per cent replication of DNA and 75 per cent synthesis of histories, both of which take place prior to onset of prophase 1, and 2. During the growth phase, tremendous changes also occur in the nucleus of the diploid complement. The stigma is protected against any foreign pollen with the help of its covering by a bag. Acetyl-CoA is a carrier molecule in which acetyl group is linked by reactive bonds so that they can be transferred efficiently to other molecules. The euphenics deals with the control of several inherited human diseases, especially inborn errors of metabolism in which the missing or defective enzyme has been identified. Bacilli cause certain most notorious diseases of man such as tuberculosis (Mycobacterium or Bacillus tuberculosis), tetanus (Clostridium tetani), typhoid (Saldiplococcus staphylococcus tetracoccus monella or Bacillus typhosus), diphtheria (Corynebacterium streptococcus diphtheriae), leprosy (Mycobacterium leprae), dysentery and streptobacillus bacillus diplobacillus sarcinla food poisoning (Clostridium botylinum). These molecules are covalent combinations of carbohydrate and lipid. The clumped red blood cells occlude capillaries and, thus, deprive vital organs of normal blood supply and may lead to death. A tRNA in the 'P' site shifts its burden of growing polypeptide to the next succeeding tRNA, followed by Contents MOLECULAR BIOLOGY 84 translocation, exit of the discharged tRNA, and entrance of a new charged tRNA, and entrance of a new charged tRNA, and entrance of a new charged tRNA. (having correct anticodon) to base pair with a new codon at 'A' site. Tobacco mosaic virus (TMV). Regulation of marriage. mutation, which would prevent transcription; or a mutation in the start codon, which would prevent initiation. To achieve their stable configuration (i.e., neutral charge) ions undergo many chemical reactions and during these chemical reactions and during the during th arranged in the following order in an inner membrane: cyt. The tubular root fibrils basal body have the diameter of 200Ao. (ii) Striated rootlets. In mice, this occurs between the third and the sixth day of development, Contents 266 CELL BIOLOGY when one or the other of the two X chromosomes in each cell is chosen at random and condensed into heterochromatin (or Barr body). scattered from objects, the images appear bright on a black background. Independent of light; thus continuous Uses molecular O2 + H2O + energy Takes place in mitochondria Because the terminal phosphate linkage in ATP is easily cleaved with release of free energy, ATP acts as an efficient phosphate donor in a large number of different phosphorylation reactions. 10-12 unfertilized eggs are seen parthenogenetic generations during the summer of here inside the brood pouch of female. Light Reaction 1/2 O2 H2O granum stroma ATP, NADPH ADP, Pi, NADP+ The most important step of light reaction is harvesting of the maximum amount of solar enCO2 carbostromal hydrates ergy for conversion into chemical energy. These cytoplasmic extranuclear genes or DNA molecules of plasmids, mitochondria, chloroplasts, endosymbionts and cellular surfaces have a char- Contents 218 GENETICS, HUMAN GENETICS acteristic pattern of inheritance which does not resemble with that of genes of nuclear chromosomal, cytoplasmic and extra-nuclear inheritance. Normally, inbreeding is affected by restrictions in population size or area which brings about the mating between relatives. Likewise the pedigree analysis of A and B parents revealed that their children have both A and B antigens on the Contents GENETICS, HUMAN GENETICS, HUMAN GENETICS and B antigens on the Contents of A and B antigens of A and B ant smaller units called mutational sites. Later on, it was resolved that both of these views were only partly correct. The number of cells in the multicellular organisms and, therefore, small-sized organisms and, therefore, small-sized organisms usually remains correlated with size of the organisms and electron (hydrogen ions) acetyl carboxyl methyl ATP NADH, NADPH Coenzyme A Biotin S - Adenosyl-methionine 3. The ooplasm B consists of large amount of reserve food material in the form of yolk. During duplication of chromosomes, initially the chromomeres are duplicated and the newly formed chromomeres remain tightly juxtaposed to the old ones Thalassemia. A karyotype also suggests primitive or advanced features of an organism. anew) from the simple building blocks such as amino acids and lipids. Describe the process of cytokinesis in animal and plant cells. 2.7). The linkage maps of other chromosomes of Drosophila have been constructed by C.B. Bridges. In the arrhenotokous parthenogenesis, the haploid eggs are not fertilized by the sperms and develop into the haploid individuals (Fig. However, intermixing occurs as the antigens are dispersed and the two colours become less and less detectable. ¹/₄ 14. Methods of Inbreeding In plants, ova fertilized by the pollen of either the same plants (in case of bisexual plants) or of the other plant of the same genotype (in case of unisexual as well as bisexual plants), is called selffertilization. Later, in 1865, Louis Pasteur (1822–1895) in France gave experimental evidence to support Virchow's extension of the cell theory. information regarding relative distances between these genes, and also shows us the linear order in which these genes should be present on chromosome. Control plants are shown in B, D and F. Multiple alleles always influence the same character. (ii) Hyperactivity of X chromosome in male Drosophila. Bisexuality is common in plants and lower animals. Histone H1 molecules are found responsible for packing nucleosomes into the 30-nm fibre. Present edition of this book has been thoroughly revised, updated and enlarged. The diploid thelytoky may occur by the following methods (a) By autofertilization. An inversion heterozygote has one chromosome in the inverted order and its homologue in the normal order. Multiple crossing over. Contents 282 CELL BIOLOGY 1. These are iron (Fe, 0.10 per cent), iodine (I, 0.014 per cent), molybdenum (Mo), manganese (Mn), Cobalt (Co), zinc (Zn), selenium (Se), copper (Cu), chromium (Cr), tin (Sn), vanadium (V), silicon (Si), nickel (Ni), fluorine (F) and boron (B). It helps in the maintenance of an equilibrium in the amount of DNA and RNA in the cell. Presently, this technique is regarded as a very potential source of monoploid production. mic reticulum forms the nuclear envelope around the chromosomes and the nucleolus reappears due to synthesis of ribosomal RNA (rRNA) by rDNA and also due to accumulation of ribosomal proteins. Dolicol is long and very hydrophobic : its 22 five-carbon units can span the thickness of lipid bilayer more than three times, so that the attached ribosome oligosaccharide is firmly mRNA anchored to the membrane. The plasmolysis of plant cells in hypertonic solutions suggests the existence of the plasma membrane in the plants. 4.1 A). RNA contents of ribosomes. Attachment or adsorption of phage to bacterial (host) cell. However, in a cross between homozygous normal female and a waltzer Phenotype male, one of the seven offABC aBC spring was a waltzer. RNA polymerase III Nucleoplasm rRNA (50-70%) (except 5S rRNA) hnRNA (mRNA) (20-40%) tRNA(~ 10%) (and 5S rRNA)
Sensitive Inhibited in animals at high levels; not in yeast and insects. Contents LYSOSOMES 175 C H A P T E R 8 Lysosomes T he lysosomes (Gr., lyso=digestive + soma=body) are tiny membrane-bound vesicles involved in intracellular digestion. Like the exoskeleton or endoskeleton of animals, cell wall acts like a skeletal framework of plants. results of a dihybrid cross between a homozygous sweet pea (Lathyrus odoratus) having dominant alleles for blue or purple flowers and round pollen grains. Muscular pain, fatigue; 3. As the cell. This protects the aquatic life from freezing. tures of inbreeding : (1) increase in variability between different inbred families, (3) reduction in value of quantitative character in the direction of recessive values, and (4) the dependence of this reduction in value upon dominance. SER performs synthesis of lipids (e.g., phospholipids, cholesterol, etc.) and lipoproteins. Small molecules, the cyclic AMP (cAMP), are present in E.coli and many other bacteria. The cell formed by the fusion of an egg and a sperm; the unique diploid cell that will divide mitotically to create a differentiated diploid organism. This individual was found to be engaged in male sexual activity in the early years but gradually shifted to a preference for the female role. The first formed cell wall is known as primary cell wall. What are the chemical units of DNA that correspond to the number of the nuclei following types of cells have been recognised : 1. In this way the flow of radioactivity through a maturation process can be followed, together with in the cell. phosphatidyl inositol. The erythrocytes (RBC), egg and embryonic cells lack in endoplasmic reticulum. By this technique monoploids have been obtained in large number in potato. Translation is disrupted by erythromycin, tetracyclines, chloramphenicol, neomycin, puromycin, and streptomycin, incomycin, puromycin, and streptomycin, incomycin, puromycin, and streptomycin, and streptomycin. (b) Gangliosides. polypeptide chain into the ER cisterna takes place during translation leaving only a small segment exposed to the cytoplasm at any one time. Why ? 3 : 6 : 3 : 1 : 2 : 1 Ratio When the dihybrid parent have dominant and recessive alleles at one gene locus and codominant alleles at second gene locus. the F2 9 : 3 : 3 : 1 phenotyic ratio becomes 3 : 6 : 3 : 6 : 3 : 1 : 2 : 1 Ratio When the dihybrid parent have dominant and recessive alleles at one gene locus and codominant alleles at second gene locus. 1:2:1. A single particle of phage T2 consists A.D. Hershey (1908-) of DNA (now known to be a single molecule) encased in a protein shell (Fig. de Graaf (1641-1673) observed that the progeny would have characteristics of father as well as of mother and, therefore, he proposed that both the parents should contribute to the heredity of progeny. 3.9. Life cycle of Semliki forest virus : An animal virus containing a single-stranded RNA genome, capsid and spiked envelope (after Alberts et al., 1989). They are thought to function like the rubber bands subfibre (B) is larger and incomplete, having only 11 protofilaments. Telocentric. The types of transcription products and how they are converted to the RNA molecules needed by the cell. DNA exists in the lateral loops, the Contents 278 CELL BIOLOGY rest being tightly condensed in the chromomeres which are transcriptionally inactive. A B C D There is no addition or Normal product A B C D loss of genes during translocations, only a rearDuplication A A B C A A B C A Arm; deletion D rangement (i.e., change arm in the sequence and posiD B C D Duplication D tion of a gene). Cells 1. Three amino acids, namely leucine, arginine and serine, have six codons each (see Table 6-3). During the cell division (mitosis and meiosis) chromatin fibres become thick ribbon-like structures which are known as the chromosomes. Thus, in a classical study using isolated bovine brain tubulin, Weingarten et al., (1975) demonstrated that tubulin alone was not sufficient to bring about in vitro assembly into microtubules. As a result of crossing over, ++ and ab gametes are produced from the F1 individuals and in the F2 generation ++/++ or ++/ab will express the wild phenotype. Rice. The genetics of animals. The nucleoprotein structure which are generally more or less rod-like during nuclear division. It gives a positive Feulgen reaction and has a relatively constant position in each tissue and species. In Drosophila the recessive gene for vestigial wings cause vestigial wings in homozygous condition. Do the two strands of DNA helix carry the same generative gene for vestigial wings in homozygous condition. information? Examples of Active Transport 1. Direct repeats of the target gene (represented by numbers) flank the transposon. CONSTRUCTION OF A LINKAGE MAP OR GENETIC MAPPING The method of construction maps of different chromosomes is called genetic mapping. Most of these structural lipids are highly unsaturated which confer to the membrane of thylakoids a high degree of fluidity. Determine the expected F1 sex ratios from such matings in species with (a) ZW method of sex determination; (b) XY method of sex determination. (3) DNA poll III HE causes elongation of the leading strand and finally DNA pol I and ligase enzymes give final touch to the leading strand as in case of the lagging strand. Oxidized substrate FAD O2 2. Tubulin in the form of dimers (rather heterodimers of α- and β- tubulins; each with 115,000 MW, see Berns, 1983) polymerizes into the microtubules. Contents HUMAN GENETICS 245 REVISION QUESTIONS 1. Thus, the size and number of Golgi apparatus in a cell indicate the active metabolic, mainly synthetic, state of that cell. It is characterized by multiple malformations, primarily low-set ears; small receding lower jaw; flexed and clenched fingers; cardiac Plant of Datura stramonium. with each other due to lack of telomeres. Microfilaments are generally distributed in the cortical regions of the cell just beneath the plasma membrane Accumulation of residual bodies may be one reason why macrophages have a very short life time (i.e., less than a few days). In pea the alleles (rr) for red flowers and the alleles (rr) for red flowers and the alleles (rr) for red flowers and the alleles (rr) for ma diterpene, six a making them autotrophs. (a) P: Dd × Dd Gametes : D d D d Progeny : 1 DD : 2 Dd : 1 dd Dies Dichaete : 1 Wild (b) P: Dd × dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 1 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 1 Dd : 2 Dd : 1 dd Summary : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 2 Dichaete : 1 Wild (b) P: Dd × Dd Gametes : D d d Progeny : 2 Dichaete : 1 Wild (b) P: Dd × Dd surface of all of the metaphase chromosomes and are carried as cargo to each of the two daughter cell nuclei. Enzymes, called topoisomerases, relax the supercoil duplex, nicking one of the strands and rotating it through the unbroken strand. Contents 252 GENETICS, HUMAN GENETICS AND EUGENICS neering, it has become possible to produce various blood clotting factors, complement proteins (part of immune system) and other substances for the correction of genetics is a very young science in comparison to other biological sciences and its origin can be traced in the works of Mendel in the nineteenth century. The hnRNA molecules which are destined to produce functional mRNA, undergo RNA processing which includes the following steps : 1. Thus, homozygous tall pea plant has two identical alleles TT on both gene loci of the homologous chromosomes; likewise, homozygous dwarf 31 Attached and free earlobes. Cilia are used for locomotion in isolated cells, such as certain protozoans (e.g., Paramecium). A mutation that converts a wild-type allele to a mutant allele. The mating type, A or a is determined by a pair of autosomal alleles and follows simple Mendelian inheritance. Examples of Complete Penetrance 1. The results of all these crosses exhibit that c+ (agouti), cch (chinchilla), ch (Himalayan) and c (albino) are allelic to each other and the alleles of this multiple allelic series have following dominance hierarchy: c+ > cch > c The possible phenotypes and their associated genotypes of this multiple allelic series have following dominance hierarchy: c+ > cch > c The possible phenotypes and their associated genotypes of this
multiple allelic series have following dominance hierarchy: c+ > cch > c The possible phenotypes and their associated genotypes of this multiple allelic series have following dominance hierarchy: c+ > cch > c The possible phenotypes and their associated genotypes of this multiple allelic series have following dominance hierarchy: c+ > cch > c The possible phenotypes and their associated genotypes of this multiple allelic series have following dominance hierarchy: c+ > cch > c The possible phenotypes and their associated genotypes of this multiple allelic series have following dominance hierarchy: c+ > cch > c The possible phenotypes and their associated genotypes of this multiple allelic series have following dominance hierarchy: c+ > cch > c The possible phenotypes and their associated genotypes as the second genotype as the ribosome ? Four comb shapes namely rose, pea, walnut and single in poultry are known to be governed by two gene loci. 4.2 A). All alleles of a gene are produced due to mutation of a wild gene (or normal gene). Based on the nature and sources, the vectors are grouped into bacterial plasmids. For example, the vectors are grouped into bacterial plasmids. reproductive cycle asexual reproduction of Chlamydomonas includes a sexual reproduction long haploid generation. One essay described cork as a honey comb of chambers or "cells". Cortico-medullary antagonism. Type I collagen tropocollagen is present in the dermis, tendons, ligaments, bone, molecules "head to tail" cornea, dentine of teeth and internal organs and accounts for 90 per cent of body's collagen. Though, the morphology of lateral and central elements may vary from species, but the basic structure and the spacing of the synaptonemal complex is constant within the species to species. Amino acids (i.e., 20 amino acids forming the pool of amino acids in the cytoplasm) 2. Besides the cellulose, the tertiary cell wall consists of another chemical substance known as the xylan. How many chromosomes would be expected in (a) a monopolid (g) a triploid, (h) an autotetraploid ? The time of synthesis of 12 different enzymes in yeast corresponds to the position of their respective genes in the chromosomes. They are present as short, unbranched or branched or branched respective genes in the chromosomes. They are present as short, unbranched or branched or branched or branched or branched or branched either to exterior ectoproteins (forming glycoproteins) or to the polar ends of phospholipids at the external surface of the plasma membrane (forming glycolipids). coli are known to recognise and bind specifically to Contents CELL 51 sugar-containing target cells on the surface of gut lining of mammals (e.g., D-mannose residues of epithelial cells of human gut or colon; King, 1986). In the third found as the 5' base of the anticodon; at the time of pairing site (5' end) of the anticodon I can with the base of the codons it wobbles and can pair either take either of three wobble posi with U, C or A of three codons (see Table 6-5). 16.10. HowCTL T-cell ever, during the devel(cytotoxic T virus-infected cell opment of a mammal a lymphocyte) killing reaction certain number of antibodies (e.g., Ig G) pass from the mother to the foetus via the placenta or after birth via the milk (e.g., Ig lysis A). However, one of the main function is the synthesis of ATP. When the fertilization cone is irregular in shape it contains many pseudopodialike processes of the ooplasm. (4) Peritrichous. Thus, one sees references to D (+) -glucose, also called dextrose. Such universality of the code was demonstrated by Marshall, Caskey and Nirenberg (1967) who found that E.coli (bacterium), Xenopus laevis (amphibian) and guinea pig (mammal) amino acyl-tRNA use almost the same code Evidently, the acetylation of the core histone lysines would tend to loosen the nucleosomal structure which brings about the transition from a silent condensed gene to a transcriptionally active and extended one. The apoenzyme are collectively known as holoenzyme. flowers so that they attract pollinating insects. Contents TRANSPOSABLE GENETIC ELEMENTS 257 4. Method of interaction between dominant and recessive genes. Inborn errors of metabolism 1. The homologous chromosomes (paternal and maternal) duplicate into two chromatids. Some type of lipids do not contain fatty acids in their constituents and they are of following three types : A. While the organisms which have DNA along with RNA, they use the RNA in carrying the orders of DNA and in them because RNA has no genetic role, so called non-genetic RNA. What is meiosis ? Lysosomes have a high acidic medium (pH 5) and this acidification depends on ATP- dependent proton pumps which are present in the membrane of lysosomes and which accumulate protons (H+) inside the lysosomes. In female maize plants dicentric bridges are found to form and they undergo the bridge-breakage-fusion-cycle. 4.21). In a microtubule, the assembly of tubulin dimers takes place at one end, while disassembly is common at the other end (Fig The centromere divides the chromosomes into two parts, each part is called chromosome arm. Any coded message is commonly called cryptogram. The sigma factor gets dissociated from the core enzyme (after open region extends only over Freifelder, 1985). anion-exchange protein; 2. cervisiae) Fruit fly (D. They pass into the lumen of the ER, glycosidated and are transported to the Golgi apparatus by ER-derived transport vesicles. Table 2-3. According to Green and Taylor (1990), starting with an individual cell, growth of a multicellular organism can be divided into following three phases: (i) cell division or hyperplasia, i.e., an increase in cell number as a result of mitotic division; (ii) cell expansion or hypertrophy, i.e., an irreversible increase in cell size as a result of the uptake of water or the synthesis of living material: and (iii) cell differentiation, i.e., the specialization of cells; in its broad sense, growth also includes this phase of cell development (viz., differentiation). This means that growth is a linear measure and can be studied as a function of time. 5.2). inversion in which broken segment reattached to original chromosome in reverse order, and 4. "rotor" "stator" B A Flagella-like axial filaments are the characteristics of some Fig. Her further studies have established that both Ac and Ds are members of a family of transposable elements. Common name Paramecium Hydra Round worm House fly Mosquito Frog Pigeon Rabbit Gorillia Man Scientific name Chromosome number Paramecium aurelia Hydra vulgaris Ascaris lumbricoides Musca domestica Culex pipiens Rana esculenta Columba livia Oryctolagus cuniculus Gorilla gorilla Homo sapiens 30-40 32 24 12 6 26 80 44 48 46 Contents CHROMOSOMES Group nas reinhardii Bread mold Yellow pine Cabbage Coffee Potato Sugar cane Onion Mucor heimalis Pinus ponderosa Brassica oleracea Coffea arabica Solanum tuberosum Saccharum officinarum Allium cepa Fungi Gymnosperm Angiosperm Scientific name 259 Chromosome number 10?; 12 Contents CYTOPLASMIC OR EXTRA-NUCLEAR INHERITANCE 227 male genotype permits their retention, and conversely, why XY cells are sensitive to their presence is not yet known. population. Some important enzymes present in the plasma membrane (Source : Sheeler and Bianchi, 1987). The mitochondrial protein synthesis is inhibited by chloramphenicol, while synthesis in the cytosol (cytoplasmic matrix) is not affected by this drug. First, β -hydroxybutyric there are organic polymer of glucose, called granulose (i.e., glycogen). The cycle then involves the enzymatic conversion of isocitrate to glyoxylate and succinate by isocitratase enzyme: Isocitratase Isocitrate – --> Glyoxylate + Succinate The glyoxylate and another mole of acetyl-CoA form a mole of malate by malate synthetse: Malate synthetase Acetyl CoA+Glyoxylate --→ Malate → This malate is converted to oxaloacetate by malate dehydrogenase for the cycle to be completed. The mRNA molecule is folded to form a stem-andloop structure thought to exist (after Freifelder, 1985). Proteases and peptidases 1. If the 16S rRNAs previously extracted with phenol is placed in the presence of 20 different protein molecules of 30S ribosomal subunit, the reconstitution or self-assembly of 30S ribosomal subunit takes place in two steps : R1 heat + S proteins 16S RNA + ---- RI particles ----- 30S ribosomal subunit. It was soon realized that unit of mutation can occur between two DNA bases. The portion of the cytoplasm contail thick fibre taining the egg pronucleus remains often separated from the yolk and occurs towards the upper side of egg forming the animal pole. Give the structure of triglyceride. Zygote genotypes produced by each possible mating are then entered in the appropriate squares of the grid. Nexin protein has a molecular weight of about 150,000 to 160,000 daltons The SER contains several key glycogen enzymes that catalyze the synthesis of cholesterol which is also glucose-6enzyme a precursor substance for the biosynthesis. A nucleolus is often associated with the nucleolar organizer (NO) which represents the secondary constriction of the nucleolar organizing chromosomes, and are 10 in number in human beings (Fig. The four monoploid (haploid) cells arising from meiosis of a megasporocyte in plants; also, a group of four associated chromatids during synapsis. What are microbodies ? Since the mechanism of biogenesis of 70S and 80S ribosomes differ greatly, so can be studied separately as follows : Contents RIBOSOMES 289 1. While the secondary trisomic means trisomic that the extra chromosome should be an isochro2 2 4 4 4 mosome (i.e., both chromosome arms genetically Fig. There are SP50 and SP30 proteins which may reconstitute the functional ribosomal subunit when added to their corresponding core. DNA polymerase δ synthesis), whereas DNA on the leading strand (continuous DNA synthesis), whereas DNA polymerase δ
synthesizes the DNA on the leading strand (continuous DNA synthesis), whereas DNA polymerase δ synthesizes the DNA on the leading strand (continuous DNA synthesis). CTP, dTTP, dGTP are also present in the reaction mixture. The mitosis (Gr., mitos=thread) occurs in the somatic cells centroles plasma membrane developing bipolar spindle cytoplasm nuclear envelope centromere condensing chromosomes nucleolus polar. nuclear membrane fragments stationary chromosomes E Anaphase P Telophase Pig. The enzymes catalyzing the oxidation and reduction reaction of the cell are known as oxireductases. First base Second base U U C A G UUU UUC UUA UUG CUU CUC CUA CUG Thirdren fragments stationary chromosomes E Anaphase P Telophase Fig. The enzymes catalyzing the oxidation and reduction reaction of the cell are known as oxireductases. AUU AUC Ileu AUA AUG* Met ACU ACC ACA ACG GUU GUC GCC GCA GCG } Val } Ala * AUG-Met or chain initiation codon. Skin Colour in Man Another classical example of polygenic inheritance was given by Davenport (1913) in Jamaica. The protein of chromatin is of two types : the histories and the non-histories. 10.1). Normal and polytene chromosomes of Drosophila melanogaster. According to the precocity theory of meiosis, chromosomes enter into meiotic prophase, as unreplicated structures, each of which consisting of a single chromatid which he considered as unbalanced or unsaturated state in electrostatical Contents 96 GENETICS, HUMAN GENETICS AND EUGENICS relations. Thus, they initiated the branch of biochemical genetics. Ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and electron microscopic observations on "christmas tree" spreads stained with antibodies against specific ribosomal proteins bind to rRNA at the nucleolus, and el bind before the synthesis of 45S rRNA is completed (Chooi and Leiby, 1981). (II) Messenger RNA (mRNA) The RNA molecules which are transcribed from large number of genes of the total genome (i.e., 99 per cent genes of the total genome of E.coli) and have base sequence complementary to DNA, carry DNA's genetic informations for the assembly of amino acids into the polypeptide chains (protein molecules), to the cytoplasmic sites of protein synthesis, the ribosomes, to which they become associated to participate in codon-anticodon interaction with tRNA, are called informational or messenger RNAs (mRNA). (b) Eye pigmentation in water fleas and flour moths. Same system of genic balance in which the X/A ratio is critical, has been reported for the flowering plant (angiosperm) Rumex acetosa. The proteins which take basic stain are known as the basic proteins. consumed for two NADH molActive acetaldehyde O ecules. The common house mouse occurs in a number of coat colours, i.e., agouti, black and albino. Knippers ; Kornberg and Gefter ; Moses and Richardson isolated DNA-polymerase-II enzyme. 4.13). van Benden W. normally pigmented. Pontecorvo. The diploid zygote undergoes embryological development and forms an adult animal which upon attaining sexual maturity produces haploid gametes. Further the percentage of water in the matrix also varies from cell to cell according to the rate of the metabolism. A- Structure of internal promoter of a 5S RNA point (+1bp) and the promoter region gene. The ability of chemicals to induce mutation was first of all demonstrated by Auerbach and Robson in 1947 using mustard gas and related compounds as the nitrogen and sulphur mustards, mustard oil and chloracetone in experiments with male Drosophila melanogaster. The RNA core is protected by an icosahedral capsid. Fifteen oligonucleotides ranging from pentanucleotide (5 bases) to an icosanucleotide (20 bases) were synthesized (Table 9-1). The nature and function of RNA polymerases. Contents CELL BIOLOGY 190 2. It is also called gametic meiosis and is found in animals and a few lower plants. 16.9. As the two thymine residues associate, or dimerize to form a dimer, their position in the DNA helix becomes so displaced that they can no longer form hydrogen bonds with the opposing purines and thus regularity of the helix becomes distorted. Hence, the karyotype of a cri du chat patient is 5p-. tids fuse together and twist spirally around the axial filament. This is a special type of passive transport, in which ions or molecules cross the membrane rapidly because specific permeases in the membrane facilitate their crossing. This bundle of furrow filaments, called contractile ring, is bound to the cytoplasmic face of the plasma membrane by unidentified attachment proteins. Union of eggs with Y- bearing sperm will produce males in the phenotypic proportion of 41 per cent facet, 41 per cent singed, 9 per cent facet, singed, and 9 wild type. Basic structure of an amino acid. Calcium ATPase. S General Events of Interphase is characterized by the following features : The nuclear envelope remains intact. At this stage the sister chromatids are still held together by centromere and the kinetochores of the two sister chromatids face opposite poles; this would permit proper separation in the next phase (anaphase). 15.3. A microtubule associated protein (known as MAP-2) showing its two domains (after Alberts et al., 1989). It is heavier than water and capable of flowing. Described and coined the term Golgi complex for the reticular structure found in the cytoplasm of nerve cells of owls and cats. The cristae greatly increase the area of inner membrane is 3-4 times greater than the outer membrane is 3-4 times greater than the outer membrane area. It was discovered by Iwanowski (1892) and obtained in a pure state (i.e., in paracrystalline) form) by Stanley (1935). In eukaryotes histories are associated with DNA of chromosomes to form nucleoproteins. = 5900 bp δ 340 bp TyA TyB 340 bp Fig. Under appropriate conditions of pH and ionic strength, the dimers spontaneously associate into filaments that have a diameter and repeating structure similar to those of cytoplasmic filaments. The framework would be disturbed as soon as there is a deletion or addition of one or more bases. Syntenic genes may be so far apart in their chromosome that they seem to segregate independently; that is, they may show as much as 50 per cent recombination as would be exhibited by non-syntenic genes. Thus, both the viral protein and viral nucleic acid penetrate into the host cell. Union of eggs with fa+, X- bearing sperm will produce females in the phenotypic proportions of 50 per cent wild type and 50 per cent facet. A cell hybrid between an antibody-producing B cells and a tumour cell, which divides indefinitely and produces a single antibody (monoclonal antibody). Between the peripheral heterochromatin and the nucleolar heterochromatin and theterochromatin and the nucleolar heterochromatin correspond in size to some of the large viruses. Nageli and C. The female and male of the echiuroid Bonellia viridis. This is called copy choice mechanism of recombination or crossing over. The pyrimidine ring can be numbered in two O NH2 HOCH2 H O C C H H N1 OH H 5 2 Chemical formula of deoxyribose. This situation is termed as multiple allelism, and the set of alleles itself is called a multiple allelic series. Write short notes on the following : (i) Enzymes of ER; and (vi) Origin of endoplasmic reticulum. Each cellulose microtubule molecule has a polarity, having a 1' and a 4' end). 14.9). Because of this effect on gene expression, McClintock (1956) referred to Ac and Ds as controlling elements. Why are extremely short regions used in establishing genetic map ? Consequently in these polyploids chromosomes belonging to different triplets can exit. microvilli microfilaments plasma membrane exocytosis endocytosis rough endoplasmic reticulum (RER) Fig. Chromosome. In most cases, the aperture is less because the edges of the lens introduce distortions and so cannot be used. These activities may be either constructive in nature. If the polynucleotide chain is singlestranded (e.g., viral DNA), such an attack will obviously cut the chain into two pieces. Contents GENETICS, HUMAN GENETICS AND EUGENICS 150 4. Sulphotransferase Transfer of sulphate from activated donor 4. 13.5). If the centromere is not included in the inversion included in the inversion and when inversion
includes the centromere is not included in the inversion included in the inversion included in the inversion included in the inversion includes the centromere is not included in the inversion included in the inversion included in the inversion included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion included in the inversion includes the centromere is not included in the inversion included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the inversion includes the centromere is not included in the centromere is not included in the centromere is not included 92 MOLECULAR BIOLOGY to the free-living unicellular eukaryotes such as yeast, algae and protozoa. This sort of exchange of chromosome is known as crossing over (Fig. About 0.4 per cent IF3 site 5S RNA peptidyl of a E.coli chromosome is devoted to 3' end L7 /L12 transferase carrying rRNA sequences. Furthermore, a diminishing growth rate and a period of constancy at the end of Amoeba growth reflect a decline in feeding before division. The next enzyme of Krebs cycle, the succinic acid into fumaric acid into fumaric acid and then fumarase enzyme produces malic acid. Tissues are ground very carefully to save microbodies from disruption. The proteins to be secreted are synthesized on the rough endoplasmic reticulum (RER). The X-ray film is pressed against Contents MOLECULAR BIOLOGY 124 the nylon filter and exposed at bands carrying the radioactive probes attached to the fragments. The frequency of crossing over appears to be closely related to physical distance between genes on chromosome and serves as a tool in constructing genetic maps of chromosomes. Enumerate various methods of synthesis of a gene. During breakage of DNA molecule due to ionizing radiation the active role of oxygen is predicted. In order to understand the structure-function relationship of tRNA, its three dimensional structure (TDS) was worked out by the help of X-ray crystallography study. IFs are found resistant to colchicine and cytochalasin B and are sensitive to proteolysis. Fertilization could be accomplished only by a pollen grain with one of the alleles not present. EUPHENICS The symptomatic treatment of genetic diseases of man is called euphenics (see A.C. Pai, 1974). Biogenesis of 80S Ribosomes In eukaryotes, the biogenesis of ribosomes is much more complex and involved. bacteriophages (Phage T4). β-lactamase enzyme which confers resistance to the antibiotic ampicillin. He coined the name because the chromosomes look like the brushes which were used for cleaning the glass chimneys of old-fashioned paraffin or kerosene lamps. Thus, we have no trouble in recognized as distinctive individuals by their parents and close friends. As helicase (or Dna B) travels in 5 → 3′ direction, it generates a replication fork by opening the DNA duplex. Different cell biologists have defined the cell differently as follows : A.G. Loewy and P. Blood groups actually represent the presence of an immunological antigen on the surface of red blood cells. 12.19). What are the major classes of carbohydrats ? TYPES OF THE PLASTIDS The term 'plastid' is derived from the Greek word "plastikas" (= formed or moulded) and was used by A.F.W. Schimper in 1885. Promoter, enhancer and silencers. Duplicate Genes with Cumulative Effect (9: 6: 1) Certain phenotypic traits (e.g., coat colouration) depend on the dominant alleles of two gene loci. The fertilization activates the egg for the cleavage. (e) Sex reversal gene (Sxr) in mammals. Cereals 1. This degradation occurs in the regions that are non-methylated and have a higher content of GC. In Fig. In phagocytosis, first the target particle is bound, to the specific receptors on phagolysosome the cell's surface (process is called lysosome adsorption), then the plasma memtransport vesicle with lysosomal enzymes brane expands along the surface of the particle and eventually engulfs it. Oxygen binding to haemoglobin causes release of the proton from haemoglobin (b) calculate the amount of recombination between Px and R. He continued his careful work up to his death in 1895, recognizing (with the help of his student Richard Altmann in 1889) that nuclein was of higher molecular weight and was associated in some way with a basic protein, to which he gave the name protamine. Cytochemistry). When the F1 hybrids were allowed to cross among themselves they produced four types of seeds in the ratio of 9:3:3:1 given as follows: 1. These enzymes catalyze the linkage of the molecules by splitting a phosphate bond. ? Holley died in 1993. A translocation between the long arms of chromosome 9 and 22, often found in the white blood cells of patients with chronic myeloid leukemia. Chemical formula of chlorophyll. found to be similar to the primitive wheat T. No carbohydrate is located at

the cytoplasmic or inner surface of the plasma membrane. Shadow casting or heavy metal shadowing. large subunit lorge subunit sor capsomeres. For example, for the metabolism of the histidine protein the cell synthesizes about 10 specific enzymatic proteins and a mRNA in this case may carry codons for all the 10 enzymes. molecule across the membrane is far greater than would be expected from a simple diffusion. 1979). Lethal alleles in human beings. Thus, each chloroplast contains three distinct membranes which define three separate internal compartments—the intermembrane is far greater than would be expected from a simple diffusion. space, the stroma and the thylakoid space. Contents DETERMINATION OF SEX AND SEX DIFFERENTIATION 159 Sex Determining mechanism occurs but here the Y chromosome contains potent male sex-determining genes which can almost completely overcome the feminizing action of the rest of the genotype. For example, in common wheat, since 21 pairs of chromosomes are present, 21 possible Fig. Here, these plasma membrane plasmodesmata reticulum polypeptide chains unFig. Dehydrogenases, 6. RBC are replaced by nucleotide, is called substitution mutation. coli and other prokaryotes a single RNA polymerase (RNA-P) enzyme is responsible for the synthesis of all kinds of RNAs (such as mRNA, tRNA and rRNA). He coined the term genetics in 1905. The incomplete linkage has been reported in female Drosophila and various other organisms such as tomato, maize, pea, mice, poultry and man, etc. XY embryos, on the other hand, ordinarily develop testes, male external genitalia, and Wolffian ducts are suppressed; in XY embryos the Mullerian duct remain under developed. P700 (PS I) also captures light, and for absorbing each photon, it ejects an electorn. The proof of such a colinearity between DNA nitrogen base sequence and amino acid sequence in protein molecules has first obtained from an analysis of mutants of head protein of bacteriophage T4 (Sarabhai et al., 1964) and the A protein of tryptophan synthetase of Escherichia coli (Yanofski et al., 1964). 1987 S. In the electron transport system, the successive electron acceptors are at lower and lower energy levels. The amphibians have metacentric chromosomes. (c) The puffing (i.e., chromatin decondensation) of restricted segments of the polytene chromosomes of Drosophila, Chironomus (Fig. Subsequent condensation was done between groups of two, three or four nucleotides. Transport of small molecules such as water, oxygen, carbon dioxide, ethanol, ions, glucose, etc., across the plasma membrane takes place by various means such as osmosis, diffusion and active transport. Every effort has been made to ensure that readers may get a balanced idea of the subject. What genetic explanations might be advanced to explain this dimorphism ? In 1879, W. Initially genes were considered as beads. and chromosomes as strings of beads (Morgan, 1911). The specific role of lipid asymmetry of the membrane is still not clear. The allele h is found to be epistatic to the multiple alleles at the A-B-O locus. As indicated in Figure 10.18C, this gradient through the action of Contents MITOCHONDIRA 211 the proton pump of the F0-F1, drives the oxidative phosphorylation of ADP to form ATP by which mechanism free energy is conserved : ADP + Pi ATP + H2O In this reaction H2O is also formed because membrane of the dehydration, which leads to the removal of M-side C-side H+ and OH⁻ ions. The nuclear membrane and the nucleolus disappear. 27. Both the meiotic divisions occur continuously and each includes the usual stages of the meiosis, viz., prophase, metaphase, anaphase and telophase. There is only one C chain bears a hydroxyl or OH group). NATURAL PARTHENOGENESIS In certain animals the parthenogenesis occurs regularly, constantly and naturally in their life cycles and is known as the natural parthenogensis. Sometimes whole arm fusions occur in the non-homologous chromosomes. Colloidal theory has been forwarded very recently after the electron microscopical observations of the matrix. Protein asymmetry in plasma two phospholipid molecules in a monolayer (after membrane. In what way is the regulation of a gene that is active in a differentiating cell inherently different from regulation of a bacterial gene. Describe various types of syndromes related to variation in number of sex chromosomes. During 19th century and dawn of 20th century, the science of genetics have received solid support from landmark investigations in the field of cytology, embryology, biochemistry and genetics. Cyanobacteria also contain a variety of antibodies; the diversity of antibodies has been found to be under control of genetic regulation. It produces homozygous stocks of dominant or recessive genes and eliminate heterozygosity from the inbred population. In the case of sea urchins and vertebrates, the two pronuclei (male and female) come close to each other and the close contact takes place between the two. The chromatin has two forms : 1. These IF proteins assemble into neurofilaments, a major cytoskeletal element in nerve axons and dendrites, and consequently are called neurofilament proteins. If an allopolyploid, tetrads composed of two chromosomes (four chromatids) each should occur. Follicle-stimulating hormone (FSH) 3. AA X + Xv Xv 3. For example, the pattern of bands and interbands of polytene chromosomes of Drosophila does not vary between different larval tissues, yet it is now concluded that the interband regions probably represent housekeeping genes which code for essential proteins, that they are retained in a state of permanent decondensation (Bautz and Kabisch, 1983). The most effective wave length of ultrapigmentosum. gested that environment somehow regulates the activity of certain genes to produce only male phenotype. The fluid mosaic model is found to be applied to all biological membranes in general, and it is seen as a dynamic, every changing structure. When France invaded Spain, merino sheep were removed to France where they were maintained and eventually distributed to other parts of the world. The entire photosynthetic process can be visualized as a series of interlocking gears, with the energy from light turning the two photophosphorylation gears. Killer = (a) (c) Unstable = (c); Sensitive = (b) (d) (f). The last quarter of 19th century is usually considered as "classical period of cell biology". Concepts of sex determination as developed for Drosophila are verified by the occasional occurrence of gyandromorphs which are individuals in which part of the body expressed male characters, whereas other parts expressed male characters of sex determination as developed for Drosophila are verified by the occasional occurrence of gyandromorphs which are individuals in which part of the body expressed male characters. female characters. 2.3. A comparison of sectioning and fracturing tissues (after Sheeler and Bianchii, 1987). Fertility of inversion heterozygotes lead to establishFig. (a) Xenopus provides a good example of regulation of 5S genes. The radioactive mRNA hybridizes (i.e., establishes the hydrogen bonds) only with the single-stranded DNA in restriction fragments that contain complementary sequences. It can utilize either the whole genomic DNA or the cloned fragment. 5.29. Certain landmark cell biological discoveries and Nobel Prize winning investigations of 20th century have been tabulated in a chronological way in the Table 1-3. Lectins are proteins which are normally derived from the plants and they tend to bind to the cell surface and cause agglutination. Aquatic ecosystems; subdivisions of aquatic ecosystems; freshwater ecosystems; physico-chemical nature of freshwater : pressure, density and buoyancy, temperature, light, oxygen, carbon dioxide, other gases, pH or hydrogen ion concentration; lentic ecosystems : lakes and ponds, biotic communities of lakes and ponds, biotic communi environment, rapidly flowing water, slowly flowing water, revision questions. The chromatin fibres; and 4. For example, in humans the r RNA genes are located near the tips of each of the 5 different chromosomes (i.e., paired autosomes 13,14,15,21 and 22; Franke, 1981). (1) Prokaryotic DNA polymerases. Lastly, many cyanobacteria (about (b) scanning electron micrograph (a) Root-nodules of a shows the nitrogen-fixing bacte20 species) tend to fix atmospheric nitroleguminous plant. Similarly, deamA:T ination converts cysosine to uracil, which H:T (Rare tautomer) has pairing properties H:C similar to thymine and A : T (Normal replication) in such a case G: C pair would be changed into (Keto tautomer) A : T pair. However, viral envelope capsid sometimes viral particles are pinched off as extracellular space buds from the cell surface and they retain the host's plasma membrane around them, e.g., cytosol influenza virus, Semliki forest virus, fusogenic protein retroviruses such as AIDS virus. Likewise, GGA codon codes for netic cod with comma. The genes for different characters may be either situated in the same chromosome or in different chromosomes. When they are found in nature, their autopolyploidy nature is deduced by their meiotic behaviour. Examples of SER-bound enzyme include HMG-Co A reductase and squalene syn- Fig. al., 1981). As already described in Chapter 3, the cytoplasmic matrix or cytosol is the fluid and soluble portion of the cytoplasm that exists outside the organelles (Suzuki et al., 1986). F factor. Euchromatin contains structural genes which replicate and transcribe during G1 and S phase of interphase. However, in them it is far more complex. These hormones are synthesized by the ductless or endocrine glands and transported to various cells of multicellular organisms by blood vascular system. The cytological studies on plants and geographical distribution have the correlation with chromosome numbers. Contents NUCLEUS 247 Alternatively, DNAase digestion followed by extraction with salts releases
envelopes which again can be banded on sucrose or cesium chloride gradients (see Thorpe, 1984). It is caused due to jumping gene. What are the fundamental assumptions on which genetic (linkage)mapping is based? Why are chromosomal aberrations considered to have less significance than gene mutations for subsequent generations. A nuclease enzyme which begins its attack from a tree end of a polynucleotide is called exonuclease. overlapping 3 Recently, however, it has been shown that in the bacte2 riophage $\phi \times 174$ there is a possibility of overlapping 3 Recently, however, it has been shown that in the bacte2 riophage $\phi \times 174$ there is a possibility of overlapping of genes 1 and codons (Barrel and codons (Bar be determined whether streptomycin-dependence is due to a chromosomal gene or to a cytoplasmic element? It is composed of three concentric layers (S1, S2 and S3) which occur one after another. Certain lysosomal enzymes are good ATP ADP + Pi histochemical markers. This nature of plasma membrane is termed as permeability. In man, the mutations cause variation in hair colour, eye colour, skin pigmentation. Tall Tt Variation. Viruses do not easily fit in these parameters of a true cell. 1970 Howard Temin and David Baltimore demonstrated the synthesis of DNA on RNA template tumour viruses. These dideoxynucleotides are used as triphosphates (ddNTP) and can be incorporated in a growing chain, but they terminate synthesis (Fig. into ADP and phosphate. Gene M is located on the Y chromosome, i.e., it is a holandric or Y-linked gene. S.J.Singer and G.L.Nicolson (1972) suggested the widely accepted fluid mosaic model of biological membranes. receptors for the hormone are withdrawn from the cell surface, thereby hampering hormone action (see Sheeler and Bianchi, 1987). Chemical formula of D-ribose. On the basis of these and similar experiments Sturtevant proposed that exceptional flies arise as a result of unequal crossing over. MICROBODIES : STRUCTURE AND TYPES Microbodies are spherical or oblate in form. 7.5. Coupled transcription-translation. a gene whose mutation can produce a mutant phenotype, and the term recon to the smallest distance within which recombination can occur. Tubulin and actin are globular proteins, while subunits of intermediate filaments are fibrous proteins. Further, all these processing steps do not take place on naked RNA, but rather on RNA-protein complexes. 5.10). The case of sex B reversal of hen can be interpreted as follows : A During embryonic C development, the XY (ZW) genotype stimulates Fig. 3.6. Numbering of carbon atoms in a pyrimidine ring. The copies are themselves not endowed with the same kind of permanence as the genetic material; instead, they are typically degraded by cellular nucleases, once their functional usefulness has been spent. For example, in the E. He concluded that DNA synthesis occurred during the interphase. Structure of tRNA. Give the distance between the two loci in map units. The undulant movement. Resistant endospores, here coloured red, have Under unfavourable ecological conditions, formed inside bacteria of the germs (clostridium). Albino. Prophase 3. Gangliosides act as antigens. Duplicate Recessive alleles and both of them produce identical phenotypes, the F2 ratio 9:3:3:1 would become 9:7. These specialized crops require extensive cultivation and costly fertilizers. In birds, the primary lymphoid organ includes a gut-associated lymphoid organ, called bursa of Fabricius. In the year 1846, Johann Gregor Mendel attended courses of agriculture, pomiculture at the Philosophical Academy in Brunn (now called Brno in Czechoslovakia). Fungal genetics or mycogenetics. Thus, a gene was considered to be a unit of mutation, recombination and function. They depend exclusively on the parthenogenesis for the self-reproduction. Meiosis occurs in the germ cells (the cells of the testes or ovaries) during the process of gametogenesis. In it, the object is viewed only with oblique rays and since one sees only. those light rays that are Phase-contrast microscopy. Cross breeding produces sterile hybrids in comparison to normal outbreedings. Roux (1883) suggested that the chromosomes must contain qualitatively different hereditary determiners arranged in linear orders. A cleavage furrow tends to form midway between asters originating from two centrosomes in fertilized sand dollar eggs. For example, in lysosomes the concentration of protons (H+) is 100 to 1000 times that of Comparison of ion concentration inside and outside of a typical mammalian cell Table 5-3. Therefore, the 'Giant' chromosome from a cell in the salivary gland of Drosophila, showing banding. The total thickness of the membranes too turned out to be about 7.5 nm. The change in redox potential between any two electron carriers is directly proportional to the free energy released by an electron transfer between them. Diagrammatic representation of meiosis in a plant cell showing one pair of homologous chromosomes (2n=2). Table 14.1. Some characteristics of ribosomes of various organisms (Avers, 1976). The sperms of one particular species fertilize the ova of the same species. b, Cyt. The permeability is reduced or abolished. Multiplication Phase The primordial germinal cells divide repeatedly to form the oogonia (Gr., oon=egg). well as recessive alleles. A, B, AB and O Blood Groups in Humans Landsteiner in 1900 and 1902 discovered two kinds of agglutinogens or antigens, called A and B antigens from the surface of red blood cells of human blood. The chromosomes were then transferred to glass slides and coated with a photographic emulsion sensitive to the low-energy beta-particles emitted by the 3H-thymidine. He visualized genes as beads (described as chromomeric regions. He was born in July 22,1822 in Heinzendorf in Austrian Silesia, where his father, Anton Mendel was the owner of a small farm. In some cases (e.g., in the festuciod grasses) the matrix contains numerous threads or fibrils, while in others they are observed to contain either an autotrophic (photoautotrophic or chaemoautotrophic), or heterotrophic (saprotrophic or parasitic) mode of existence. and binds primase to 1. For example, a muscle cell by trapping the sodium ions. Araldite: Vestoplaw, Epan 812 Maraglas; Durcopan. The grana form the main functional units of chloroplast and are The ribbon - like chloroplast as seen in the Spirogyra. The proper size of each region is indicated by the number of base pairs. The cellular structures that stain with acid stains are called base pairs. where DNA unfolds into open loops as a consequence of intense gene transcription (l) = wavelength (λ) numerical aperture (n sin α) where λ (lambda) is the wavelength ("colour") of the illumination or radiation used to form the image, n is refractive index (a function of density) of the material (i.e., mostly air or water) between the specimen and the first lens (or objective lens), and sin a is sine of the cytoplasm in association with Ran-GTP (step 5), where the Ran-GTP is hydrolyzed. Thus, synapsis is the phase of prolonged and close contact of homologous regions or chromomeres. (xxii) 272-283 18. brings together active amino acids, which are otherwise Contents CYTOPLASMIC MATRIX 99 scattered along the chain, and may form a distinctive cavity or cleft in which the substrate is bound. This hypothesis also could not provide direct evidences, therefore, it is not well accepted at present time. 5.26). The gene for yellow body colour y in Drosophila is recessive and sex linked. One gene may control one step, while the other gene is close proximity may control another step in the same reaction. Somatic or Mitotic Crossing over occurs in the chromosomes of body or somatic cell division it is known as somatic cells of an organism during the mitotic cell division it is known as somatic or Mitotic Crossing over. Large spikes of trimers (i.e., each unit of three monomers) of the mitotic cell division it is known as somatic cells of an organism during the mitotic cell division it is known as somatic or Mitotic Crossing over. hemagglutinin or Ha protein. bathed in the homogeneous matrix, called the stroma. This complex conlower tains a reactive centre comthylakoid posed of P700 (Type of membrane space outer inner pigment which is bleached membrane at the wavelength of 700 intermembrane space nm), several polypeptides, Fig. The name messenger RNA has been proposed by Jacob and Monod (1961). Other homogeneous chains of nucleolides (Poly A, Poly C and Poly G) were inactive for phenylalanine incorporation. Discuss. In prophase, when growth stops, nucleoli disappear, emptying their contents into the nucleoplasm. They are anaesthetised and examined. Some lysosomal enzymes and their substrates (Source : Sheeler and Bianchi, 1987). How has the phenomenon of heterosis been utilized for plant breeding ? This property, caused by the great cohesiveness of water molecules, is important in the maintenance of protoplasmic form and movement. Where are they produced? In 1990, researchers at the National Institutes of Health treated Ashanthi Desilva for the genetic disease SCID (severe combined immunodeficiency disease). The male pronucleus and the centriole move towards the egg pronucleus. However, the nuclear material is usually concentrated in a specific clear region of the cytoplasm, called nucleoid. The inheritance of mouse body colour was studied by the French geneticist, L. Contents 106 CELL BIOLOGY Vitamin Daily requirement Sources 7. Given a single strand of DNA.....3' TACCGAGTAC 5'...., construct (a) the complementry DNA chain, (b) the mRNA chain which would be made from strand. The pyrophosphate group (PP) ticipate in RNA synand the bold hydrogen do not appear in the RNA strand. It seems likely that the sigma (σ) subunit first binds to the -35 sequence in a highly specific interaction and then, the appropriate region of this huge enzyme
can come in contact with the -10 sequence of Pribnow box (Fig. In ing two phalanges in each finger; B—A nor1908, an English physician, Archibald E. Deletion F B A of some chromosome regions produce their own unique phenotypes. There may be several vacuoles in a single cell, each separated from the cytoplasm by a single unit membrane, called the tonoplast. Contents GENE MUTATION cluding man. and many problems of similar nature. '+' and the remaining X+X+ XW Y 50 per cent carry the gene 'w'. Citrus exocortis (Its viroid contains 371 nucleotides in RNA molecule); 3. The ultraviolet (UV) light is a non-ionizing radiation which may The inherited genetic disorder xeroderma cause mutation. The free and bound ribosomes were found to be continuously interchanging and show no differences between them. The following two lines of evidences have suggested the association of p+ with mitochondrial DNA (mt DNA); (1) Ethidium bromide, which induces petite mutations with 100 per cent efficiency, causes degradation of mt DNA after prolonged exposure of cells. The cells of macrophleucocyte ingesting a yeast particle Following theories have been advanced by different workers to explain the process of breaking b+ a+ b+ a+ of chromatids : 1. If solutes can penetrate the plasma decreases below 0.9% the membrane, the cell will eventually regain water—a process erythrocytes will swell up due to endosmosis. Ovaries Leucocytes Amoeba Tetrahymena Paramecium Euglena Plants Onion seeds Barley seeds Corn seedlings Yeast Neurospora Tissue culture cells HeLA cells Fibroblasts Chick cells Lymphocytes ISOLATION AND CHEMICAL COMPOSITION Lysosomes are very delicate and fragile organelles. The oligomers contain small number of monomers, while the polymers contain large number of monomers. The genes for full colour may be represented by capital letter C or c+. While, the single type comb is produced by the double recessive, rrpp, genes. 14.8. A three dimensional model of eukaryotic cytoplasmic ribosome (after Sheeler and Bianchi, 1987). By the microtome, serial sections, 5 to 10µm thick can be cut and placed on slides in the order of cutting and permitting a sequence of specimens for observation. Second, many bacteria contain large reserves of inorganic phosphate polymers known as volutin. ISOLATION AND CHEMICAL COMPOSITION Initially, Golgi apparatus was isolated only from cells of the epididymis, however, in recent years, it has been isolated from number of plant and animal cells. (a) What are intervening sequences or introns? The 7-MeG caps are absent in mRNAs of continues initiates histone proteins. According to Thorpe (1984), ciliary necklace may have following two functions : 1. The cisternae at the convex end of the dictyosome comprise proximal, forming. or cis-face and the cisternae at the concave end of the dictyosome comprise the distal, maturing or trans-face. The study of chemical compounds found in living systems and reactions in which they take part is known as biochemistry. dinucleotide in Z-DNA as against a mononucleotide unit in B-DNA (Fig. The bicarbonate anion formed by carbonic anhydrase is transported out of the total erythrocyte cytoplasm, this exchange triples the amount of bicarbonate that can be carried by blood as a whole. apparent difficulty. cytoplasm tight bilayer microvillar surface) of the epithelial proteins junction cells and act as permeability barriers. Mules are larger than the donkey and sturdier than the horse. The protein chain may then fold back upon itself, forming internal bonds, ionic bonds, and strong disulphide bonds, ionic bonds, and strong disulphide bonds, and strong disulphide bonds, ionic bonds, and strong disulphide bonds (including hydrogen bonds, drugs, drugs dyes, etc.) may cause malignant transformation of cells by bringing about leakage of lysosomal enzymes that attack the genetic material in the DNA. When phage progeny was studied for preparation of transforming principle from S strain radioactivity in this experiment, it was found lysis transforming that the phage progeny precipitation cell-free principle carried labelled only with extract from S strain 32 P. For years, it was thought to be an artifact of various fixation and staining procedures. - GCA Glutamic CGG acid CGC (Glu) CGU Histidine Aspartic (His) acid - GAC Isoleucine (Asp) GAU (Ile) Asparagine AAC (Asn; Aspn) AAU Cysteine - UGC Lysine (Cys) UGU (Lys) - - - - - GGA GGG GGC GGU CAA CAG GAG GGC GGU CAA CAG GAG GAC AGU UCA UCG UCC (Leu) - Methionine - (Phe) Proline (Pro) - Serine (Ser) - AAA AAG CUA CUG CUC CUU UUA UUG AUG UUC UUU CCA CCG CCC CCU AGC AGU UCA UCG UCC UCU Threonine (Thr) - ACA ACG ACC ACU Tryptophan - UGG (Trp) UAU Tyrosine - UAC (Tyr) Valine - GUA (Val) GUG* GUC GUU Terminator (Nonsense codons) - UAA (ocher) UAG (amber) UGA (opal) * GUG is also used as a start codon for some proteins. In some cases the lysosome appears to flow around the cell structure and fuse, enclosing it in a double membrane sac, the lysosomal enzymes being initially confined between the membranes. Some Gram positive bacteria have tubular, pericellular and rigid appendages of single protein moiety, called spinin. (b) If F1 males and females ? Contents CELL GROWTH AND CELL DIVISION 331 adult sporophyte seed endosperm flower embryo stamen carpel ovule triple fusion nucleus nucellus zygote anther pollen chamber megasporocyte (2n) (3n) (n) meiosis microspores megaspore female gametophyte male gametophyte medasporocyte (2n) (3n) (n) meiosis microspores megaspore female gametophyte medasporocyte (2n) (3n) (n) meiosis microspores megaspore female gametophyte medaspore female gametophyte ga number of nuclei in the various organs are found to be constant in any given species. The endoplasmic reticulum forms the nuclear envelope around the chromosomes become uncoil. 23. In this technique, genes have been introduced by any of the traditional gene transfer methods such as calcium phosphate mediated gene transfer (or transfection), electroporation or microinjection. The iron (Fe) occurs in the haemoglobin, ferritin, cytochromes and some enzymes as catalase and cytochromes and cyt provided evidence in support of semi conservative mode of DNA replication in Fig. Ultimately when numerous viral particles are formed by self-assembly method inside the host cell, they are released after lysis of the cell. Contents REGULATION OF GENE ACTION 107 Unfertilized sea urchin eggs store large quantities of mRNA for many months in the form of mRNAprotein particles (= masked mRNA) made during formation of the egg. The homologous chromosomes start pairing (synapsis), each homologous chr Although it is now known that this is not the case and that under certain situation centrioles can arise de novo in the cytoplasm. Multiple genes (Quantitative genetics); Change in chromosome structure; Change in chromosome number; Human genetics); Change in chromosome number; Human genetics; Change in c distance A-B we must count all crossovers (both singles and doubles) that occurred in region I = 18% + 2% or = 20% or 20 map units between the loci A and B. Thus, heterodimers of tubulins assemble to form linear "protofilaments" with the α - tubulin of one dimer in contact with the α - tubulin of the next. In these extracellular materials the most of tubulins assemble to form linear "protofilaments" with the α - tubulin of one dimer in contact with the α - tubulin of the next. In these extracellular materials the most of tubulins assemble to form linear "protofilaments" with the α - tubulin of the next. In these extracellular materials the most of tubulins assemble to form linear "protofilaments" with the α - tubulin of the next. In these extracellular materials the most of tubulins assemble to form linear "protofilaments" with the α - tubulin of the next. In these extracellular materials the most of tubulins assemble to form linear "protofilaments" with the α - tubulin of tubulins assemble to form linear "protofilaments" with the α - tubulin of tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulin of tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with the α - tubulins assemble to form linear "protofilaments" with tubulins assemble to form linear "proto conspicuous components are collagens and mucopolysaccharides (glycosaminoglycans). In principle, looped domains in chromatin could be esta- blished and maintained by DNA binding proteins micrococcal nuclease that clamp two regions of the 30- nm attack points fibre together by recognizing specific moderate digestion DNA sequence that will form the neck nucleosome core particle of each loop. In fact, polyteny differs from polyploidy, in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but in which there is also an excess DNA per nucleus, but
in which there is also an excess DNA per nucleus, but in which there is also which is the unit membrane. The result of this type of pairing is the formation of a DNA molecule that contains an exceptional base pair. Von Mohl, in 1846, applied the name protoplasm to the contents of embryonic cells of the plants. Origin and Growth of Cell Wall The mechanism of cell wall formation includes the following steps : 1. The genetic dictionary. They are found primarily in epithelial cells and include two subfamilies of keratin (also celled tono, perakeratin or cytokeratin) : acidic keratin and neutral or basic keratin in temperature regulation; it produces large quantities of body heat necessary for arousal from hibernation. Dog 3. Substance 1. In such cases, the diploid eggs produce females and the unfertilized pg 100 eggs produce females. On completion of the okazaki fragments, the RNA primers are excised by DNA polymerase I, which then fills the resulting gaps with DNA. A pollen tube will not grow if the S allele that it contains is present in the female parent (after Suzuki et al., 1986). When there is a heavy demand for ribosomes, as in maturing many additional nucleoli (up to 1000 in some species), each equipped with a segment of DNA containing many copies of the rRNA genes. Multiple Alleles 1 1 . 237 Recessive Curly hair Dark brown hair Coarse body hair Pattern baldness (Dominant in males) Normal kin pigmentation Brown eyes Near or far sightedness Normal hearing Normal colour vision Broad lips Large eyes Polydactylism (webbed digits) Hypertensioration Brown eyes Near or far sightedness (Dominant in males) Normal kin pigmentation Brown eyes Near or far sightedness (Dominant in males) Normal kin pigmentation Brown eyes Near or far sightedness (Dominant in males) Normal kin pigmentation Brown eyes Diabetes insipidus Huntigton's chorea Normal mentality Migraine headache Normal resistance to disease Enlarged spleen Enlarged spleen Enlarged spleen Enlarged spleen Enlarged colon A or B blood factor Straight hair All other colours Fine body hair Baldness (recessive in females) Albinism Blue or grey eyes Normal vision Deafness Colour blindness Thin lips Small eyes Normal digits Normal digits Normal blood pressure Normal excretion Normal nervous system Schizophrenia Normal Susceptibility to disease Normal spleen Normal system Schizophrenia Normal Susceptibility to disease Normal system Schizophrenia Normal Susceptibility to disease Normal Susceptibility also contains smooth or agranular micro-somes which lack attached ribosomes. Tubulin (8 nm) 2. Proportion of the arms, i.e., it is ratio between the long arm and short arm of the chromosome. Ion pumps ; 6. Write an essay on the viruses. Neurospora. In the following summary chart, agglutination is represented by + and nonagglutination by - sign Genotype 1. If one strand of DNA is found to have the sequence 5' A A C G T ACT G C 3\ what is the sequence of nucleotides on the 3',5' strand? The mitochondria have lipoprotein framework which contains many enzymes and coenzymes required for energy metabolism. What ways are available to improve contrast in light microscopy ? All cells divide daughter cells receive a full complement of membrane systems which undergo growth until the next division, to be passed on to subsequent progeny. The hypothesis that "genes can change (mutate) to give rise to new genes (mutate) to give rise to new genes)" was seriously tested, beginning in 1908 by American biologist Thomas H. The reaction centre (chlorophyll a molecule) is called P 700 because it has a Contents PLASTIDS 231 maximum light absorption at 700 nanometers. If parts of an older female is amputated, the worm reverts to the male form, indicating that size rather than age is the important factor controlling the sex of the individual. Microtubules play a role in the contraction of the spindle and movement of chromosomes and centrioles as well as in ciliary and flagellar motion. A light compound microscope in which many lenses are combined together has a useful magnification of about 1,500 times. In fact, the stability of human society depends on the ability of geneticists to juggle the inherited traits that shape life forms, keeping a jump ahead of the destructive parasites and predators (Fig. The recessive mutants do not possess pigment in the eye (viz., kynurenineless) and have the genotype aa or kk. Both in prokaryotes, the mechanism of protein synthesis can be divided into the following three main steps : 1. Functions of smooth ER include lipid metabolism (both catabolism and anabolism; they synthesize a variety of phospholipids, cholesterol and steroids); glycogen being polymerized in the cytocytoplasm nucleolus nuclear pore nuclear nucleus chrome P-450; Darnell membrane et al., 1986). It degenerates in the egg without fusion with the egg nucleus, e.g., Rhabditis aberrans. W. A virus with this capacity is called temperate virus. Intermediary or sporic meiosis. sues) have relatively few cristae. The resulting compound is a dipeptide whose carboxyl end is still bonded to the second tRNA, but whose amino end is free. The two nucleotides are then joined together the first base is released from the initiation site, and initiation is completed. In 1963, Nass and Nass demonstrated the presence of DNA fibres in the matrix of mitochondria of embryonic cells. Some of the N C He N C H cytosol, maintaining a low concentration of it inside the cytosol. The XYlinked type sex-linked inheritance is performed by those genes which are localized in homologous sections of X and Y chromosomes. Addition of a cap of 7-MeG or m7G. An example of unidirectional replication is the replication of mitochondrial DNA (mt DNA) by D-loop (or displacement loop) in vertebrates. In endosomes, the LDL particles and their receptors are separated from each other ; the receptors are returned to the plasma membrane, while LDL ends up in the lysosomes. Prostaglandins. Pyruvic acid directly enters the mitochondrial matrix and is converted into acetyl-CoA by the help of a huge Pyruvic acid enzyme, called pyruvic acid dehydrogenase (Fig.10.12). If the spindle is tipped toward the left of the median line of the egg cell, the sinistral pattern will develop. Small quantity of RNA may also be present but the RNA rarely accounts for more than about 5 per cent of the total chromatin present. Its place on a chromosome is called a locus (Demerec, 1955). Barley. The lipids are non-polar and hydrophobic. The cytoplasm of blue green algae also contains a variety of membrane-free inclusions such as (1) cyanophycin granules which are located in chromatoplasm and are protein storage products, Fig. The agouti colour pattern is commonly occurred one (wild type) and is characterized by colour banded hairs in which the part is either black or brown. True leucoplasts do not contain thylakoids and even ribosomes (Carde, 1984). Carotenoids 4.5 6. LIMITED AND UNLIMITED GROWTH Studies of the duration of growth in plants and animals show that there are two basic patterns, called limited (indefinite or indeterminate) growth. Golgi apparatus consists of at least three distinct classes of cisternae : cis Golgi, median Golgi and trans Golgi, each of which has distinct enzymatic activities. The polymerase used for this synthesis is polymerase III. Patau (1960) divided the human chromosomes into the following seven groups designated A to G : 1. Somatic mutation. These enzymes are required by peroxisomes in detoxification activity, i.e., in the metabolism or production and decomposition, of hydrogen peroxide or H2O2 molecules which are produced during neutralization of certain superoxides—the end products of mitochondrial or cytosolic reactions. Tobacco mosaic virus is known to in ER and synthesize a protein, called P30 (30,000 dalton M.W.) plasma that nullifies the normal regulatory mechanisms of membrane plasmodesmata (Zaitlin and Hull, 1987). Such a transposed duplication DEF OPQ. At the time of adsorption or attachment of the virus to the host cell, these HA spikes bind to virus-specific receptors on the surface or plasma membrane of the host cell, these HA spikes bind to virus-specific receptors on the surface or plasma membrane of the host cell. potential may depolarise from -90 mV and overshoot to + 50 mV). Structure The cell wall; (ii) Tertiary cell wall; (iii) Te in relation to the axis of the helix than in the B-DNA. Find the phenotypic expectations of the progeny. (3) A = 18%, C = 32%, U = 32%, C = 32%, U = 32%, C = 32%, C = 32%, C = 32%, C = 32\%, C frequent mutations in the chloroplast genome that result in the production of lines of abnormal plastids. RST. (Note : In some organisms nucleosome DNA may vary from 162 base pairs (e.g., rabbit cortical neurons) to 242 base pairs (e.g., rabbit c porphyrin ring or tetrapyrrole nucleus from which extends a hydrophobic tail which is made up of a 20-carbon grouping, called the phytol. Anaphase II
The daughter chromosomal microtubules and stretching of interzonal microtubules of the spindle. Of more value, however, are the restriction enzymes that cut between the same two bases away form the point of symmetry on two strands, thus, producing a staggered break. Until recently, there was no foolproof test. Glyoxylate cycle containing peroxisomes, Peroxisomes illuminated by the hydrolysis of the molecule of GTP to GDP and phosphate. The prosthetic groups are permanently associated with the molecule, usually through covalent linkages with the side chains of certain amino acids. A×B A×C A×D B×C C×D F1 Black Bl Medium sepia 3 Black : 1 White 3 Dark sepia : 1 White 1 Medium sepia : 1 White 1 Medium sepia : 2 Light sepia : 1 White 3 Dark sepia : 1 White 3 Dark sepia : 2 Light sepia : 1 White 3 Dark sepia : 2 Light s ribosome meets a termination codon, this codon is recognized by protein release factors (RFs) which bind to the 'A' (or aminoacyl) site of the ribosome. In regard to blood cell shape there is incomplete dominance. Q. The combined growth rate of the ribosome. In regard to blood cell shape there is incomplete dominance. has not changed. eIF3 Multimer; 7500,000 Multimer; 200,000 Binding mRNA 2. Recently, certain other holandric genes have been reported in humans, e.g., genes for H-Y antigen, histocompatibility antigen, spermatogenesis, height (stature) and slower maturation of indiP1 vidual. On the other hand, although the operator is transcribed in large part, it is not translated. It may be of following types : Contents REPRODUCTION A severed arm of starfish can regenerate into a whole new organism. What is the length in micrometers of its DNA complement? This pattern will lead to stable Contents CELL BIOLOGY 370 oscillations which need not correspond in frequency to other events in the cell cycle such as DNA synthesis. OCCURRENCE Centrioles occur in most algal cells (notable exception being red algae), moss cells, some fern cells and most animal cells. In exogamy (Gr. exo=external; gam=marriage) the male and female gametes are produced by different head parents and both unite to form a zygote. This type of epistasis is called recessive epistasis. Described chromosomes (nuclear filaments) for the first time. The morphology of the chromosomes is best studied during metaphase and anaphase, which are the periods of maximal contraction. Thus, IFs in epidermal cells are called tonofilaments, in nerve cells stereocilium myosin Vlla they are referred to as neurofilaments actin filaments. within and in neuroglial cells they are desigstereocilium stereocilia nated as glial filaments. Students appearing in entrance exams of C.P.M.T., I.F.S., P.C.S. and I.A.S., etc, may be immensely benefited by this book. The second step involves a change of code from nucleotide sequences to amino acid sequences and is called translation. Contents 34 MOLECULAR BIOLOGY helix; the helix remains in one piece but it now possesses a gap that contains two tree ends, which can serve as substrates for exonucleases. Some of the common types of techniques of electrophoresis, which are currently used in cell biology, are the following (Sheeler and Separation of DNA restriction fragments by gel Bianchi, 1987; Alberts et al., 1989): electrophoresis. Each of these four mitochondrial regions contains a special set of proteins that mediate distinct functions : 1. Down's syndrome is named after the physician J.Langdon Down who first described this genetic defect in 1866 and it was formally called mongolism or mongolian idiocy. Genes are located on the chromosomes which exist as chromatin network in the non- dividing cell, i.e., during interphase. DNA contents in picograms (gram × 10-12) of various cells. Magnification, the increase in size of op4 µm 0.10 µm tical image over the size of the object being viewed, Microscopes magnify microorganisms manifold and help us to determine their is of no use unless the shape and structure like spherical shaped cocci and rod-shaped, bacilli bacteria observational system can as shown here. The coefficient of inbreeding is also calculated by counting the number of arrows connecting the individual through one parent back to the common ancestor and back again to his other D parent by the following equation : B F = $\sum (\frac{1}{2})n$ (1+FA) G I n = number of arrows which connect the E individual through one parent back to the com- A mon ancestor and back again to his other parent. Changes in number of chromosomes : 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes = 1. Quantitative Genetics (Inheritance of Multiple Genes) Multiple factor hypothesis ; historical; characters of multiple genesation = number of chromosomes examples of quantitative inheritance: kernel colour in man, eye colour in man, eye colour in man; transgressive variation; modifiers or modifying genes; significance of quantitative genetics; revision questions and problems. The protoplasm is alive because of the highly complex organization of these non-living substances and the way they interact with one another. In all type of cells, cytosol contains the soluble proteins and enzymes which form 20 to 25 per cent of the total protein content of the cell. After the formation of transcription occurs. (a) Since uracil represents 1 among 4 nucleotides; the probability that uracil will be the first letter of the codon is 1/4 and the probability that U will not be the first letter is 3/4. Environmental control of mutation rate. BRANCHES OF GENETICS In recent years, the science of genetics has proliferated into numerous distinctive subdisciplines. 12.18. Aspargine (Asn, N) 93 NH2 | O=C-CH2-CH2-CH-COOH | NH2 20. Thus, the sequences of meiotic pairing or synapsis are determined precociously. The Gram-negative cyanobacteria (i.e., oxygen yielding photosynthetic blue green algae) are one of the most successful and primitive (3.5 billion year old) groups of organisms on earth All of the membrane proteins of the peroxisomes, including signal receptor proteins, are imported directly from the cytosol (cytoplasmic matrix). The primary cell is comparatively thin and permeable. In this instrument a narrow beam of electrons is scanned rapidly over a specimen and a three-dimensional image resulting from differential scattering of electrons by different parts of the surface of specimen is recorded on a cathoderay oscilloscope and a photographic emulsion. Two homozygous varieties of Nicotiana longiflora have mean corolla lengths of 40.5 mm and 93.3 mm. The stability of gel depends on the nature and strength of chemical bonds. The interference microscope is based on the principle of the phase contrast microscope and permits detection of small, continuous changes in refractive index. When exposed to light, the etioplasts rapidly develop into chlorophyll and by synthesizing new membrane, pigments, photosynthetic enzymes and components of electron transport chain (Thomson and Watley, 1980; Mullet, 1988). The term karyotype has been given to the group of characteristics that identifies a particular set of chromosomes. The LDL - binding site of the receptor is exposed to cell surface. (ii) It can be reemitted as a new photon of light at a longer wavelength, with the shift representing losses to other processes—if with the shift representing losses to other processes. remission occurs very quickly, it is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; of there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a long lag (milliseconds to seconds) between absorption and reemission, the process is called fluorescence ; if there is a
long lag (milliseconds to seconds) between absorption and reemission and reemission ; if there is a long lag (milliseconds to seconds) between absorption and reemission ; if there is a long lag (milliseconds to seconds) between absorption and reemission ; if there is a long lag (milliseconds to seconds to second to faba) 1 500 3,500 15,000 25,000 35,000 4200 40 40 200 150 300 50,000 3,600 2,200 No known 8. The C chain is shown in dark shade. A gene, called silkless, sk, is responsible for the absence of silks. Without the middle marker (B), double crossovers would appear as parental types and hence we underestimate the true map distance (crossover percentage). Contents CELL 39 viruses are tobacco rattle virus (TRV), tobacco mosaic virus, beet yellow virus (BYV), southern bean mosaic virus (TRV), tobacco mosaic virus (TRV), t separate branch of biology. B-Binding of TF III B to downstream (+55 and +80) simultaneously and starts promoters (box A), located at different positions transcribing the start point without any in 5S and tRNA genes. All rights reserved. Units of measurement used in cell biology (Avers, 1978). through the Golgi apparatus, then transported from the trans Golgi network to an intermediate compartment (an endolysosome) by means of transport vesicles (which are coated by clathrin protein; Fig. (DNA) Callan and Llyod (1960) suggested that each loop pair and thus each chromomere is associated with the activity of one specific gene. Lysosomal membrane also contains transport proteins that allow the final products of digestion of macromolecules to escape so that they can be either excreted or reutilized by the cell. The vacuum tion. Eye Colour in Man In human beings, the colour of eye is found to be determined by polygenes. Give the life cycle of a virus. 3.15. These lysosomal enzymes are associated with the tonoplast of large vacuole of differentiating cells. Very recently the scientists felt the urgent need of establishment of sperm and egg banks to protect these precious germ cells from the radiation. 199 Exchange Decarboxylate carrier 2. Selection in Action 69-78 (Examples and Types of Natural Selection) Melanism in moths or industrial melanism, Australian rabbits, resistance of insects to pesticides, antibiotic resistance in bacteria, infectious diseases in humans, sickle cell anaemia, heavy metal resistance in plants; types of selection, sexual selection, disruptive or diversifying selection, sexual selection, disruptive or diversifying selection, sexual selection, sexual selection, disruptive or diversifying selection, sexual selection, sexual selection, disruptive or diversifying selection, sexual selection, disruptive or diversifying selection, disruptive or diversifying selection, disruptive or diversifying selection, sexual selection, sexual selection, disruptive or diversifying selection, disruptive cell division, so all the descendants of this cell would lack part of the paternal chromosome. Who had discovered the cell ? Some fine transverse (paternal) strands also cross between lateral Fig. b-Glucuronidase Enzymes acting on lipids 17. Running from cell to cell through the centre of most plasmodesmata is a narrower cylindrical structure, the glyco- desmotubule, which remains, continuous protein with elements of the SER membranes of each of the connected cells. They cultured Escherichai coli cells in a medium in which the nitrogen was 15N (a 'heavy' isotope of nitrogen, but not a radioisotope) instead of commonly occurring and lighter 14N. CH2OH CH2OH C. Plastids are present. Other short-haired individuals when crossed with long-haired ones produce approximately equal numbers of short-haired and long-haired offspring. 4.5). What kinds of progeny are to be expected from each of these crosses : (a) Green female X White male, (b) White female X Green male ? When 30S and the 50S subunits beFig. Examples of auxetic growth are quite rare and include nematodes, rotifers and tunicates. Various types of eukaryotic cells showing different shapes. A — Simplistic view; B— Complex view (after Berns, 1983; Sheeler and Bianchi, 1987). If assortative selective mating is continued for many generations, the heterozygotes are eliminated and the resulting population consisted of homozygous dominants and homozygous recessives. The chromatids of two homologous chromosomes occur as the tetrads. The human eye has no power of magnification, so magnifying glasses may be used to magnify images up to about 10 times. Creighton and McClintock like Stera made convincing correlation between cytological evidence and genetical results of crossing over in maize. DISTRIBUTION OF THE CILIA AND FLAGELLA The flagella occur in the protozoans of the sponges, spermatozoa of the Metazoa and among plants in the algae and gamete cells. Once the inacX P P tivation is established, it is irreC M M versibly maintained in somatic Late blastocyt X cells, however, in germ cell line X X X reactivation occurs at a specific P Zygote stage of germ cell development Early blastocyst (i.e., entry into meiotic prophase; A B X X Martin, 1982). What is the difference between primary and secondary triticales ? enzymes per gene). Effects of Physical Conditions on Nucleotide Sequence A:T etc. Thus, the release factors help the ribosome to recognize these triplet codons. Two (a) In a reciprocal chromotypes of translocation, the tips of chromotypes of translocation, the tips of chromotypes of translocation are labelled with 32 P. This "oneway" mutational effect (or polarity) is referred to as a polar mutation. 1993 M.J. Chamberlain proposed the inchworm model for elongation of transcript of DNA template. 7). Yellow skin spots can appear only if cells are homozygous for y, indicating thereby that whenever yellow spots appear in heterozygous flies, there is prior crossing over between Y and sn alleles. The relative amounts of purines and pyrimidines in samples of DNA of different living organisms are tabulated as follows : Table 3-2. The equivalence rule. Through genetic analysis, McClintock demonstrated that both Ac and Ds elements could move. The progeny was not labelled with 35S. Thus, only 5 per cent hn RNA (by mass) enters geneticists have to modify the classical concept of gene; they hold that a classical gene can consist of more than one functional units or cistron is possible. Chemical formula of adenine. Transmission of a gene from male parent to female child to male grandchild—for example, X-linked inheritance. It mostly occurs in nucleolus, nucleoplasm and cytoplasm. Diploid cells supernatant protein coat (unlabelled) phage DNA contain twice as much DNA as do Fig. ORIGIN OF CILIA The newly formed basal bodies become aligned in rows beneath the apical plasma membrane and each basal body may then produce satellites from the side, a root from its base and a cilium from its apex. to their proper destinations. When poly (U) was presented as the message to the cell-free system containing all the amino acids, one amino acids, one amino acids, it encourses the message to the cell-free system containing all the amino acids. has been investigated that the nuclear-specific proteins (called karyophilic proteins) have in their molecular structure some type of signals, called karyophilic signals, that enable them to accumulate selectively in the nucleus. Their centromeres occupy the plane of the equator of the mitotic apparatus (a region known as th equatorial or metaphase plate), although the chromosomal arms may extend in any direction. In a nutshell, presently the following types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of different types of chromatography are used for the isolation of that DNA synthesis or chromosome duplication takes place later in pachytene or diplotene and then results in separation of homologous chromosomes. Several plant organs of vegetative propagation, dicotyledonous leaves and stem internodes. It is thought to arise when a centromere divides in the wrong plane, yielding two daughter chromosomes, each of which carries the information of one arm only but present twice. enzyme have been shown in Figure 5.4. Functions of different polypeptide subunits of RNA polymerase are now known, but not in any detail. The number of the nucleoli in the cells may be one, two or four. mitochondria occur in greater concentrations at work sites, for example, in the oocyte of Thyone briaeus, rows of dense fibres mitochondria are closely associated with RER membranes, where ATP is required for protein biosynthesis. It also tries to explain the phenomenon of evolution and cytodifferentiation. What do you understand by first division segregation and second division segregation in Neurospora. (b) Change in chromatin consists of DNA and proteins. The best known example of nuclear expansion is that of the neutrophil
leukocyte of female in which the sex chromatin (Barr body) appears as a small rod called the drumstick. 1989 T. Boveri in 1902 suggested that chromosomes were the physical structures Theodor Boveri (1862-1915). Thus, it can be concluded at last that inbreeding, both, provide new allelic combinations which may be good or bad for the natural selection. The loop of the lampbrush chromosomes can be viewed in the following two ways : 1. An individual which is hybrid or hetrozygous in two pairs of alleles or allelomorphs is known as dihybrid. With technology (see Dubey, 1995). Molecular structure of insulin (After Sheeler and Bianchi, 1987). Both ends of the eye are moving and serve as replication forks (Fig. Being earliest oxygenic photosynthesizers of earth, they made early earth's atmosphere aerobic providing the conditions favourable for the evolution of aerobic bacteria and eukaryotes. Chloroplasts Fig. Contents 96 CELL BIOLOGY (iv) Nucleoproteins. In a monoploid, since there is only one copy of each chromosome and only one allele of each gene, so, in it each gene is expressed whether it is dominant or recessive. Child AB adopted. The latter tends to increase the glycolate is available for additional oxidation and CO2 release. Lysosomes were investigated according to following two schools : (1) C. To accomplish this job, the first amino acid (N-formylmethionine) is removed from its attachment to its tRNA and transferred to the free-NH2 terminus of the second amino acid. Triticale is an artificial allopolyploid which has been derived by crossing wheat (Triticum) and rye (Secale). Bivalent. ENZYMES OF THE ER MEMBRANES The membranes of the endoplasmic reticulum are found to contain many kinds of enzymes which are needed for various important synthetic activities. This method uses grid grid bar a cutting device known as ultramicrotome ribbon of to remove ultrathin (i.e., 10 nm to 100 nm sections thick) sections from the specimen. The ER membranes form the new nuclear envelope after each nuclear division. ER closely associated with chloroplast Relationships among organelles in a hypothetical brown alga. However, if used hapazardly and carelessly, genetic engineering could have negative impact on the quality of our life. These sections are stained with a non-vital-stain to increase the contrast. All lysosomal enzymes are acid hydrolases, optimally active at the pH5 maintained within lysosomes. The membrane of the lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or cytosol (whose pH is about ~7.2), but the acid dependency of lysosome normally keeps the enzymes latent and out of the cytoplasmic matrix or c even if leakage of lysosomal enzymes should occur. These seed, the activity of hydrolases is enzymes break down the macromolecular stored refound to be retained in the cytoplasmic matrix (cytosol) (e.g., haemoglobin), the ER is poorly developed or non-existent, although the Drawing of a mucus - secreting goblet cell from the rat colon showing presence of RER. The intercellular core or central stratum between the two membranes consists of specific desmosomal material rich in proteins and mucopolysaccharides. Typically bacteria range between 1µm (one micrometre) to 3 µm, so they are barely visible under the light microscope. movement of ions and small molecules Examples of Facilitated Diffusion recovery transport (i) Ionic transport through charged pores. It was concluded that one of them was deletion and the other an addition, so that the disturbed The fusion of the foetal membranes permitted the blood of each twin to circulate in the blood vessel of the other. Proteinoplasts accumulate protein. 13.19. lag phase so cells cannot divide infinitely. Alanine (Ala, A) 3. Often numerous microfibrils get associated to form the macrofibrils having up to 0.5 µm diameter and observable under the light microscopy. The fact that progeny phage containing Escherichia coli DNA is the genetic material of higher 32P but not 35S organisms has been supported by 32 the following facts : S-labelled DNA enters 1. Precipitin type antibodies cause aggregation of antigen molecules leading to the formation of a precipitate. If the inserted nucleotide contained a purine, the complementary strand would contain a transversion. What basic activities occur during mitosis ? In contrast to lipids, the mobility and distribution of protein interactions to form spe- desmosome mitochondrion intercellular space intercellular space Fig. They were discovered. The single crossing over produces two cross over chromatids and two non-cross over chromatids. ASEXUAL REPRODUCTION The development of new individuals without the fusion of the male and female gametes is known as asexual reproduction. The appearance of thin-thread like condensing chromosomes marks the first phase of mitosis, called prophase (Gr., pro=before; phasis=appearance). What is the difference between a chromosome and a gene ? The allele y may be associated with the allele r to give rise yr combination. The telophase always occurs. These workers modified the known schemes for isolating DNA and prepared samples of DNA from S-III bacteria. The split proteins have been further fractionated and divided into acidic (A) and basic (B) proteins. The males locate females as they forage for food over large tracts of grazing land. After exposing the emulsion to the beta rays, the emulsion was developed and examined by light microscopy. A densely staining mass that represents an X-chromosome inactivated by dosage compensation. Contents 160 CELL BIOLOGY 3. Heredity 3. Generally, DNA makes two complete interphase (A and B) and in metaphase (C). The outer surface of rough ER has attached ribosomes, whereas smooth ER do not have attached ribosomes. In Drosophila, the ratio between the number of X chromosomes and the number of X chromosomes (A) is called the "sex index". In this synthesis the AU/GU ratio of RNA is similar to the AT/GC ratio of DNA. Wherever the probes fit a band containing repetitive DNA sequences, they attach. Oxireductases. In fact, puffing is a cyclic and reversible phenomenon : at definite times and in different tissues of the larvae, puffs may appear, grow and disappear. 7.4. The compartmentalization of the Golgi apparatus. The value of different units of measurements has been tabulated in Table 1-4. Mendel crossed a homozygous red flowered pea plant. Thus, the nucleoli and Xenopus has 600 to 1200 nucleoli due to the synthesis of ribosomal RNA. The rhodoplast (Gr., rhode= red; plast=living) contains the pigment phaeoerythrin which absorbs the light. The term transposon was coined by Hedges and Jacob in 1974 for a DNA segment which could move from one DNA molecule (or chromosome) to other and carried resistance for antibiotic ampicilin. chromosome set plus an aberrant set. Contents NUCLEUS 249 Nuclear pores appear circular in surface view fused pores and have a diameter between 10nm to 100 nm. The A chain may also be linked to the C chain. Double monosomics (2n-1-1) or triple monosomics coupling and repulsion' to explain the unexpected F2 Theodor Boveri (1862 - 1915). In these cases, the number of genes controlling the character were many and usually more than two or three. Although all the pigment molecules in the unit (carotenoids, chlorophyll b, etc.) are capable of capturing light energy, they must transfer it to a single key chlorophyll a molecule called the reaction centre. Introduction 3-11 Historical : vapour and fluid theories, particulate theories; scope of genetics; importance of genetics; importance of genetics; branches of genetics; mortance of genetics; initiation of synthesis of the mRNA, possibly before RNA polymerase II leaves the initiation site, and precedes all excision and splicing events. The chosen organisms, accumulate within lysosomes as residual bodies. mone, is released by the embryo to the aleurone layer where, in turn, the hydrolases are released to the endosperm. Enumerate and define various branches of genetics. Contents C H A P T E R 17 Cytoplasmic or Extra-Nuclear Inheritance I The variegated leaves of the shrub, Acanthopanax. IF1 Properties of three initiation factors (IFs) of E.coli (a prokaryote). 11.12. However, in actual practice six bases code for not more than two amino 1 2 acids. In it, the RNA and proteins are intertwined and arranged in a complex manner in the two subunits. (For obtaining pure lines Johannsen performed classical crosses on common garden bean plant or Phaseolus vulgaris). If it is shown cervical canal cervical canal by
one member of the identical twins, vagina then the environmental factor is Fig. A-Leukocyte of human male without any drumstick. Clinical genetics. He concluded that during bacterial photosynthesis carbon dioxide was not split, rather hydrogen sulphide was broken down, the resultant hydrogen reduced carbon dioxide and sulphur was left behind : 6 CO2 + 12 H2S — \rightarrow C6 H12O6 + 6H2O + 12S This led van Niel to hypothesize that (1) oxygen produced during photosynthesis of higher plants comes from water and not from carbon dioxide. 3.1. Different kinds of viruses. within the ordinary range of earth's temperatures. The chemical structure of chitin is closely related to that of cellulose; the difference is that the hydroxyl group of each number 2 carbon atom is replaced by an acetamide group. It is not surprising that temperature can be mutagenic. Further, production of OAA in C-4 plants is a favourable step, since it permits closure of stomata Fig. Generally this matrix is asymmetrical, being thicker at one end of the loop than at the other. What is meant by the terms primer and template? They have chlorophyll pigment and are involved in the photosynthesis of food and so act like the kitchens of the cell. Hydrophobic compounds entered cells more rapidly than hydrophilic ones. For his experiments Benzer utilized mutations of the rapid lysis (r) character. Also in bilayer pancreatic acinar tissue, they prevent the leakage of pancreatic secretory proteins, including digestve enzymes, into the blood. Heitz (1935), Kuwanda (1939), Geitter (1940), and Kaufmann (1948) have described the morphology of chromosomes. How many triplet codons can be made from the four ribonucleotides A, U, G and C containing (a) no uracils; (b) one or more uracils; (c) one or more uracils process known as the fertilization cone (Fig. The isolated Golgi apparatus is washed with distilled water for purifying it, though, its secretory components are lost (see Thorpe, 1984). Considering all the six alleles of gene I, i.e., four forms of IA, one of IB and one of i, dominance within the multiple allelic series can be shown in the following way : [(IA1> IA2>IA3>IA4)=IB] > i A4 Neglecting the very rare I allele, this series of multiple alleles produces 15 genotypes and 8 phenotypes (see Table 10-3). NADH- cytochrome c-reductase Removal or addition of hydrogen 7. This fact was discovered by Dr. A.S. Mukherjee of Calcutta University. 14.17. These cells are plated in sterile petri-dishes and grown in the appropriate culture medium. The heat, light, chemical substances and other factors stimulate the cytoplamic matrix to contract. This experiment involves to take purified 30S ribosomal subunits, dissociate them by chemical means into their component RNAs and proteins and then allow them to reassociate under appropriate ionic conditions. Some activator proteins bind and bring about the formation of nucleosome-free regions. It also acts as a sensor of external signals. Tongue 9. aconitase, citrate synthetase, α-keto acid dehydrogenase, β-oxidation enzymes. SEX LINKAGE In Chapter 12 we have discussed several cases of inheritance of X-linked recessive alleles, such as, of colour blindness and haemophilia and Y-linked are generally mixtures of intact and broken organelles. When a maize plant with seeds having coloured and full endosperm (CS/CS) is crossed with another plant having recessive alleles for coloured full and genotype of CS/cs. A few important examples are described as follows : 1. It consists of three types of rRNA molecules, i.e., 28S rRNA, 5.8 rRNA, and 5S rRNA, and 5S rRNA, and 40 proteins (named as L1, L2, L3 and so on). One value of cutting DNA molecule up into discrete fragments is being able to locate a particular gene on the fragment where it resides. Since mitochondria act as the 'power-houses' of cells, they are abundantly found on those sites where energy is earnestly required such as sperm tail, muscle cell, liver cell (up to 1600 mitochondria), microvilli, oocyte (more than 300,000 mitochondria), etc. O 6 3 C N Chemical formula of adenine (6-aminopurine, mw=135.13 daltons). Gorter and F. Hence, a higher than usual fraction of the oxidatively released energy is converted directly to heat (called non-shivering thermiogenesis). CHROMOSOMAL ABERRATIONS In human beings various types of chromosomal variations, both numerical as well as morphological, have been reported (Fig. So fraternal twins differ from each other in their traits, development and often even sex. But when he self-pollinated the tall plants of second generation then he found that onethird (1/3) tall plants yield only tall plants in third generation, while rest two-third (2/3) tall plants yield tall and dwarf plants in the ratio of 3:1. It stains telomeres of chromosomes. Muller and Alfred H. Thus, the appearance of wild type in F2 generation could be explained. H1 histore is absent in yeast, Saccharomyces cerevisiae. Electron microscopic observations have been made on the pinocytotic process at sub-cellular or sub-microscopic level in the cells. The breakdown of nuclear envelope signals the commencement of prometaphase and enables the mitotic spindle to interact with the chromosomes. The DNA molecule of herpes virus is a single

linear, double-stranded having a molecular weight of 108 daltons and codes for about 100 average sized protein molecules. This involves the following two steps: (a) Activation of amino acids. Lastly, in an adult organism, growth and cell division in most cell types have stopped, and each cell needs only to maintain itself and its properties. The net result of inversion is neither a gain nor a loss in the genetic material but simply a rearrangement of the gene sequence. A cell born after a division, proceeds to grow by macromolecular synthesis, reaches a species-determined division size and divides. and filling the resultant gaps due to its 5' \rightarrow 3' polymerizing capacity. This enzyme is produced by the pancreas and secreted into the small intestine where it catalyzes the hydrolytic digestion of polyribonucleotide chains (RNA). No lac mRNA is made in the presence of glucose, because in an addition of an inducer to inactivate the lac i repressor, another element (i.e., cAMP-CAP) is needed for initiating lac mRNA synthesis; the activity of this element is regulated by the concentration of glucose. Contents GENETICS AND EUGENICS 216 ANSWERS TO PROBLEMS 7. Scurvy. The main function of the kinetochore is to provide a centre Contents 262 CELL BIOLOGY of assembly for microtubules, i.e., it serves as a nucleation centre for the microtubules metaphase polymerization of tubulin protein into chromosome microtubules (Telzer et al., 1975). Heterophagosomes are formed by the fusion of primary lysosomes with cytoplasmic vacuoles containing extracel- Contents LYSOSOMES lular substances brought into the cell by any of a variety of endocytic processes (e.g., pinocytosis, phagocytosis, see Chapter 5). Contents FERTILIZATION 355 C H A P T E R 21 Fertilization (L., fertilis = to bear). They are called essential fatty acids and include linoleic acid, linolenic acid, linolenic acid, 14.13). AA, Aa 3. Yeast cells absorb exogenous nutrients directly across the cell membrane, there while Amoeba engulfs solid food. In corn, Zea mays chromosome 9 and 6 contain 'darkly staining knobs' or nucleolar organizers (Heitz and McClintock, 1930s). In the neuronal membrane, there while Amoeba engulfs solid food. In corn, Zea mays chromosome 9 and 6 contain 'darkly staining knobs' or nucleolar organizers (Heitz and McClintock, 1930s). are a number of Ca2+ channels that are driven by the membrane potential and are essential in the release of neurotransmitters (acetylcholine). Kornberg (1974) proposed the 'nucleosome model' of the basic chromatin material. The lz locus is responsible for smaller darker and more elliptical (narrow ovoid) eyes (fig. In Chlamydomonas, the mating type alleles are called mt+ and mt— (in Nerospora they are A and a; in yeast a and a). Lampbrush chromosomes also show the possible way of gene amplification which is required during the growth phase of ocytes. The two pairs of centrioles migrate to opposite poles of the cell along with the asters and become situated in antipodal positions. (ii) Spot desmosomes (Macula adherens). Disassortative mating refers to the mating of unlike phenotypes and tends to maintain heterozygosity, as in the case of mating between unlike sexes. Old world cotton, Gossypium herbaceum, has 13 pairs of chromosomes, while, American or "upland cotton" also contains 13 pairs of chromosomes 20.5. Insertion of phage Mu into a lac gene upon receipt of an appropriate signal, the Mu renders the gene inactive (lac-). The amount of secretory vesicle membrane is inserted into the apical plasma membrane (whose area is only 30 µm3) when the cell is stimulated to secrete. He interpreted these results in terms of two genes, each with a pair of alleles exhibiting cumulative effect (Fig. In the following crosses, sm-r and sm-s indicate streptomycin resistance and streptomycin sensitivity, respectively, and mt is the matingtype gene mt+ sm-r × mt— sm-s → progeny all sm-r mt+ sm-s × mt— sm-r → progeny all sm-s Here, occurs a difference in reciprocal crosses; all progeny cell show the streptomycin phenotype of the mt+ parent. 28. (2) In both DNAs, two polynucleotide strands of double helix are antiparallel. It also helps in regulating the concentration, and uptake of essential ions and water. Using quantitative techniques in 1940s, a very significant observation was made regarding the ribosome function. phatase, adenosine diaminase, nucleoside phosphorylase, guanase, aldolase, enolase, 3-phosphoglyceraldehyde dehydrogenase and pyruvate kinase. Contents 188 CELL BIOLOGY D. If mRNA transcribed from a specific gene is made available in purified form, it can be used in the production of cDNA which will represent the synthetic gene. Ancestor E is inbred, because its parents (G and H) are full sibs and are 50 per cent related. 5.28). They are also richer in phosphotidyl- choline and poorer in sphingomyelin (Thorpe, 1984). Thus, the changes in the structure of somatic cells or somatoplasm which are caused by the environment (acquired characters) cannot influence the reproductive cells or germplasm. PLEIOTROPISM Uptill now we have observed that a specific gene has this is not the case. The mammalian erythrocytes and the myelin sheath of the nerve fibre, however, have proSEM of neurons. The human male has A mitotic chromosome; c = centromere. Chemical formula of uracil. Thus, peroxisomes are a collection of organelles with a constant membrane and a variable enzymatic content. A karyotype of human metaphase chromosomes is obtained from their microphotographs. These two organelles of eukaryotic cells in some respects operate in opposite directions. Tissue (glycolipid) proteins are extremely lipophilic and form the main bulk (i.e., backbone) of the plasma 1. Extending from each A subfibre are two dynein arms —an outer arm and an inner arm. that are oriented in the same direction in all microtubules (i.e., peripheral doublets). This bacterium can be grown in large quantities and the recombinant plasmids are isolated from such bacteria. Half of the meiotic products (gametes/pollen Break Break grains) are non-functional and invi4 able due to the presence of duplications and deletions in them. These linkers provide mechanical coupling and chemically are made of glycosylated proteins, called desmogleins I and II, with the carbohydrate moiety exposed toward the intercellular space (Steinberg, 1984). Sidney Altman (1939-). They have selective combination with certain stretches of nuclear DNA and, thus, are involved in the A3 B I I B B A2 I I IB i ii B O A3 The H Antigen and Bombay Phenotype Antigens A and B of A, B and O blood phenotype are synthesized from a precursor mucopolysaccharide in the presence of the dominant allele of another pair designated as H and h. (after productive cycle includes a long Burns, 1969). Intermediate female X ij/ij male cross (Fig. green plants with chlorophyll; 2. Heterozygous tall P1 Dwarf dd ¹/₂dd or Test cross ratio = 1:1 Homozygous dwarf Example of Dihybrid Test Cross The test cross of a heterozygous yellow round seeded pea plant with a double recessive parent (green wrinkled, yyrr), yields the test cross genotypic and phenotypic ratio of 1:1:1:1 as follows : Parents : F1 Heterozygous × F1 Homozygous vellow round green wrinkled Yy Rr yrr + 4 Gametes : YR, Yr, yR, yr yr Test cross progeny : 1/4 Yy Rr : 1/4 yrr or 1/4 green round : 1/4 gre chromosome chromatin set or haploid set (e.g., oocytes of slamander Triturus; see Grant, C 1978). Isolation; types of isolatio isolation), seasonal isolation (temporal isolation), ethological or behavioural isolation), mechanical isolation; postmating or postzygotic isolation; postmating or postzygotic isolation; the coaction of isolating mechanisms; the genetics of isolating mechanisms; role of (xvii) isolating mechanisms; origin of isolation; revision questions. The sucrose and maltose occur mainly in the matrix of animal cells. Therefore, depending on the specificity of the enzyme, an exonuclease will either begin at a tree 3'-OH end of a polynucleotide and progressively cleave the bonds on the 3'-OH side of the phosphodiester backbone or it will begin at a free 5'-P end and digest the polynucleotide in a 5' -> 3' direction. Such a multiple translocation heterozygotes would form a ring of 14 chromosomes during meiosis. Contents GENETICS, HUMAN GENETICS AND EUGENICS 54 5. Identification of the "transforming principle or substance". The substance bound with the receptor is called the ligand. Besides naturally occurring spontaneous mutations, the mutations, the mutations (i.e., temperature) and chemicals. The ribosomes of the chloroplasts consist of two ribosomal RNAs, 23S rRNA and 16S rRNA (Stutz and Noll, 1967). Formation of various types of lipid aggregates. Oncogene. However, in going from RNA to protein the language is changed from a nucleotide sequence to an amino acid sequence. The mutant form of allele too can mutate once again to give rise to another mutant form of allele. This preserves the dissimilarities both genetic as well as phenotypic. Ubiquinone (coenzyme Q or Q), 6. Jeffreys developed a series of DNA that seek out any specific sequence they match, and base pair with that sequence. Except the protozoan Euglena no animal cell possesses plastids. Xenopus borealis possesses 19,000 copies of the oocyte and in no other cell. Haemoglobin 8. When both 50S and 30S ribosomal subunits are dissociated by centrifuging both of them in a gradient of 5 M cesium chloride, then there are two inactive core particles (40S and 23S, respectively) which contain the RNA and some proteins (CP) at the same time several other proteins (CP) at the same time several other proteins (SP) are released from each particle (Fig. In mammals, these intermediate filaments are of three types : lamins A, B and C having M.W. 74,000, 72,000 and 62,000 daltons, respectively. (ii) Pyrimidines—cytosine and uracil. Discuss the roles of different enzymes or proteins in this process.
MECHANISM OF MEIOTIC CROSSING OVER The process of crossing over includes following stages in it, viz., synapsis, duplication of chromosomes, crossing over and terminalization. Number. Three different DNA polymerases are known in E. By the use of double infections, Benzer performed complementation tests between pairs of rII mutants and found that all could be assigned to one or the other two functional groups, indicating the presence of two separate genes called A and B (Fig. Non-genetic Ribonucleic Acid (RNA) and Transcription 6. Fundamentally, it remains related with the growth of an individual from zygote to adult stage. Its reaction-centre chlorophyll a is designated P 690 or shorter-wavelength trap. The fast runners of F1 were selected and inbred and stallions of the F2 appear as beginning points in the pedigrees of almost all modern race horses. The marine annelid Ophryotrocha differentiates into a sperm producing male as a young animal and then changes into an egg-laying female when it gets older. The standard units are metres, grams, litres and seconds. The flagellar motor comprises four distinct parts : rotor (M ring), stator, bearing (S ring) and rod. It has long been assumed that proteins destined for secretion (i.e., export) from the cell or proteins to be used in the synthesis of cellular membranes are synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA SRP GDP Signal peptide on nascent SRP polypeptide SRP cytosol receptor GTP GDP ER membranes are synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA SRP GDP Signal peptide on nascent SRP polypeptide SRP cytosol receptor GTP GDP ER membranes are synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA SRP GDP Signal peptide on nascent SRP polypeptide SRP cytosol receptor GTP GDP ER membranes are synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA SRP GDP Signal peptide on nascent SRP polypeptide SRP cytosol receptor GTP GDP ER membranes are synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA SRP GDP Signal peptide on nascent SRP polypeptide SRP cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA tRNA set of the synthesized on rough ER-bound ribosomes, while cytoplasmic proteins are mRNA trnA set of the synthesized on rough ER-A schematic model for the synthesis of a secretory protein on a membrane - bound ribosome of the RER. The second meiotic division includes following four stages. Hermaphroditism. The carbohydrate portion may be a single monosaccharide or a linear of branched chain. In the process of metamorphosis of amphibians and \tunicates many embryonic tissues, e.g., gills, fins, tail, etc., are digested by the lysosomes and utilized by the other cells. During gametophyte is nurtured in archegonium gametophytes antheridium specialized tissues of sporophyte. (b) Endonuclease enzyme. (b) Show how you would determine the rate of mutation from a recessive to a dominant allele in man. They added this DNA to a live R bacterial culture; after a period of time they placed a sample of S-III containing R-II bacterial culture; after a period of time they placed a sample of S-III containing R-II bacterial culture; after a period of time they placed a sample of S-III containing R-II bacterial culture on an agar surface and allowed it to grow to form colonies. to reveal details of structure is expressed in terms of limit of resolution (l) which is defined as the smallest distance that may separate points. The capsule serves mainly as a protective layer against attack by phagocytes and by viruses. Potao spindle tuber (Its viroid contains 359 nucleotides in single and circular RNA molecule); cytosol 2. This gave birth to a hybrid science, called cytogenetics which attempts to correlate cellular events, especially those of chromosomes, with genetic phenomena. Thus, it is a case of monohybrid inheritance, with agouti completely dominant to albino. The cytosol is the aqueous portion of the cytoplasm (the extranuclear protoplasm) and of the nucleoplasm (Mg++) and amino acids. Temperature probably affects both thermal stability of DNA and the rate of reaction of other substances with DNA. Note that the flat sacs within the plastid are arranged in extended parallel arrays other than separated into grana and stroma systems as in higher plants. Introduced the term chromatin and described only a few times or perhaps not at all during the life of a cell, the rRNA genes are in a state of perpetual transcription. Without the plastids, the pollen cannot affect this aspect of the F2 to be as extreme as one of the other parental average. A-Wild type non-allelic, i.e., both occupying different sites, eye; B-Lozenge eye (after Gardner, 1968). Hyaluronidase 16. Land snail C. The lack of synthesis of β-galactosidase is a result of lack of synthesis of β-galactosidase is a result widely used to observe unstained and living cells (especially in mitotically dividing cultured Oil-immersion microscopy. The gametes of both parents unite during both tall (T) and dwarf (t) characters. In a diploid organism each gene has two alleles occupy the same locus. The parthenogenesis serves as the means for the determination of sex in the honey bees, wasps, etc., and it supports the chromosome theory of inheritance. Synthesis of various ribosomal proteins) are transcribed by genes (DNA). The existence of more than one stop codon might be a safety measure, in case the first codon fails to function. The organisms which have been A pod of the garden pea chosen for the genetical experiments should produce large number of which was selected by offsprings after each successive mating because it will help in deducing Mendel for his experiment. In this method of reproduction the nuclear and cytoplasmic contents of the cell divide or split completely into smaller-sized daughter individuals. But, because a heterozygous individuals pure or homozygous offsprings. The mode of formation of transcription complex at the promoter for RNA polymerase II. Presumably because a double dose of X chromosome products would be lethal, the female cells have evolved a mechanism for permanently inactivating one of the two X chromosomes in each cell (this process is called dosage compensation). The outer membrane of the amyloplst encloses the stroma and contains one to eight starch granules. He related the bands on the giant chromosomes and applications concerning speciation than in the association of chromosome sections with particular genes. Now each spermatogonial cell is known as the primary spermatocyte. They discovered that when diploid barley, Hordeum vulgare, is pollinated using a diploid wild relative called Hordeum bulbosum, fertilization occurs, but during the ensuing somatic cell divisions, the chromosomes of H. In 1934, Barbara McClintock recognized and named nucleolar organizers in the chromosomes. Further, a combination of amniocentesis with analysis of restriction enzyme fragments now enables scientists to do prenatal screening for sickle cell anaemia. Some females may have 4 or 5X chromosomes besides the normal autosomes. Suff-sterility Alleles A series of self-sterility alleles insures cross pollination in many plants. At replication, this situation would allow the insertion of an extra nucleotide in the complementary chain at the position occupied by the proflavin molecule. Ruth Sager. In light reaction solar energy is trapped in the form of chemical energy is trapped in the form of an extra nucleotide in the complementary chain at the position occupied by the proflavin molecule. the membrane permeable to molecules having molecular weight as high as 10,000. Monosomy Diploid organisms which are missing one chromosome of a single pair are monosomic with the genomic formula 2n -1. (0.0014) (4000)/1.5
= 4. Since mature mammalian red blood cells are without any nuclei, they are called red blood "corpuscles" rather than cells (L. 15.2. Comparison of size of leaf epidermal cells of a diploid (B) saxifrage (after Burns and Bottino, 1989). The situation is the same for identical triplets, but they are quite rare in human beings. Plowe in 1931. Table 5-3. Generally, chloroplasts of plants grown in the shade are larger and contain more chlorophyll than those of plants grown in sunlight. Thus, this process operates to maintain homeostatic levels of glucose in the blood for the maintenance of matrix functions of red blood cells and nerve tissues. 13.2). How do the functions of rRNA, mRNA and tRNA differ during the process of protein synthesis ? 1956 A. Alwine et al., (1979) devised a technique, nicknamed northern blotting in which RNA bands are blot transferred from the gel onto chemically reactive paper. 4.30. If the substitution produces a protein that is active at one temperature (typically 30°C) and inactive at a higher temperature (typically 30°C). The lipids are classified into three main types : 1. (2) Supressive petites contain mt DNA which is greatly altered in base composition with respect to wild mt DNA. For example, in case of an overlapping 3 corresponding protein. 13.5. From this cross he obtained normal diploid males, triploid females, intersexes, supermales and superfemales. In such an event they differentiate into the type of cells that they reinforce and replace. The 70S ribosomes of Euglena chloroplast are found to require Mg++ for their stability and also have a requirement for N-formy1 methionyl-tRNA in chain initiation protein synthesis like the bacteria. Dynein arms. In the radiolarian protozoan Aulacantha is found a diploid number of approximately 1600 chromosomes. As they are being synthesized, the nascent cellulose chains spontaneously assemble into microfibrils that form a layer on the surface of the plasma membrane (a lipid bilayer lamella) in which all the microfibrils have more or rosette less the same alignment (Note. The matrix has a Surface tension: A baby's first breath is facilitated by a definite pH value and it does not tolerate special coating called a surfactant, which the lungs secrete. Anaphase I At anaphase I fibres or microtubules each homologous chromosome with its two chromatids and undivided centromere move towards the opposite poles of the cell. cholesterol and help in fat breakdown. They are replicated autonomously quite electron-dense. These are genes which have very less effect than the standard gene, i.e., they do not cause any significant change in phenotype. However, he failed to explain the exact process by which these factors pass on the sex cells. Protoplasmic streaming 4. Therefore, crossover eggs will be ++ (9 per cent) and fa sn (9 per cent) and noncrossover eggs will be fa+ (41 per cent) and +sn (41 per cent). They are capable of oxidizing palmitoyl-CoA, using molecular oxygen and NAD as electron acceptors (Lazarow and de Duve, 1976). They change the meaning of a codon, changing one amino acid into another. For example, in immotile cilia syndrome, a condition characterized by severe respiratory difficulty (chronic bronchitis and sinusitis) and male sterility, the underlying genetic defect is the An eukaryotic flagellum. A sexually reproducing species may have individuals which are unisexual or bisexual. (a) Haemophilia A. 1989). The genes are linked and 20 map units apart. If the conplasma centration of NaCl solution is membrane nucleus increased above 0.9% then the erythrocytes are shrinked vacuole due to excessive exosmosis. At the surface of the liquid, however, they are subjected to unequal stress and sideways or inward, more than upward; consequently they are subjected to unequal stress and sideways or inward. are held together to form a membrane. Who is the child's father ? The formation of the cilia from the basal bodies. Another classical example of hormonal control of sex determination has been found in cattles. The haploid (n) refers strictly to the number of chromosomes in gametes. Each of these types can be bred true. In certain metazoan animals the asexual bodies known as the gemmules and statoblasts. The prokaryotic cell of E. Ultrastructure of the cell wall of a Gram-negaceous scaffold. In fact, coated-pits serve as molecular filters and selective concentrating devices, since, they tend to collect certain receptors and leave others. P1 and F1 crosses were made between varieties with the following results : P1 1. Blending inheritance. The code is degenerate. In the double crossing over, the formation of each chiasma is independent of the other and in it four possible B classes of recombination occur. Before the onset of DNA synthesis, there is a presynthetic stage of 8-1 0 minutes duration for the formation of unwound DNA complex. The amyloplasts occur in those cells which store the starch. Tissue is placed in final embedding mixture and the plastic is polymerized in an oven. An ideal tracer should be non-toxic, physiologically inert, composed of small-sized particles of uniform and known size and preserved in situ during the processing of the tissue. However, since the hepatocytes of liver contain exceedribosomes ingly large quantities of smooth ER (see Alberts et al., 1989). Structural details smaller than this, e.g., cell, is unresolved unless some instrument capable of higher resolution is used. 10.8. A part of inner mitochondrial membrane (cristae) showing the distribution of different dehydrogenases and cytochromes on M face and C face. Further, inversion heterozygotes often have mechanical pairing problems in the area of the inversion; this also reduces crossing over a b c d e and recombinant frequency in the vicinity c a (see Suzuki et al., 1986). cc 2. The gemmules occur in freshwater sponges (family Spongilidae) and the statoblasts occur in the bryozoans. SIGNIFICANCE OF MEIOSIS The meiosis has the greatest significance for the biological world because of its following uses : Meiosis produces egg and sperms. Whenever, the products of meiosis consists of eight spores, they result from mitosis of four meiotic products. Crystallographic studies on synthetic nucleotides consisting of alternating purines and pyrimidines such as GCGCGCGC have shown that left-handed DNA can also exist. Define the term microfilament. By what means does evolution appear to be taking place in this genus? Contents HUMAN GENETICS Table 18-1. Cell wall. Thus, the mutant genes caused "metabolic blocks" in synthetic pathway. The law states that the hybrids or heterozygotes of F1 generation have two contrasting characters or allelomorphs of dominant and recessive nature. E.coli as seen in a electronmicrograph. Exact explanation of this question is still not known. The amino ends or N-termini of both heavy and light chains, however, are extremely diverse in primary structure, even within a class and are called vari- Contents MOLECULAR BIOLOGY 130 able (V) regions. (iv) Oblique binary structure, even within a class and are called vari- Contents MOLECULAR BIOLOGY 130 able (V) regions. fission. The Diploid female Super female A+XX sex determining 2A+XXY 2A+XXX genes were so distributed that the net efFig. ing paired loops given out by two chromatids; C— Thus, about 5 to 10 per cent of the Single pair of loop (after Alberts et al., 1989). Answers to the problems have also been given at places where required. In mammalian cells, anaphase B begins shortly after the chromatids have begun their voyage to the poles and stops when the spindle is about 1.5 to 2.0 times its metaphase length (15 times increase in certain protozoa). (e) How is heterosis related to effects of inbreeding? Satellite DNA may have a higher or lower G + C content than the main fraction. Cholesterol anaerobic cell mitochondrial DNA is eukaryotic cell also similar to bacterial DNA. Induction of transcription was explained as the result of the binding of the inducer (= lactose) to the repressor protein such that the repressor dissociated from the operator. Do you think that all effective eugenic programmes must based on detailed knowledge of the genetics of the trait being selected ? MECHANISM OF PROTEIN SYNTHESIS Protein synthesis is the most complex biochemical transformation which cells perform, and at least 200 different proteins are required for the protein synthesis itself. A monosomic individual forms gametes of two types, (n) and (n - 1). Ribosomes also stud the rough endoplasmic reticulum, giving it a rough appearance and allowing the synthesis of proteins within the ER. Messenger RNA chain growth is rapid—from 15 to 100 nucleotides per second in vitro. Benzer coined the term cistron to denote a genetic unit that has a single function as demonstrated by failure to complement in the trans conFig. In between the lamellae occur certain granules of 400A0 diameter. The ooplasm. 3.4. A,B,C — Mode of attachment of a T-even phage (bacteriophage) on chromosome may exa bacterial cell wall and injection of DNA into the bacterium (host ist as a fragment of cell); D,E,F and G — Steps of viral reproduction inside the host cell. Define the positive control of gene action. Various genetical diseases of human beings such as haemophila, colourblindness, phenylketonuria, etc., form other examples of mutation in human beings. There are two broad classes of immune responses and (2) cell-mediated immune responses. What is the Calvin cycle, and what is its purpose? The Brownian movement is the peculiarity of all colloidal solutions and depends on the size of the particles and temperature. In mammals, B lymphocytes originate from the haemopoietic tissue – spleen – lymph nodes – gut-associated lymphoid tissue thymus T cell bone marrow lymphocyte haemopoietic stem cells thymus lymphocyte (mammals) antigen cell mediated immune response B cell (bir ds) ds (bir) bursa of Fabricius (birds only) Fig. C group : 6 to 12 pairs
— Submetacentric 4. Following four types of lysosomes have been recognized in different types of cells or at different times in the same cell. Heredity also determines biochemical conditions such as genetic diseases, e.g., brachydactyly, Huntington's chorea, porphyra, phenylketonuria, sickele-cell anaemia, and dibetes. "Structural complexity of eukaryotes is reflected in their subcellular structures". (directly or indirectly) to the lipid in an orderly sequence. Likewise, another green alga, Eudornia, has 16, 32 or 64 cells in its colony. 15.11. Plastids located in the cotyledons and the primordium of the stem are colourless (leucoplastes) but eventually become filled with chlorophyll and transform into chlorophyll and control of a single gene. The Wyandotte breed has a comb called "rose", the Brahmas breed has a comb called "rose", and the Leghorns have a comb called "single'. The repulsive forces between the homologous chromosomes increase greatly and the chromosomes increase greatly and the chromosomes become ready to separate. in three possible combinations, viz., RR, Rr and rr, to produce three types of individuals in F2 generation. In higher animals these are termed tight junctions (see Maclean and Hall, 1987). (ix) Microgamy. In Laemmli's radial DNA loop model DNA is arranged in loops anchored to the nonhistone scaffold. The potentials drop in three large steps, one across each major respiratory enzyme complex. Energy funneling into P 700 is responsible for the ejection of an electorn from the viral capsid and gets attached to ribosomes to start the process of viral multiplication (Fig. Pyrophosphate contains a "high-energy" or "~" bond, meaning that when the released pyrophosphate is hydrolyzed into two phosphate molecules, energy is liberated which a single base substitution results into a single amino acid change in insulin, tryptophan synthetase, TMV coat B C A T G A T C 4 protein, alkaline phosphatase, haemoglobin, etc. Discovery and use of polynucleotide phosphatase, haemoglobin, etc. have accumulated. Disassortative mating B A also results from dichogamy, (Dichogamy = producing mature B male and female reproductive structures at different times); D C self-sterility in plants in which the mating of like phenotypes E (inbreading) is not possible and fertilization between plants with different genotype is favoured. Water's therma exposed on other side. Presently most human societies are money-minded and for the marriage relationship the wealthy or highly placed persons which, however, may contain several defective genetical traits, are more preferred than those which have eugenically sound hereditary traits but having no money and which fail to reach to highest status of the marriage relationship the wealthy or highly placed persons which have eugenically sound hereditary traits but having no money and which fail to reach to highest status of the marriage relationship the wealthy or highly placed persons which have eugenically sound hereditary traits but having no money and which fail to reach to highest status of the marriage relationship the wealthy or highly placed persons which have eugenically sound hereditary traits but having no money and which fail to reach to highest status of the marriage relationship the wealthy or highly placed persons which have eugenically sound hereditary traits but having no money and which fail to reach to highest status of the marriage relationship the wealthy or highly placed persons which have eugenically sound hereditary traits but having no money and which fail to reach to highest status of the marriage relationship the wealthy or highly be and the marriage relationship the wealthy or highly be an end of the marriage relationship the m the society due to lack of opportunities. Contents CHEMICAL NATURE OF GENETIC MATERIALS (i.e., DNA AND RNA) 21 Watson and Crick's Structural Model of DNA In DNA molecule the adjacent deoxyribonucleotide unit deoxyribonucleotide unit by phosphodiester bridges or bonds which link the 5' carbon of the deoxyribose of one mononucleotide unit with the 3' carbon of the deoxyribose of the next mononucleotide unit. Some individuals have a patch of blond hair in a head of brown hair. will be a cytosine in the other and so on. Nexin links. Biosynthetic or anabolic activities. 10.7). (The base pairs are rotated 36° with respect to each adjacent pair). Primary structure also includes other covalent linkages in proteins, for example the linkages that may exist between sulphur atoms of cysteine amino acids located in the chain of the protein insulin. Both organelles are related to the immobile life-style of plant cells. Three, as any other number of deletion (or addition) would cause a frameshift and other amino acid changes. The cytoplasmic or extra-nuclear inheritance of colour in plant by plastids was first of all discribed by C. LEVELS OF GROWTH Among living organisms, growth can be recognised at the following two levels : Contents 366 CELL BIOLOGY A. The platform separates the head from the base by the help of a cleft. Synemin is a protein of 230,000 daltons, which is also presen in the intermediate filaments of muscle, together with desmin and vimentin. So this trait was believed to be caused by a holandric or Y-linked gene (See Stansfield, 1986). This vectorial movement of protons creates a difference in pH (i.e., lower pH on the C side and higher on the M side), which results in an electrical potential (Fig. Some characteristics helix sense strand of each subunit of RNA-P has been 5' 3'OH antisense tabulated in Table 5-2. In 1940s Albert Claude homogenized chick and mammalian embryos and obtained a fraction containing what he called microscope. The large DNA polymerase is the predominant DNA polymerase enzyme in eukaryotic cells and was belived for long time to be only enzyme involved in DNA replication. R.C. Punnett devised the Punnett's square for making gametic combinations theoretically. In 1835, H.von Mohl (1805–1875) described cell division. What part of chloroplast is associated with the light reaction ? Cross of F1 striped females (of cross b) to normal (green) males. The classical studies of Bridges (1936) showed that the bar trait of Drosophila is associated with the duplication of a segment of the X-chromosome, called section 16A, as observed in salivary gland chromosomes (Fig. 4.4. Structure of a water molecule : A— How two hydrogen persion medium for the colatoms share their single electrons with oxygen atom; B— loidal system of the matrix. Such oligosaccmembrane charide "trimming" or SRP "processing" continues in receptor (Hirschberg and Snider, 1987; Kornfeld, 1985). It comprises a variety of transport proteins, called permeases which control the entrance and exit of small molecules and ions. Exposing a culture of white yeast to the mutagenic action of mustard gas produced some red individuals. 3.6. A monohybrid cross between black and splashed white abnormally low oxyAndalusian fowl showing the incomplete dominance. Demonstration of the X and Y chromosomes (the blue and the pink dots respectively) in mammalian fetal cells using fluorescent in situ hybridization (FISH). Chemical formula of deoxyribose sugar. Both are homozy- actate and other derivatives, all of which gous for the same mutant PAH gene. Such membranes allow only certain selected ions and small molecules to pass through them. The meiocytes of gonads are called gonocytes which may be spermatocytes in male and oocytes in female. Contents CELL 49 Modes of respiration of bacteria are both aerobic. A typical eukaryotic mRNA molecule has a life-time of about three hours before it is degraded. selected structures in Protozoa such as the axostyle of parasitic flagellates, the axoneme of Echinosphaerium, the fibre systems of Stentor, and the cytopharyngeal basket of Nassula. This complex comprises two intrinsic proteins that bleaches when absorbing light at 680 nm). A definite relationship has been found between cell shape, the number and direction of microtubules and cAMP. B One-gene, one-band hypothesis. Recombination in bacteria whereby DNA is transferred by a phage from one cell to another. Import mechanism of mitochondrial proteins. Circulation and transport. 3.12). 2.7. Column chromatography. During insertion of a transposon, the singular target sequence becomes duplicated and, thus, appears as direct repeats flanking the inserted transposable element. Lethal gene. Regulation at the level of post-translation. Most of the recent knowledge about the structure of ribosomal protein molecules. (v) Iron-sulphur proteins (Fe2S2 and Fe4S4) are electron carriers of mitochondria containing iron and sulphur in equal amounts. The n -1 gametes do not survive in plants, but, in animals that may cause genetic imbalance, which is manifested by high mortality or reduced fertility of resulted organism (Fig. The somatic cells always multiply by mitotic division. The complete and incomplete type of natural parthenogenesis may be of following two types : (a) Haploid or arrhenotokous parthenogenesis; (b) Diploid or thelytokous parthenogenesis; (b) Diploid or thelytokous parthenogenesis; (b) Diploid or thelytokous parthenogenesis may be of following two types also coalesces in a chromocentre. Describe the biogenesis of the mitochondria. But the karyokinesis is not followed by the cytokinesis. A point mutation in spleen removes altered RBC, eventually causwhich a nucleotide of a triplet is replaced by another ing severe anaemia. (iv) Uses of monoploids. Golgi Apparatus 166-174 Historical ; occurrence ; distribution] morphology ; isolation and chemical composition ; origin; functions ; revision questions. (d) Missense; GGA codes for glycine, CGA for arginine. The inner membrane impermeable to a variety of ions and small molecules (e.g., Na+, K+, Cl---, NAD+, AMP, GTP, CoA and so on). Antibiotic are toxic for microorganisms but safe for humans, because all of these metabolic
processes are subtly different in bacteria and humans. All of which might be practically impossible and troublesome too for the DNA. Of the known 100 monosaccharides, only nine are found to occur as regular constituents of glycoproteins (e.g., glucose galactose, mannose, fucose, acetylglucosamine, acetylglucosamine, acetylglucosamine, acetylglactosamine, acety where the transposon exists in the chromosome; the inverted terminal repeats, however, remain the same for a given transposon. 8.3. Lysosomes of the kidney cells of rat, showing the presence of residues (A). In the marine archiannelid Dinophilus sex appears to depend solely on size of the egg produced by a female. On the other Burns and Bottino, 1989). In vivo control of assembly and disassembly of tubulin involves Ca2+ and the calcium-binding protein calmodulin. Examples of such gene regulatory molecules are the following : (i) RNA polymerases. The contractile axostyle of some (a) cilium propulsion of fluid power stroke (b) flagellum plasma membrane direction of locomotion return stroke. propulsion of water continuous propulsion How cilia and flagella move. elF6 UAA GDP elF + GTP 5' aa1-aa2-||-aan -2-aan-1-aan Pi + GDP eEF1 I > + met elF3 60S AUG 5' C elF1 elF 4A elF 4B 5' A site GTP 3' 5' E 3' aa1 met GTP 3' aa + ^ GDP Pi 5' met aa1 peptidyl transferase aa2 G eEF2 eEF1 aa1 ternary complex aa1 met 5' met D 3' eEF1 H aa2 ternary complex elF5 elF4C P site 5' 3' F +> GTP Pi aa1 met deacylated tRNA Fig. Mendel studied seven pairs of contrasting characters in the garden pea. Would you expect plant cells to have the Embden-Meyerof glycolytic pathway ? The irritability is the fundamental and inherent property of the matrix. Plasmolysis and deplasmolysis in plant cells. (b) F1-particle. Cell Physiology (Cytology and Physiology). In other cases the reacting cell secretes ing microorganisms These enzymes catalyse the reaction involving in the isomerization or intramolecular value of their two subunits. Differentiate between repressors and inducers. Wilson and Morrison (1966) have defined the cell as "an integrated and continuously changing system." John Paul (1970) has defined the cell as "the simplest integrated orgainization in living systems, capable of independent survival." All these definitions have excluded the viruses (see 'Exception of Cell Theory' in Chapter 1). It is difficult to see their structure; more difficult to understand their mo lecular composition and still difficult to find out the function of their various components. Thus, on the mitoribosomes are made the following proteins : three largest subunits of cytochrome oxidase (Fig. Contents CYTOPLASMIC MATRIX 69 C H A P T E R 4 Cytoplasmic Matrix (Chemical Organization of the Cell) C All of life is conditioned by the chemistry of water. Pigment system II or photosystem II (PS II) units occur in the thylakoid membrane in the form of larger, more widely spaced particles (or quantosomes). Synapsis Synapsis or intimate pairing between the two homologous chromosomes (one maternal and another paternal) is initiated during zygotene stage of prophase I of meiosis I. Parents : Gametes: Progeny : X+Xh Normal (Carrier) mother (X+)(Y) = = = = Normal daughter Normal but carrier daughter 3 Normal :1 Normal son Haemophilic or Haemophilic son 3:1 Fig. Polyploidy in animals. Haemoglobin A (human) 2. In all but the lowest vertebrates, haemoglobin is a tetramer (a heteropolymer). Epistatic alleles Hypostatic alleles Hypostatic alleles Phenotypic expression of allele 1. 12.13). How can each be produced experimentally ? This property of fusion has been attributed to the high proportion of membrane lipids present indicated to the high property of fusion has been attributed to the high property of fusion has b the micellar configuration (Lucy, 1969). Uridine diphosphate (UDP). Simple diffusion. The loops can be categorized by size, thickness and other morphological characteristics. The synthesis of rRNA molecules is initiG A U ated at promoter and completed at a terminator sequence. Vitamin 105 Vitamins and their characteristics. Plasmagene. A B C D E FADCBEFAdvantages of inversions. This model is popularly known as operon model and has been variously modified, ever since it was originally proposed by Jacob and Monod. Some species of amoebae have a flagellated stage as well as an amoeboid stage; a centriole develops during the flagellated stage but disappears during the amoeboid stage. Moreover, the molecules of the matrix are strongly hydrophilic ("water-loving") with the result that in normal Contents PLASMA MEMBRANE AND CELL WALL 151 circumstances the cell wall is saturated with water like a sponge (e.g., primary cell wall is saturated with water like a sponge (e.g., primary cell wall is 60 per cent water by weight). In the cytoplasm, the most conspicuous change is the formation of the spindle or mitotic apparatus. An increase in active cell mass is the result of synthetic and degenerative processes acting An elephant's growth is limited growth. The shape of the cell may vary from animal to animal and from organ. Introduction Techniques in Cell Biology Cell Cytoplasmic Matrix (Chemical Organization of the Cell) Plasma Membrane and Cell Wall Endoplasmic Reticulum (ER) Golgi Apparatus Lysosomes Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Chromosomes Ribosomes Microbodies: Peroxisomes and Glyoxysomes Microbodies: Peroxisomes and Glyoxysomes Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Chromosomes Ribosomes Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Chromosomes Ribosomes Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Chromosomes Ribosomes Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Chromosomes Ribosomes Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Chromosomes Ribosomes Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Chromosomes Ribosomes Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Cytoskeleton: Microbodies: Peroxisomes Aitochondria Plastids (Chloroplasts, Photosynthesis and Vacuoles) Nucleus Cytoske Filaments Centrioles and Basal Bodies Cilia and Flagella Cell Growth and Cell Division (Cell Cycle, Mitosis and Meiosis) Reproduction I Nature's variety is boundless. Single crossing over. During this process, a single species of oligosaccharide (which comprises Nacetyl-glucosamine, mannose and glucose, containing a total of 14 sugar residues) is transferred to Example of a reaction catalyzed by a glycosyltransferase. All progeny from this cross were expected to have the lozenge phenotype, but few were wild type. (d) Define cistron and polycistronic mRNA. The alignment of many chromomeres 2 OH CH2OH CH O CH O H 2 O O O O O O CH2OH O CH2OH O CH2OH O CH2OH O CH2OH O CH2OH O O CH2OH O CH2 laureate), this variety of wheat pave the way for the Green Revolution in India (see Gupta, 1994). Thus, the growing polypeptide is adopted in turn, by each tRNA, with each successive amino acid being added in effect, to the bottom of the stack. For instance, the synaptonemal complex may serve crossing over by facilitating effective synapsis in one or more of the following ways—(a) to maintain pairing in fixed state for an extended period, (b) to provide a structural framework within which molecular recombination DNA from the bulk of the chromosomal DNA. Since the original de Duve's isolated lysosomal fractions were having contaminations of mitochondria, microsomes and microbodies, so, in 1960's it was investigated that rats injected with
dextran or Triton WR-1339, incorporated these compounds into their lysosomes, thereby altering their density gra0.05 - 0.5 µm dients (see Reid and Leech, 1980). Over dominance hypothesis of heterosis. (a) Starch. 4.22. The role of ε subunit of F1 physically separated from the membrane, F1 particle complex is not known (after Darnell is capable only of catalysing the hydrolysis). (ii) Visualization of replication in E. The protein molecules of the plasma membrane are synthesized on both attached and free ribosomes. In sooty areas, this new form was better chance of avoiding predators. It was in the beginning of 20th century that three botanists, namely Hugo de Vries, working on Cenothera; Carl Correns working on Xenia, peas and maize and Erich von Tschermak working on various flowering plants, independently drawn the conclusions like Mendel. The elongation of polypeptide chains is achieved by the following steps : (i) The second charged tRNA binding) to the first ribosome at the latter's 'A' site with the help of the proteins, called elongation factors (e.g., EF-Tu). TATA binding sites initiation site binding sites TFIID - accessory factor acts from a distance TFIID binding sites accessory factor TFIID binding sites accessory factor they be a shotgun experiment where whole genome of a cell is cloned in the form of random and unidentified clones. This type of mutation occurs in sex chromosomes. The non-disjunction may be of following types: 1. In fact, the ability of mitotically produced cells with exactly the same genetic dowry to produce tissues with different sexual functions in a perfect flower clearly indicate the bipotentiality of such plant cells. Further, the assembly is tentacles projecting from its cell body. When haploid gametes of both sexes (male and female) unite in the process of fertilization a diploid zygote with two genomes is formed. Trisomy in humans. Determination of Map Distance The intergene distance on the chromosomes cannot be measured in the customary units employed in light microscopy, geneticists use an arbitary unit to measure the map unit, to describe distances between linked genes. He was astonished to note both tall and dwarf offsprings in the second generation. TRP OH TRP O H2O TRP O Activating enzyme tRNATRP ACC ACC Anticodon Tryptophan attached to tRNA TRP ACC mRNA UGG tRNATRP binds to UGG codon of mRNA Each kind of activating enzyme recognizes and binds a specific amino acid, such as tryptophan. replicating one. Prof. PROPERTIES OF CYTOPLASMIC MATRIX The matrix is a living substance and it has following physical properties : Physical properties of the matrix are due to its colloidal nature and these are as follows : Fig. Write about the contribution of the genetic material: (i) F. The proportion of individuals of a particular genotype that show the expected phenotype under a certain set of environmental conditions. The chlorophylls are essential photosynthetic green pigments of the They contain the degradative enzymes which have not participated in any digestive process. A—A part of nuclear pore in top view; C—A nuclear pore in cross section (after De Robertis, Jr., 1987). Sections are cut on an ultramicrotome with a glass or diamond knife. The percentage of meIn this experiment plants treated with compounds that interfere with DNA helicases are A TPdependent unwinding enzymes which promote separation of the two parental strands and establish replication forks that will progressively move away form the origin. Any change in sequence of nucleotides in the DNA will result in the corresponding change in the nucleotide sequence of mRNA. Often the triplets are thought to run parallel to one another and to the long axis of the cylinder, but this is not always the case. Contents 40 CELL BIOLOGY Poliomyelitis is a most extensively studied RNA-containing animal virus. 17.6C) and its rebinding at an angle, with a new, more proximal site on subfibre B (Fig. These sites can be identified by examinslide ing the stained tissue sections under the light microscope. Why are mitochondria termed as the "power houses" of the eukaryotic cells ? Later on Sanger (1986) developed a more powerful method, utilizing single-stranded DNA as the template for DNA synthesis, in which 2', 3' dideoxynucleotides were incorporated leading to termination of DNA synthesis, in which 2', 3' dideoxynucleotides were incorporated leading to termination of DNA synthesis. operator such as z, y and a that designate proteins required for Fig. Since close relatives have similar genes because of common heritage, inbreeding increases the frequency of homozygotes, but does not bring about a change in overall gene frequency of homozygotes. Red clover contains more than 200 alleles for the self-sterility (Bateman, 1949). G2 phase. Among plants, the cell shape also depends upon the function of the cell. Contents MITOCHONDRIA 191 C H A P T E R 10 Mitochondria (Gr., mito=thread, chondrion =gran ule) are filamentous or granular cytoplasmic or ganelles of all aerobic cells of higher animals and plants and also of certain micro-organisms including Algae, Protozoa and Fungi. The 5S RNA genes are also organized in tandem repeats, each repeat consisting of a gene 120 bp long and a spacer region. 12.14. (v) Merogamy. The fate of this hnRNA may be one of the followings : 1. All types of oligosaccharides of the plasma membrane are formed by various combinations of six principal sugars (all of which are glucose-derivatives) : D-galactose, D-mannose, L-fucose, Nacetyl-D-glucosamine and N-acetyl-D-glucosamine and proteins of RER are sorted and some of them are returned back possibly by coated vesicles), and the trans region in which the most refined proteins are further separated for their delivery to the various cell surface membrane material passes out of cell lysosome material passes into cell secretory vesicle endocytotic vesicle (Fig. 7.5; Rothman 1981; rothman and Leonard, 1984). an enzyme complex, called ATP synthetase that makes ATP in matrix; and 3. Enzymes of outer membrane. The other strand of DNA which is not transcribed at the moment, is called antisense strand. X-linked Classification of Mutations According to the Size and Quality 203 I Wild type A T G A C C A G G T C II Base substitution A T G A C T A G G T C II Base substitution A T G A C T A G G T C A C A G G T C A C A G G T C II Base substitution A T G A C A C A G G T C II Base addition A T G A C A G G T C II Base substitution A T G A C T A G G T C II Base substitution A T G A C T A G G T C II Base substitution A T G A C A C A G G T C II Base substitution A T G A C A G G T C II Base substitution A T G A C A G G T C II Base substitution A T G A C A G G T C II Base substitution A T G A C A G G T C II Base substitution A T G A C A G G T C II Base substitution A T G A C A G G T C II Base substitution A T G A C A G G T C identified. The polymerase III C Box A Box B enzyme is big enough to occupy start Fig. In some cells, myelin fibres of undigested fat granules vacuole Fig and the peroxisome largely obsolete because many of the same reactions—which had formerly been carried out in peroxisomes without producing energy—were now coupled to ATP formation by means of oxidative phosphorylation. A cell, born after a division size and replicates to repeat the cycle. The primary transcript is capped before it is released. Certain enzymes of the endoplasmic reticulum such as nucleotide diphosphate are involved in the biosynthesis of phospholipid, ascorbic acid, glucuronide, steroids and hexose metabolism. Monosaccharides (Monomers), B. Some of significant effects of autopolyploidy are as follows : (1) With the increase in cell size, the water content increases which leads to a decrease in osmotic pressure. The allele Y may be associated with the allele r to give rise Yr combination. The genetic code is the same for all living organisms, and eukaryotic ribosomes are able to translate bacterial mRNAs efficiently, provided that a "cap" is added enzymatically (Paterson and Rosenberg, 1979). The antibody may be labelled with 125I and fragments with the signal is detected again with autostaggered radiography. G:C A :C (reversion of tautomerism mutant O H . 5.4. unwinding point RNA-DNA hybird Active centres in the core enzyme of bacterial RNA polymerase enzyme. (ey= eyeless is a recessive fourth chromosome gene). Lipids Per cent dry weight 35-55 20-30 Components (per cent) Insoluble 80% Fats 50% Sterols 20% Wax 16% Phosphatides 2-7% Contents PLASTIDS Chemical constituents 3. Inbreeding allows natural selection to operate on recessive genes, but does not permit the introduction of good mutations from outside. A different approach was taken by H. However, some sugars are added to the proteins in the lumen of RER. 4.5. Structure of some monosaccharides. Various transcription factors are also involved in the formation of a transcription. Contents PLASMA MEMBRANE AND CELL WALL 141 slender projections of plasma membrane which are found in mesothelial cells, hepatic cells, epithelial cells of intestine (striated border), uriniferous tubules (brush border), gall bladder, uterus, growing oocyte and yolk sac. Write short notes on the following: (i) Z-DNA), (ii) B-DNA, (iii) Tetranucleotide hypothesis, (iv) Left- handed DNA versus right-handed DNA versus right-handed DNA. This number would be more in certain other multicellular organisms. Both H3 and H4 can have up to four lysines in the acetyl form, and there is a strong correlation between this type of histone acetylation, especially tetracetylation, especially tetracetylation of all available lysines, and transcriptionally active chromatin. It is postulated that the mRNA for secretory proteins contain a set of special signal codons localized after the initial codon AUG. (ii) Repressible System Metabolites Some enzymes are normally present in the cell but cease to be synthesized when high concentrations of their end product are present. In
the matrix, each fatty acid molecule exists in the form of "active fatty acid" or "fatty acid" or " (i.e., one acetyl group) at a time from its carboxyl end (B-end), generating one molecule of acetyl - CoA in each turn of cycle (Fig. The other important hexose sugars of the matrix are the fructose and galactose. These petites differ from wild type, called grande and are characterized by (i) their insensitivity to inhibitors of aerobic pathways (such as cyanide), (ii) absence of cytochromes a, a3, b and a number of other changes in mitochondrial respiratory enzymes; (iii) incomplete development of mitochondria. Similar signals are also noted in a short sequence (126-132 amino acids) of simian virus 40 T antigen molecule. The metacentric chromosomes are V-shaped and in these chromosomes the centromere occurs in the centro and forming two equal arms. It contains multiple copies of three enCH3-C~S-CoA zymes namely pyruvivc acid dehydrogenase, dihydrolipoyl transacetylase and dihydrolipoyl transacetylase and dihydrolipoyl transacetylase and be a standard to the centre and forming two equal arms. It contains multiple copies of three enCH3-C~S-CoA zymes namely pyruvivc acid dehydrogenase, dihydrolipoyl transacetylase and dihydrolipoyl transacetylase and dihydrolipoyl transacetylase and be a standard to the centre and forming two equal arms. It contains multiple copies of three enCH3-C~S-CoA zymes namely pyruvivc acid dehydrogenase, dihydrolipoyl transacetylase and dihydrolipoyl transacet technique in visualizing viruses, bacteria and protein filaments. They multiply at a rapid rate. 7.2). Environment. Each spermatogonium is diploid and contains at least 8 different polypeptide chains and is thought to function as a dimer of about 500,000 daltons. In a positively regulated system, an effector molecule (which may be protein, a small molecule, or a molecular complex) activates a promoter; no inhibitor must be countermanded. linked and recessive to another X-linked, dominant gene for red-eye colour. The first meiotic anaphase figures appear normal, but the two chromatids of each chromosome normal (bar reverted) B C D E 15 F 16 A B bar C double bar normal Fig. Many ions such as those of calcium, magnesium and manganese directly affect chromatin conformation, which modulates gene activity. The haploid set of the chromosomes is also known as the genome. Thus, Golgi saccules are constantly and rapidly renewed. First division segregation. Development in molecular genetics led to a fine analysis of the structure and function of the gene and has given a new concept (i.e., chemical basis of gene) of the hereditary unit. Anion exchange permease of erythrocyte. The first, which is essentially biochemical, consists of isolating a large enough number of nuclei to permit analysis by biochemical methods. Middle lamella. Contents 4 MOLECULAR BIOLOGY important factor in rapid growth of molecular biology. Sex linkage. Mode of action of steroid hormones on the gene expression (i.e., transcription) (after Gardner, et al., 1991). The protein molecules are embedded within this lipid bilayer, some spanning it, some exist on its inner side and some are located on its external or outer side. The rejoining mechanism is different 5' 3' from DNA ligase enzyme. In a tertiary trisomic a characteristic pentavalent is observed. Describe the transposable elements of E.coli and bacteriophage Mu. Contents MOLECULAR BIOL OGY BIOLOGY Contents CHAPTERS 1. For example, one of two mRNA and DNA code words for the amino acid phenylalanine is UUC and AAG Fig. These linkers hold the cylindrical array of the microtubules and maintain the typical radial tilt of the triplets. It is possible to isolate these plasmids in large quantity. Attached to each A subfibre is a B subfibre with 10 protofilaments. The linked genes do not always remain linked, but, occasionally are departed from other members of their linkage groups by crossing over. Y linkage. Particles (P) are anchored to cytoplasmic ring and are thought to be inactive ribosomes. The coiling of double helix is right handed and a complete turn occurs every 34 A^o. In this case, a segment from one chromosome is exchanged with a segment from another nonhomologous one, so that in reality two translocation chromosomes are simultaneously achieved. Cheilosis (cracking of skin at the corners of mouth and scaling of lips). Some important coenzymes which act as carrier molecules in transfer of a group (Source: Alberts et al., 1989). The monomers usually link with other monomers to form oligomers (Gr., oligo=few or little, meros=part) and polymers (Gr., poly=many, meros=part). To characterize a chromosome in the karyotype, the following parameters are used : 1. Their main funcnucleus of the steroids. He, thus, opened a new field of scientific inquiry, called neuromorphology. 8.6). These results are summarized in Table 17-1. A given enzyme (genetically controlled as to absence or presence is also genetically controlled) to produce the purple or red colour of flowers. Usually objective lenses of various magnifying powers are mounted on a revolving turret at the lower end of the tube. Adjacent doublets are joined or linked by peripheral, interdoublet or nexin links ; the nexin links ; the nexin links have a periodicity of 86 nm. Early marriage of those having desirable traits. to provide a scaffold for the ordered interaction of all the molecules involved in protein synthesis. For example, a single epithelial cell of intestine there may be 200,000,000. Like the proteins, newly synthesized lipids are inserted into SER membranes, then they are passed to Golgi apparatus for the processing and ultimately are dispatched to the plasma membrane via small secretory vesicles. Wind or insect carry pollen from one plant to another in essentially a random manner. The test of DNA fingerprinting can show conclusively whether the genetic material in a drop of blood matches that of the suspect, or it can be used to solve paternity case. Chromatin in these cells is highly condensed but not organized into discrete chromosomes (Chegini et al., 1981). Process of phagocytosis. Generally such symbionts are coined by letters of the Greek alphabets (sigma, kappa, mµ, etc.). club-shaped. RNA It contains pentose sugar known as deoxyribose. STRUCTURE The lysosomes are round vacuolar structures which remain filled with dense material and are bounded by single unit membrane. I A II d III d 22 2 8 b b 10 10 e c c 30 c Then finally we may combine the three segments into one map : The a to d distance = (d to b) - (d to e) = 14-2 = 12 d 2 e 12 a 8 b 10 c Contents 110 GENETICS, HUMAN GENETICS AND EUGENICS Normal allele X chromosome Locus Mutant allele Short wing Wavy wing 41.9 40 30 20 Red eye White eye 10 Yellow body Tan body 1.5 0.0 Map of the Drosophila X Chromosome. Since in most organisms genes are segments of DNA molecules, so a mutation can be regarded as a change in the DNA sequence which is reflected in the change of sequence of corresponding RNA or protein molecules. During second anaphase, sister chromatids move to opposite poles, affecting segregation of c+ and c. There are 36 nm long radial bridges or links between the A subfibre and the sheath containing the central microtubules. Andromonoecious Perfect (O) and male (O) flowers on the same plant. Mycoplasmas range in size (diameter) from 0. Directional gliding of cultured cells is found to depend on the microtubules. Further, recent evidence suggests that the aminoacyl synthetase enzyme checks for correct binding before the release of the charged tRNA (i.e., tRNA-AA). Plant breeding, (1) The viral RNA functions directly as a messenger RNA which, in association with the ribosomal apparatus of the host, directs the synthesis of both the RNA polymerase enzyme (required for RNA replication) and the proteins of the viral coat. C O C H NH2 N1 H2N N H Fig 3.2. C 9 3 N Fig 3.1. N CH 8 CH C H N H 7 C 4 HC OH N 6 4CH H N C O C C N H H Fig. F2 or Second filial generation. abnormal plane of division of the centromere normal X chromosome with two chromatids attached-X (isochromosome) Fig. R.W. Holley (who died in 1993) and his coworkers (1965), first of all gave the detailed structure of yeast alanyl tRNA (containing 77 nucleotides; see Chapter 5). Change in the structure of a gene. The most useful aspect of restriction enzymes is that each enzyme recognizes the same unique base sequence regardless of the source of the DNA. Gupta, an eminent cytogeneticists of Northern India, working in Dept. It is mainly composed of carbohydrates such as cellulose, pectin, hemicellulose and lignin and certain fatty substances like waxes. By mapping experiments the operator element was o-z-y-a. (v) Strobilation. Several investigators, e.g., Spirin, Beltisina and Lerman (1965), Perry and Kelley (1968) and Henshaw (1968) have reported that in certain eukaryotic cells the mRNA does not enter in the cytoplasm as a naked RNA strand but often remains ensheathed by certain proteins. A completely pistillate inflorescence (female flower) is produced in the castor bean by the recessive genotype nn. One of the main proteins in the inner mitochondrial α β β membrane is the multisubunit coupling factor (Fig. Fig.18.7. Comparison of a brachydactyl hand and a normal hand. Several other elements, called trace elements, are also found in minute amounts in animals and plants. Heterogeneity of these proteins is not conserved in evolution as the histones The cell coats of some cells contain some antigens which provide histocompatibility, i.e., they permit the recognition of the cells of one organism and rejection of grafts from another organism). The cell 27 nm inner bears at least one flagellum at (plasma) each pole. In the Drosophila, mutation causes white and pink eyes, black and yellow body colours, and vestigial wings. In Telomeres (shown here in yellow colour). The parthenos=virgin, genesis= birth) is the special type of sexual
reproduction. (c) Define coding strand and antisense strand. Glycine (Gly, G) H—CH—COOH | NH2 2. In the G2 phase of interphase apparcentromere ently there is a decisive Tetrad change that directs the cell toward meiosis, instead of toward mitosis (Stern and Hotta, 1969). The spermatocytes have poorly developed endoplasmic reticulum. The function of microtubules is the transportation of microtubules is the transportation of microtubules of toward meiosis, instead of to fibres or asters of the mitotic or meitotic spindle during cell division. (e) What parts of an mRNA molecule are not translated? A basal foot is composed of microfilaments that terminate in a dense bar. Genetic redundancy, of which duplication is one type, may protect the organism from the effects of a deleterious recessive gene or from an otherwise lethal deletion. The basement membrane provides structural support for epithelia and may constitute an important barrier to the passage of materials between the epithelial and connective tissue compartments. Moreover, the production of each of the five enzyme responsible for deamination of theronine to α-ketobutyrate is inhibited by the end product, isoleucine. Due to this fact, viruses have been variously described such as "naked genes that have not a cellular forms that have degenerated through parasitism", or as "primitive organisms that have not reached a cellular state." Tobacco mosaic virus A Paramyxovirus (Mumps virus) T-even phage Rhizopus Paramecium Fig. Now, let us discuss, in brief, the polypeptide synthesis in eukaryotes : 1. Controlled human breeding based on notions of desirable and undesirable and undesirable genotypes. All these steps often are time-consuming and cause artifacts in the cells. The heterogametic females may be of following two types : (i) ZO-ZZ system. Eugenics; eug amoeboid movement. For example, mRNA with life time of six hours has been detected in the bacterium Bacillus cerus at a time when the cells are induced to become long lived spores. The Golgi appaplasma ratus is concentrated near acrosomal nucleus to form the acrosome. cells are the most primitive cells from the morphological point of view. Ultiing heating of the rotor and allowmately one is left with a supernatant solution having ing the refrigeration system to only soluble, molecular-sized components. Such proteins are called homopolymers. These RNA HO 5' primers are later excised and filled with DNA with the help 5' 3' of DNA repair system in eukayrotes (or DNA polymerase I in E.coli). BIOGENESIS OF MITOCHONDRIA invagination tubule cytoplasm vesicle vesicle tubule mitochondrion mitochondrion tubule cytoplasm vesicle vesicle tubule mitochondrion tubule cytoplasm vesicle vesicle tubule mitochondrion and be determined by microspectrophotometry, a technique that measures with precision the amount of Feulgen staining material each nucleus contains. Robertsonian translocation. The remaining four mRNAs are translated at all times. Edward's syndrome or Trisomy-18. C.B. Anfinsen; S. (c) The nucleus of mature nucleated erythrocytes of amphibians is transcriptionally inactive. is to be expected with unlinked genes. Classification of Mutation According to the Direction According to their mode of direction following types of mutations. Generally post-embryonic growth of animals and plants occurs due to mitotic multiplication of some special types of cells occurring in specific

locations of the body. Temperature sensitive mutations or Ts mutations. In fact, from a genetic perspective, a significant feature of packing mechanism through the nucleosomes lies in its topology : at no point is the DNA buried ; instead, it is freely exposed along the entire surface of the "spool", available for genetic expression. Histories are very basic proteins, basic because they are enriched in the amino acids arginine and lysine to a level of about 24 mole present. Cytokinesis usually begins in anaphase and continues through telophase and into interphase. All such ribosomal proteins which are involved in autogenous regulation of translation have one common property—they are primary or initial binding proteins, i.e., they can bind directly to rRNA. As we have already described, the nuclear envelope of a typical mammalian cell contains 3000 to 4000 pores (about 11 pores/ µm2 of membrane area). 10.15. What do you understand by 'genetic code'? Recessive allele. Their importance for the animals has been reported by Hopkins, Osborne, Mendal, and McCollum (1912-1913). Stein, G. A—Unfertilized tion to the plasma membrane, the eggs of egg as taken from oviduct; B—Fertilized egg with swolmost animals except the sponges and certain len jelly membrane (after Balinsky, 1981). dGMP dCMP TM The four deoxyribonucleotides besides occurring in DNA molecule occur also in nucleoplasm and cytoplasm, but in their triphosphate forms such as deoxyadenosine triphosphate (dATP), deoxyguanosine triphosphate (dATP), deoxyguanosine triphosphate (dCTP) and thymidine triphosphate (dATP), deoxyguanosine triphosphate (dCTP) and thymidine triphosphate (dATP), deoxyguanosine triphosphate (dATP), deoxyguanosine triphosphate (dCTP) and thymidine triphosphate (dCTP) and thymidine triphosphate (dATP), deoxyguanosine triphosphate (dCTP) and thymidine The 70S ribosome consists of two subunits, viz., 50S and 30S. vibrio (3) Spirilla (sinlophotrichous gular, spirillum). The incomplete linkage takes place due to the occurrence of new combinations or recombinations of linked genes. All dictyosomes of a cell have a comcis face mon function (see Berns, 1983). These organelles develop in a germinating plant seed (e.g., castor bean or Ricinus) to utilize stored fat of the sperms with the egg occurs regularly in the nature and remains fruitful only due to the large number of the sperms and enoromously large size of the ovum. Incomplete Penetrance Some genes in homozygous as well as in heterozygous conditions fail to provide complete (cent per cent) phenotypic expression of them. Such a lampbrush stage may persist for months or years as the primary oocyte builds up a supply of mRNA molecules and other materials required for its ultimate development into a new individual. They are half desmosomes which resemble spot desmosomes but join the basal surface of an epithelial cell to a basal lamina. It becomes large and metabolically active in most growing and proliferating cells, such as tumor, and disappears in cells not active in most growing and proliferating cells. firm, but a different gene, strand B might be copied; in that case resultant core enzyme (α ββ) does 2 strand A would not be copied in that region of the DNA. Chemical formula of nicotinamide adenine dinucleotide (NAD+). Within the cells of a multitude of non-living constituents o : proteins, nucleic acids, fats (lipids), carbohydrates, vitamins, minerals, waste metabolites, crystalline aggregates, pigments, and many others, all of which are composed of molecules and their constituent atoms. Contents 122 CELL BIOLOGY hydroxyl groups remain close to polar head groups of the phospholipids, their rigid plate-like steroid rings interact with and partly immobilise those regions of hydrocarbon chains that are closest to the polar head groups, leaving the rest of the chain flexible (Fig. In an automatic thermal cycler, this process is automatically repeated 20 - 30 times (as predetermined by a computer device), so that in a single afternoon a billion copies of the sequence flanked by the left and right primers, can be produced (Fig. In the spring of 1856, he began experimental crossing of pea varieties. Lysosomal fractions have been isolated by sucrose-density centrifugation) after mild methods of homogenization. The primary cell wall is followed by secondary cell wall. The broken piece gets attached to one end of a nonhomologous chromosome. A type of chromatin that is non-condensed during interphase and condensed during nuclear division, reaching a maximum in metaphase. Inhibit catabolism (i.e., oxidation) of certain fatty acids of cellular membranes. Primary cell wall is composed of pectin, Contents CELL 57 hemicellulose and loose network of cellulose microfibrils. sites of rupture of membrane matrix outer membrane inner membrane inner membrane treatment with trypsin reconstitution sonication or urea cristae mitochondrial vesicles (respiratory chain phosphorylation) soluble F1 ATPase molecules the reconstituted vesicles with inner-membrane spheres (restoration of oxidative phosphorylation) Fig. PTC tasters. In cells that have not previously been exposed to lactose, how can lactose enter an uninduced i+ z+ y+ cell to affect induction of synthesis of β- galactosidase enzyme ? Parat and Painleve (1924) suggested vacuome theory : they believed that all plant and animal cells have only two fundamental but morphologically independent cytoplasmic components, i.e., vacuome (watery vacuoles) or canals stainable with neutral red, and the chodriome, consisting of lipoidal mitochondria. Bridges (1936) that each band might correspond to a single gene. The substitute groups are either above or below the plane of the ring (see Ambrose and Easty, 1977). There is some evidence that connectives exist between them. The mitochondrial matrix contains lipids, proteins, circular DNA molecules, 55S ribosomes and certain granules which are related to the ability of mitochondria to accumulate ions. Nullisomy An organism which has lost a chromosome pair is a nullosomic. 19.4. Regeneration in Planaria. Chlorides of K+, Ca++, ++ Na, Mg++, etc. less than 1 per cent in some insects to over 50 per cent in some insects to over 50 per cent in some higher plants and vertebrates. In bacteria the nuclear material includes a single, circular and double stranded DNA molecule which is often called bacterial chromosome. The results obtained from such a cross are shown in Fig. The pure and isolated membranes are then studied by biochemical and biophysical methods. Prions are described as 'rodviral and endosomal membranes (Alberts et shaped' proteinaceous particles though to al., 1989). The chosen organisms should be able to mate in controlled or well-planned conditions. A number of triskelions assemble into a basket-like network of hexagons and pentagons on the cytoplasmic surface of the membranes (Pearse and coworkers, 1981, 1987). Further, earlier maturity of F1 hybrids than in either parent is another manifestation of heterosis and is sometimes accompanied with actual decrease in total plant weight. UGA AUA CUA AGA AGG } Mammalian mitochondrial code Trp * Met Leu Stop Trp Met Thr Arg "Universal code" Stop Ile Leu Arg * Italic type indicates that the code differs from the 'universal' code. The 'rotor' is a protein disc integrated into the plasma membrane. Such chromatin material is called facultative heterochromatin, since it becomes inactive proximal for entering the germ line. In the production of female individual the particles of female might dominate on particles of male. Montrose J. Growth Phase proximal The growth phase of the oogenesis is comcentriole paratively longer than the growth phase of the neck distal spermatogenesis. The pea comb is supposed to be produced by combination of a homozygous or heterozygous dominant condition (PP or Pp). Heterophagosomes They are also called heterophagic vacuoles, heterolysosomes or phagolysosomes. 5.2. Here five phenotypic classes are obtained in F2; each 'dose' of a contributing allele for pigment production increases depth of colour. 67 Eukaryotic cell Absent Great variations Bound to plasma membrane as composite chromatophores Rare : if present one way (and usually partial); transfer of DNA from donor to recipient cell occurs. CH3 CH3 – CH – (CH2)3 – CH three steps, the equation can be written as follows: NADH + H+ + 3ADP + 3 Pi + 1/2 O2 \rightarrow NAD+ + 4H2O + 3ATP One way of indicating the ATP yield from oxidative phosphorylation is the P/O ratio, which is expressed as the moles of inorganic phosphate (Pi) used per oxygen atom consumed. 3 4 Contents PLASTIDS 235 expenditure of an ATP molecule. The chloroplast signal peptide initiates translocation into the stroma through a membrane contact site by a mechanism similar to that used for translocation into mitochondrial matrix. The molecules in the interior of a homogeneous liquid are free to move and are attracted by surrounding molecules in the interior. However, the most significant difference being the need for ultra-thin sections. This region is generally referred to as the TATA box and is believed to orient the RNA polymerase enzyme, so that synthesis proceeds from left to right. Initiating amino acid, the methionine is not formylated (There occurs only one tRNA for methionine, i.e., tRNAMet). Adenosyl methionine, 11. Moreover, because during the chiasma formation out of two chromatids of a chromosome, one has changed its counterpart, therefore, the two chromatids of a chromosome do not resemble with each other in the general, is similar to that of Drosophila, i.e., it is dependent upon the ratio between the Z chromosomes and the number of autosomal sets of chromosome cycle are linked together as dependent sequence). The active sites of core (after Freifelder, 1985). The nucleolus detaches from the nucleolar organizer and ultimately disappers. The chromatin binds strongly to the inner part of nuclear lamina, a 50 to 80 nm
thick fibrous lamina lining the inner side of the nuclear envelope. hetXWX+ XWY erogametic produces two types of sperms, 50 per cent sperms carry the gene '+' and remaining 50 per cent sperms carry no F2 such genes on the Y chromosome Number) Euploidy; monoploidy, polyploids, p allopolyploids, synthesized allopolyploids; aneuploidy : monosomy, nullisomy, trisomy, tetrasomy; revision questions and problems. Kendrew, for their studies of haemoglobin. Such differential labelling would enable one to distinguish between DNA and proteins of the phage without performing any chemical tests. According to Stoneburg (1937) and Dounce (1955), the nucleoplasm contains small lipid content. According to their hypothesis, the mitochondria and chloroplasts may be considered as intra-cellular parasites of the cells which have maintained the symbiotic relations with the eukaryotic cells. The polynuclethe performance of anticotide chain is represented as a continuous coiled tube; B—The way that the clover leaf representation must be transformed in order to odon, when isolated from show the physical connections between various parts of the moltRNA, is weak and inacecule. The chemica reactions which synthesize the energy rich bond or~P bond require great amount of energy which is supplied by the oxidation of the foodstuffs in the mitochondria. 6.1). A study has shown that some forms of heart diseases may be inherited as an autosomal dominant trait (L.K. Altman, 1972). A multiple allelic series is known in the Chinese primrose where A (Alexandria type = white eye)> an (normal type = yellow eye)> a (primrose queen type = large yellow eye). Identical or Monozygotic Twins having no variability in their traits are called identical twins. A—Typical wave-form action of an oar in a rowboat ; Fig. F2 2. (b) SEM of human epidermis. turns around the histone octamers and these two Contents 270 CELL BIOLOGY turns (200 bp long) are sealed off by H1 molecules. + (xv) EVOLUTION 1. By this mechanism acquired characters would also be inherited because as the parts of the body changed so did the pangenes or gemmules they produced. Contents C H A P T E R Release factor 7 Subunits released Stop codon Chain released Protein Synthesis Amino acid D Polypeptide chain formation mRNA transcript Small ribosome subunit tRNA initiator Start codon The process of protein synthesis. In such cells nuclei are present during the early stages of development. It produces sterile males with some mental retardation. Moreover, once established, it becomes independent of the ij gene, as can be demonstrated by crossing F1 Ij/ij variegated females to Ij/Ij normal males. In the former it leads to the production of XX and O eggs. They are the actual respiratory organs of the cells where the foodstuffs, i.e., carbohydrates and fats are completely oxidised into CO2 and H2O. recessive allele b. As a result each species of animals and plants would have a specific number of groups of linked genes which would correspond with the number of chromosomes found in that species. Apricot eye colour in Drosophila. Lamin proteins are homologous in structure to IF proteins are homologous in structure to IF proteins and serve the following functions : 1. This technique has resulted in the rapid production of new varieties of barley and applied to other plant species also. Roux (1883) suspected the involvement of the chromosomes in the mechanism of inheritance. migrate at the solvent front; other substances move more slowly according to their solubility. He had six Fig. 20.4). A test has now been developed that provides hundred per cent positive identification. A typical bacterial cell has the following components: A. The pedigree analysis has shown that alleles IA and IB have dominance over i allele. Chemical Composition Biochemically, a protofilament of microtubule is made of a protein called tubulin. 11.13). When purified by centrifugation and electrophoresis, they were found to contain half RNA and half protein. FUNCTIONS Ribosomes play a very significant role during biosynthesis of proteins and that will be discussed in a separate chapter. The messenger RNA formed at the chromosome is directly available for translation without processing, and so ribosomes may attach to the beginning of the mRNA strand and commence translation, while the other end of the mRNA is still being formed by transcription from DNA. Multicoloured figures and photographs of this edition would help our target readers to understand and fully appreciate the very gist of the subject matter. Colchicine is a drug (i.e., an alkaloid obtained from the corms of plants-Colchicum autmunale and C. Almost half of alcohol one drinks is oxidized to acetaldehyde in this way. These kinds of genetic interactions give the classical ratios of 3: 1 and 9: 3: 3: 1. For example, the mobility of lipid molecules surrounding cytochrome oxidase (an enzyme involved in the synthesis of ATP) are immobilized by the enzyme and makes boundary lipid layer. R.D. Palmiter and R.L. Brinter produced transgenic mice by genetic engineering. Write short notes on the following : (i) ATP ; (iii) Vitamins ; (iv) Hormonemata which are embedded in the achromatic and amorphous substance, called matrix. Thus, in F2 75% individuals have coloured flowers. Thus, in plant cell walls 2000 cellulose molecules are organized into cross-linked, parallel microfibrils (having 25 nm diameter), whose long axis is that of the individual glucose chain. The smallest heritable extra chromosomal unit is called a plasmagene. The delivery of more than one baby by a mother is called multiple births. Each disaccharide consists of Dgalactose and sulphated N-acetylglucosamine. tiation, for example, constitutively expressed "housekeeping" genes could be confined to the bands. Nucleolus Most cells contain in their nuclei one or more prominent spherical colloidal acidophilic bodies, called nucleoli. In unicellular organisms the cell shape is maintained by tough plasma membrane and exoskeleton. This is called nucleoli. In unicellular organisms the cell shape is maintained by tough plasma membrane and exoskeleton. already noticed that when Mendel made a monohybrid cross (Fig. Galactosyl transfer galactose to lipids or proteins B. Differentiate between the following : (ii) Passive transport from active transport from active transport ; (iii) Macula adherens from macula occludens ; (iv) Primary cell wall. Because the number of genes usually exceeds the number of chromosomes in different species, therefore, many genes have to be located on same chromosomes. More detailed picture of flagellum in the cross section (after Berns, 1983; Alberts et al., 1989). The dominant allele or alleles (CC or Cc) of gene C are responsible for the presence of chromogen, while the homozygous recessive alleles (cc) of this gene are responsible for the absence of chromogen. For example it contains the enzyme alkaline phosphatase. Oligosaccharides (Oligomers), and C. The unit membrane of Golgi vesicles fuses during cell plate formation and becomes part of plasma membrane of daughter cells (For details see Chapter 5). According to this model, 5' - P 5' - P by some initiation event, a nick is made in the duplex circle and this nick has 3'- Fig. Most accepted one is that of Mitchell's chemiosmotic coupling theory, proposed in 1967. This phenomenon is known as independent segregation. The conclusion is that genes play a major role in shaping almost any type of behaviour including alcoholism, criminality, intelligence (I.Q.), political attitudes, scizophrenia and sociability. Addition of tail of poly-A. The secondary cell wall, if the latter occurs. The corresponding DNA code word for phenylalanine can be deduced to be AAA. A recessive allele in homozygous condition causes a fatal disease called infantile Small pale abnormally - shaped RBC are amaurotic idiocy in juvenile stage. The isolated outer memmitoplast brane is revealed by negative staining and shows a "folded- Fig. vesicular form or vesicle and 3. Barr and Bertram (1949) reported a deeply stained chromatin body (i.e., a chromocentre) in the nerve cells of female cat which was absent in the male. SIGNIFICANCE OF PARTHENOGENESIS 1. the nucleosome beads is degraded (Fig. Organic compounds form 30 per cent of a typical cell, rest are the inorganic substances. Contents 332 CELL BIOLOGY 2. The distal centriole changes into the basal bodies and gives rise to the axial filament of the sperm. The code is non-ambiguous. (c) Movement of the mRNA is such that the effect is the apparent movement of the ribosome in AUG UUU GCA 5' P site A site AUG UUU GCA 3' delivery of charged tRNA fMet fMet Phe peptide bond formation by peptidyl transferase AUG UUU GCA empty A site translocation driven by EF-G AUG UUU GCA Phe Phe fMet fMet Fig. The endoplas- Contents CELL GROWTH AND CELL DIVISION diploid nucleus homologus chromatids 339 chiasma nuclear membrane A B Prophase - I (leptotene) C Prophase - I (zygotene) Prophase - I (pachytene) chromatids chiasma spindle fibre D G Prophase - I E Metaphase - II F Metaphase - II F Metaphase - I E Metaphase - I S Met in various invertebrates and chordates, while the internal fertilization occurs only in those animals which possess specialized sex organs for receiving and transmitting the sperms, e.g., reptiles, birds, mammals and an External fertilization is seen in fish. (c) How many bivalents will be seen during the process of gametogenesis in the female? (c) Females usually pass the condition (defective phenotype) on to one-half of their sons and daughters (Fig. 12.4). Tsarina Alexandra (granddaughter of Queen Victoria of England) was a carrier of haemophilia. The anion Fig. Would you expect a non-sense mutation in one of the structural genes of the his operon to affect transcription or translation? If a F1 hybrid having the genotype Ab/aB produces 8% of cross over gametes AB and ab, then the distance between A and B is estimated to be 16 map
units or centimorgan. 3.19 and Fig. The expressivity of a given gene is often influenced by environmenta conditions. duced. Sexduction. 11.2. B fu+ f B+ fu (4) f Bu fu+ (2) Genotypes of the females flies (A) and of the seven and two abnormal progeny (B) produced by them as a result of crossing between marker genes f and fu. Bone 11. Certain other base analogues such as urethane triazine, caffiene (in coffee, tea and soft drinks), phenol and Contents GENE MUTATION 211 carcinogens, acridines (proflavin, etc.), have mutagenic effects. These linkage or they may be segregated or separated during gametogenesis and, thus, displaying the incomplete linkage. 1986). Four major kinds of molecule. With genetic engineering (also called gene cloning, recombinant DNA technology or gene manipulation), thus, genes can be isolated, cloned and characterized. One sex has two of the same kind of sex chromosome and the other has one of each kind. In 80 s cou rst i other words, one of the consequence f e ubl o of inbreeding is a loss in vigour (i.e., D 70 s in s less productively) which commonly ac60 companies an increase in homozySecond cousins gosity. This permits the primers to bind to their complementary strands through renaturation. led to Contents CELL BIOLOGY 308 the earlier suggestion that centrioles might be fully autonomous, self-replicating organelles. The alteration in the morphology or physiology of an organism in response to its ecological factors (environment) is known as acquired character. The heavy black line in each molecule goes from phosphate group to phosphate group, indicating a smooth right-handed helix in B-DNA and irregular or zigzag left-handed helix in Z-DNA (after De Robertis and De Robertis Jr., 1987). (B) By discouraging the marriages between the molecules of rRNA and proteins, following classical experiment of dissociation and reconstitution of Nomura and Traub (1968) can be considered. Cilia move by a whiplike power stroke. In monoploids each chromosome is represented only once due to which there is no zygotene pairing and all the chromosomes appear as univalents on the metaphase plate at the time of meiosis. Mitoplast includes inner membrane with unfolded cristae and matrix. Due to their presumed high lipid contents, Golgi apparatuses were called lipochondria (Baker, 1951, 1953). The flagella usually beat independently, while the cilia tend to beat in a coordinated rhythm. Trisomy Trisomics are those diploid organisms which 1 1 1 3 3 have an extra chromosome (2n + 1). The gene regulatory systems of prokaryotes and eukaryotes are slightly different from each other. CELL GROWTH The cell is a dynamic system that exhibits a unique phenomenon of growth. Muller (1932) have compared the mutant genes with wild type genes (or standard genes) and classified them into the following types : (1) Hypomorphs. Frye and M. Thylakoids, forming a system of anastomosing tubules that are joined to the grana thylakoids. Inbreeding. By studying the surture. (iv) Immunological properties of the extraneous coats. ANTIBIOTICS AND PROTEIN SYNTHESIS Many antibacterial agents (called antibiotics) have been isolated from fungi. Later on, the trait of short legs was found to be resulted from fungi. Constructed like woven ropes, they are typically between 8 nm to 10 nm in diameter, which is "intermediate" between the thin and thick filaments) and microtubules. RNA synthesis starts at the thinner end and progresses toward the thicker end. Even the process of cytokinesis is prevented by colchicine and with duplications of chromosomes the number goes on increasing. A—Plasmodesmata pierce the cell wall and connect all cells in and protein phosphorylation. Two mutations within the same functional gene (B) (A) can produce different effects depending on gene whether they occur in the Heterozygous inversion and translocation in Drosophila. Like the mitochondria, chloroplasts have a highly permeable outer membrane ; a much less permeable outer membrane ; a much less permeable only when they infect a living host cell and in the process only the nucleic acid core enter the host's cell. A daughter cell, thus, receives only a maternal cells. 18.7) : (1) polar fibres, which extend from the two poles of the spindle toward the equator ; (2) kinetochore fibres, which attach to the (a) Interphase in a cell of the en- (b) Late prophase: The spindle equator of the cell. The sterilization method is based on surgical operation of sperm duct or vas deferents in males and oviducts or fallopian tubes in females. Phage DNA contains more than 200 different proteins (i.e., proteins involved in DNA replication and in the assembly of head and tail). Desmosome ; 3. Two or more tertiary becomes the continuous phase and the water is in the discontinuous phase. Schneider (1873) published a most significant paper dealing with the relation between chromosomes and stages of cell division. The appearance or discernible character of an individual, which is dependent on its genetic makeup usually expressed in words, e.g., "tall", "dwarf", "wild type", "albino", "prolineless". The eggs with '+' gene if fertilized by the sperms with X+X+ X+XW X+Y XWY 'Y' chromosomes produce the red-eyed males. Fimbriae or pili. male fertile (c) Cytoplasmic genetic male sterility. The most important effect of polyploid plants in variable degrees. The long terminal repeat (LTR) sequences are denoted by the Greek letter delta (δ). Such cells are the erythroblasts, developing muscle cells, skin and hair. Waste CO2 that is released from cell into the capillary blood, diffuses across the membrane of erythrocyte. Monosaccharides. The flagella occur at one end of the cell, while the cilia may occur throughout the surface of the cell. In October 1843, Mendel was admitted to the Augustinian monastery at Brunn in Moravia (a Czechoslovakian town) where he took keen interest in natural sciences. These classes are controlled by two competing alleles in the same locus. Most probably this is due to the fact that most lysosomal hydrolases are membrane-bound, which may prevent the active centres of enzymes to gain access to susceptible groups in the membrane (see Reid and Leech, 1980). When the histories are removed, the DNA which has packed about 40-fold in the 30-nm chromatin fibre, becomes extended and proH1 duces loops with an average length of 25µm (75,000 base pairs). These organisms are known as the following methods : (1) X-ray treatments, (2) delayed monoploids and are quite rare. Following crosses between white eyed colour in it : (a) Red eyed female × White eyed male. Early molecular geneticists have assigned the informational roles of genes to the chromosomal proteins because, they found nucleic acids too simple to carry genetic informations. Even Na+ ions are stored in these organelles, where their osmotic activity contributes to turgor pressure. Both types of changes (structural and numerical) in chromosomes can be detected not only with a microscope (i.e., cytologically) but also by standard genetic analysis. Among plants, it is applied to crop plants, ornamentals and fruit crops. The gene pair conSplashed white, bb cerned HbA (for haemoglobin A) and Black, BB S Hb (for haemoglobin S) affects the oxygenetic analysis. transport molecule haemoglobin—the major constituent of red blood F 1 cells (erythrocytes). mal hand with three phalanges in each finger. The algae usually have a single huge chloroplast. In order to do that however, special lenses (e.g., of quartz) must be used since ordinary glass blocks much ultraviolet light. The term molecular biology was first used in 1945 by Oswald Avery 1877-1955. The 28S, 5S and 5.8S rRNAs occur in the larger 60S ribosomal subnit, while the 18S rRNA occurs in the smaller 40S ribosomal subnit, while the 18S rRNA occurs in the smaller 40S ribosomal subnit. compound. It affects about 8 per cent of human males but only about 0.7 per cent of females. Lysosomal Enzymes According to a recent estimate, a lysosome may contain up to 40 types of hydrolytic enzymes (see Alberts et al., 1989). Schematic representation of homozygotic reciprocal translocations compared with the normal arrangement. Thus, chloroplast proteins may be synthesized by three avenues : (1) by an exclusive chloroplastic mechanism, (2) by a mechanism involving nuclear genes and cytoplasmic ribosomes. Molecular structure of an immunoglobulin molecule (after Stansfield, 1986). 41 parental DNA helix replication origin initiatior protein binding of initiator protein to replication origin binding of DNA helicase to initiator protein Synthesis (= elongation) of lagging strand than for the leading strands takes place by somewhat different methods; it is far more complex for lagging strand than for the leading strand. An understanding of the genetic basis of such heart diseases would alert persons from families with an incidence of the disease to the possibility of incurring heart conditions and perhaps cause them to alter their diets and life habits accordingly. Here the Y chromosome determines a tendency to maleness just as it does in humans. Chromoplast structure is quite diverse ; they may be round, ellipsoidal or even needle-shaped, and the carotenoids that they contain may be localized in droplets or in crystalline structures. In the diakinesis stage the bivalent chromosomes become more condensed and evenly distributed in the nucleus. Let us narrate in brief the saga of evolution of presently well accepted fluid-mosaic model of structure of the plasma membrane : 1. Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 4. (a) All progeny resistant. four-o'clock plant. In heterozygous condition it expresses itself only in the presence of male hormones (in male sex): Genotype Phenotypes Men Women BB Bald Bald Bb Bald Non-bald bb Non-bald No 2. Same genetic code is found valid for all organisms ranging from bacteria to man. Synapsis often starts when the homologous ends of the two
chromosomes are brought together on the nuclear envelope and it continues inward in a zipper-like manner from both ends, aligning the two homologous chromosomes side by side (e.g., mammals). The possible genotypes and phenotypes of this trihybrid cross have been summarized in Table 3-7. This type of parthenogenesis or obligatory parthenogenesis is known as the complete parthenogenesis is known as the complete parthenogenesis or obligatory parthenogenesis. seen in light microscope as collagen fibres, thus, a DNA topoisomerase can be viewed as a 'reversible nuclease' that adds itself covalently to a DNA strand. They also were mystified about the inheritance of desirable and undesirable traits in the human population. The pollen, then at the dehiscence stage is brought from the plant to be used as a male parent and by the help of a brush is dusted on the feathery stigma of the emasculated flower. Lethal alleles in animals. Mitochondria are oxygen-consuming ribbon-shaped cellular organelles of immense importance. In dioecious organisms, thus, two types of chromosomes were recognised which are as follows : (i) Autosomes. How will you distinguish cytologically between the following ? The cytological investigations have now established that the genes are the units of deoxyribonucleic acid (DNA) which along with ribonucleic acid (RNA) and nucleoproteins constitute the thread-like stainable structures the chromosomes. In electron-micrographs the synaptonemal complex appears as three parallel dense lines that lie equally spaced in a plane and are flanked by chromatin. Both may occur in the macromolecular state or in the form of their monomer nucleotides. Apart from peroxisomes and glyoxysomes, a number of other terms have been used to describe microbodies. including cytosomes, phragmosomes and crystal-containing bodies. This amplified DNA is ultimately lost during development. They, often, occur between the maturing face of Golgi and the plasma membrane. Irritability. that the ring formed is either five- or six- membered; a seven-membered ring would involve too much strain. Contents PLASTIDS 223 (ii) Rhodoplast. Upon self-fertilization, it produces progeny all of which showed sinistral coiling. Granules are prominent in the mitochondria of cells, Contents MITOCHONDRIA 195 epithelial cells, and the ribosome osteoblasts of bone-forming cells, and the ribosome osteoblasts of bone-forming cells are prominent in the mitochondria of cells concerned with the transport of ions and water, including kidney tubule cells, Contents MITOCHONDRIA 195 epithelial cells of the small intestine, and the ribosome osteoblasts of bone-forming cells concerned with the transport of ions and water, including kidney tubule cells, Contents MITOCHONDRIA 195 epithelial cells of the small intestine, and the ribosome osteoblasts of bone-forming cells concerned with the transport of ions and water, including kidney tubule cells, Contents MITOCHONDRIA 195 epithelial cells of the small intestine, and the ribosome osteoblasts of bone-forming cells concerned with the transport of ions and water, including kidney tubule cells, Contents MITOCHONDRIA 195 epithelial cells of the small intestine, and the ribosome osteoblasts of bone-forming cells concerned with the transport of ions and water, including kidney tubule cells, Contents MITOCHONDRIA 195 epithelial cells of the small intestine, and the ribosome osteoblasts of bone-forming cells concerned with the transport of ions and water, including kidney tubule cells, Contents MITOCHONDRIA 195 epithelial cells of the small intestine, and the ribosome osteoblasts of bone-forming cells concerned with the transport of ions and water, including kidney tubule cells, concerned with the transport of ions and water, including kidney tubule cells concerned with the transport of ions and water, including kidney tubule cells concerned with the transport of ions and water including kidney tubule cells concerned with the transport of ions and water including kidney tubule cells concerned with the transport of ions and water including kidney tubule cells concerned with the transport of ions and water inc The molecules of such orpeptide bond ganic compounds which H O contain both acidic and O H H O H O basic properties are NH2-C-C-OH + H - N - C - C - OH known as amphoteric molecules. It lines the inside surface of the inner nuclear membrane, except the areas of nucleopores, and consists of a square lattice of intermediate filaments. Contents CYTOPLASMIC MATRIX 97 received a Nobel Prize), several hundred proteins have been fully sequenced. Hermaphrodites All perfect (O) flowers. The germ cells could be collected during early adulthood and stored in lead lined containers in the deep freeze. Britten-Davidson model or gene-battery model of transcription regulation. PROCESS OF FERTILIZATION The process of fertilization includes two successive steps which are as follows : 1. Gamow suggested the following properties of the genetic code : (i) A triplet codon corresponding to one amino acid of the polypeptide chain. This amino acid is then partly converted into phenylpyruvate, phenylacetate, phenyllThe women in this photograph are sisters. (e) Sperm cells clearly contain a complete genetic endowment but no transcription occurs until the sperm nucleus is activated within the egg cytoplasm. They may also be vegetative, i.e., non-segregational or extra-chromosomal. Immotile Cilia Syndrome (Kartagenre's Syndrome) Ciliary motion can be affected by many deficiencies in the protein composition of the organelle. AA XvXvY 6. How do the polysaccharides differ from the protein synthesis, and their DNA-dependent RNA polymerase is sensitive to the kind of repression is called coordinate represFig. H-Y antigen. However, in prokaryotes and yeast, 5S RNA genes are present in close vicinity of rDNA. Contents PLASTIDS 221 from pre-existing chloroplasts. Property Microtubules Intermediate filaments 1. Evolution of Fluid Mosaic Model of Membrane The existence of the plasma membrane of the cell was difficult to prove by direct examination before 1930's (when electron microscopy was invented) because of technological limitations. (iii) Immunoglobulins. Once inside the appropriate target cells, the steroid hormones become tightly bound to specific receptor proteins which are present only in the cytoplasm of target cells. The radiations which are important in mutagenesis are of two categories : one type is ionizing radiations such as X-rays and gamma rays; electrons, neutrons, protons Contents GENE MUTATION 209 and other fast moving particles. 8.1. Somatic or mitotic crossing over in Drosophila. In one extreme case, that of the creeping vole, Microtus oregoni, the X chromosome is eliminated from the germ cells of males by a special process of nondisjunction (see Farnsworth, 1988). continuous membrane retrieval, and 3. Mutations occur much more frequently in certain regions of the gene than in others. can be analyzed to determine whether the foetus has a genetic abnormality. These changes frequently include altered patterns of gene expression. The DNA becomes and tubulin of the flagellum is more concentrated and the stained red. 3' strand The complete RNA polymerase enzyme is termed holoenzyme and Fig. In cattle, a recessive lethal gene in homozygous condition (aa) causes calves to born "amputated" which die soon after birth. 18.4. Developing foetuses of Fig. They then developed techniques for forming "reconstituted" viruses containing the protein from one mutant strain of TMV and RNA from another, or vice-versa. Sequential gene expression model. Proteins occur in a wide spectrum of molecular sizes from small mole 8200 amino acids and has a molecular weight Keratin: major protein component of hair. In addition transport H+ ions are driven to the C side of 10NADH in glycolysis, 2NADH in gl membrane; C—this gracycle) and 2FADH2 are produced which are equivadient drives the proton pump of the ATPase lent to 34 ATP molecules. In the life cycle, diploid and haploid adult alternates, the former reproducing by asexual meiospores called ascospores, the latter by isogametes. traces the fying persons in a pedigree; here the history of the character monozygotic twins 2 propositus is child 1 shown to be interesting in 2 in generation II the propositus back through sex unspecfied the history of family, and a II family tree or pedigree or 3 1 2 pedigree chart is drawn up number of using certain standard sym2 3 children of consanguineous sex indicated bols (see Fig. Thus, in case of lambda phage the DNA first becomes circular due to joining of its both cohesive ends and then is integrated into the circular DNA molecule of the bacterium. The dark reaction may be summed up as follows : 6 RuBP + 6CO2 + 18 ATP + 12 NADPH ---- 6 RuBP + C6H12O6 + 18 ADP + 18 P + 12 NADP Hatch and Slack Pathway of CO2 - fixation in Angiosperms In many angiosperms (e.g., maize, sugarcane, sorghum) having Krantz anatomy (i.e., bundle sheath with chloroplasts), an alternative pathway of CO2 fixation occurs called C4 pathway of CO2 - fixation. Paraffin. to be added to the kinetochore end of kinetochore microtubules and then lost as anaphase A proceeds, indicating that kinetochore "eats" its way poleward along its microtubules at anaphase (Fig. Sometimes small amounts of phosphorus, nitrogen and sulphur are also present. Peptidases Nucleases 4. In mammals, administration of testosterone hormone to the mother produces in the foetus a shift in the differentiation of XX genitalia to a male type, producing masculine pseudohermaphroditism. The ribulose is a pentose sugar which is necessary for photosynthetic mechanism. All of them are amphipathic molecules, possessing both hydropholic and hydropholic domains. 8 9. The photograph shows a tobacco plant. The long chain fatty acids which are released by the hydrolysis are then broken down by the successive removal of two carbon or C2 fragments in the process
of β-oxidation. Their deficiency in the cell causes metabolic disorder and leads to various diseases. differ widely in DNA content, such differences may be attributed to one of two causes : (1) lateral multiplication of chromonemata where length wise duplication of chromonemata where length wise duplication of chromonemata where length wise duplication of DNA or chromonemata where length wise duplication of chromonemata where length wise duplication where length wise duplication of chromonemata where length wise duplication of chrom mitochondria, endoplasmic reticulum and lysosomes are homologous. quences that read the same on the two strands but in opposite directions. Hydrolysis of ATP is coupled to the transport of H+ ions out of the cell (into stomach lumen). At mitotic metaphase each chromosome consists of two symmetrical structures, called chromatids. Initiation of DNA replication. 10.7. Action of digitonin on liver mitochondrion to produce mitophase membrane (after De Robertis and De bag" appearance (Fig.10.7). A limiting plasma membrane that permits controlled exchange of matter and energy with the external world. 3' mRNA 5' 70S beginning protein ribosome nearly completed protein 30S 50S Fig. Uterus 14. How do the properties of water make it of importance to living systems ? Synthesis and orientation of cellulose microfibrils. In the binary fission, the cell divides into two genetically identical daughter cells. Autosomes and Sex chromosomes. The two ribosomal subunits remain united with each other due to high concentration of the Mg++(.001M) ions. Here, superiority of heterozygotes (HbA HbS; which is resistant to malaria) over the normal homozygotes (HbA HbA) maintains the two alleles of haemoglobin (i.e., normal and sickling) in an equilibrium. 40% of the gametes of ds mp/++ parent will carry both ds and mp; 10% of the gametes of ds mp/++ parent will carry both ds and mp; 10% of the gametes of ds mp/++ parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes of ds mp/++ parent will carry both ds and mp; 10% of the gametes of ds mp/++ parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes of ds mp/++ parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes of ds mp/++ parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes produced by the ds+/+mp parent will carry both ds and mp; 10% of the gametes parent will carry both ds and mp; 10% of the gametes parent will carry both ds and mp; 10% of the gametes parent will carry both ds and mp; 10% of the gametes parent will carry both ds and mp; 10% of the gametes parent will carry both d diploid number of the honey bee is 16, (a) how many chromosomes will be found in the somatic cells of the drone (male) ? 25. Isolated cell components such as ribosomes, mitochondria and nucleus in relatively pure form by differential centrifugation. ANSWERS TO PROBLEMS 6. Translated eukaryotic genes in which introns have been demonstrated (Source: Freifelder, 1985). Tetrasomy The diploid organisms having two extra chromosomes are known as tetrasomic. RNA synthesis and cell growth. The sex of the offspring depends upon the sperm that fertilizes the egg (each of which carries a single X chromosome) as shown in Fig. It is also the degree of physical or chemical change normally occurring in that substance under stated conditions. The main banding techniques are identified by letters such as Q, G, C, R, T, F and N bands: 1. Homotypic or second Meiotic division which divides each haploid cells. This protein bears B ankyrin band 4.1 about 100 sugars on 16 sepaband 3 glycophorin rate oligosaccharide side Fig. Thomas Morgan and Hermann Muller, in the early 1900s, established the cytological basis for the laws of heredity. There are certain other molecules such as AMP, ADP, ATP and connexin cAMP that can pass through gap junctions. Ca2+ ions have a of a bacterial K+ ion channel as it opens and closes. Certain landmark cell biological discoveries of second half of the 19th century have been tabulated in a chronological order in the Table 1-2. The un- Work in a cytology laboratory where DNA, extracted from human cells, is analysed by techniques including electrophoresis and autoradiography. Because such crosses yielded dihybrids and at a time two pairs of contrasting characters had been considered in them, therefore, these crosses were known as dihybrid crosses. How do complementation differe? For example, the inbreeding coeffi- Contents INBREEDING, OUTBREEDING, OUTBREEDING and at a time two pairs of contrasting characters had been considered in them, therefore, these crosses were known as dihybrid crosses. panmicticly. 18.8A). A—External structure; B—Parts. (5) Agar is a polysaccharide, found in the cell wall of sea weeds and containing D-and L-galactose residues. It mesosome ribosomes producing thylakoid may also contain other plants, so evidently they are not sterile. The permecytoplasm vacuole ability of these two membranes is partly regulated by turgor pressure and is determined by the distinct set of membrane transport proteins that (water gain) transfer specific sugars, amino acids, and other metabolites across each lipid bilayer. The lethal alleles modify the 3:1 phenotypic ratio into 2 : 1. Show why codons cannot consist of one or of two bases. The A- Mature bull sperm. Character 1. 13.7. Diagram showing the effect of nuclease enzymes on chromatin. The reaction of two genetic systems (i.e., chloroplastic and nuclear genetic systems). Thus, a catabolic system may be regulated positively or negatively. REVISION 1. Morganian genetics. Waltzer, Jittery = .1681 or 16.81% 3. .41 vji .41 + + .09v + .09+ji .1681 .1681 .0369 .0369 vji/vji Waltzer, Jittery vji / + + Wild type vji / v + Waltzer vji / + ji Jittery .41 + + .1681 + + / vji Wild type .1681 + +/+ Wild type .0369 + +/v + Wildresults : 1. Cytoskeleton and microtrabecular lattice. ANSWERS TO PROBLEMS 2. Since no cellular membrane (except the mitochondrial membranes) contains any permease for facilitated diffusion of phosphorylated nucleosides are never released from the cells containing a normal intact plasma membrane. Watson and F.H.C. Crick proposed a model for DNA comprising of two helically Contents INTRODUCTION 5 intertwined chains tied together by hydrogen bonds between the purines and pyrimidines. The fertility factor in the bacterium, Escherichia coli. In mice, a dominant allele C must be present in order for any pigment to be developed in the coat. Yeast 25.4 24.6 22.6 27.4 6. coli, there are also termination sites (ter A-F), each consisting of ~ 23 bp. Respiratory Chain and Oxidative Phosphorylation Two molecules of FADH2 and six molecules of FADH2 and six molecules of FADH2 and six molecules of acetyl-CoA) are oxidized by molecular O2 in a respiratory chain or electron transport system or ETS involving a series of enzymes and coenzymes. 22.1. Schematic representation of haploid parthenogenesis in bees (after Grant, 1978). The conjugation is most common among the ciliates, e.g., Paramecium and bacteria. The elongation phase begins when the polymerase releases the base and then moves along the RNA polymerase DNA chain. 10.1. Mitochondria of the flight muscle of a dragon fly, showing profuse cristae. Recently, it has been found that the antibodies is formed by only about 20 to 30 of the amino acid residues in the variable regions of both L and H chains. Plastids are often more or less spherical or disc-shaped (1 µm to 1 mm in diameter), but may be elongated or lobed or show amoeboid characteristics. For example, the cytochemical analysis has revealed the presence of carbohydrates, lipids, proteins, nucleic acids and other organic and inorganic chemical compounds in the cells. In sexually reproducing organisms, the most rapid inbreeding system is that between brothers and sisters who share both parents in common. The helper T lymphocytes achieve their effects by producing hormone-like chemical substances (local chemical mediators), called lymphokines or interleukins, that help B cells to make antibody responses, stimulate activated T cells to proliferate and activate macrophages (see Alberts et al., 1989). The fundamental physical and functional unit of heredity, which carries information from one generation to the next; a segment of DNA, composed of a transcribed region and a regulatory sequence, that makes possible transcription. Melvin (1945–1954) made experiments with unicellular green alga Chlorella and used radioactive form of CO2 (14CO2) to work out those anabolic reactions by which CO2 is fixed into hexoses and other carbohydrates. This meiosis takes place at some intermediate time between fertilization and the formation of gametes. The AY allele for yellow coat in mice is also a good example of pleiotropic gene. The somatic or body cells of most organisms contain two haploid set or genomes and are knows as the diploid cells. Contents CHEMICAL NATURE OF GENETIC
MATERIALS (i.e., DNA AND RNA) 17 In 1880, Emil Fischer identified pyrimidines and purines. The larvae are taken at the third instar stage and the salivary glands are dissected out and squashed in aceto-carmine. Silicate deposits are common in the cell wall of Graminae family. This oxaloacetate is converted to phosphoenol pyruvate in the phosphoenol pyruvate carboxykinase reaction with the loss of two molecules of CO2: 2 Oxaloacetate + 2ATP 2 Phosphoenol pyruvate + 2CO2 + 2ADP The phosphoenol pyruvate is converted into monosaccharides (e.g., glucose, fructose), disaccharide (sucrose) and polysaccharide (starch) by following reation : Phosphoenol pyruvate -→ Triose-phosphate ——→ Fructose-1, 6 - diphosphate ↓ UDP Glucose ←— Glucose-1-phosphate ← Glucose-6- ←-Fructose-6 1 phosphate + Fructose-6 ADP Glucose (Fructose) Sucrose (Starch) REVISION QUESTIONS 1. At certain points the nuclear envelope is interrupted by structures called pores or nucleopores. In 1953, one of the most significant twentieth-century discoveries in biology was made by James watson and Francis Crick. Write short notes on the following : (1) Sigma factor, (2) Pribnow box, (3) TATA box, (4) Snurps and post-transcriptional cleavage, (5) Antiterminators, (6) Silencer sites, (7) Enhancer sites, (7) Enhancer sites, (7) Enhancer sites, (7) Enhancer sites, (8) Ribozymes, (9) Polyadenylation, (10) Spliceosome, (11) Smart genes. Some of the common hemicelluloses go under the names xylans, arabinoxylans, glucomannans, galactomannans and xyloglucans. Robert Holley (1965) and his colleagues reported the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer-generated, three-dimensional model quence of alanine tRNA of yeast (Holley received the complete nucleotide seComputer half had normal wings. As in mitochondria, this complex consists of a CF0 hydrophobic portion, a proteolipid that makes a proton channel, and a CF1 (or coupling factor one) that synthesizes ATP from ADP and Pi, using the proton gradient provided by the electorn transport. CC, Cc aa a F2 Phenotypic ratio Albino=4 Agouti=9 (due to supplementary genes) Black=3 When a homozygous black (CC aa) is crossed with a homozygous albino (cc AA) in F1 all agouti (Cc Aa) offsprings appear. Ultrastructure of nuclear lamina were worked out by Kirschner et al., (1977), Schatten and Thoman (1978), etc. The Q and G bands are generally similar and correspond to intercalary heterochromatin. It is a special form of inbreeding utilized for the purpose of maintaining a high genetic relationship to a desirable ancestor. Define the multiple-gene hypothesis. 14.1B). Contents 224 CELL BIOLOGY CHLOROPLASTS We will describe here only the chloroplasts in detail because of two reasons. The rearrangement of genese of two reasons are set of two reasons. may occur within a gene. 13.1. The four morphological types of chromosomes according to the position of the centromere. After the M phase of previous cell cycle, the daughter cells begin G1 of interphase of new cell cycle. Darwin also attached great importance to the eugenics and he compared it to a signpost with three directions. He also postulated various enzymes involved in this metabolic error, but he could not identify them. This site is also called Shine-Dalgarno sequence and occurs near the 3' terminus of the ribosome (Fig. A-Bivalent or paired homologies) homologies and base pairs with a complementary sequence and base pairs with a complementary sequence and occurs near the AUG codon used for initiation purpose and base pairs with a complementary sequence near the 3' terminus of the ribosome (Fig. A-Bivalent or paired homologies) homologies (Fig. A-Bivalent or paired homologies) h chromosomes in pairing showthat is unfolded from the chromoing chiasmata, B—A part of one homologue showsome for the intense RNA synthesis. 18.10). Consequently, with the gradual loss of the pre-existing normal collagen in the matrix, blood vessels become extremely fragile and teeth become loss in their sockets. The spherical cell of a mycoplasma is bounded at its surface by a 75 A0 thick plasma membrane which is composed of molecules of proteins and lipids, but there is no cell wall. The size of seed and stomata as well as diameter of pollen were found smaller in monoploids than in the diploids. According to the number and arrangement of the flagella in a bacterial cell, folhook lowing four types of flagellaflagellum flagellar tion patterns have been recfilament "bearing" ognized : (1) Monotrichous. Duplication of Chromosomes (in pachytene). When long-haired individuals are inter-crossed, they always produce progeny like themselves. The food is digested by the hydrolytic enzymes (acid hydrolase) of the lysosomes and the digested food is ultimately diffused to the surrounding cytoplasm. Recently, two types of X-linked haemophilia have been recognized : × X+Y XcXc Colour-blind female hemizygous male (Marriage of F1 carrier female with a colour blind male produces the following progeny—) F2 : $\frac{1}{4}X + Xc = Normal$ but carrier female c c $\frac{1}{4}XX = Colour$ -blind male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour$ -blind male 2 Normal male 1:1 $\frac{1}{4}XcY = Colour-blind male 2$ Normal male 2 Normal ma side by side of long-term regulation. Explain : (i) Why geneticists find most mutations to be deleterious? 4 Fig. A diagrammatic representation of parallelism between cytological and genetic crossing over showing the phenotypes of aleurone and endosperm of F1 grains and chromosome morphology and genotypes for microsporocytes produced by F1 plants (after Burns, 1969). In some chromosomes is (b) 4,000 nucleotides. For the sake of clarity, the regulatory region is enlarged with respect to the coding region. Red-green colour blindness in humans is recessive and sex-linked. Heparin is a blood anticoagulant and found in the skin, liver, Chitin is a primary component of the glistening outer lung, thymus, spleen and blood. For example, in human erythrocyte's plasma membrane, outer half contains those phospholipids which polar have more saturated fatty acid chains, head polar group and inner half contains those phosphohead lipids which contain terminal amino group groups and less saturated fatty acid chains. Why did H.G. Khorana select the gene for yeast alanyl-tRNA for artificial synthesis ? The microtubule is being disassembled at the bottom while being simultaneoasly assembled at the top. Despite this conspicuous decline, maize was found more tolerant to inbreeding, e.g., alfalfa and onions. The mediation of malate dehydrogenase enzyme produces oxaloacetic acid, and thereby closes the Krebs cycle. (iv) Prolamines. Both matrix and pellicle are non-genetic materials and appear only at metaphase Contents CHROMOSOMES 261 when the nucleolus disappears. This simple, basic and formal biological generalization is known as cell theory or cell doctrine. In Drosophila, the recessive sex-linked genes abnormal eye facet (fa) and singed bristles (sn) show 18 per cent recombination. some set Induced autopolyploidy. The oxidation of fatty acids by the β-oxidation bon atoms nearest to CoA. Studied fine structure of cilia of higher plants. Oscillatory repression model. It was found that when these type A protein (A) chimeras were used for infection, the infection progeny had proteins which correspond RNA (A) to the virus from which RNA of the infecting virus particle was derived (Fig. he synthesis of particular gene products is controlled by mechanisms collectively
called gene regulation. Waxes have a higher melting point than neutral fats and are the esters of fatty acids of high molecular weight with the alcohol except the glycerol. At least 9 classes of eye colour can be equated with granular rough portions of ER, the origin of endoplasmic smooth microsomes cannot be so reticulum easily assigned. The two isomers are designated as 'D' or 'L' by analogy to D- and L- glyceraldehyde, which are aldotrioses. 12.3). Elaborate the specific role of two different DNA polymerases for the leading and the lagging strands. Mostly the mRNA carries the codons of single cistron (i.e., codes for one complete protein molecule) of the DNA. A specimen is exposed to a solution containing molecules that have been made radioactive by the incorporation of radioactive isotopes, such as tritium (3H), carbon 14 (14C), phosphorus (32P) and sulphur (35S). 14.19). For example, Mougeotia is an alga in which each cylindrical cell contains a single plate-like chloroplast. Another example from higher plants also suggests the existence of plastid genes controlling plastid integrity. Most plant and animal cells contains DNA which is not transcribed and is not found in males. OCCURRENCE The lysosomes occur in most animal and few plant cells (Table 8-1). However, on the basis of the following three criteria, a cellular entity can be identified as a lysosome: (1) It should be bound by a limiting membrane; (2) It should contain two or more acid hydrolases; and (3) It should demonstrate the property of enzyme latency when treated in a way that adversely affects organelle's membrane structure. In the E.coli chromosome the genes encoding these enzymes are located adjacent to one another in the same order as they are translated from a single polycistronic mRNA molecule. 17.8). Structure Peroxisomes are variable in size and shape, but usually appear circular in cross section having diameter between 0.2 and 1.5µm (0.15 to 0.25 µm diameter in most mammalian tissues; 0.5 µm in rat liver cells). For example, in E. The chloroplasts are transformed into etioplasts, in which there is a paracrystalline Contents CELL BIOLOGY 238 chloroplast signal peptide cytosol thylakoid signal peptide cleavage of chloroplast signal peptide thylakoid precursor protein postulated receptor outer membrane stroma translocation into thylakoid inner membrane thylakoid signal peptide ATP-dependent translocation into thylakoid signal peptide ATP-dependent translocation into thylakoid signal peptide which have been isolated. Ph : 22367459, 22373914 Mahabeer Market, 25 Gwynne Road, Aminabad, Lucknow-226 018. Wallace and M.L. Birnstiel isolated ribosomal RNA genes in Xenopus. The precursor oligosaccharide is held in the ER membrane by a special lipid molecule, dolicol (the carrier). DNA polymerase α helps in synthesis of an okazaki fragment in 5' to 3' direction. On the ribose portion of each NTP, there are two OH groups—one each on the 2'- and 3'- carbon atoms. 15.6. All IF proteins share a similar central region (about 310 amino acid residues) that forms an extended helix with three short interruptions. MICROFILAMENTS Thin, solid microfilaments of actin protein, ranging between 5 to 7 nm in diameter and indeterminate length, represent the active or motile part of the cytoskeleton. (v) Heptoses contain seven carbon atoms in their molecules, e.g., sedoheptulose. To facilitate its analysis, the sequence of glycolysis can be subdivided into following three main steps : (i) Activation (stage I); (ii) Cleavage (stage II); and (iii) Oxidation (stage III). Some other examples of X-linked recessive traits include (1) deficiency of enzyme glucose-6 phosphate dehydrogenase (G6PD deficiency) in erythrocytes causing haemolytic anaemia during allergy reaction of persons for the drugs such as sulphonamides or for the broad bean (Vicia faba), called favism; (2) two forms of diabetes insipidus; (3) one form of anhidrotic ectodermal dysplasia (absence of sweat glands and teeth); (4) absence of central incisors; (5) certain forms of deafness; (6) spastic parapelagia (i.e. tetanoid or partial paralysis of lower extremities with increased irritability and spasmodic Contents SEX LINKED INHERITANCE 139 contraction of the muscles); (7) uncontrollable rolling of the eye balls (nystagmus); (8) a form of cataract; (9) night blindness; (10) optic atrophy; (11) juvenile muscular dystrophy and (13) white frontal patch of hair. He tion also showed that presence of a anaphase I complete set of chromosomes was a important for survival). Three repair mechanisms are known in E. Functions of IFs The main function of most intermediate filaments is to provide mechanical support to the cell and its nucleus. It has been estimated that in the mitochondria of liver 67 per cent is located in the inner membrane, 6 per cent is situated in the outer membrane and 6 per cent is found in the outer chamber. The inducer (lactose) changes the shape of repressor, so repressor can no longer bind to the operator whose products participate (after Freifelder, 1985). The somatic cells form various organs of the body and provide a phase for the maturation, development and formation of the germinal cells. Describe the contribution of the following instrumention and techniques in the growth of molecular biology : (i) Radioactive labelling; and (v) Autoradiography; (ii) Denaturation and annealing of DNA; (iv) Radioactive labelling; and (v) Autoradiography. If double crossovers do not occur, map distances may be treated as completely additive units. Figure 4.2 also outline what would be DNA replication. This is easily observed in the alga Nitella, which contain a single huge chloroplast. Thus, the gene of sperm (S+) do not manifest themselve, although the generation is S+S. The sections are picked off the surface with a copper grid. Similar zones of exclusion are associated with microtubules (Porter, 1966), centrioles (Bainton and Farguhar, 1966), and regions of centriole formation (Sorokin, 1968). (d) Monogenic sex determination in Drosophila. The 40S-60S joining reaction really deADP pends on eIF4C. cytoplasmic genes (plasmagenes) of plastids. (b) On what template? For the process of elongation AUG codon of the peptide chain the next (second) codon in Fig. Congenital ichthyosis occurs only when there occurs homozygous condition for its recessive lethal genes. After incorporation of tritiated thymidine, when root cation, whereas loop C retips were transferred to unlabelled culture medium (and mains to be replicated. QUESTIONS What are the characteristic structural features of mitochondira that support your answer. She is showing the symptoms of phenylketonuria. These genes (i.e., C and A) have been termed as supplementary genes (see Villee et al., 1973). In the sister chromatids 1 nodule and 2 (paternal) pachynema stage the pair of chrochromosomal fibers of sister chromatids 3 mosomes become twisted spirally and 4 (maternal) around each other and cannot be The synaptonemal complex. Carbohydrases, 2. Lindegren (1933) studied the inheritance of two pairs of constrasting characters in Neurospora crassa and presented the first direct evidence to prove that crossing over occurs at a four-strand stage and involves only two of the four strands at any one place (Fig. DNA primase associates with DNA B helicase, forming the primosome which synthesizes multiple primers for lagging strand and single RNA primer for the leading strand. Glucose and galactose are optical isomers or stereoisomers. RST represent the gene sequence ABC.GH and LMNDEF List the nitrogenous bases which occur in DNA and RNA. To withgrid stand the passage of ultrafine diamond or handle glass knife without tearing, the specimen is specimen first embedded in a hard plastic such as, epoxy resin (Table 2-1). Suppose a certain cistron is found to consists of 1500 deoxyribonucleotides in sequence. chromosomal abnormalities, such as loss Contents HUMAN GENETICS 243 of a very small part, insertion of an additional segment and addition is held in position by weak secondary bonds which are of different types such as ionic bonds (or electrostatic bonds or salt or salt bridges); hydrogen bonds; hydrogen bonds; hydrogen bonds are of different types such as ionic bonds or salt or salt or salt bridges); hydrogen bonds; hydrogen bonds; hydrogen bonds; hydrogen bonds; hydrogen bonds are of bridges); hydrogen bonds are of bridges); hydrogen bonds are of bridges); hydrogen bonds; hydrogen an anode. Economically important traits such as body weight gains, mature plant heights, egg or milk production records, yield of grain per acre, etc., are also quantitative traits. Since only alternate disjunction from the ring can form viable gametes, each group of 7 chromosomes behaves as though it Contents GENETICS, HUMAN GENETICS AND EUGENICS 182 were a single large linkage group with recombination confined to the pairing ends of each chromosome. Plastids occur only in the plant cells. Describe the structure of the prokaryotic chromosome. Ovists who attached more importance to ova; they thought that "homunculus" was present in the ovum. certain limits) between two daughter cells. However, group O 2 2 (two) unaffected children, sex persons produce only unspecified antigen H if they are of the genotype ii H- Fig. The chloroplasts also contain some metallic atoms as Fe, Cu, Mn and Zn. The carbohydrates occur in very low percentage in the chloroplasts. inversion. Such angles require an excellent lens. Some amino acids such as alanine, cysteine, glycine, hydroxyproline, serine and threonine undergo enzymatic reaction to become pyruvic acid which enters mitochondria and is changed into acetyl-CoA and oxidized by Krebs cycle. A quite a similar enzyme complex is located in the thylakoid $\beta \alpha$ F1 membranes of chloroplasts and in the plasma memcytoplasmic brane of bacterial cell. The four globin molecule. Some biosynthetic funcCuA c1 tions of mitochondria are of
(FeS) (FeS) a (FeS fatty acid molecule may be either saturated or unsaturated. Lastly, photorespiration is driven by atmospheric conditions in which the O2 tension low. Sandy coat colour results from a dominant gene S, and the homozygous recessive (ss) is white in colour. The ATP microtubule (B tubule) (after Alberts et al., 1989). The movement of sliding is converted to bending by virture of radial spokes that bridge each other doublet to the inner pair of microtubules (Warner and Satir, 1974; Huang et al., 1981). not lose its catalytic activity of tranThe arrow shows the direction of RNA chain growth scription. It may occur via the phospholipid bilayer or by the help of specific integral membrane proteins, called permeases or transport proteins. For every guanine in first chain there molecule. In XX- XY type organisms, sex-linked genes (see Fig.12.1) can be classified into following three types: A. This chromosome number was confirmed by Ford and Hamerton while working with testicular material in the same year. All the terpenes are synthesized from various numbers of a five-carbon building block, called isoprene unit (Fig. The microgamy (Gr., micro=small; gam=marriage) is common in certain protozoans, e.g., foraminiferans and Arcella. For this purpose, the technique of cell fractionation is employed. This union does not occur at the catalytic site, but it does modify the tertiary structure of an enzyme and, hence, inactivates the catalytic site. Proton pump or H+- pump. Recessive lethal genes kill only when they are in a homozygous state and they may be of two kinds : 1. In case of unicellular organisms (Protophyta and Protozoa) the extra-cellular fluid may be fresh or marine water, while in multicellular organisms the extra-cellular fluid may be blood, lymph or interstitial fluid. Water The most abundant inorganic component of the cytosol is the water (the notable exceptions are seeds, bone and enamel). In 1839, his coworker, a German

zoologist, Theodor Schwann (1810—1882) applied Schleiden's thesis to the animals. George W. Asexual reproduction by multiple fission. Mult pinches off, forming two daughter cells Cytokinesis in an animal cell. Finally, a suitable metaphase spread is photographed through a high power microscope. from a newly synthesized chromomere of whole chromosomes is called heteroploidy (see Burns and Bottino, 1989). Mendelians, who believed that all evolutionary important heritable differences were qualitative and discontinuous (e.g., Bateson and de Vries). Hormonal or genital sex. In addition to these pigments, these algae contain certain unique pigments collectively called phycobilin; one of the phycobilin is blue and called phycocyanin, while other type of phycobilin is red and called phycocrythrin. Transfer RNA has several unique characteristics: 1. Contractile vacuole changes in Amoeba introduce extraneous perturbations into cell mass measurements. LHC is localized in stacked membranes and lacks photochemical activity. (Note. male fertile male fertile The killer trait is stable only in killer strain with KK genotype and is suitable in sensitive strain with kk genotype. Following this event, the core enzyme interacts with a free σ (sigma) factor to reform the holoenzyme which becomes available for initiating RNA synthesis again. 7.3. Elongation phase of protein synthesis : binding of charged tRNA, peptide bond formation, and translocation (after Freifelder, 1985). centrioles and basal bodies, 3. The ribosomes are always found on the outside surface, the interior being biochemically equivalent to the luminal space of the ER. II, Ii 2. Even the size of nucleus (or the nuclear volume) of a monoploid often was found to be just half than the nucleus of the diploid cell. Nuclear lamina. The procentriole (or daughter centriole) is formed at right angles to the centriole and is located near the proximal end of the centriole. through coral (wc), blood (bbl), eosin (we), cherry (wch), appricot (wa), honey (wh), buff (wbf), tinged (wt), pearl (wp) and ivory (wi), to white (w). Cytogeneticists believe that humans evolved from a common human/ape ancestor due to centric chromosomes to produce a single large chromosome containing the combined genetic content of two acrocentric chromosomes number 2 reducing the number of pairs of chromosomes to 23. Dehalf molecule scribe them for three different RNA acquires mature polymerases in eukaryotes. Woodliff and Jackson in 1966 have found the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, they concluded that the two loci (i.e. haemophilia in an unusual family, both segregating independently; therefore, the two loci (i.e. haemo A and haemophilia B) were far apart on the X chromosome (i.e., having a distance of more than 40 map units between them. For example, in Drosophila melanogaster, the normal (natural or A fruitfly with a mutant gene, which has resulted in legs wild) body colour is brown and a heredideveloping on its head in place of antennae. Edidin (1970). In balanced polymorphism, Contents HUMAN GENETICS 241 there establishes an intermediate equilibrium between the frequencies of these alleles and two classes are maintained together in the same population. Sometimes, intermediate phenotypes. Chromonema (ta). 4.12B) chains of α -glucose molecules. The inheritance pattern of human disease sickle-cell anaemia shows, P1 besides many other genetic phenomena, the incomplete dominance (at cellular or cell shape level) and codominance (at molecular, i.e., haemoglobin level). The forensic application of the DNA fingerprinting technique involves a comparison between the DNA fingerprint obtained from cells at a crime scene with a DNA fingerprint from cells provided by the suspect. The sigma (σ) factor helps in the recognition of start sig"core" enzyme "Holoenzyme" nals on DNA molecule and directs RNA polymerase in selecting the Fig. the rest of the species. For example, black body colour in Drosophila is governed by a recessive gene b and wild type (gray body) by its dominant allele b+. According to these results Mendel described the phenomenon of dominance in following way : in crossing between pure (homozygous) organisms for contrasting characters of a pair, only one character of the pair appears ir the first filial generation. Prokaryotic cells; B. 5.7. Method of initiation of transcription. In the Duroc-jersey breed of pigs, coat colour is influenced by two pairs of genes that interact in peculiar manner (Table 4-6). Another okazaki fragment is then synthesized from the replication fork on the lagging strand by pol α - primase complex and this step is repeated again and again, till the .entire DNA molecule is covered. Why sexually reproducing organisms evolve more rapidly than the asexually reproducing organisms evolve more rapidly than the asexually reproducing organisms. (ii) Sphingolipids. glycoproteins, only the core sugars survive the extensive oligosaccharide trimming process in the Golgi apparatus; B—Mode of transfer of the oligosaccharide to the asparagine residues of the nascent protein inside RER lumen (after Alberts et al., 1989). This is clearly the basis for uniparental or maternal inheritance where the progeny always resemble one parent, most commonly the female parent (e.g., shell coiling in Limnaea peregra). 700 Å The individual collagen polypeptide chains 14 Å (α-chains) are synthesized on membrane bound ribosomes and injected in the lumen of ER as larger A B C precursors, called pro- α-chains. 10.9 and Fig.10.10). The fertilization cone may be conical cylindrical or irregular. (a) All mixed ; (b) ³/₄ mixed : ¹/₂ pistillate; (c) ¹/₂ mixed : ¹/₂ pistillate. The segmental allopolyploids are intermediate between autopolyploids and can be identified by their peculiar meiotic behaviour. They are absent in bacteria and mature mammalian erythrocytes. The second class of essential molecules for many DNA polymerase enzymes are polynucleotide chains with tree 3'-08 ends (often called primer strands), meaning that they cannot initiate the de novo synthesis of a new strand. Cells Mean DNA Feulgen content (Picograms) Spermatids Liver Liver 1.68 3.16 6.30 12.80 Presumed chromosome set (Ploidy) Haploid (2n) Tetraploid (4n) Octoploid (8n) 3. B The axis of each homologue consists of a row of granules or chroextended momeres from which lateral loops chromatin of extend. He reported the map distances for three genes, c (colourless aleurone), Sh Coefficient of coincidence = Contents GENETIC AND CYTOLOGICAL MAPPING OF CHROMOSOMES 111 (shrunken grains), and wx (waxy endosperm) of corn and observed following crossing over frequencies between these genes : Table 9-1 Crossing over frequencies between these genes c, Sh and wx of corn. Although the SER forms a continuous system with RER, it has different morphology. HISTORICAL With wings beating 60 times per second, the ruby-throated following crossing over frequencies between these genes c, Sh and wx of corn. hummingbird has a metabolic rate 50 times that of a human. In yeast, the process of tRNA splicing involves the following two steps : 1. Mutagenic agents. It comprises at least eight different polypeptide chains and is isolated as a dimer of about 300,000 daltons; each monomer contains two cytochromes (a, a3) and two copper atoms. The latter act as carriers of the gene from generation to generation as shown below : HbA HbS Sickle cell carrier 1 A 1/4 Hb HbA Normal; haemoglobin A; no sickling of RBC 1 X 1 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle
cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS Sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS A; no sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS A; no sickle cell carriers; produce both type of haemoglobin A; no sickling of RBC 1 X 1 A 1/4 Hb HbS A; no sickle cell carr anaemia; normally die early in life; produce haemoglobin S only 1 Heterosis : More susceptible Better adapted suffer to malaria from infection in prone area lethal prone area which are necessary for facultative heterochromatin. This parallelism of behaviour in DNA and chromosomes clearly indicates that DNA is the genes, i.e., rRNA has high G+C content, i.e., rRNA has 45 to 60 per cent G+C; while the remaining RNA has only 40 per surface where cellulose cell walls are being formed. Complete Linkage The complete linkage is the phenomenon in which parental combinations of characters appear together for two or more generations in a continuous and regular fashion. This facilitates genetic experiments and this is the reason why microorganisms have been able helpful in genetic studies. Therefore, the selected young men and women of best eugenic value should be encouraged to increase their birth rate. So, its mode of replication is called RNA-dependent RNA synthesis. 3.6). Column chromatography. Most of these flurries of research are initiated by new technical developments. The centriole duplicates and each daughter centriole migrates towards the opposite poles of the cell. Most mitochondrial proteins are coded by nuclear genes and are synthesized on free ribosomes in the cytosol (cytoplasmic matrix). This probably leads to higher osmotic pressure and, hence, higher water content and larger cell volume in rr (ww) seeds. ii CC, Cc, cc CC, Cc cc I Coloured White Coloured Cc II case of infective agent transmitted in the milk. In another cross when barred hens and non-barred cocks are crossed, the F1 have half barred male and half non-barred females (Fig. is released as shown by the following reaction, A—P~P + Pi + 7300 calories ATP ADP Phosphate group Contents 200 CELL BIOLOGY In the above reaction, we have seen that by the breaking of the energy rich bond about 7300 calories of energy are released, while the common chemical bond releases only 300 calories of energy. Theoretical framework to the different aspect of the genetic code. 7.1). Polygenes. HORMONAL CONTROL OF GENE EXPRESSION In higher plants and animals, intercellular communication is a very important phenomenon. In the lactose system of E.coli, there are three structural genes under control of a common operator locus determining production of (1) β- galactosidase, (2) galactoside permease and (3) galactoside acetylase. (b) If all the F2 albino mice are allowed to mate at random, what genotypic ratio is expected in the progeny ? If the DNA pattern matches exactly, certain identification is made. intercellular space plasma membrane connexon pore gap junction B A Fig. The cell wall is a non-living structure which is formed by the living protoplast (A plant cell without its cell wall is called a protoplast; Alberts et al.,1989). Thus, modifier is a gene that affects the expression of another nonallelic gene. (a) Haploid or arrhenotokous parthenogenesis. This complete synthetic gene was cloned in the vector bacteriophage (lambda phage) by gene cloning technique Finally, photosynthesis is an endergonic reaction, which means that it captures energy; oxidative phosphorylation is an exergonic reaction, meaning that it releases energy; oxidative phosphorylation is an exergonic reaction, meaning that it releases energy; oxidative phosphorylation is an exergonic reaction, meaning that it releases energy; oxidative phosphorylation is an exergonic reaction, meaning that it releases energy; oxidative phosphorylation is an exergonic reaction, meaning that it releases energy; oxidative phosphorylation is an exergonic reaction, meaning that it releases energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation is an exergence of the exercise energy; oxidative phosphorylation exercise energy; oxida combinations, viz., $\nu + \nu + \nu$ and $\nu \nu$, to produce genotypically three types of individuals $\nu + \nu +$, $\nu + \nu$ and $\nu \nu$ in 1:2:1 ratio in F2 generation. 17.2. Schematic diagram of a flagellar tip (A), in the middle of the flagellum (B), and at the basal body (C). Antibodies to HMW and tau proteins show that both proteins bind along the entire length of cytoplasmic microtubules. Growth phase; 3. The coordinated effect of two or more genes in producing a given phenotypic trait. What is cell theory ? In other cells, residual bodies may remain for a long time and may load the cells to result in their aging. Uniparental Inheritance in Chlamydomonas reinhardi Like fungi, algae rarely have different sexes, but they do have mating types. The experiment was repeated using synthetic poly (A) and poly (C) chains, which gave polylysine and polyproline respectively. The major differences between the two are following : Table 5.1. Differences between qualitative traits or genetics. Animal cells have centrosome and centrioles. White Leghorn and white Plymouth Rock. Further, catabolic enzymes are denied access to the mRNA when the ribosome coated at their 5' ends (i.e., in case of polyribosomes) DEFINITION OF CELL BIOLOGY The biological science which deals with the study of structure, function, molecular organization, growth, reproduc- Contents CELL BIOLOGY 4 tion and genetics of the cells, is called cytology (Gr., kytos = hollow vessel or cell; logous = to discourse) or cell biology. Generally, Golgi apparatus performs the following (Gr., kytos = hollow vessel or cell; logous = to discourse) or cell biology. important functions : 1. Involved in fat metabolism. It provides strong support to chromosome theroy of inheritance (i.e., Mendelian factors or genes are carried on the chromosomes). Ribosomes from mitochondria and chloroplasts show resemblance to 70S ribosomes of bacteria. 15.3), whereas those with Each is depicted in a different colour. Later, in the 1930s it was shown that insertion of nuclei into enucleated amoebae restored pseudopodial activity, feeding behaviour and growth. The chloroplasts have a definite orientation in the cell cytoplasm. tau proteins, with molecular weights of 40,000 to 60,000. The nucleolus becomes large or its number is multiplied due to excessive synthesis of ribosomal RNA by rDNA of nucleolar organizer region of chromosomes. Dosage Compensation of Genes The term dosage compensation was originally discovered in Drosophila. Immunoelectrophoresis (used for antigens and antibodies). It is composed of DNA and must be present in a cell to function as a donor in conjugation. Describe the structure and function of the nucleolus. lular solutions having less concentration of the solutes than the cytoplasm are known as hypotonic solutions. Subsequently, different shades between red and white were recovered. Eukaryotes vary greatly in DNA content but always contain much more DNA than prokaryotes. Contents 30 CELL BIOLOGY C. Similarity in aerobic prokaryotic DNA molecule. The gene for the large subunit of carboxydismutase enzyme has been fully sequenced and is found to contain 1425 nucleotides. In case of ring formation, adjacent type segregation may occur and as a result each of translocation chromosomes and normal chromosomes move to opposite poles. 1984,86 Alec Jeffreys discovered the technique of DNA fingerprinting. It is strange that Mendel could not detect the phenomenon of linkage in pea plant, since extensive linkage groups (chromosomes 1,4,5 and 7). The most abundant amino acid of these proteins is arginine (pH 10 to 11). General pattern of organization of nucleotide sequence around the anticodon, i.e., in anticodon and loop and stem of tRNA. Rapidly destroyed by heat. (ii) They are useful in predicting results of dihybrid and trihybrid crosses. They also designed drugs for treating gout, malaria and viral infections such as herpes. Strasburger (1882) introduced the terms cytoplasm and nucleoplasm. 17.5). The union of micro-and macrogametes is known as the anisogamy (Gr. an=without ; is=equal; gam= marriage). Sickle-cell
anaemia. Salton (1962) has reported respiratory chain enzymes in the mesosomes. Cell wall Present in most but not in all cells Present Absent Absent Absent Circular or linear, double -stranded DNA : genes are not interrupted by intron * 4. A mature lymphocyte (plasma cell) produces antibodies with a single class H chain and a single type of L chain, hence, also a single antigen-binding specificity. They perform most important biological activities as the synthesis of food and storage of carbohydrates, lipids and proteins. The ascorbic acid content has been reported to be higher in tetraploid cabbages and tomatoes than in corresponding diploids. To explain the question that why do homologous chromosomes, during synapsis, approach each other from a considerable distance and become closely associated, a British cytologist C.D. Darlington in 1937, proposed the precocity theory of meiosis which embraces well the cause of synapsis in it. In cell division, where does this additional surface come from. The cytoplasmic matrix can perform movement due to cyclosis. (ii) Exogamy. Explained division of labour in body cells. GENETICALLY CONTROLLED SEX DETERMINING MECHANISMS Most of the mechanisms of the determination of the sex are under genetic control and they may be classified into following categories : 1. White Rr rr Symbolism for codominant alr leles. Then rapid replication of the lysogenic bacterium free viral DNA and its packaging into is ruined, for the phage virus particles DNA that the host bacterium is harbouring enters the lytic phase. Metchnikoff C.A. MacMunn T.Boveri 1890 W.Waldeyer R.Altmann 1892 O.Hertwig 9 Contents 10 CELL BIOLOGY 1897 C.Benda 1898 Camillo Golgi Coined the term mitochondrion and studied it in spermatozoa and other cells. Ran-GTP Exportin Nucleoplasm Cytoplasm Importin β Importin α NLS protein Ran-GTP 1 2 3 4 5 Importing proteins from the cytoplasm into the nucleus. They crossed an emmer wheat, Triticum dicoccoides, (tetraploid : 2n = 28) with goat grass, Aegilops squarrosa (diploid ; 2n = 14) and doubled the chromosome number in the F1 hybrid (Fig. Contents MULTIPLE ALLELES 119 saccharides (sugars + aminoacids) of 300,000 molecular weights. The A-C distance is, therefore, 30 map units when double crossovers are detected in the two-point linkage experiment above. (ii) Cleavage. The cyto- (characteristic of a phagocyte) plasm of animal cells contains many tiny, spheroid or irregular-shaped, membrane-bounded vesicles known as lysosomes. The DNA probes labelled with radioactive material are added to a solution containing the nylon membrane. 4.2. Semi-conservative model of white. chromosomes are long and thin. Adrenocorticotrophic hormone (ACTH) 2. NADPH2+O2—requiring steroid transformations: Aromatization and hydroxylation. (b) From the data the crossover frequency between fa and sn is 18 per cent. permease acetylase 275 30,000 monomer 30,000 Fig. This membrane, Fig.10.3. Mitochondria of different type of animal cells. In 1937, Richard Goldschmidt stimulated exploratory questions on the chemical nature of gene (of Drosophila). Onion (root tip) 21 102 13 13 5 9 4 57 78 14.4 4.2 13.2 71 6.5 2.4 3.8 4. Chromosome cycle. ER Contents LYSOSOMES 181 1. Contents C H A P T E R 13 Chromosomes T he chromosomes are the nuclear components of special organisation, individuality and function. 12.9). In case of multiple births, the number of infants may be three (triplets), four (quadruplets), four (quadruplets), for the replication of DNA molecule, Watson and Crick proposed that replication of hydrogen bonds followed by a rotation and separation of the two polynucleotide strands. 9.12. The scrutiny of established matings parents abortion or still birth is called pedigree analysis. Write short account on the following : (ii) K a r y o type ; (iii) Kinetochore ; (iv) Heterochromatin ; (v) C-value and C-value paradox; (vi) Salivary gland Contents 280 CELL BIOLOGY C H A P T E R 14 Ribosomes T he ribosomes are small, dense, rounded and granular particles of the ribonucleoprotein. A continuous layer of bacteria on the surface of an agar medium. giosperms, etc. The least effective of these three regions is the TATA or Goldberg-Hogness box (7 bp Sp1 -100 GC CTF Sp1 -80 -60 CAAT GC -30 -10 +1 DNA TATA RNA enhancers may control initial binding of protein start point may control choice of start point Fig. It accepts electrons from NADH Contents 208 CELL BIOLOGY and passes them through a flavin and at least five iron-sulphur centres to ubiquinone (Q) that transfer its electrons to the next complex, the b-c1, complex. 16A, 16A/16A Heterozygous bar eye 358 3. Abyssinian oat (Avena abyssinica) appears to be a tetraploid with 28 chromosomes. proacrosomal granule develops inside the vacuole. F1 : vji / + + F2 : If 18% are crossover types, then 82% should be parental types. These enzymes are called restriction enzymes because they restrict infection of bacteria by certain viruses (i.e., bacteriophages), by degrading the viral DNA without affecting the bacterial DNA. What is the chloroplst? Nucleus 243-256 Historical; nucleo-cytoplasmic relationship - Hammerling's experiment; isolation techniques; ultrastructure — nuclear envelope, nucleoplasm, chromatin fibres; revision questions. About 80 per cent proteins are insoluble and forming the unit membranes of the chloroplasts along with the lipids. People always tried to know those factors which determine the male and female sexes of a species. The product glucose penetrates terol 7α hydroxyl cholesterol, which is then converted into bile acids by the lumen of the endoplasmic reticuthe help of hydroxyl as enzymes. To follow this tially labelled "painting" probes. The specificity of the kind of hydrogen bonds that can be formed assures that for every adenine in one chain there will be thymine Fig. The reverse is true in crocodiles, alligators and some lizards, where males are produced at high temperature and females are produced at low temperature. classification, each of the 22 Contents 242 GENETICS, HUMAN GENETICS and a+/+b exhibit different phenotypes. An individual or cell containing two complete haploid sets of chromosomes is containing two complete haploid sets of chromosomes is containing two completes. An individual or cell containing two completes and a+/+b exhibit different phenotypes. An individual or cell containing two completes are gene +/ab and a+/+b exhibit different phenotypes. An individual or cell containing two completes are gene +/ab and a+/+b exhibit different phenotypes. known as diploid. Each proleft-handed a- helices ; B— Staggered α-chain then combines with two others to form a arrangement of tropocollagen molecules, (super helices) in a collagen fibril; C— called procollagen. Cytochemical studies have shown that the lateral elements of synaptonemal complex are rich in DNA, RNA and proteins, but that the central element of it contains mainly RNA, protein and little DNA. MOLECULAR STRUCTURE OF IMMUNOGLOBULINS OR ANTIBODIES The human body is capable of synthesizing more than a million different kinds of immunoglobulin molecules, each capable of reacting with a different antigen, but all of them appear to share the same fundamental quaternary (globular) structure. coli, a gene mutation suppressor gene called rec A (rec for recombination) is known which is necessary for recombinational repair (see Goodenough and Levine, 1974). Such 'loaded' lysosomes can be demglycosidases onstrated by fluorescence microscopy. These three forms are extreme variants and contain only 8 and 7½ base pairs per turn respectively. Indeed, there are many evidences to support the idea of singlestranded nature of chromatin. Such translocations also drastically change the size of a chromosome as well as the position of its Sequence for rapid centromere. (2) Water is the hydrogen donor. It is thought that in heterochromatin the DNA is tightly packed in the 30 nm fibre. Examples of Prokaryotic Cells The following three types of prokaryotic cells are well studied ones : 1. Each of vesicular transport these large protein molecules surperinuclear rounded by a lipid monolayer and endosome also contains a single large protein molecule. (apoprotein). Chromoloops are also detected in polysomes can be broken when struck by ionizing radiation (wavy arrows). J. Selection aganist them would be total; however, when they do develop normally and produce progeny, every member of the next generation would be a carrier of the mutaiton, assuming that the wife of such person being normal. Poly (U) seemed a good choice, because there could be no ambiguity in a message consisting of only one base. But realizing fixation (dark phorylation that many tropical plants would otherwise lose more reaction than half of the photosynthetic carbon in photorespiration, the C-4 pathway is of adaptive adlight PGAL CO2 vantage. The result of this cross have been shown in Figure 5.3. The F2 phenotypic and genotypic and genotypi 20 being single stranded. Multicellular forms Mostly 1-10 µm Rare 3. The individual which is heterozygous for three pair of alleles is known as Tt trihybrid. Box A of 5S RNA and tRNA genes contain similar conserved sequences and is recognized by the same transcription factor (TF III B). Specimen vial Specimen holder for microtome When the plastic is hard, the block is trimmed and is ready for sectioning. In interallelic genetic interactions, the independent (non-homologous) genes located on the same or on different chromosomes interact with one another for the expression of single phenotypic trait of an organism. The aa progeny, however, has no means of continuing the supply of that their eves eventually become light. This protein may be involved in the transport of materials through the nuclear pores. Such transcellular passage of fluids is also found to occur in other types of cells such as Schawn and satellite cells of nerve ganglion, macrophages, muscle cells and reticular vesicles are coated by
clathrin (see Alberts et al., 1989). In the mouse, the genes studied to date (approximately 300) fall into 20 linkage groups. Thus, a single plant may produce both male and female gametes but pollen grains of this plant fail to fertilize the ovules of the same plant; so as a result no seed will ever be produced. The nucleoplasm also contains certain cofactors and coenzymes such as ATP and acetyl CoA. Occasionally a repressor molecule will momentarily become dissociated from the operator and RNA polymerase will attach and begin transcription of the β- galactosidase and permease genes before the repressor reattaches. pp fail to produce an enzyme called phenylalanine hydroxylase. Contents 46 GENETICS, HUMAN GENETICS AND EUGENICS TIME OF GENETICS AND EUGENICS TIME of beginning of the S period of DNA synthesis to provide the new DNA with nucleosomes. Could he be the father ? These electrons with high potential E'0 -0.6 E 0' X cyclic photophosphorylation -0.4 cytochrome-553 2e- +Pi plastocyanin ATP ADP +Pi ATP noncyclic NADP+ 2e-NADP+ +2H+ ADP +Pi H2O photophospho- +0.6 +0.8 2e- ferredoxin NADPH + H+ light 2hv rylation photosystem II Fig. Contents 4 GENETICS, HUMAN GEN periods of stagnation punctuated by bursts of rapid progess. 2.4). The direction in which the complex moves and the underlying cytoplasmic microtubules (i.e., microtubules of cell, cortex, Herth, 1985). 7.2. B The position and orientation of the Golgi apparatus in the secretory pathway. Genetic Engineering (Isolation, Sequencing, Synthesis of Gene and DNA 110-125 Fingerprinting) Tools of genetic engineering - isolation and use of restriction enzymes, Southern blotting technique, western blotting technique vectors, transformation and molecular cloning, isolation of genes — isolation of ribosomal RNA genes in Xenopus; sequencing of gene— Maxam and Gilbert's chemical degradation method, direct DNA (xiv) sequencing using PCR; synthesis of gene — organochemical synthesis of polynucleotides (or chemical synthesis of tRNA genes), synthesis of gene from mRNA (or enzymatic synthesis of gene); application of genetic engineering — DNA fingerprinting : the ultimate identification test; revision questions and problems. The preparation of a slide of the polytene chromosomes of dipterans for light microscopy is rather easy ORGANIC COMPOUNDS The chemical substances which contain carbon (C) in combination with one or more other elements as hydrogen (H), nitrogen (N), sulphur (S), etc., are called organic compounds. Clone. is reassembled at telophase. 5.11. It is also shown that different S alleles may have different sequences. The fertilizin is a glycoprotein which is composed of different types of amino acids and monosaccharides (glucose, fructose and galactose) according to the species. In endocytosis, small regions of the plasma membrane fold inwards or invaginate, until it has formed new intracellular membrane limited vesicles. Contents inactivation of one X chromosome in homogametic female sex, as observed in mammals, or by the Photomicrograph of human sex chromosomes lack in degradative enzymes. between the object and the light source and serve to focus the light on the object. Aristotle (384 - 322 B.C.) Various levels of biological organization and instrumental resolving power (Source: De Robertis, Jr., 1987). The different types of techniques used include the use of polymers (copolymers) containing a single type of nucleotide (called homopolymers), the use of mixed polymers (copolymers) containing a single type of nucleotide (called homopolymers) more than one type of nucleotides (heteropolymers) in ribosome-binding or filter-binding. What are the major classes of lipids and what types of functions are served by them? Oxidases, 7. Thus, the amino acid sequence, and, hence, the structure and properties of the enzyme formed will be changed. 18.9B). FUNCTIONS OF LYSOSOMES The important functions of lysosome are as follows: exocytosis lipofuscin residual body lysosome forming autophagic vacuole mitochondria A summary of the autophagic pathway. Contents MOLECULAR BIOLOGY 26 4. astral spindle fibers centriole pericentriolar material astral spindle fibers chromosomes chromosomes chromosomes chromosomes chromosomes chromosomal spindle fibers centriole polar spindle fibers centricle polar spindle fibe ("half-zygous") in the males. Its molecules appear to be single polynucleotide strands which are unbranched and flexible. An(iv) mu other type of killer trait known as mate killer has been re50% Male fertile 50% Male sterile ported in Paramecium by Fig. In the formyl group leaving. only the -COOH group available to react with the -NH2 group of the second amino acid (AA2). The F1 plants when self-pollinated or crossed among themselves, produced the F2 generation with the phenotypic ratio of 9 coloured and 7 white flowered plants. 11.6. Localization of the light and dark reacpigment. During G1 phase, chromatin is fully extended and not distinguishable as discrete chromosomes with the light microscope. The free amino acids react with ATP, resulting in the production of aminoacyl adenylate and pyrophosphate : Contents 80 MOLECULAR BIOLOGY AA + Amino acid ATP + Enzyme Aminoacyl adenylate enzyme complex + PP Pyrophosphate The reaction product aminoacyl adenylate (or aminoacyl adenosine monophosphate) is bound to the enzyme in the form of a monocovalent complex. Proteins form stable colloids because, firstly, they are charged ions in solution that repel each other, and, secondly each protein molecule attracts water molecules around it in definite layers. DIRECT EVIDENCES FOR DNA AS THE GENETIC MATERIAL The most conclusive evidences in support of DNA as the genetic material came from the following three avenues of approach on microorganisms : transformation of bacteria, mode of infection of bacteria, mode of infection of bacteria, mode of approach on microorganisms : transformation of bacteria, mode of infection of bacteria, mode of infection of bacteria, mode of infection of bacteria, mode of approach on microorganisms : transformation of bacteria, mode of infection of bacteria, mode of infecti firmly with the membrane, while the extrinsic proteins have a weaker association and are bound to lipids of membranes. He got the Nobel Prize in 1978 for the development of this model. Plasma membranes Nucleus Nuclear membranes Chromatin with histone Genetic material 9. The intracellular movements of the pinosomes, entrioles, etc., occur only due to cyclosis of the matrix. (ii) Glycoproteins. Organism Chicken Bovine Carp Human Kidney Liver Erythrocytes Sperm 2.4 6.4 - 5.6 2.5 6.4 3.0 5.6 2.5 - 3.3 - 1.3 3.3 1.6 2.5 4. Contents GENETIC INTERACTION AND LETHAL GENES 51 3. Concerned with individual matings and their progeny. 5.28. LMLN 3. Unidirectional replication B. These are comma-shaped or bent-rod like bacteria (Fig. uterus The hereditary trait is most likely shown by both members of the identical twins. Lower eukaryotes in general have less DNA, such as nematode Caenorhabditis elegans which has only 20 times more DNA than E.coli, or the fruit fly D. Galton and Pearson choose to work with human beings and with what they considered important human traits such as intelligence, stature and special abilities. KINDS OF LINKAGE W.E. Castle T.H. Morgan and his co-workers by their investigation on the Drosophila and other organisms have found two types of linkage, viz., complete linkage and incomplete linkage. subunits (i.e., a larger 50S ribosomal subunit). Transcription of mRNA in this case is evidently initiated only on demand and must, therefore, be subject to regulation. Other mechanical or physical properties of matrix. Within a selective and retentive semipermeable membrane, it contains a complete set of different set of different set of different set of different set. kinds of units necessary to permit its own growth and reproduction from simple nutrients. COMPARISON BETWEEN DNA REPLICATION AND TRANSCRIPTION The replication and transcription are two chief activities of DNA and they should be compared at the outset in the following manner : 1. The nucleolus remains prominent up to this stage and it is found to be associated with the nucleolar organizer region of the chromosome. Such a kind of reversible change in the conformation of a molecule is called allostery. In maize (Zea mays) the amount of chlorophyll is controlled by a recessive allele (g) which exhibits a lethal effect in homozygous (gg) and in heterozygous condition (Gg) has phenotype similar to homozygous condition for dominant gene GG. 12.2. Different shapes of the nucleus in animal cells. These results are consistent only with the model of semiconservative replication. For karyotyping of human chromosomes venous blood is taken and blood leucocytes are stimulated to divide (by mitosis) in vitro by the addition of phytohaemagglutinin. METHOD OF DETECTION OF SEX-LINKED LETHAL MUTATION H.J. Muller devised an easy method for detecting lethal mutations in the sex chromosomes of Drosophila. Tay-Sachs disease Essential pentosauria Classic haemophilia Phenylketonuria Cystinuria Metachromatic leuko dystrophy Galactosemia Mutated gene unknown Mutated gene unknown Defective glucocerebrosidase enzyme Defective glucocerebrosidase enzyme Defective glucocerebrosidase A A benign condition Defective glucocerebrosidase enzyme Defe tiny particles of ribonucleoprotein later to be called "ribosomes'. The allele y may be associated with the allele R to give rise yR combination. Development of the Idea of Organic Evolution 8-17 Period of obscurity; period, the agnostic period, the modern synthesis period; present state of evolution idea; revision questions. With rare exceptions, such as human erythrocyte, microtubules are found at a region in the cilium where microtubules and basal bodies make contact with the membrane. In 1858, Virchow published his classical textbook Cellular Pathology and in it he correctly asserted that Louis Pasteur
(1822-1895) as functional units of life, the cells were the primary sites of disease and cancer. Glucose, the Amino acids CoA-SH fuel for metabolism, must also be Condensing Citric acid broken into smaller Oxaloacetic acid enzyme C6H8O 7 C4 H4O 6 pieces. Mode of inheritance of sex-linked recessive lethal genes in Drosophila. Steroids. His sketches of these protozoa included so many details that they could only have been made if he had used some form of magnifying lenses. Each chromosome of a homologous pair is known as homolog. 4.12). Nucleic acids. Glycogen is more soluble than starch and exists in the cytoplasm as tiny granules. Such a mechanism occurs during expression of immunoglobulin (Ig) genes. However, in the reciprocal cross (dark female × light male), all the female progeny have light wings and all the male progeny have dark wings. The independent behaviour of genes occurs on different pairs of chromosomes. Most fibrous proteins have secondary structure. G1 phase is most variable as to duration (Table 18-1); it either occupies 30 to 50 per cent of the cell cycle or lacks entirely in rapidly dividing cells (e.g., blastomeres of early embryo of frog and mammals). What is parthenogenesis ? Sex-linked and sexinfluenced characters. Cory et al., 1970). (a) 24; (b) 23 (c) 12; (d) 12. Heteroploidy may involve entire sets of chromosomes (euploidy), or loss or addition of single whole chromosomes (euploidy), or loss or addition of single whole chromosomes (euploidy), or loss or addition of single whole chromosomes (euploidy), or loss or addition of single whole chromosomes (euploidy). X-linked lethals have been reported both in Drosophila and human beings. It consists of central nuclear components (viz., DNA molecule, RNA molecule, RNA molecule, RNA molecules). and nuclear proteins) surrounded by cytoplasmic ground substance, with the whole enveloped by a plasma membrane. Describe various theories regarding the physical nature of the matrix. Generalized two-dimensional clover-leaf model of following structural peculiarities : tRNA, based on analyses of several yeast tRNA molecules by (i) All tRNA molecules have various investigators. The nucleosome 'beads' can be removed from long DNA "string" by digestion with enzymes that degrade DNA, such as bacterial enzyme, micrococcal nuclease. In 1963, J. The remaining 5 per cent of the total cellular water remains loosely linked with protein molecules by hydrogen bonds or other forces and is known as bound water. In green leaves of plants, peroxisomes carry out the process of photorespiration. Contents CELL GROWTH AND CELL DIVISION 319 as a unit of biological time and defines life history of a cell. Mutants of either crp or the adenyl cyclase gene are unable to synthesize lac mRNA, indicating that both CAP and cAMP are required for lac mRNA synthesis. Chemically, microtubules are composed of two kinds of protein subunits : α-tubulin (tubulin A) and β-tubulin (tubulin A) and β-tubulin (tubulin B), each of M.W. 55,000 daltons. A out cross (outbreeding) between two inbred lines can produce more heterotic F1 individuals than the parents, in following manner : Parent : Phenotypic value : F1 : AA bb CC dd 2+1+2+1= 6 × 1 as BB cc DD 1+2+1+2 = 6 Aa Bb Cc Dd 2+2+2+2 = 8 The dominance hypothesis of heterosis has been supported by certain experiments. cell and are in contact with thin bands of Contents 142 CELL BIOLOGY tight junction adherens juncti establish by experiments with pneumonia-causing (virulent) bacteria that genes were composed of a specific type of nucleic acid, called deoxyribonucleic aci usually only one sperm enters in the egg, this Contents FERTILIZATION 359 type of fertilization is known as monospermic fertilization. Certain puffs, known as heat-shock puffs, known as heat-shock puffs, known as monospermic fertilization. initiation codon is hatched (after Freifelder, 1985). (2) In the polymerization reaction a 3'-OH group of one nucleotide reacts with the 5'-triphosphate of a second nucleotide; a pyrophosphate is removed and a phosphodiester bond results (Fig. access to the DNA, although other controlling factors might also be involved. Here, the sequence of genes in the duplicated region of a chromosome is just the reverse of a normal sequence. For example, genes coding for larger ribosomal RNA (28 S or 18 S rRNA) or transfer RNA (tRNA) are present as multiple copies forming simple multigene family. HbSHbS : Severe, often fatal Blue, anaemia. IMPORTANCE OF GENETICS The cultural evolution of human beings is strongly influenced by knowledge of hereditary phenomena of early man. Type III collagen occurs in skin, fibre cardiovascular system, gastro-intestinal tract and 2800 A uterus. (i.e., glycerine or propane1, 2, 3 triol) and fatty acids. These vapours unite and form a new individual. The heredity and variations play an important role in the formation of new species (speciation). The dihybrid cross between red, broad plant (RR BB) and white, narrow plant (rr bb) produces heterozygotes (dihybrids produce the F2 progeny in 9 phenotypic classes as follows : Red Broad × White Narrow P1 Phenotype Genotype RR BB rr bb 1 P1 Gametes : 1 Red Narrow : 2 Pink Intermediate : 1 Red Broad : 2 Red Intermediate : 1 Red Narrow : 2 Pink Intermediate : 1 White Broad : 2 Red Intermediate : 1 Red Narrow : 2 Pink Intermediate : 1 Re other cell components (Fig. X chromosomes Phenotype Mean number of facets 1. Contents 46 CELL BIOLOGY II. This one allelic condition in contrast to the homozygous or heterozygous condition in contrast to the homozygous or heterozygous possibilities in the female. for redcoloured eyes. Cairns worked out generation time of E. During DNA synthesis, each double-helical DNA molecules and during mitosis the duplicated copies of the genome are ultimately separated. The life cycle of certain fungi (e.g., Neurospora) enables us to analyse the products of a single meiosis. It is also involved in the production of microspores (in anthers) and megaspores (in ovary or pistil) or in microsporegenesis, respectively. It is associated with a sex- or X-linked recessive gene. Functions of Cell Wall The chief function of cell with a sex- or X-linked recessive gene. Sterilization. In rat liver, the membranes of microsomes are 60 to 70 per cent protein and 30 to 40 per cent phosagranular microsomes pholipid by weight. (3) Single-stranded DNA was fixed on a filter paper. Antibody-mediated (humoral) responses involve the production of antibodies which are proteins, called immunoglobulins (Ig) (Fig. (b) Movement or physical shifting of tRNA dipeptide from the 'A' site to the 'P' site. Contents TRANSPOSABLE GENETIC ELEMENTS 259 4957 bp tnp A tnpR bla transposase resolvase/ repressor B-lactamase 38 bp inverted terminal repeats Fig. Organochemical Synthesis of Polynucleotides (or Chemical Synthesis of tRNA dipeptide from the 'A' site to the 'P' site. Contents TRANSPOSABLE GENETIC ELEMENTS 259 4957 bp tnp A tnpR bla transposase resolvase/ repressor B-lactamase 38 bp inverted terminal repeats Fig. Organochemical Synthesis of Polynucleotides (or Chemical Synthesis of tRNA dipeptide from the 'A' site to the 'P' site. Contents TRANSPOSABLE GENETIC ELEMENTS 259 4957 bp tnp A tnpR bla transposase resolvase/ repressor B-lactamase 38 bp inverted terminal repeats Fig. Organochemical Synthesis of tRNA dipeptide from the 'A' site to the 'P' site. Contents TRANSPOSABLE GENETIC ELEMENTS 259 4957 bp tnp A tnpR bla transposase resolvase/ repressor B-lactamase 38 bp inverted terminal repeats Fig. Organochemical Synthesis of tRNA dipeptide from the 'A' site to the 'P' site. Contents TRANSPOSABLE GENETIC ELEMENTS 259 4957 bp tnp A tnpR bla transposase resolvase/ repressor B-lactamase 38 bp inverted terminal repeats Fig. Organochemical Synthesis of tRNA dipeptide from the 'A' site to the 'P' site. Contents TRANSPOSABLE GENETIC ELEMENTS 259 4957 bp tnp A tnpR bla transposase resolvase/ repressor B-lactamase 38 bp inverted terminal repeats Fig. Organochemical Synthesis of tRNA dipeptide from the 'A' site to the 'P' site. Contents TRANSPOSABLE GENETIC ELEMENTS 259 4957 bp tnp A tnpR bla transposase resolvase/ repressor B-lactamase 38 bp inverted terminal repeats Fig. Organochemical Synthesis of tRNA dipeptide from the 'A' site to the 'P' site. Contents TRANSPOSABLE GENETIC ELEMENTS 259 4957 bp tnp A tnpR bla transposase resolvase/ repressor B-lactamase 38 bp inverted terminal repeats 58 bp inverted terminal re Genes) 119 base P P OCH2 O H H H H H 2', 3' dideoxy analogue DNA to be sequenced 3' 5' GAATTCGCTAATGC C T T A A DNA polymerase dATP, dCTP, Fig. ANSWERS TO PROBLEMS 3. ISOLATION METHODS Several methods have been developed over the years to prepare chromatin for microscopical examination. This type of method of improving the human race is known as euthenics. The assembly of microtubules from the tubulin dimers is a specifically oriented and programmed process. Three collagen polypeptide chains are lefthanded α-helices or alpha chains, each is about 1000 amino acid residues long. (4) Substances are introduced which prevent attack by microorganisms. matrix contains certain chemical compounds as carbonate-bicarbonate system known as buffers which maintain a constant state of pH in the matrix. In our example, this point is in the centre between the AT/AT. Haemophilia B results from a defect in plasma thromboplastic component (factor IX). Some of these are inborn disease, gout, Pompe's disease, gout, Pompe's disease, etc.) and others are induced by some environmental pollutants (e.g., silicosis). This type of parthenogenesis is known as apomiotic or ameiotic parthenogenesis and occurs in Trichoniscus (Isopoda), Daphnia pulex (Crustacea) Compelona rufum (Mollusca), weevils and long-horned grasshopper. Pseudohermaphrodites have either testicular or ovarian tissue, generally rudimentary, but not both. In trans3 1 verse section the triplets are arranged like 1 2 2 3 I vanes or blades of pinwheel or turbine.
5.10. An eukaryotic DNA segment showing promoter by an unknown signal and about 104 fibroin mRNA molecules are made in a period of several days (such a synthesis). forms an example of transcriptional regulation). The liposomes can attach to the surface of target cells and may fuse with the plasma membrane, following which their contents are released into the cytosol or cytoplasmic matrix. These kinds of gene and are usually referred to as intraallelic or allelic genetic interactions. Each ribosome is porous, hydrated and composed of two subunits. A—Spermatogenesis; B—Oogenesis, B—Oogenesis, B—Oogenesis, B—Oogenesis, B—Oogenesis, B—Oogenesis, B—Oogenesis, B C-S and C-halide bonds. Explain, using a specific example. The various molecules of polypeptides unite to form the peptones, proteases and proteins. According to him, the genotype of an individual represents the sum total of heredity, while phenotype of an individual represents the sum total of heredity. by the interaction between genotype and environment. If the material has an ordered crystalline atomic structure, the resulting X-ray diffraction pattern is also ordered and reflects the Scanning electron micrograph: the head and the three-dimensional arrangement of atmouthparts of a weevil. Diagram of the evolution of XX chromosome. This trend has been well studied in the genus Crepis of the family Compositae. (ii) Tetroses contain four carbon atoms in their molecules, e.g., erythrulose and erythrose. 6.2. Bases in mRNA are read sequentially in the 5' to molecules which have 372 amino acids. The F2 progeny showed a continuous gradation from the size of the dwarf to that of the tall parent. (vii) Anisogamy. Several things can happen to this energy : (i) It can be dissipated in molecular motion, manifest as heat. DNA polymerase I enzyme can also remove thymine dimers produced due to UV-irradiation and fill the gap due to excision. In such type of movement, when the cilia contract it becomes double and acquires a hook-like shape. There are three important diseases associated with metabolic breakdown of the phenylalanine : (i) Phenylketonuria (PKU). Fig. Kolreuter (1764) described self-sterility in tobacco plant (Nicotiana). The mitochondria appear to catalyze electron transport in the usual way but are much less efficient at producing ATP. Chromomeres. The first evidence came from Drosophila studies in which presumed alleles were found to be pseudoalleles, that is, closely linked genetic units that behaved ordinarily as if they were alleles but were not in exactly corresponding position. A B C D Fig. Hence, lignified tissue is always dead. 10.3. Generalized chemical structure of an antibody molecule (after Alberts et al., 1989). The small subunit (called P20) is synthesized as a precursor weighing 20,000 daltons on free ribosomes; it then enters post-translationally into the stroma to be cleaved to attain its final size. The homozygous creepers having such a gross deformities that they die during incubation. The process by which a membrane is modified chemically and structurally is called membrane differentiation. The muscle cells are also rich in smooth type of endoplasmic reticulum and here it is known as sarcoplasmic reticulum. 3.8. Cross between long-winged and vestigial-winged Drosophila. It deals with the genetics of microorganisms (viz., viruses, bacteria, unicellular plants and animals). The nuclei of the cylindrical, prismatic or fusiform cells are ellipsoid in shape. Each daughter nucleus in later stage is surrounded by the little mass of the cytoplasm and forms the asexually reproducing body such as schizogont, gamont, spore, etc. 14.7. Lake's model of the 70S ribosome. This aminoacyl adennylate enzyme complex then esterifies to specific tRNA molecule. If light winged females are crossed with dark wings, thus, showing that the allele for the light wings, thus, showing that the allele for the light wings, thus, showing that the allele for the light wings is recessive. Subsequently, such monoploids were produced for various crop plants such as soyabean, rice, wheat, mustard, and tobbaco. (iii) Glutelins. A coated-pit may accommodate about 1000 receptors of assorted variety. This DNA is called Z-DNA because of its zigzag structure. The microvilli. It is surrounded by spherical membrane bound vesicles which appear to transport proteins to and from it. The rodFig Phospholipid asymmetry in plasma membrane. Zygotene or Zygonema. Transposable elements can be defined as small, mobile DNA sequences that move around chromosomes with no regard for homology and insertion of these elements may produce deletions, inversions, chromosomal fusions and even more complicated rearrangements. Chromosomal Mutation-I (Cytogenetics : Changes in Structure of Chromosomes) 1 5 . The molecular mechanisms for each of the regulation (Fig. (c) Human sperms. It is important to remember that the capitals D and L refer to structure, whereas the lower case d and l refer to optical activity established before the structure could be determined (see Dyson, 1978). Regulation of Gene Action at the Level of Transcription (a) Chromatin reconstitution experiments. Genotype Men Women Genotypes w dominant in men: www' Forelock Forelock Forelock Normal w' dominant in men: w'w' w'w w 'w' Normal Normal (or) ww 8. Rr 2. Each axoneme is filled with ciliary matrix, in which are embedded two central singlet microtubules, each with the 13 protofilaments and nine outer pairs of microtubules, called doublets. The first meiotic division is also known as the heterotypic division. formation of the embryo. (c) RNA polymerase. If this inbreeding effect is multiplied for many loci, there may be a large reduction in value for many loci, there may be a large reduction in value for many loci, there may be a large reduction in value for many loci. uble in water and crystallizable. Conditions 75 per cent relative humidity; Na+,K+, Cs+, ions 92 per cent relative humidity; low ionic strength 66 per cent relative humidity; Li + ions Very light salt concentration Base pair per turn Rotation per by Vertical rise per by Helical diameter 11 + 32.70 (right handed) 2.56 A0 23A0 10 + 36.00 (right handed) handed) 3.38A0 19A0 9.33 + 38.60 (right handed) - 30.00 (left handed) 3.32A0 19A0 3.71 A0 18A0 12 The B-DNA is found in fibres of living cells at a very high 92 per cent relative humidity and low ionic strength. Photosystem II (PS II). 4.26). Because, male lacks a X chromoMitosis some, therefore, during gametoMeiosis genesis produces two types of gametes, 50 per cent gametes Ova n n carry the X chromosomes, while Sperm the rest 50 per cent gametes lack Fertilization in X chromosomes. (Note : Sex chromosomes, while Sperm the rest 50 per cent gametes lack Fertilization in X chromosomes.) its occurrence and it has no genetical significance. Chemical formula of flavin adenine dinucleotide (FAD). The major sialoglycoproteins of the red blood cell membrane carry the M and N antigens that appears to be plugged by a large central granule (central plug) which is believed to consist of newly made ribosomes or other particles caught in transit. 12.11. Incomplete digestion may be due to absence of some lysosomal enzymes. Define the following : photon; a quantum of energy ; fluorescence; photoelectric effect. Further, the secretory proteins, instead of passing into the cytoplasm, appear to pass instead into the cisternae of the rough ER and are, thus, protected from protease enzymes of cytoplasm. Contents CYTOPLASMIC MATRIX Table 4-7. 12.8. A marriage between a colour-blind male. (a) s/s × r/r (c) s/r × s/s or s/r × r/r (b) A mutant wing phenotype would indicate allelism. Kossel was awarded the 1910 Nobel Prize for demonstrating the presence of two pyrimidines (cytosine and thymine) and two purines (adenine and guanine) in nucleic acids. Why are salivary gland chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in chromosomes of Drosophila commonly used for study of structural changes in ch heteropolymer having two identical α polypeptide chains, each with 141 amino acid residues and two identical β polypeptide chains, each with 146 amino acid residues. Transport vesicles (the classical primary lysosomes) originate from
trans Golgi network to fuse with endolysosome which contains already endocytosed materials for digestion (after Alberts et al., 1989). The cytoplasmic matrix being a liquid possesses the property of surface tension. Overton concluded that the peculiar osmotic properties of living protoplasts are due to a selective stationary barrier lipids movable barrier (b) (a) (a) using this apparatus Gortel and Grendel concluded that RBCs contained enough lipid to form a bilayer. The endoplasmic reticulum acts as an intracellular circulatory or transporting system. A model of DNA polymerase-I found in mammalian cells and is PCNA dependent for enzyme, showing its five-different DNA-synthesis processivity (PCNA=proliferating cell active sites. mRNA synthesis in eukaryotes. (vii) A purine, often dimethylguanylic acid, is located in the "corner" between the anticodon stem and the D stem. At the time of replication, it would be possible for any of the four bases to insert in the complementary newly formed strand. formation of a ring of 12 chromosomes and a bivalent. In rice, one of the high yielding varieties Reimei was developed through mutations isolated after gamma irradiation. They cut, splice and destabilization of U4 snRNP U4 assemble (= do processing of) precursor hn U6 U5 mature RNA. F1 Pink 3.6). Occurrence of various numerical and structural chromosomal variations in human beings (based on data computated by K. Such a diaphragm called annulus has inner nuclear membranes of all somatic cilia is the presence of multiple strands (2 to 6 and up to 11) of particles, called ciliary necklace, at the base of the organelle. It consists of a protein shell built up of 60 structurally equivalent asymmetric protein subunits of approximately 60 A0 diameter, packed together in such a way that they form a spherical shell of about 300 A0 in diameter. Terrestrial ecosystems 195-208 Physico-chemical nature of terrestrial ecosystems and their comparison with aquatic ecosystems; classification of terrestrial eco-systems : biogeographic realms or regions, biomes : tundra biomes, tropical savanna biomes, t called dominant inheritance. Described many animal tissues with a detail that has not been surpassed by any other light microscopist. This step uses two molecules of ATP and involves the following enzymes: hexokinase, phosphoglucose isomerase (or phosphoplucose isomerase) and phosphofructokinase. cause a number of diseases in animals such as Scrapie disease of central nervous system of goats and sheep (in which animals scrape or scratch themselves against some gate post or similar object). the surface of water and picked up by touching two types of endocytosis can occur : pinocytosis and receptor-mediated endocytosis. Distinguish between the term polygene and modifying gene. They occur in abundance in the epithelial cells of lungs and uterus. The foreign DNA fragment (prokaryotic and eukaryotic) can be made to recombine with the plasmid DNA and the product is referred to as recombinant DNA. Nuclei vary in size from about 3 µm to 25 µm in diameter, depending on cell type and contain diploid set of chromosomes. Three per cent of all humans have hereditary diseases which are transmitted in a Mendelian fashion. Growth ; cell growth ; the transmitted in a Mendelian fashion. involved in cell growth— RNA synthesis and cell growth, nucleolus and cell growth, protein synthesis and cell growth; revision guestions. D Albino Genotype = cc. The fragments are separated by agarose gel electrophoresis. Across this double membrane envelope occurs exchange of molecules between chloroplast and cytosol (cytoplasmic matrix). It may position the underlying basal body from which the cilium is originated. A synonymous term for this organelle is the Greek word karyon. The inbreeding because, results in the homozygosity of dominant alleles, therefore, it is a best mean of mating among hermaphrodites and self-pollinating plant species of several families. Peroxisomes differ from mitochondria and chloroplasts in many ways. The molecular weights of the various RNA molecules vary from about 25,000 to over one million. (3) Many of the lines decrease in vigour and fecundity until they cannot be maintained even under the most favourable cultural conditions. 9.13. The precursor polypeptide contains an amino-terminal chloroplast signal peptide followed immediately by a thylakoid signal peptide. sively red eyed individuals. This double helical structure of DNA is found to exist in other alternative forms (such as Aform and C-form) which differ in features such as (i) number of residues (monomers) per turn ("n") or (ii) the spacing of residues along the helical axis ("h") (Table 3-3). 2.3. Transformation experiment of Avery, MacLeod and McCarthy bacteriophages (e.g., T2). Indirect Evidences from classification (taxonomy); evidences from clas homology, analogy (homoplasy), vestigial organs; evidences from comparative embryology : genetic basis of recapitulation; evidences from comparative physiology and biochemistry ; protoplasm chemistry, enzyme similarities, hormonal similarities, comparative serology, amino acid sequence analyses, excretory product analyses, phosphagens; evidences from comparative cytology; evidences from genetics; evidences from biogeographical relations : continental islands; revision questions. TOOLS OF GENETIC ENGINEERING There are various biological tools which are used to carry out manipulation of genetic materials and cells as well. The extragenic suppressor mutation occurs in a different gene from that of the mutant gene. (iii) The energy of light can cause a chemical change in the compound that absorbs it. The removal of enol forms of bromouracil. When eggs are fertilized = Contents DETERMINATION OF SEX AND SEX DIFFERENTIATION 161 juglandis) and honey bees-are known to produce males by homozygosity at a single gene locus. Isochromosomes. (This is the same as the direction of chain growth in DNA synthesis). At this point, a gene or set of genes, called testis-determining factor or TDF, present in the Y chromosome causes the undifferentiated gonad to differentiate into a testis and the absence of this gene allows the gonad to become an ovary. The so-called latency of the lysosomal enzymes is due to the presence of the membrane which is resistant to the enzymes that it encloses. Genetics of virus. Because this woman's clothing leaves little or no skin may also occur by this type of flow (see De exposed to sunlight, her smooth ER may not be able to Robertis and De Robertis, Jr., 1987). Active transport. For example, a honeybee queen (whose diploid number is Ovipositor 32) can lay two types of eggs. The helix of Z-DNA is 18 angstrom in diameter, containing 12 base pairs per turn. 6.2. Expected increase in homozygosity due to inbreeding. The F1 plants were intermediate in size between the two parent varieties. CAP and cAMP bind to one another to form a unit, called cAMPCAP which is an active regulatory element of the lac operon repression loop. Contents GENETICS, HUMAN GENETICS 86 the members of a pair of homologous chromosomes); different gene pairs act independently (so do different chromosome pairs) (Fig. 8.8), etc., provides visible evidence of the activity of genes coding for cell-specific products. 1944 O.T. Avery, C.M. MacLeod and M. Likewise, various cellular components have been separated by ultracentrifugation; different biochemical events of the cell could be known in detail by autoradiography; and methods of tissue culturing have made possible the study of living cells. and De Robertis Jr., 1987; Maclean and Hall, 1987). The chromosomes which are not associated with sex are known as autosomes. cells). In transverse to the longitudinal axis of the body of the organisms. Bacterial viruses or bacteriophages. For this reason, this type of separation is called equilibrium density or isopynic centrifugation (King, 1986). In a normal male (AAXY) the male and female determinants are in the favour of maleness. In F1 generation he expected B A segregation for apricot and white, but to his surprise, he recovered from F2 wild type (red eyes) Wild type eye Lonzenge eye also, showing that the two presumed alleles were Fig. Random inactivation of X chromosome male Drosophila is heterochromatic, even though creates a mosaic of tissue patches. Contents 186 GENETICS, HUMAN GENETICS AND EUGENICS A. In merogony, egg fragments devoid of nucleus develop when fertilized by a normal sperm. When a beam of strong light is passed through the colloidal system, reflect the light. This binding results in an arrow-head pattern to the microfilaments in which the arrowheads all point in the same direction (Fig. (a) Male; (b) ½ (11A + 1X) : ½ 11A; (c) 24. Thus, if both glucose and lactose are present in the growth medium, activity of lac operon is not needed, and indeed, no β- galactosidase is formed until virtually all of the glucose in the culture medium is consumed. It constitutes about 25 per cent of the membrane associated protein mass (about 2.5 x 105 copies per cell). The glycosidic bonds are established between carbon 1 and 4 of glucose (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages
between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points, which involve linkages between carbon 1 and 6 (i.e., α -1 \rightarrow 4 linkages) except at the branching points at the the gap. 5.1) for measuring the specific minimum surface area occupied by a monomolecular film Contents PLASMA MEMBRANE AND CELL WALL of lipid and the force necessary to compress all the lipid molecules into this area. Cysteine was attached to its tRNA (tRNA cys) by cysteinyl tRNA synthetase to form cysteinyl tRNA (cys-tRNA). Thus, the anticodon is extended into the nearby sequence and consists of in all 12 nucleotides arranged in the following way: (i) two nucleotides of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotide); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotide); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotide); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides of anticodon being very important and termed cardinal nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotides); (iii) two nucleotides at the 3' side of anticodon (3' nucleotide loop; and (iv) five pairs of nucleotides in the anticodon stem which can be conveniently written by giving only the bases on 3' side of the stem (Fig. (b) Waxes. a and Cyt. In cell biological studies, the following two types of microscopes are most extensively used : Light Microscopy The compound light microscope uses visible light for illuminating the object and contains glass lenses that magnify the image of the object and focus the light on the retina of the observer's eye. of Botany of Delhi University (Guha and Maheshwari, 1967). B also contributes 50 per cent of his genes to A. Therefore, it forms trivalent which may take a variety of shapes in primary and secondary trisomics (Fig 15.14). A-Elongated in counts. Describe the method of isolation of lysosomes in the cells of plants and animals. The former is known as vasectomy and the later is splengectomy, somal genes, inherited as a unit Contents 16 GENETICS, HUMAN GENETICS from one parent, or the entire genotype of a cell or individual. 6.6. Wobble hypothesis. This pale-staining part represents the innermost region of nucleolus. ters, one at the site of each future nucleus. Assembly of IFs A current model of assembly of a intermediate filament includes the following steps : 1. 3.19. Two dimers then line up side-by-side to form a 48 nm by 3 nm protofilament containing four polypeptide chains. OH OH The fourth and most rare, the A B blood group or type, was discovered HN CCH3 in 1902 by two of Landsteiner's OH students, Von Decastello and Sturli. This diagnosis could not be made until several months after birth, as the gene is inactive before that time. interaction and as a part of binding site for initiation factors of protein synthesis. These channels allow diffusion of solutes. This enzyme is likely to make DNA less available for transcription, and factors that antagonize methylation principle to R strain Thus, Hershey and Chase experiment proved that growth DNA entering the host cell carries all the genetic information or synthesis of new phage particles, R strain culture containing hence, is the sole genetic S transforming both S and R cells principle material in DNA Fig. Rather it appears that new centrioles are either produced de novo or are synthesized using an existing centriole as some form of template (semi-autonomous replication). They contain homogeneous and granular acid mucopo- Contents CELL BIOLOGY 354 nucleus vitelline membrane chalaza shell air space yolk C vegetal pole B micropyle shell nucleus cytoplasm yolk D Fig. Table 1-1. In positive regulation an effector molecule must bind to the DNA (after Freifelder, 1985). Therefore, some laws should be formulated to prevent the late marriages of highly endowed persons by applying high taxation on them and at the same time the young persons having best hereditary traits should be encouraged for early marriage. Glycoprotein Percentage of carbohydrate Function 1. The pyruvic acid generated in the bundle sheath cells is transferred back to the mesophyll. In these insects, queen and workers are diploid females. During diakinesis the chiasma moves from the centromere towards the end of the chromosomes and the intermediate chiasmata diminish. Splicing. He named this organelle, the bioblast. A— Left-handed helix formed by the amylase polysaccharide; B—"Bush"- or "tree-like" structure of the glycogen molecule. Developed the microtome for cutting serial sections of tissue for cell study. A prokaryotic cell of cyanobacteria (electron microscopic view). Origin of Life 141-162 Historical and theories : special creation theory, Hindu concept of origin of life, theories of spontaneous generation, hypothesis of panspermia, theory of chemical evolution and spontaneous origin of life at

molecular level, experimental support of Oparin's hypothesis — Miller's experiment, proteoid microspheres, CairnsSmith's model, RNA first model, why RNA and not DNA was the first living molecules; process of origin of life : structure of cosmos, primitive earth, prebiotic synthesis, evolution of progenote— origin and evolution of RNA world, origin and evolution of ribonucleoprotein (RNP) world, origin of progenote, retrograde evolution, adaptive radiation in progenote, evolution, adaptive radiation of surface membrane hypothesis; molecular evolution, examples of protein evolution — insulin, haemoglobin, cytochrome c, neutral theory of protein evolution; revision questions. 3' TIGCA TGACG 5' because of pairing qualities of deoxyribonucleotides. The T-antigen, using its DNA-binding domain, forms a multi-subunit complex with site I and site II in the presence of A TP and caused local unwinding. The shortest strand represents the small dotlike IV chromosome. It is also called Kornberg enzyme. Contents 300 CELL BIOLOGY The HMM binding method has become a very useful method for identifying and localizing microfilaments in any type of cell. When a cell dies, the lysosome membrane ruptures and enzymes are liberated. The term viroid was coined by Diener (1971) who discovered the first viroid, called potato spindle tuber viroid or PSTV. Contents GENETICS, HUMAN GENETICS AND EUGENICS 74 B (iii) The sum of these two pathways, the coefficient of relationship, between the full sibs B and C = $\frac{1}{4} + \frac{1}{4} = \frac{1}{2} = 50$ per cent. Evidently nucleosomes continue to be present on most transcriptionally active DNA sequences, but they are probably reduced in number. Tautomerization Common form Uncommon tautomer H NH2 5 6 4 Cytosine NH N 1 3 N N 2 A O Pyrimidines 5 6 3 N 2 4 Thymine CH3 O CH3 OH 1 NH N N O O N 8 9 N Adenine N NH2 H N 7 5 6 3 1 N 2 4 N N NH N Purines In a DNA molecule, N OH N O normally, the purine, adenine (A) is linked to the 8 7 pyrimidine, thymine (T), 5 6 N 9 N 4 1 NH by two hydrogen bonds, N 2 3 while the purine guanine Guanine N N (G) is linked to the pyrimiNH2 NH2 dine, cytosine (C) by three hydrogen bonds. Give a comparative account of light microscopy and electron microscopy. Haemophilia Glucose-6-phosphate dehydrogenase deficiency Ornithine transcarbamoylase deficiency Antithrombin - 3 deficiency Cholesterol metabolism/heart disease Cancer Leukemia, lymphomas Immune deficiencies Contents EUGENICS, EUPHENICS AND GENETIC ENGINEERING 253 (ii) Embryo therapy. (a) Deletion; (b) Inversion; (c) Duplication. Many other pigments of animal cells such as myoglobin and cytochromes have porphyrin rings in their molecules. According to them, the synaptonemal complex pulls homologous chromosomes into approximate association with each other but plays no role in molecular pairing of DNA strand. The technique of designed genetic engineering of living cells has many potential applications. Expressivity. The white-eyed female contains the XWXW X+Y gene 'ww' located on both X White eyed Red eyed chromosomes. This is the outermost region of the nucleus where processing and maturation of pre-ribosomal particles occur. 5' - OH. Preparations spread for electron microscopy exhibit the typical 'christmas tree" images with nascent ribonucleoprotein contraction biosynthesis of cell material The ATP consists of a purine base adenine, a pentose sugar riactive transport bose and three molecules of the transmission of impulses phosphoric acids (Fig. Nuclear lamina has contact with the chromatin (or chromosomes) and nuclear RNAs. The inner nuclear membrane is surrounded by the nucleous outer nuclear membrane, which closely renuclear matrix sembles the membrane of the endoplasmic reticunuceloplasm lum, that is continuous with it. ISOLATION OF GENES cleavage with same restriction endonuclease anneal with DNA ligase recombinant plasmid Fig. Recently it has been found that in the cells exists a complex set of heterogeneous membranebound tubes and vesicles, called endosome, which extends from the periphery of the cell to the perinuclear region, where it lies quite close to Golgi apparatus. In these cases the haploid individuals are always males and the diploid individuals are the females e.g., 1. Transposed duplication. Such a vectorial organizab tion of membrane proteins has been experimentally Matrix proved. Direct DNA Sequencing Using PCR band position 118 electrophorese DNA from four tubes in (D) above represent these 15 fragments identified by nucleotides at their ends T T G GA G GA C C C G G A A T A C CT C CT GGGC C T T A sequence inferred from above Maxam and Gilbert's chemical degradation method for sequencing of DNA. The phenomenon of adsorption helps the matrix to form protein boundaries. It has been shown that L4 ribosomal protein can inhibit the translation of several of these ribosomal proteins from the polycistronic mRNA (Fig., 14.11) (Yates and Nomura, 1980; Dean et al., 1981). Contents 74 CELL BIOLOGY oxidase. Thus, these flies are the phenocopies of yellow mutant, but would give rise to wild type brown flies in normal environmental factors; essential elements and limiting factors, Liebig - Blackmann law of limiting factors; threshold and rate; Shelford's law of tolerance; light on the plants, effect of light on the plants, effect of light on the plants, effect of light on the plants, light variations in different environment, effect of light on the plants, effect of light on the plants different environments, range of temperature tolerance, poikilotherms and animals; thermal adaptations to fire, effect of fire, adaptations to fire, effect of fire, adaptations to fire, wind factor; physiographic factors: latitudes and altitudes, height of mountain chains, direction of mountains and valleys, steepness of slope; revision questions. 4.5. Complementary genes. They partially purified the transforming principle from the cell extract (i.e., cell free extract of S-III bacteria) and demonstrated that it was DNA. Lethal mutations. The infundibuliform ciliary movement. Hydrases, 9. The random type of synapsis occurs at various points of the homologous chroAnaphase mosomes. Fawcett and Ito (1958), Thiery (1958) and Rose and Pomerat (1960) have made various important contributions to the endoplasmic reticulum. Basically an infectious virus particle (called virion) is composed of a core of only one type of nucleic acid (DNA or RNA) which is wrapped in a protective coat of protein, called capsid. Virus 1. The hormones activate or depress the gene at the Hormones control metamorphosis in insects. This exciting finding in molecular biology gave rise to the concept of "central dogma reverse" or teminism, suggesting that the sequence of information flow is not necessarily from DNA to RNA to protein but can also take place from RNA to DNA. Contents 146 CELL BIOLOGY The cell coat is a 10 to 20 nm thick layer and is in direct contact with the outer leaflet of the plasma membrane. interphase cell + + + + + centrosome ciliated cell centriole + + mentally deficient, with widely spaced incisors, with pigmented patches on skin, with excessive sweating, and with non-pigmented hairs and eyes. The protein comprising a prion has a molecular weight between 50,000 to 100,000, corresponding to a particle size that is 100 times smaller than the smallest virus (see Sheeler and Bianchi, 1987). Contents REGULATION OF GENE ACTION 95 The i gene specified a product (called repressor) that promoter repressor could diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from the site structural gene of transcription and transA i z y a plation to the altogether diffuse from transcription and transcription and transcription and transcription and transcription and transcription and transcr Mechanism of lac operon. In many plant cells, there are tunnels running through the cell wall called plasmodesmata which allow communication of 80S ribosome into 60S and 40S subunits. Because it is always transferred to the NH2 group on the side chain of an asparagine residue of the protein, this oligosaccharide is said to be N-linked or asparagine-linked (Fig.6.5 A). In the animals with large yolky eggs such as molluscs, selachians, urodels, reptiles and half had normal wings. These reactions are found to be independent of light and are called
dark reactions, Contents 222 CELL BIOLOGY biochemical reactions, Calvin cycle or C3 cycle (since it involves the formation of a 3-carbon product). The centromeres of the chromosomes bear no loops. When the mitochondrial cristae are disrupted by matrix space sonic vibrations or by detergent action, they produce submitochondrial vesicles of inverted orientation. Elongation of DNA chain. The oligosaccharide is built up sugar on the membrane-bound dolicol (towards the cytosolic side) prior to its transfer to a protein. Protein Synthesis 8. The cytoplasmic matrix consists of various kinds of ions. Because a gamete can contain only one chromosome of a homologous pair, therefore, each gamete can carry single allele R or r. Thus, cells may have diverse shapes such as polyhedral (with 8, 12 or 14 sides; e.g., squamous epithelium); flattened (e.g., squamous ep follicles); columnar (e.g., the cells lining the intestine); discoidal (e.g., red blood cells or erythrocytes); spherical (e.g., nerve cells or neurons); or branched (e.g., chromatophores or pigment cells of skin). A virus is neither an organism nor a cell, yet it consists of a core of nucleic acid (DNA or RNA) enclosed in an external mantle of protein. 18.12. 1.3 mg (boys) Yeast; whole cereals 1. Having no protein coat or capsid, they exist as naked RNA molecules and pass from plant to plant there is no membrane barrier for the insert into endosome membrane viroid to pass (see Alberts et al., 1989). The concepts of Wiener and Fisher has been compared in Table 10-4. Once the phage is attached to its prospective host, injection can take place involving a movement of phage back in the phage is attached to its prospective host. of the tail into the bacterium. Since DNA is 2nm wide, there is a possibility that a single fibril corresponds to a single DNA molecule. Functions of DNA polymerase-I enzyme. Erythroblastosis fetalis. Live Smooth (S) and rough (R) characters IIR are directly related to the presence or absence of the capsule and this trait is known to be genetically determined. The chloroplasts of polyploid plant cells are comparatively larger than the chloroplasts of the diploid plant cells. Polyneuritis. If too much free cholesterol accumulates in a cell, this stops cell's own cholesterol accumulates in a cell, this stops cell's own cholesterol accumulates in a cell the synthesis and the synthesis and the synthesis of LDL-receptor proteins, so that less amount of it is taken up by the cell (Brown and Goldstein, 1984, 1986). Describe the process and mechanism of fertilization in animals. 8.4. Coordinate repression in Salmonella typhimurium. The slide section cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is then removed and background over cell silver grains labelled precursor is the removed and background over cell silver grains labelled precursor is the removed and background over cell silver grains labelled precursor is the removed and background over cell silver grai for long that some plants just will not self-pollinate in contrast to selfing in pea plant by Mendel. The stability of different microtubules varies. Studied fine structure of the flagellum of sperm. The plasma membrane is followed by the colloidal organic fluid called matrix or cytosol. The glyoxysomes and it involves some of the flagellum of sperm. the reactions of the Krebs cycle in which citrate is formed from oxaloacetate and acetyl-CoA under the action of citrate synthetase enzyme. The gametic mutations only form the raw material for the natural selection. Due to a mutation in a gene photoreactivation type reverse regulating a critical stage during development it possesses two thorax mutation reversal of ultraviolet in- segments and thus two sets of wings. 4.41. (2) Ribosomal DNA was isolated by density gradient centrifugation). Smooth (S) forms sometimes mutate Live mouse Dead mouse to rough (R) forms, but this change has not been found reversible. In recent years, such successes led to the concept of "Green Revolution". These granules contain phycobilisomes. Punnett and Bailey (1914, 1923) have reported first case of transgressive variation from a cross in between a large Golden Hamburg chicken with the smaller Sebright Bantam variety of chicken. The cell becomes spheroid, more refractile and viscous. (c) There is a constant and universal requirement for the products of certain genes in all cells and at all times. Force is generated when dynein arms move. ova of frogs and In spring and early summer, when food is abundant, aphid females reproduce parthenogenetically. The chromosomes are specific in number, shape and size to a particular species. Thus, on an average, nucleosomes repeat at intervals of about 200 nucleosities or base pairs. Both exocytosis and endocytosis involve the fusion of initially separate regions of lipid bilayer and occur in at least two steps : first the two bilayers come into close apposition, it is called bilayer adherence, and then they fuse together (This is called bilayer adherence, and then they fuse together (This is called bilayer adherence, and then they fuse together (This is called bilayer adherence, and then they fuse together (This is called bilayer adherence, and then they fuse together (This is called bilayer adherence, and then they fuse together (This is called bilayer adherence, and then they fuse together (This is called bilayer adherence). one enzyme molecule exists per 150,000 base pairs of DNA (Maclean and Hall, 1987). Nilsson-Ehle (1908), East (1910) and C.B. Davenport (1913) demonstrated segregation and independent assortment of genes controlling quantitative traits such as kernel colour in wheat, corolla length in tobacco and skin colour in negro and white population of USA, respectively. It is found both in nucleus and cytoplasm. Each pair of centrioles migrates to the opposite pole. Amino acids. Isolated lysosome relative to the mRNA strand. Similarly, a tautomeric shift may occur in thymine changing it form the keto (C= O) form to the rare enol (COH) form. of the genes in the family, coding for subunit C, is active only in spermatocytes within the developing testes. Contents 194 GENETICS, HUMAN GENETICS phenotypic characteristics in a polyploid organism : (i) Morphological effect of polyploidy. What are three components of a nucleotide ? But in certain animals, e.g., mammals and Mollusca, etc., there are somatic cells lying in between germinal cells, these somatic cells are known as Sertoli cells. The cell coat is found to be equivalent to the oligosaccharide side chains of glycolipids and glycoproteins that stick out from the cell surface and are covalently attached to protein moieties. What are multiple alleles ? A fatty acid molecule is amphipathic and has two | distinct regions or ends: a long hydrocarbon chain, which is hydrophoH - C - OH bic (water insoluble) and not very reactive chemically, and a carboxylic | - acid group which is ionized in solution (COO), extremely hydrophilic H (water soluble) and readily forms esters and amides. They control the important biosynthetic activities of the cell and carry hereditary informations from generation. Calvin was awarded the Nobel prize in 1960. N.L. Dhawan and R.L. Paliwal (1964) studied the cytoplasmic inheritance in maize. The appearance of white colour in F2 generation indicates that in the hybrid the allele (R) for red colour but does not mix with it or contaminated by it and it separates or segregates during gametogenesis. crassa, first isolated by Mitchell and Mitchell (1952). When the cross takes place between the parents differing in a single pair of contrasting characters resulted into a monohybrid individual. As a result of the chromosomes, the chromosomes break at the point of contact and, thus, recombination of three lines of maize, the chromosomes break at the point of contact and, thus a result of the chromosomes break at the point of contact and, thus a result of the chromosomes break at the point of contact and the chromosomes break at the point of contact and the chromosomes break at the point of contact and the chromosomes break at the point of contact and the chromosomes break at the point of contact and the chromosomes break at the point of contact and the chromosomes break at the point of contact and the chromosomes break at the point of contact and the chromosomes break at the point of contact and the chromosomes break at the point of contact and
the chromosomes break at the point of contact and the chromosomes break at the point of contact at the chromosomes break at the point at the chromosomes break at the point at t derived from a variety, found to be fairly tolerant to inself-fertilized for 30 generations. Such sort of synthesis was conducted through condensation between hydroxyl group at 5' position of the eukaryotic genomes must be of a non-coding nature. In contrast, in a biosynthetic pathway the final product is often the regulatory molecule. 4.11). Vimentin is widely distributed in cells and white blood cells, Desmin is found in both striated (skeletal and cardiac) and smooth muscle cells. So, the frequency of gametes with the haploid set or n number of chromosomes will be (½)n. By genetic engi- The most successful example of gene therapy. Purple, red and white flowers of pea. Leucoplasts (Gr., leuco = white ; plast = living) are the colourless plastids which are found in embryonic and germ cells. How are the centrioles and basal bodies (kinetosomes) are originated in the cell ? 0 2 4 6 8 10 12 14 16 Generations Inbreeding depression is found Fig. Polyspermic fertilization. This complex accepts electrons from ubiquinone (Q) and passes them to cytochrome oxidase complex These enzymes are likely to affect the transcription, especially in vitro cellfree systems, by introducing into DNA nicks that may serve as initiation sites for some polymerases. The theta structures reveal the protein is stick on the outer surextended but different on the two faces of the membrane (after Thorpe, 1984). Contents 220 GENETICS, HUMAN GENETICS, HUMAN GENETICS, HUMAN GENETICS AND EUGENICS It is easy to understand that the results of a reciprocal cross that is, of P the fertilization of the eggs of a homozygous dextral individual (S+S+) + + SS S S by the sperm of a sinistral SS sinistral S+S+ dextral sinistral individual (SS)—will dextral lead to a somewhat difS+ egg S sperm S egg S+ sperm ferent type of pedigree : the F1 generation again all dextral (with genotypic ratio of F1 1S+S+:2S+S : ISS). The phenomenon of molecular, morphological, physiological or behavioral differentiation between male and female sexes is called sexual dimorphism. The channels are made by particles in each membrane that traverse the intercellular space. These bacteria are spherical or round in shape. 12.19. These tracers are detected by their electron opacity. The back cross of an F1 with parental types with a frequency that is suggestive of three or four polygenes influencing the trait. According to their effects on the phenotype mutations may be classified as lethals, subvitals and supervitals. Under the EM, the kinetochore appears as a plate - or cup-like disc, 0.20 to 0.25 nm, in diameter situated upon the primary constriction or centromere. Certain chemical mutagens affect DNA directly. the nuclear pores. This technique was used in the laboratories of Ochoa and Nirenberg and led the deduction Contents MOLECULAR BIOLOGY 70 of the composition of codons for the 20 amino acids. 3.11. M. Give an account of the structure of a typical animal cell. Genetical Basis of Heterosis The genetical basis of heterosis is still a subject of controversy and following two hypotheses have been propounded to explain it : 1. Their paper published in the British Journal Nature in which they proposed the molecular structure of DNA, i.e., the molecular structure of the molecular structure of DNA, i.e., the mol heterozygous condition of this lethal gene (Cc) results in a mild form of the disease called thalasemia minor or microcythemia (see Gurdon, 1968). progeny of unaffected parents. HISTORY The primary aim of many of the ancient systems of eugenics was to produce a race of physically perfect human beings. The Greeks had definite ideas regarding eugenics. This generalization is now known as chromosome theory of inheritance (or of heredity). Most of these are inhibitors of protein synthesis. from the sperm head. Phenotype 1. 11.3. A—Distribution of chloroplasts in mesophyll cells of a leaf; B— a lower chlorophyll a/b raUltrastructure of a chloroplast; C—Details of a granum (after Alberts et al 1989). reduced. The plasma membrane encloses a space consisting of hyaloplasm, matrix or cytosol which is the ground substance and the seat of all metabolic activities. Examples of Transposons 1. Both the allele R and r remain together for long time but they do not effect each other. The lamins form dimers that have a rod-like domain and two globular heads at one end. nerve processes, 4. A thin membrane in the form of a tube is filled with the solution containing the molecules to be separated. This type of growth is called multiplicative growth and occurs in embryos during morphogenesis. Such electrical coupling is found extensively in embryonic cells. It is thought that 2-AP acts by "switching" pyrimidines : for example, it may be incorporated opposite thymine during one round of replication and then pair with a cytosine at the next round to produce an AT \rightarrow GC transition (see Goodenough and Levine, 1974). There is a "master" copy at each chromomere and information is transferred from this to each of the "slave" copies which are matched against it to ensure that they are all identical to the master. The hairs on his body were quill-like Nonbarred Barred and he subsequently has been referred to as the "porcupine man". Molecular Structure of RNA RNA molecule may be either single stranded but not helical like DNA molecule. of endoplasmic reticulum is found abundantly in those cells, and liver cells, and concentration of actin in non-muscle cells is surprisingly high ; it may + HMM nonactin undecorated account up to 10 per cent of total cell protein. DEFG In all, 21 types of proteins have been isolated in smaller subunit (30S) of ribosome of E. Transcription of a section of the DNA of E. Phosphatases : Hydrolysis of phospholipids 8. Spectrin is a heterodimer and consists of two non-identical, antiparallel, loosely intertwind, flexible glycophorin Å polypeptide chains, i.e., α-spectrin band 3 (~ 240,000 daltons M.W.) and βThe plasma membrane of the human erythrocyte. Process of cell division, whereby the generated. 13.16. It involves the study of heredity of quantitative traits such as height, weight and IQ in human beings and milk production in cattle. By utilizing six ATP molecules of 1,3, diphosphoglyceric acid (i.e., 6C × 3C = 18C; 3C from 3 RuBP). They form a band that form a girdle around the inner surface of the plasma membrane. desmotubule Lignification. Even the embryological development of a multicellular individual (egg). MICROSCOPY In the search for information about the structure and composition of cells, the cell biologists immediately face two limitations : the exceedingly small dimensions of cells and their component parts and the transparent nature of cells. Nor does chopping glucose into smaller carbon fragment oxidize the glucose. assembly. Such as out of two allelomorphs of a single gene, one allelomorph might show simple (complete) dominance over the action of other which was recessive; or both allelomorphs might have partial or incomplete dominant relationship or both allelomorphs might have partial or incomplete dominant relationship or both allelomorphs might have partial or incomplete dominant relationship or both allelomorphs might have partial or incomplete dominant relationship or both allelomorphs might have partial or incomplete dominant relationship. Friedrich Miescher, a 22-year old Swiss physician (working in the laboratory of Felix Hoppe-Seyler in Tubingen) had isolated from pus cells obtained from pus cells obtained from background from salmon sperm, a previously identified macromolecular substance, to which he gave the name nuclein. ULTRASTRUCTURE The cavities of cisternae, vesicles and tubules of the endoplasmic reticulum are bounded by a thin membrane of 50 to 60 A^o thickness. Gupta, 1994). Secondary constriction. During the development of the matrix always move in zig- Fig. However, rare or prolonged conjugation (i.e., lastRr rr ing for long time) permits mixing of cytoplasm of both cons F jugants and results killers only. Suberin is a water-resistant substance, comprisig of fatty acids and found in the cork and cell wall of many plants. There is only one kind of glycerol : its molecular configuration H - C - OH shows no variation and it is exactly same in all lipids. The exchange of the genetic material between the homologous chromosomes does not occur. Thus, there is a distinction between male and female genital sex. There ence; within each blade the tubules twist from are nine groups of three microtubules (after one end to the other or describe a helical between the homologous chromosomes does not occur. De Witt, 1977). ENVIRONMENTALLY CONTROLLED SEX DETERMINING MECHANISM In some organisms, the environment determines the sexual phenotype of the individuals. Hormones are the complex organic compounds which occur in traces in
the cytoplasm and regulate the synthesis of mRNA, enzymes and various other activities. The differentiated cells of organs and tissues of the body lose the capacity of division and growth (e.g., muscles, nerve cells, osteocytes of bone, fat cells, xylem, phloem, parenchymal cells, etc.). Differences in reciprocal crosses which cannot be attributed to six-linkage or some other chromosom implicate extranuclear factors (e.g., chloroplast inheritance in Mirabilis jalapa). Regarding the origin of the mitochondria, several hypotheses have been postulated which are as follows: 1. Determine the chromosome number and level of ploidy for each of the following : (a) F1; (b) F1 backcrossed to R. Moreover, the size of the nucleus is related with the number of the chromosomes or ploidy. Cells produce their own chromosomes, proteins, membranes and other constituents and these materials are partitioned into progeny cells after a division process in the presence of suitable electron acceptor (e.g., ferricyanide) 2H2O + 4Fe3 + Ferricyanide illuminated chloroplast ——— \rightarrow O2 + 4 H+ + 4Fe2 + Ferrocyanide In 1941, Ruben and Kamen used O18 to show that in photosynthesis oxygen comes from water. For example : AA BB CC DD 8 Contributing alleles Larger than Golden Hamburg Aa BB CC DD 7 , , , Aa bb cc dd aa bb ,, No contributing allele (physiological minimum) } } Smaller than Sebright Bantams MODIFIERS OR MODIFYING GENES The inheritance of certain traits is governed by a single pair of genes which determines the presence or absence of the trait plus a number of multiple genes which determine the extent of the trait. AMP, d CMP, d cc dd 1 0 Contents REPLICATION OF DNA 35 GMP, and d TMP) with two additional phosphate groups attached to the initial or a. Contents ENDOPLASMIC RETICULUM (ER) 155 cell may contain many ribosomes). Each human erythrocyte contains about 106 and band 3 proteins, each of which forms either a dimer or tetramer in the membrane. In addition they usually contain sugars, salts, acids and nitrogenous compounds such as alkaloids and anthocyanin pigments. 18.4). 10.19. The other member of the heteromorphic pair is never found in females; she called this the Y chromosome. (An amino acid residue is that which is left when the elements of water are split out during polymerization). Oscar Hertwig (1875) observed the entrance of the sperm into the sea urchin. COMPARISON OF MICROTUBULES, INTERMEDIATE FILAMENTS AND MICROFILAMENTS The three components of the cytoskeleton, namely microtubules, intermediate filaments and editors have remained quite. choosy and vigilant regarding relevance and authenticity of each and every illustration/picture finding its place in this textbook. high G + C high A + T strand last base transcribed A transcription mRNA terminus B Fig. Got Nobel Prize for his studies on biological oxidation and the involvement of vitamine C. (This is called tetranucleotide hypothesis). In short, the selective permeability of the plasma membrane allows the cell to maintain a constant internal environment (homeostasis). After the karyokinesis, cytokinesis occurs and two haploid cells are formed. It is found more important in vegetatively propagated perennial plants. (a) membrane exhibits a tri-laminar (i.e., three-layered) structure with a translucent layer sandwiched between two dark layers. chromomere have questioned the occurrence of pellicle and matrix in them. In 1927, a Russian geneticist, G.D. Karpechenko performed a cross between radish (Raphanus sativum, 2n = 18) and cabbage (Brassica oleracea, 2n = 18) and cabbage (Brassica oleracea, 2n = 18) and occur mostly on the ribose moiety (producing 2'-O- methylations) and 28S (71 methylati ER performs the following functions of the cell : 1. In humans several hereditary diseases have lethal effects. In fact, the gene for haemophilia is a recessive sex-linked lethal, since it may cuse death. The operator gene, in its turn, is under the control of a repressor molecule synthesized by a regulator gene, which is not a part of the operan. Each individual gets only a sample half of his genotype from one of his parent, each arrow in the above arrow diagram represents a probability of half. are also called spirochetes. Model of a DNA replication fork in prokaryotes during elongation. By that time, biochemists had discovered many fundamental intracellular chemical reactions. For example S1/S2 plants if pollinated by S1/S2 pollen would set no seed because neither S1 nor S2 could affect fertilization. The somatic cells form sperm and ova. The cartilage proteoglycan is found extracellularly in cartilage and bone. Thus, at the end of S phase, each chromosome has two DNA molecules and a duplicate set of genes. Similarly, the organelles within the cell often have a difference. The acidic proteins either occur in the nucleoplasm or in the chromatin. For example, early in this century a new wheat strain called Marquis was developed in Canada. So it is used in reducing water pollution due to petroleum spillage. Tryptophan, which has only one codon. The direct repeats are not considered part of the transposon. EVIDENCES FOR CYTOPLASMIC FACTORS Traits with extranuclear basis are identified by the accumulated evidence from a number of the transposon. diagnostic criteria such as follows : 1. These proteins are produced in such small quantities in humans that the cost of their extraction and purification from tissues has been very expensive, thus, restricting their medical use in prophylaxis (prevention) and therapeutics (treatment) of disease. Mendel's Dihybrid Cross In one of his hybridization experiment Mendel crossed a homozygous pea plant having yellow round seeds with the homozygous pea plant having green wrinkled seeds (Fig. Described and named microbody in mouse kidney tissue. Described the scanning hypothesis for initiation of translation by eukaryotic ribosomes. tion regarding the structure and properties of the plasma membrane. Inheritance of eye colour in Drosophila due to primary non-disjunction of sex chromosomes. Nineteen of the twenty biologically important amino acids are included in the globin of haemoglobin. Likewise, males are found totally lacking in the lizard Lacerta sexicola armeniaca (Lantz and Cyren, 1936). Functions of synaptonemal complex. Isolation and Use of Restriction endonucleases which cut the DNA double helix in very precise ways. At molecular level, it consists of a continuous bilayer of lipid molecule (i.e., phospholipids and cholesterol) with protein molecules embedded in it or adherent to its both surfaces. coli. Mucus (=a glycoprotein) secretion by goblet cells of intestine ; 3. How many of the 64 triplets will contain (1) no adenine, (2) at least one adenine? Each of the 20 amino acids occur in the cytoplasm in an inactive state. Similarly merino sheep are widely known as fine wool producers. Cell 32-68 Viruses ; cells of cellular organisms ; prokaryotic cells - mycoplasma or PPLO, Escherichia coli, cyanobacteria or blue-green algae; eukaryotic cells - mycoplasma or PPLO, Escherichia coli, cyanobacteria or blue-green algae; eukaryotic cells - mycoplasma or PPLO, Escherichia coli, cyanobacteria or blue-green algae; eukaryotic cells - mycoplasma or PPLO, Escherichia coli, cyanobacteria or blue-green algae; eukaryotic cells - mycoplasma or PPLO, Escherichia coli, cyanobacteria or blue-green algae; eukaryotic cells - mycoplasma or PPLO, Escherichia coli, cyanobacteria or blue-green algae; eukaryotic cells - mycoplasma or PPLO, Escherichia coli cytoplasm, nucleus; revision questions. For their activity many proteins also depend on being complexed into compound proteins together with other subunits, either the same or different in nature. (i) Activation. Offspring individuals. As meiosis proceeds further, number of loops gradually decreases and the loops ultimately disappear either due to disintegration or by reabsorption back into the chromosome mutations are inherited once they occur and are of the following types : A. 239 protoplast chloroplast membrane vesicles primary granum crystal lattice Origin of Amyloplasts The starch development begins with the formation of a particle in the stroma. 11.7. A—rII region of T4 phage showing two cistrons; B-Gene map of rII locus. role since both possess the same genes. Arginine has six codons. For example, parthenogenesis in animals and apomixis and self-fertilization in plants are the most extreme type of inbreeding. If we suppose, that a quantitative trait is governed by four genes. Karyotype of true hermaphrodites may be 46, XX or 46, XY. Nocard and E.R. Roux in 1898 while studying ribosomes pleural fluids of cattle suffering from the disease pleural fluids of cattle suffering fluids s and lung inflammation). Differences Between Genetic and Chromosome Maps The frequency of crossing over usually varies in different segments of the chromosome but is a highly predictable even between any two genes loci. Why are most mutations in structural genes recessive to their wild type alleles? Thus, Coat colour in mice is govwhen two yellow coated heterozygotes (AYA) are crossed, they produce erned by multiple alleles. This membrane comprises two basic layers : 1. Further, the meiospores may be enclosed in two different ways: (1) Unordered tetrads, e.g., Saccharomyces cerevisiae (baker's yeast), Chlamydomonas rheinhardi (green alga), Aspergillus nidulans (green bread mold). By visualizing these similarities between proplastid double chloroplast membrane proplastid phase flattened cisternae granum Fig. The complete β-oxidation chain can be represented as follows : Activation Oxidation Fatty acid — \rightarrow Fatty acid occurs in glyoxysomes (Cooper and Beevers, 1969). When two such white coat colours appear in 12 : 3 : 1 ratio as shown in (Fig. body fluids, or in the case of marine animals, the sea water. Mycoplasma gallisepticum (0.25 µm in diameter) is parasitic and pathogenic; it is the parasite of cells
and cell exudates of respiratory organs of warm-blooded animals causing in them various chronic respiratory diseases. Liebig, in 1845 indicated that carbon dioxide was the source of all organic compounds synthesized by green plants. Contents CYTOPLASMIC MATRIX 85 They are esters which are formed due to reaction of organic acids with H | alcohols. 1973 S.H. Kim suggested three dimensional structure, i.e., L-shaped model, of tRNA. 1 2 3 4 5 6 7 8 the chromosome and the se 5 6 7 8 quences of genes are the same in Pachytene normal and duplicated region. CAAT box sequence lies between -70 and -80 base pairs and includes GGT/ACAATCT base composition. The production of an infinite variety of genotypes has much higher evolutionary significance in the sense that the better genotype can be selected and perpetuated by natural selection. Example Combs in fowl (9:3:3:1). The tubules are branched structures forming the reticular system along with the cisternae and vesicles. B. φ × 174 bacteriophage. The A: T pair, thus, can be converted to a G: C pair. The copper (Cu), manganese (Mn), molybdenum (Mo), zinc (Zn) are useful as cofactors for enzymatic actions for en Only those with the genotype aa bb would produce plants with top-shaped capsules. Continuous synthesis of enzymes, either linear or exponential, is typical of many respiratory enzymes in mouse fibroblasts. About 60 per cent of the rRNA is helical (i.e., double stranded) and contains paired bases. This cDNA has been replicated to get multiple copies of the rat insulin gene. Discuss the evolutionary advantages of the haplodiploid scheme of sex determination. Since an electrochemical gradient, that drives ATP synthetase, is established across this membrane by the respiratory chain, it is important that the membrane by the respiratory chain, it is impor types of sex expressions in higher plants. The Gram staining method is named after Christian Gram who developed it in Denmark in 1884. If the medulla was stimulated to develop, it was thought to This individual has the vitelline Contents GAMETOGENESIS 353 membrane, while in tunicates and fishes this memsecondary oocyte brane is known as the chorion. Inside and separated from the outer membrane (Fig.10.4). Due to its wide application in various branches of biological science, many new hybrid biological sciences, have sprung up. Explain the difference between a transition and a transversion and give an example of each. Inner mitochondrial membrane is rich in many enzymes, coenzymes and other components of electron transport chain. ISOLATION Mitochondrial membrane is rich in many enzymes, coenzymes and other components of electron transport chain. electron microscopy (STEM). The Chlorophyll present in green isoprene units are bonded together in a head-to-tail organization. Like the centrioles, the basal bodies are found to possess some capacity for self-assembly and they appear suddenly in Naegleria as it changes from its amoeboid form to a typical ciliate (see Reid and Leech, 1980). The spherical inner nuclear nuclear nuclear pore membrane contains specific proteins that act as binding sites for the supporting fibrous sheath of intermediate filaments (IF), called nuclear lamina. In recombinant DNA technology, prokaryotic and eukaryotic DNAs as well as the plasmid DNAs are cut into specific fragments with restriction enzymes. Write an essay on "Golgi apparatus and secretion". In addition, a smaller nuclear ribonucleoprotein (U3 sn RNP) becomes tightly bound to the 32S RNA precursor and is believed to be involved in its processing. Heavy chains contain antigenic determinants in the "tail" (carboxyl) segments by which they can be classified as Ig G, Ig M, Ig A, Ig D or Ig E. 4.36 Authors (iv) CONTENTS CELL BIOLOGY Chapters 1. Holley (1965) stem anticodon first of all proposed a clover leaf X X loop ala model for yeast tRNA. This type of light microscope is useful mainly for viewing highly ordered objects such as crystals or bundles of parallel filaments (i.e., microtubules of mitotic spindle.) It is based on the behaviour of certain cellular materials when they are observed with polarized light. For example, the green alga, Pandorina has a colony consisting of 8, 16 or 32 cells. Pyruvic acid dehydrogenase occurs in the mitochondrial matrix and is larger than a Acetyl-Co A O ribosome in size. Following the conjugation, the progenies of the recipient express some of the characteristics of the donor. On circle represents branch from which pollen is used the other hand, the Ij/ij progeny are all and outer circle shows the progeny. The contractile ring assembled, it develops a force large enough to bend a fine glass needle inserted into the cell. In addition, free radicals and peroxides can affect the membranes by causing peroxidation of lipids and proteins. In fact, the Fig. Another cross between pea combed and single combed chickens in the ratio of 3 : 1, showing dominance of pea over P1 Rose RRpp Pea rrPP F1 Walnut RrPp F2 analysis Phenotypes Ratio Explanation furnishes strong support to the manner of origin of certain taxonomic units. Each cisterna is bounded by a smooth unit membrane (7.5 nm thick), having a lumen varying in width from about 500 to 1000 nm (see Sheeler and Bianchi, 1987). In this method, normal foreign gene sequences for the defective gene are introduced. Retrovirus. very small genome (7X107 nucleotide pairs); 5. Once inside the host cell, the phage DNA becomes a vegetative phage, i.e., phage genes take over the metabolic machinery of the cell and direct it to produce replicas of the infecting virus. 17.3. Leaf variegation in Mirabilis jalapa, the by receiving nourishment from green parts. There are sixteen or more different prostaglandins, falling into nine Fig. Some of them are as follows: 1. Contents 352 CELL BIOLOGY 3. The gene controlling blood types has been labelled as L (after the name of discoverer, Landsteiner) or I (from isoagglutination, the technical term for the agglutinogen (antigen) or clumping of the red blood cells by an agglutinin or antibody. indistinctly visible chromatin fibres. Three types of synapsis have been recognised. If the two cells are originally labelled with fluorescent antibodies of different colours, such as fluorescein (green) and rhodamine (red), it is possible at the onset of fusion to recognise the parts of the plasma membrane corresponding to each
cell. Each complex acts as an energy conversion-device to harness this free-energy change, pumping H+ across the inner membrane to create an electrochemical proton gradient as electrons pass through. Mutation of the promoter causes a decrease in enzyme synthesis. A marriage between two carriers (i.e., heterozygotes possessing a deleterious recessive allele hidden from phenotypic expression by the dominant normal allele) results in carriers and disease free children in the ratio of 2 : 1 due to the death of homozygotes : Contents MENDEL AND HIS WORK Sickle cell carrier (HbA/HbS) HbA/HbA Disease free (Normal) (Homozygotes : Contents MENDEL AND HIS WORK Sickle cell carrier 35 Sickle cell carrier (HbA/HbS) HbA/HbS Carrier Normal (Heterozygotes with sickle cell trait) HbS/HbS Sickle-shaped erythrocytes; usually dies due to anaemia (Homozygous recessive) LAW OF SEGREGATION Mendel's first law-the law of segregation is also known as law of purity of gametes. usually fails to move to either pole, it is not included in any meiotic products (gametes). In contrast, cycloheximide has the reverse effect. These characteristics of the chromosomes help a taxonomist in determining the leading strand is primed once on each of the parental strands. The DNA in nuclei was stained using the Feulgen reactions and the amount of stain in single nuclei was measured using a special microscope (called cytophotometer). Viruses tend end plate to be named in a random fashion according to the disease caused (e.g., poliomyend fibres elitis virus), the host organism (e.g., bacterial viruses or bacteriophages, plant viruses and animal viruses), or some Fig. Back cross. Altmann correctly speculated that bioblasts were autonomous elementary living particles that made a genetic and metabolic impact on the cells. Thus, four types of alleles are assorted independently to produce four types of gametes, viz., YR, Yr, yR and yr. pressed itself. In fact, bending force is produced by the sliding of microtubules. travel through the electron microscope in a very high vacuum and the samples must be completely dry and otherwise non-volatile. It is a relatively small molecule of 75 to 90 ribonucleotides and is, thus, smaller than either mRNA or any of the rRNAs, and has a sedimentation coefficient of 4S. Table 5-1. The range of temperature may induce parthenogenesis in the eggs. Each daughter cell receives the daughter cell receives the daughter cells. Terminally differentiated somatic cells (i.e., end cells such as neurons and striated muscle cells) that no longer divide, are arrested usually in the G1 stage; such a type of G1 phase is called G0 phase. For instance, to get pure character for tallness, he self fertilized a tall pea plant for many generations till the resulted offsprings always produced only tall plants. Non-permissive growth which permits an animal virus to enter the host cell but does not allow it to multiply lytically. Sears and also by H. Each tubule appears to be made up of 4 or 5 protofilaments arranged in parallel fashion (Thorpe, 1984). The function of RF3 seems to stimulate the action of RF3 seem protamines occur in the spermatozoa of the certain fishes. 11.5). proteins In the first step, performed at a low temperature, the 16S RNA binds some of the 30S ribosomal proteins, forming an RI particles (i.e., a reconstitution intermediate) that is inactive. In man various types of dominant and recessive characters have been reported. A.Kolliker H.Fol Contents INTRODUCTION Year Name of contributor Cell biological contribution 1875 E. Strasburger 1876 E. By cutting the tails of mice for many generations, Weismann always got tailed mice. A heterozygous has both dominant and recessive characters, therefore, its genotype can be expressed by 'Tt' letters. (a) Eggs : 1 +/+ : 2 +/ey : 2 + : 1 ey Phenotypic ratio: 5 +: 1 ey (i.e., 5 wild type: 1 eyeless); (b) 1/3 of the diploid progeny will be eyeless. This sugar may be imbilayer portant in the life cycle of the erythrocytes as it has been shown that cells lose sialic acid as they age in the circulatory system. Entire Y chromosome of A calico cat. Garrod published a book called Inborn Errors of Metabolism. Artificial selection is also posD sible as the homozygous recessives are phenotypically differentiated from E C the dominant population. These cells multiply by repeated mitotic divisions and produce the cells which are known as the spermatogonia (Gr., sperma=sperm or seed; gone=offspring). Determine the genotypic and phenotypic ratios expected in the F1 from the following crosses : (a) MRM × MRm, (b) MRM × MRm, (c) MRM × MRM electrons from the substance with the more negative E'o value). The primary cell wall of the yeast and the fungi is composed of the chitin. Half of the gametes carry the allele R and other half carry the allele r. Both dominant alleles when present together, complement each other and are called complementary genes and produce a different phenotype In case the common ancestors are inbred, the inbreeding coefficient is calcutated as follows: $F = \sum (\frac{1}{2}) n1 + n2 + 1$ (1+F ancestor) 4. Such genes are called to have incomplete penetrance. Ecoli cells were removed from the medium after various periods of incubation and gently lysed to release the chromosome from the cell (since the shear forces) 4. created by harsh lysis break the chromosome into small pieces). These three major subdivisions of genetics are arbitrary and there is considerable overlapping. Within the same cell, each protein may be regulated independently of others. However, such an exploitation of heterosis in maize posed one problem; most inbred lines were so infertile that they did not produce enough seeds for commercial plantings. H.J. Muller got Nobel Prize in 1946 for the discovery of the induction of mutation in Drosophila by X-rays. When we consider the future welfare of the human race then the following two factors alarm us greatly: (i) the declining birth rate among the normal and superior people (those having best germplasm) (ii) a relative rapid increase of the abnormal and defective individuals (those having defective germplasm). They form the main source of the energy of all living beings. Thus, each gene is responsible for the synthesis of 109 protein molecules in four target cell nuclear envelope steroid hormone in days. In 1884, he described fertilization in angiosperms. One-fourth for brother-sister matings. It fills all the spaces of the cell and constitutes its true internal milieu. A study of the pollenogenesis, however, reveals that pollen contains very little cytoplasm which in most cases is devoid of plastids. Various steps of DNA fingerprinting process (after Burns and Bottino, 1989) Recent data, however, have contradicted this simple "one-band, onegene" hypothesis, now it is held that bands as well as inter-bands contain more than one genes. O v e r c o o k i n g destroys it. Each enzyme is synthesized in a stepwise manner with the position of gene seemingly dictating the order of its held that bands as well as inter-bands contain more than one genes. O v e r c o o k i n g destroys it. Each enzyme is synthesized in a stepwise manner with the position of gene seemingly dictating the order of its held that bands as well as inter-bands contain more than one genes. expression during the cell cycle. When the second ribosome has moved along a distance similar to that traversed by the first, a third ribosome is able to attach. Boivin, R.Vendrely and C. These rare DNA variants are found only in some DNA molecules which lack guanine. Negative Eugenics attempts to eliminate the defective germplasm of the society by adopting following measures : 1. Each chromatid contains a single DNA molecule. (b) During meiotic division of germ cells a somewhat similar situation to (a) is evident, although in some rare cases, such as lampbrush chromosomes of meiotic division of germ cells a somewhat similar situation to (a) is evident, although in some rare cases, such as lampbrush chromosomes of meiotic division of germ cells a somewhat similar situation to (a) is evident, although in some rare cases, such as lampbrush chromosomes of meiotic division of germ cells a somewhat similar situation to (a) is evident, although in some rare cases, such as lampbrush chromosomes of meiotic division of germ cells a somewhat similar situation to (b) During meiotic division of germ cells a somewhat similar situation to (c) is evident, although in some rare cases, such as lampbrush chromosomes of meiotic division of germ cells a somewhat similar situation to (c) is evident, although in some rare cases, such as lampbrush chromosomes of meiotic division of germ cells a somewhat similar situation to (c) is evident, although in some rare cases, such as lampbrush chromosomes of meiotic division of germ cells a somewhat similar situation to (c) is evident, although in some rare cases, such as lampbrush chromosomes of meiotic division of germ cells a somewhat similar situation to (c) is evident. which lies on the inner surface of the nuclear envelope. Stained mitochondria with a specific stain (1886), recognised their role in cellular respiration and considered them as autonomous organelles. In certain macronucleus contractile vacuole contractile vacuole metazoan animals a special type of transverse fission known as the strobilation occurs This process of sorting might be described as "mitotic segregation" of this is a pure extra- nuclear phenomenon. The enzymes photosynthetic light reaction by photosynthetic light reaction is completed by passechloroplast ing through the transcription of this is a pure extra- nuclear phenomenon. the adjacent operon and coordinate enzyme synthesis would follow. The spindle fibers are disappearing, and the microtubules of the two daughter cells are rearranging into the interphase pattern. Dominance. An allele whose phenotypic effect is not expressed in a heterozygote. Due to the shape of
cell walls many types of plant cell as the parenchymatous, collenchymatous, etc., have been recognised. (vi) Phosphoproteins. Apparently pollen tubes will not grow down a style of the same genotype (Fig.10.11). In fact, there are two types of termination protein, called rho (p discovered by J. The Contents MOLECULAR BIOLOGY 62 64 TyC arm 5' position 73 54 3' 5' mRNA Fig. MATERIAL OF THE CHROMOSOMES The material of the chromosomes is the chromatin, the structure of which has already been described in previous chapter (Chapter 12). Ruckert in 1892. The primer RNA synthesis is performed by primase which is tightly associated with DNA polymerase α. eIF4B 5. These NA spikes remove those virus-loaded receptors from the host's surface which have not entered the host cell through the process of receptor-mediated endocytosis. Thus, the 70S ribosc thought to consist of 55 different proteins. A much greater correlation exists between the methylation or under-methylation or under-methylation or digoxigenin), single stranded nucleic acid (20-40 nucleotide long) with a sequence complementary to at least one part of the desired DNA. These spermatids cannot act directly as the gametes so they have to pass through the next phase, the spermatids cannot act directly as the gametes so they have to pass through the next phase. startFig. PENETRANCE The ability of a given gene or gene combination to be expressed phenotypically to any degree is called penetrance. Now only the term plasmid is used for all kinds of extrachromosomal autonomous transposable circular DNA fragments (see Alberts et al., 1989; Burns and Bottino, 1989). Since none of the 444 F2 plants had flowers this extreme, more than four loci (minimum of five loci) are probably segregating from the F1. KINDS OF LYSOSOMES (POLYMORPHISM IN LYSOSOMES) Lysosomes are extremely dynamic organelles, exhibiting polymorphism in their morphology. The first antibodies produced by a developing plasma cells are usually of class Ig M. The eggs with '+' + w + X X X Y genes if fertilized by sperms with '+' genes produce homozygous red-eyed females. The simple or orthodox type of binary fission occurs in the irregular-shaped organims, e.g., Amoeba in which the plane of division is difficult to observe. The parthenogenesis may be of two types : 1. n+1 n-1 n n Fig. Longer. However in many cases lethal genes become operative at the time the individuals become sexually mature. The AY allele also acts as a recessive lethal, since in the embryonic stage (i.e., during gastrulation). The completely lethal genes usually cause death of the zygote, later in the embryonic development or even after birth or hatching. OUTBREEDING AND HYBRID VIGOUR When a mating involves individuals that are more distantly related than the average of the selected group it is classified as outcrossing or outbreeding which is a negative genetic assortative mating. Here, the duplicated portion of chromosome becomes attached to a non-homologous chromosome. relatively stable compared with many kinds of RNA. IFs During Mitosis of cultured epithelial cells shows striking changes in intermediate filaments of cytokeratin and vimentin. There are about 20 different amino acids (Table 4.4) which occur regularly as constituents of naturally occurring proteins. We have already discussed in previous chapters that each qualitative trait may be under genetic control of two or many alleles of a single gene with little or no environmental modifications to obscure the gene effects. In these experiments, phage DNA was made radio-active by growing infected bacteria on a medium containing radioactive phosphate (32PO4). coli for the repair of DNA damage (pyrimidine dimer formation) after exposure to ultraviolet light: (1) photoreactivation; (2) excision (dark) repair; and (3) postreplication repair around the filaments (De Rosier, 1980). cally, AAXO. Trypsin 7. In Mendelian terms, it means that there are loci at which the heterozygosity. Contents CROSSING OVER 95 these genes. The same basic structures—nuclei, cytoplasmic matrix or cytsol, plastids, mitochondria, endoplasmic reticulum, Golgi apparatus, plasma membrane, etc.,—all appear with predictable regularity. These chains are wound around one another in a regular su(a) (b) Collagen injections. Evidently above described components of ETS occur in the mitochondria in the form of following three complexes (Green et al., 1987; Capaldi et al., 1987): (i) The NADH-dehydrogenase complex. Single stranded RNA occurs as genetic material in plant viruses (e.g., TMV, TYM), animal viruses, foot and mouth viruses, foot and mouth viruses, foot and mouth viruses (e.g., TMV, TYM), animal viruses (e.g., TMV, TYM), animal viruses (e.g., influenza viruses, foot and mouth viruses, foot and mouth viruses, foot and mouth viruses). rous sarcoma viruses, poliomyelitis viruses) and bacteriophages (e.g., MS2). supporting cell Types of intermediate filaments. The first linkage map has been constructed for two chromosomes of Drosophila by Strutevant in 1911. Both varities evolve Contents 178 GENETICS, HUMAN GENETICS and later become reproductively isolated species. The mixture of compound is applied to supporting films which dip into two containers filled with a Fig. During phagocytosis by leukocytes oxygen consumption, glucose uptake and glycogen breakdown all increase significantly. The advantage of having a number of duplicate copies of a gene is that a higher rate of RNA synthesis is possible. In ciliates dynein they are thought to be coordinated by a neuroheads motor centre near the mouth since destruction of the fibres connecting the centre to the cilia results in uncoordinated by a neuroheads motor centre near the mouth since destruction of the fibres connecting the centre to the cilia results in uncoordinated movements (Taylor, 1920). every phospholipid molecule. HydroxylH:C G .. A term equated with the term gene. Analysis of the giant cells of the alga Nitella indicates that Na+ pumps located in the vacuole ; and since the vacuole occupies a much greater volume than the cytoplasm in Nitella, the greater bulk of cellular Na+ is in the vacuole. Singer in experiments published in 1957. 8.2. Diagram of a white blood cell (neutrophil) ingesting bacteria. 5.1) (3) The sequence of bases in RNA molecule is determined by the base sequence of the DNA. (i) Tubular root fibrils. Chloroplasts tend to make the lipids they require. On the other hand, cell volume follows a roughly exponential curve for the first three quarters of cell cycle, reaching a plateau prior to division. More than one codon may specify the same amino acid; this is called degeneracy of the code. In birds and molluscs the nucleus becomes spirally twisted like a cork screw. In 1961, Mitchell proposed the highly acclaimed "chemiosmotic-coupling hypothesis" for the ATP-production in mitochondria. The yeast Saccharomyces cerevisiae carries about 35 copies of a transposable element called Ty in its haploid genome. CHARACTERISTICS OF MULTIPLE GENES Multiple genes for quantitative traits have following characteristics : 1. They impart colour (e.g., yellow, orange and red) to certain portions of plants such as flower petals (e.g., daffodils, rose), fruits (e.g., tomatoes) and some roots (e.g., carrots). This type of mutual adhesion of the sperms is known as the agglutination. Such bigenic (two gene) epistatic interactions may be of following six types: 1. This Osmosis and the RBC. Basement Membrane The interface between all epithelia and underlying connective tissue is marked by a non-cellular structure called basement membrane. In 1884, Hertwig identified the hereditary substance with the chromatin of nucleus. The process of formation of new cisternae may be performed by any of the following methods: 1. Individual stacks of cisternae may arise from the pre-existing stacks by division or fragmentation. But heterozygotes who have both normal (haemoglobin A) and abnormal (haemoglobin S) haemoglobins and who also have mild anaemia, are naturally protected against contracting malaria as the parasite cannot live in these distorted cells. Bearers of this genotype associated with thalassemia major. The second region is near the loop end of the presumed stem (sometimes totally within the stem) and is a sequence having a high G+C content. The outer surface of the thylakoid is in contact with the stroma, and its inner surface encloses an intrathylakoid space (the third compartment). List the phenotypic expectations for their children. In other cases, R group contains either an extra amino group or its equivalent. It represents most of the chromatin that disperse after mitosis has completed. Translation would not cease since numerous genes for rRNA are present in the genome. The hydrazine affects DNA by breaking of rings of uracil and cytosine giving rise to pyrazolone and 3-aminopyrasole, respectively. The most important basic proteins of the nucleohistones. Show the results you would expect in the crosses you describe. The molecules to be separated are applied to the top of the column and their Thin layer chromatograph 10.5%. 14.17). He examined a thin slice cut from a piece of dried cork under the compound microscopes (Fig. cess that implies growth of the daughter organelles. The similarities between the two can be summarised as follows : 1. The differences among parents (heterozygous) and their offspring or among individuals in a TEST-CROSS. Nucleoplasm The space between the nuclear envelope and the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground
substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidophilic ground substance or the matrix known as the nucleolus is filled by a transparent, semi-solid, granular and slightly acidoph discovered by Thomas Cech (1982) U4 U6 U5 while working on RNA splicing in TetrahyU1 U2 mena (a ciliated protozoan). Since various significant cell biological discoveries have been made during this period. Explain fully. Got Nobel Prize for their contributions on phagocytosis of bacteria during infection; staining procedures for bacteria, and studies on immunity. 8.3). Discovered artificial parthenogenesis. ribosome assembly. Those segments of 45S which have to be degradde are not methylated. The spacer DNA can be subdivided into a nontranscribed spacer, the latter is copied into a nontranscribed spacer and a transcribed spacer. very rapidly about their long axes and their hydrocarbon chains are flexible, the greatest degree of flexion occurring near the centre of the bilayer and the smallest adjacent to the polar head groups (Fig. A poky mutant differs from wild type strain of Neurospora in the following aspects : (1) it is slow growing; (2) it shows maternal inheritance, and (3) it has abnormal cytochromes. B.O. Dodge in the late 1920's and early 1930's first determined the genetics of Neurospora. somes. Table 6-4. If, for example, adenine in an old chain is in its rare state at the moment that the complementary new chain. Gap Junctions (Nexus) Many cells of the tissues of higher animals are coupled together by interconnecting gap junctions, nexus or communicating junctions, nexus or communicating junctions. Infoldings of the plasma membrane of all Gram-positive bacteria and some Gram-negative bacteria give rise to the following two main types of structures: (I) Mesosomes (or chondrioids). Here, the timing of translation is regulated; the mechanism for stabilizing the mRNA, for protecting it against RNases, and for activation are still unknown. During a normal cytokinesis, the contractile ring does not get thicker as the furrow invaginates, suggesting that it continuouly reduces its volume by losing filaments. On transformation of E.coli, the phage could multiply with the cloned gene. stationary phase During this period the cells divide slowly and growth no longer remains exponential. A polymerase enzyme is called replicase enzyme is called replicase enzyme when the copy of polynucleotide chain so produced is inherited by daughter cells or viruses, that is, when the enzyme parental duplex brings about primer (elongating) strand template strand chromosome replication (see P Goodenough 5' C OH and Levine, P 1974). Women over 45 years of age are about twenty times more likely to give birth to a child with DS than women aged 20. Because the sperm or ova contains only one chromosome of a homologous pair, therefore, it contains only single gene, e.g. T or t. Phenotypically here occur only three longwinged and one vestigial-winged Drosophila. These results have proved the law of independently and bears no permanent association or relation with a particular character. Contents CELL 33 VIRUSES Viruses (L., venoum or poisonous fluid) are very small submicroscopic biological entities which though lack cellular organization (viz., plasma membrane and metabolic machinery) possess their own genetic material, genetically determined macromolecular organization and characteristic mode of inheritance. In the centre of the axoneme are two.singlet microtubules or fibrils that run length of the cilium. Gierer and G. The chromosomes are the diads, i.e., having two chromatids and single centromere. The smooth type of endoplasmic reticulum occurs mostly in those cells, which are involved in the metabolism of lipids (including steroids) and glycogen. Here, we are concerned only with autocatalytic function of DNA. Some attempts to do this have been made without much success. Beerman compared the polytene chromosomes of different tissues, the distribution of puffs different from one tissue to another. Chemical formula of cortisone. Centrioles and basal bodies are also found to be involved in ciliary and flagellar beat. CELL FRACTIONATION Sometimes it becomes necessary to break up tissues and cells and to isolate various parts of the cell for structural or biochemical analysis. Application of negative staining techniques has shown that microtubules have a lumen 14 nm wide and a protofilament or subunit structure in the wall (Fig. Bridges, Hermann J. Albinism. Hence, chitin is an unbranched polymer of N-acetylglucosamine containing several thousand successive aminosugar units linked by β -1 \rightarrow 4 glycosidic bonds. These F1 trihybrids when self-crossed among themselves, they produce a F2 progeny including 64 individuals in the phenotypic ratio of 27 yellow, round, tall : 9 yellow, round, tall : 9 yellow, wrinkled, tall : 9 green, round, tall : 9 yellow, round, tall : 9 green, round, tall above by oxidation of one molecule of glucose pass through a series of reactions of Krebs cycle to produce CO2, H2O and electrons. In parthenogenesis, the eggs by the sperms. Describe the structure of E.coli RNA polymerase and discuss the roles of different components of this enzyme in RNA synthesis on DNA template. The two genes are inherited according to Mendelian laws, but the action of shell next generation after the one in which a given genotype is found. 4.7. A cross between two white coloured breeds of fowls to get 13: 3 F2 dihybrid ratio. It is hypothesized that ribosomes attach to different starting points (ribosome-binding sites) along the polycistronic mRNA at different rates as reflected by the relative amounts of the three proteins synthesized. What is the role of RNA in DNA replication? Thus, the members of an operon are transcribed coordinately a single, long, polycistronic mRNA molecule. After performing its function, the EF-Tu protein dissociates from the ribosome, and in the cytoplasm is subsequently regenerated to its active form by another elongation factor, the EF-Ts. At this point, both sites of the ribosome are occupied by tRNA's, each of which carries an amino acid, and each of which is hydrogen bonded to the template mRNA (Fig. Contents 174 CELL BIOLOGY 2. Reaction to grafts They have different heredity in similar environments Skin grafts between the dizygotic twins are usually rejected approximately 100,000 genes, however, definite positions of few genes on the chromosomes have been worked out. When the red eyed male and red eyed female individuals of F1 are intercrossed, the F2 progeny is found to include an excluRed eyed female Drosophila. However, Schleiden was the first to describe the nucleoli and to appreciate the fact that each cell leads a double life—one independent, pertaining to its own development, and another as integral part of a multicellular plant. Crick in 1953, molecular interpretation of protein synthetic mechanism, genetic code, etc., have an extraordinary impact on modern cell biology and biology. embers of almost all species are often divided into two sections according to the kind of gamete or sex cell produced by them, i.e., male sex and female sex. Male Haploidy or Haplodiploidy Mechanism Male haploidy or haplodiploidy or haplodiploidy or arrhenotokous parthenogenesis is particularly common in the hymenopterous insects such as ants, bees, sawflies and wasps (e.g., Bracon hebetor). According to a classical estimate, each cellulose microfibril comprises three micelles or elementary fibrils : each elementary fibril contains

about 100 cellulose molecules and each cellulose molecule is made up of 40 to 70 glucan chains (see Thorpe, 1984) (i.e., One microfibril = 3 × 100 × 70 = 21000 glucan chains). Lactoprotein (casein) secretion by mammary gland cells (Merocrine secretion) ; 4. Metabolism of plasmalogens. Tjio and Levan (1956) cultured somatic cells from fibroblasts of human embryos and counted the human chromosome number as 46. Many types of mutants that fit the above criteria The green alga Chlamydomonas. Any chemical substance that affects the chemical environment of chromosomes is likely to influence, at least indirectly, the stability of DNA and its ability to replicate without error. Why do you suppose, did he not discover the principle of linkage ? The cell wall constitutes a kind of exoskeleton that provides protection and mechanical support to the plant cells, carotenoids serve as precursors of vitamin A. The chromatids separate progressively from the centromere 37°C, up to 1,000 molecules/minute 10. Back Cross and Test Cross When F1 individuals are crossed with one of the two parents from which they were derived, then such a cross is called back cross. If, however, the polynucleotide strand is a member of a DNA helix (e.g., prokaryotic and eukaryotic DNA), a single endonucleolytic cut will create a nick in the G C A T P nick OH Fig. translating mRNA molecules the codons do not overlap but are "read' sequentially (Fig. Peroxisomes may have served to lower the concentration of oxygen in such cells while also exploiting its chemical reactivity to carry out useful oxidative reactions. Klinefelter's Syndrome (XXY Males). When the F1 walnut combed chickens were bred together, in F2 all four types of combs, i.e., 9/16 walnut, 3/16 rose, 3/16 pea and 1/16 single appeared (Fig. Transduction. Normally mitochondria unt to 2.0 µm and, therefore, are not distinctly visible under the light microscope. This is achieved by peptidyl transferase enzyme present in the 60S ribosomal subunit. 135 B. Vendrely showed that in the different cells of an organism the quantity of DNA for each haploid set of chromosome is constant. Progeny of sensitives are killers only in rare situations where conjugation persists for a longer period so that kappa-containing cytoplasm is introduced into the conjugating sensitive. L is the leader (after Freifelder, 1985). Protozoa 1. Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 55 Types and synthesis of rRNA. Some of the most common enzymes are found to have different transverse distribution in the ER membranes (Table 6-1). Uracil (U) Uridine Adenylic acid (Adenosine monophosphate) Guanylic acid (Guanosine monophosphate) Cytidylic acid (Cytidine monophosphate) Uridylic acid (Uridine monophosphate) Abbreviation for ribonucleotides also occur freely in nucleoplasm but in the form of triphosphates of ribonucleosides such as adenosine triphosphate (UTP). Lastly when the sub-units of the protein myoglobin. Reticular theory suggests that the matrix is composed of reticulum of fibres or particles in the ground substances (Fig. coli contains about 5000 distinguishable components, ranging from water to DNA (i.e., three types of RNA, enzymes, glycogen, amino acids, monosaccharides and various other small molecules). (ii) Electron transport systems and oxidation of water. DNA DNA is the most important chemical component of chromatin, since it plays the central role of controlling heredity. The unciform ciliary movement. Besides these two enzymes, six more factors are involved in eukaryotic DNA replication: (1) T antigen; (2) replication factor A or RF-A (also called RP-A or eukaryotic SSB); (3) topoisomerase I; (4) topoisomerase I; (5) proliferating - cell nuclear antigen (PCNA, also called cyclin), and (6) replication factor Cor RF-C. The sequential formation of a polypeptide continues in the manner described above. Like DNA, RNA is polymeric nucleic acid of Ribose. In 1898, Golgi found that Purkinje cells (i.e., nerve cells of cerebral cortex of brain) of barn owl contained an internal reticular network which stains black with the silCamillo Golgi ver stain. In the cell fractionation, the cells are gently broken by grinding a small piece of tissue in a homogeniser having a moving close-fitting glass or plastic pestle within a tube that contains a medium such as sucrose solution to preserve the cellular ormotor ganelles (Fig. Contents C H A P T E R 20 Gametogenesis T The average healthy human male produces about 1000 new sperms every second. Localization of mRNA in the cytoplasm of a Drosophila egg. The protamines usually remain bounded with the DNA molecules by the salt linkage It is the precursor of most steroid sex hormones and cortisones. They introduced the concept of photosynthetic unit (or PS I) which is thought to be activated when light impinges on a photosynthetic unit. The immobilized boundary lipid makes 30 per cent of membrane lipid in the mitochondrial membrane. Chylomicrons. called amino acid pool. reductases, oxidases, oxygenases and peroxidases. 12.15) is male sex-limited (i.e., it is penetrant only in male environment). In achieving their ambitious goals, they often devote the best part of their youth and they are able to marry in their ambitious goals, they often devote the best part of followarm D B C A ing three types (Fig. 10H+ 4H+ 4H+ + Cyt c Cyt c 2H Cyt c involve chromosome breakage; the broken chromosome ends are highly "reactive" or "sticky", showing strong tendency to join with broken ends. 18.5. Some variations of mitosis which have been observed during anaphase (after Albert et al., 1989). Bateson and Punnett could not explain the exact reasons of coupling and repulsion, and it was T.H. Morgan who while performing experiments with Drosophila, in 1910, found that coupling or repulsion was not complete. Basal bodies and centrioles are similar in structure and function; both act as nucleating centres from which are by small via via small molecules open pores necessary for the synthesis of the DNA vesicles and RNA. Ecosystem: structure of ecosystem; structure of ecosystem; structure of ecosystem; structure of an ecosystem - autotrophic components, biotic or living components, productivity of ecosystem, food chains in ecosystems; grazing food chain, detritus food chain; ecological pyramids; types of ecological pyramids; energy flow in ecosystems; grazing food chain; ecological pyramids; types of ecological pyramids; energy flow in ecosystems; grazing food chain; ecological pyramids; energy flow in ecosystems; grazing flow in ecosystems; concept, maintenance cost of secondary producers, assimilated energy and respiration energy, ecological efficiency; revision questions. These genes have been suggested by polygenes. As a result, the concentration of phenylalanine increases in blood. The adipose tissues, brown fat cells and adrenocortical cells, interstitial cells of testes and cells of corpus luteum of ovaries, sebaceous cells and retinal pigment cells contain only smooth endoplasmic reticulum (SER). When the cell vesicular transport needs cholesterol for membrane. The most important constituent alcohol of the molecules of waxes is the cholesterol, e.g., bees wax. In post-mendelian era, there were two main groups of geneticists : 1. In 1928, Heitz defined heterochromatin as those regions of the chromosome that remain condensed during interphase and early prophase an are situated in the same chromosomes and these linked genes usually remain bounded by the chromosomal material so that they cannot be separated during the process of inheritance. 2.2. Explanation of Griffith experiment showing conversion of a non-lethal strated that the treatment bacterial strated that the treatment bacterial strated that the treatment showing conversion of a non-lethal strated that the treatment bacterial strated that the treatment b 1985). The inner membrane then breaks down and the enzymes are able to penetrate to the enclosed organelle. In other cases, the organelle to be digested is first encased by smooth ER, forming a vesicle that fuses with a primary lysosome (Fig. The improvement of already existing human beings can be achieved by improving the environmental conditions, e.g., by subjecting them to better nutrition, better unpolluted ecological conditions, better education and sufficient amount of medical facilities. Z-DNA (or Left-handed DNA). DISTRIBUTION secretory vesicles leaving the trans region trans dictyosomes are usually found scattered throughout the cytoplasm and their distribution does not seem to be ordered or localized in any particular manner (Hall et al., 1974). In certain multicellular animals such as Hydra (coelenterates) and certain tunicates, the body gives out a small outgrowth known as the bud. In both Na+- and K+- channels, the gating mechanism is electrically driven and is controlled by the membrane potential, plasma without the need of other energy source. Listed below are 7 two-factor interaction ratios observed in progeny from various dihybrid parents. Contents GENETICAL TERMINOLOGY 19 Position effect. α and β tubulin molecules heterodimers Functions of Cytoplasmic Microtubules Microtubules have several functions in the eukaryotic cells such as follows : 1. For instance, the enzyme which can function either with the coenzyme which can function either with the coenzyme which can function either with the coenzyme NAD+ or NADP. and formation of two types of cells—XX and XO. Waltzer = .0819 or 8.19% 4. Sutton's View on Linkage Sutton (1903) predicted that the chromosomes are the bearers of the units of hereditary units is much larger than the number of chromosomes, therefore, each chromosome must contain a number of genes. 10.21). The presence of gap junctions explains the ionic or Contents 144 CELL BIOLOGY electronic connections between adjamicrovillus cent cells, i.e., there are some cells which tonofilament plasma membrane B there is a rather free sealing flow of
electrical curstrand rent carried by ions. The lysosomal membrane has another unique property of fusing with other membranes of the cell. They show nonrandom assortment at meiosis. When the concentration of Mg++ions reduces in the matrix, both ribosomal subunits get separated. While still in RER C lumen, three glucose resiB D dues and one mannose F SRP (signal residue are quickly reE recognition signal protein moved from the oligosacpeptide charides of most glycoER proteins. The foreign genes can also be introduced into viral DNAs and when such recombinant viruses (phages) infect and multiply, once again large quantities of desired genes can be isolated. Here the nuclear contents, such as DNA, The white blood cell (in red) is eukaryotic and the RNA, nucleoproteins and nucleolus remain bacterial cells (in green E.coli) are prokaryotic. Thus, the size of the A C B cell. DNA replication is prevented by the bleomycins and anthracyclines. Cisternae. The whole process completes in two successive divisions which occur one after the other. The minor gene pair ss are called modifiers. According to this criterion proteins can be classified into two main types : (A) Simple proteins. Instead, they "peel off" the template as they are formed, thus, becoming available to participate in protein synthesis. (a) Bases at the 5' end of the polymer given. Contents 50 CELL BIOLOGY 4. chromosomes are in the thin, ex- fibers. Genetic and Cytological Mapping of Chromosomes are in the thin, ex- fibers. Genetic and Cytological Mapping of Chromosomes are in the thin, ex- fibers. 106-114 Construction of a linkage map or genetic mapping : determination of linkage groups, determination of gene order, interference and coincidence, linkage maps of different organisms; chromosome, physical or cytological mapping : cytological mapping of chromosome of Drosophila, differences between genetic and chromosome maps; uses of genetic maps; revision questions and problems. This change in splicing takes place within the life of a single lymphocyte cell and clearly explains the following observation. This sectioning. Compare the characteristics of prokaryotic cells. In cattles, hornless or polled (P) condition is dominant to horned (p) condition, and trait of white (W) coat is codominant to the trait for red (w) coat colour. (after Freifelder, 1985). A certain type of white forelock in man appears to follow the sex influenced mode of inheritance, being dominant in men and recessive in women. The inter-cellular space. But the Mendel's laws are not applicable on those genes which are exclusively located either in X or Y chromosome. Silent mutations. Guanosine 3. Here it should be carefully noted that the homologous chromosomes of either paternal or maternal origin. Chemically, Golgi apparatus of rat liver contains about 60 per cent lipid material. In some plants the cross of red and white produces pink-flowered progeny. (c) Proteoglycans, glycoproteins and glycolipids. As the microtubules. For example, TMV is found to produce a 30,000 dalton protein called P3O which tends to enlarge the plasmodesmata in order to use this route to pass or spread its infection from cell to cell (see Alberts et al., 1989). However, DNA isolated from higher plants and animals was in general rich in adenine and thymine (A:T) and relatively poor in guanine and cytosine (G : C) (e.g., AT/GC ratio of DNA of man was 1.40:1); whereas DNA isolated from microorganisms (viruses, bacteria and lower plants and animals) was in general rich in guanine and cytosine and relatively poor in adenine adenine adenine aden involved in the second chiasma as in the first. Primary cultures are those obtained directly from animal tissue. idaeus ; (c) F1 backcrossed to R. T banding. During interphase, no DNA replication occurs, so that chromosomes at the second prophase I 337 metaphase I meiosis I anaphase I meiosis I anaphase II telophase II metaphase II metaphase II prophase II metaphase I metaphase I metaphase II metap (ovum or egg), which carries genetic informations of female parent, to form a diploid zygote. The other X chromosome behaves like a autosome and is not heteropycnotic at interphase. Vesicles. In fact, various cytological and biochemical evidences have established that the membranes of the Golgi apparatus are originated from the membranes of the smooth ER which in turn have originated from the rough ER. Depending on whether the duplicated portion is on the same side of the centromere as the original section or on the other side, the displaced duplication can be termed either homobranchial or heterobranchial. The plasma membrane is permeable to water molecules. Contents 60 MOLECULAR BIOLOGY The significance of these un3' usual bases of tRNA was understood A OH well by molecular biologists during C C the construction of two-dimensional 5' amino acid X P X helix model from the primary-sequences of X X X nucleotides of known tRNA. Even in the best environment there is little possibility for change of defective hereditary traits. In order to bring about condensation, all other functional groups, not taking part in condensation, were protected using specific protective groups. Is this evidence for action of the inducer at the transcriptional or at the transcri (Source : Burns and Bottino, 1989). Viruses do not give rise directly to new viruses. eIF4D Trimer containing three chains : (i)α-chain 35,000 (ii) β-chain 35,000 (iii) β-chain spelta has been obtained due to colchicine treatment, contains 2n = 3x = 21. The dicentric chromosomes lead to fragmentation, since, two centromeres tend to migrate to opposite poles. Table 19-1. TMV infects the leaves of tobacco plant. Many chemical substances have been responsible to increase the mutability of genes. Somatic cell. Both dominant and recessive mutations are expressed at once in haploids. What is the evidence that a mRNA may be long enough to code for several proteins? cytes. Introduction Pages 3-15 Definition of cell biology ; history defined Grendel extracted the lipids from erythrocyte ghosts of a variety of mammals (such as dogs, sheep, rabbits, guinea pigs, movable barrier torsion wire gauge yoke and indicator needle torison wire gauge directs the organogenesis of the testis. The body, cells of which in mammals and flowering plants normally have two sets of chromosomes, one derived from each parent. Named plastids. Quantitative Genetics (Inheritance of Multiple Genes) 6. Nucleus The nucleus is centrally located and spherical cellular component which controls all the vital activities of the cytoplasm and carries the hereditary material the DNA in it. The chromatins resulting from such interchanges of chromosomal parts are known as cross overs. gaudens (G-G) or velans-velans (V-V) zygotes are lethal lamarckiana (2n=14) showing (Fig. Regulation at the level of translation; and 4. G banding. The development into a testis starts as soon as the gonocytes (i.e., primordial germ cells) from the yolk sac have finished their migration into the gonadal ridge. Monohybrid. The axial filament or the flagellum is composed of a pair of central longitudinal fibres and nine peripheral fibres. Genic Balance Mechanism By studying sex chromosomal mechanism of sex determination, it may appear at first glance that some genes carried by the sex chromosomes (X and Y) were entirely responsible for sex. The intercellular space between them is filled with an amorphous material. The specific arrangement of capsoneres in the capsid determines the shape of a virion. Death from different lethal genes may occur at any time from fertilization of the egg to advanced age. In the condensed chromosomes, the heterochromatic regions can be visualized as regions that stain more strongly or more weakly than the euchromatic regions, showing the so-called positive or negative heteropyknosis of the chromosomes (Gr., hetero = different + pyknosis = staining). Mechanism of dominant epistasis in dogs. Thus, two turns of Krebs cycle will comNAD+ pletely break up Lipoic acid, Thymine NADH+H+ pyrophosphate, CoA, one glucose molα-Ketoglutarate dehydrogenesis and division of blastema during blastogenesis, both involve mitosis. The actual reduction and disjunction occurs at this stage. Extension of lifetime of the mRNA. Biometricians, who proposed that heritable variation was basically quantitative and continuous and that genes did not exist as separate units (e.g., Galton). The informosome is used by the cell when there is a delay in the translation. However, contrast may be improved by "poststaining" with electron stains or electron-dense materials such as urynyl acetate, urynyl citrate, lead citrate, osmium tetroxide, etc. (This is called the law of constant volume. The acrosome nucleus nucleus and contains protease enzymes which help its easy penetration inside the A B C egg. It is a region of DNA that encodes a single polypeptide (or functional RNA molecule such as tRNA or rRNA). 10.5A). Actually, the doubling centromere of the DNA molecule strands which is necessnuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the
subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A - LEPTOTENE E - DIAKINESIS duplication of chromonuclear envelope sary for the subsequent A before the beginning of homologous fibres chromosomes meiotic prophase. In all these cases the amplified genetic material is not passed on the future cell generations. (b) If one map unit corresponds to 10,000 nucleotides separate these mutant sites. 1 2 3 4 1 2 3 4 Fig. Cellular functions of certain ions have been tabulated in Table 4-1. These cells tend to perform physiological functions for the survival of the animal, whereas the special cells such as erythropoietic tissue of red bone marrow, periosteum cells of bone, ciliary body cells of vertebrate eye, and epidermal cells of stratum germinativum. 7.8. Stages in the development of a functional protein. Hertwig has given the following formula for the size of the nucleus of a particular cell. A mating of two such mulattoes produces a wide variHuman skin colour is a result of polygenic inheritance. In this technique, a cell which is destined to become a pollen grain, may be induced by cold treatment to grow instead into an embryoid, a small dividing mass of cells. Female pseudohermaphrodites are 46, XX (hence females) but present a more or less masculine phenotype. Infection of influenza virus is initiated when the virus binds to specific receptor proteins on the plasma membrane of target host cell. How do you explain results. Primary trisomics 1 1 1 2 2 2 2 2 2 111 1 2 b 1 1 2. SSB protein; 5. Lake's Model (Asymmetrical Model, 1981) This completely asymmetrical Model, 1981) This completely asymmetrical Model (Asymmetrical Model, 1981) This completely asymmetrical model of ribosome has been suggested by James A. Similarly, ultrabar stocks produce some normal and some bar-eyed flies. In this book, we will follow the old numbering system. Biotin, 12. The Himalayan type coat is white except for black extremities (nose, ears, feet and tail). Biosynthesis of the steroids, e.g., cholesterol biosynthesis has been proposed which suggests that the structures of anticodon loop and that of the proximal anticodon stem are related to the sequence of anticodon (Michael Yarus, 1982). The experimental species should be of a type that can be raised and maintained conveniently and inexpensively in the laboratory. Most animal cells, for example, must take up glucose from the extracellular fluid, where the H+ concentration of the sugar is relatively high, by passive H+ transport through the glucose carriers (such as D-hexose ph 5 .0 permease) that operate as the uniports. Peroxisomes of glycolate oxidase, glutamate glyoxylate, serine-glyoxylate and asparate-αketoglutarate aminotransferases, hydroxy pyruvate reductase and malic dehydrogenase. The starch of amyloplasts on the other hand can be stored for longer periods and is, therefore, called isoalleles. OH and 5' -ptermini (Fig. Genetics of fruit fly, Drosophila sp. The coat of the ordinary (wild type) rabbit is referred to as "agouti" or full colour, in which individuals have banded hairs, the portion nearest the skin being gray, succeeded by a yellow band, and finally a black or brown tip. Contents CYTOPLASMIC OR EXTRA-NUCLEAR INHERITANCE 225 found in wild type, cyt a and cyt b are absent, and cyt c is in excess in poky mutant. Sandy coat colour may also result from a non-allelic dominant gene R; its homozygous recessive (rr) is also white. The two proteins show very little divergence from the lowest to the Contents CYTOSKELETON : MICROFILAMENTS AND Arabidopsis thaliana is a small, economically unimportant member of mustard family. Chromosome Theory of Linkage Morgan along with Castle formulated the chromosome theory of linkage which is as follows: 1. For example, the cell coat of the intestinal epithelium is quite strong—it resists vigorous mechanical and chemical attacks; in other cells the coat is labile and may be depleted by washing or enzyme exposure (Luft, 1976). high seed production (up to 40,000) seeds per plant); 4. Kappa particles, however, are maintained only in the presence of K-nuclear genotype (after Burns, 1969 and Gardner, 1968). The dehydrated specimens are embedded i.e., they are infiltrated with molten paraffin which hardens upon cooling and provides enough support to allow thin sections to be cut with a microtome. Short Gynandromorph or gynander. G .. (c) Does segregation occur in asexual reproduction ? chanical and biochemical activities of the cell. Add a note about histochemical activities of the cell. Add a note about histochemical activities of the cell. Add a note about histochemical activities of the cell. growth of preformed part. System 1. Because mitochondria synthesize energy rich compound ATP, they are also known as "power houses" of the cell. Structure and Function The amyloplasts resemble proplastids and differ from them only in size. In man the polydactylous condition may be penetrant in the left hand (6 fingers) and not in the right (5 fingers); or it may be penetrant in the feet and not in the hands. Brazzel and coworkers Contents 244 GENETICS, HUMAN GENETICS (1978) reported a case of pregnancy in a hermaphrodite that terminated in delivery of a stillborn child. Fig 3.13. 1957 H. Example of expressivity. secondary In fact, for long time most geneticists considered constriction I these chromomeres as genes, i.e., the units of (nucleolar F organizer) heredity. Aleurone Grain The aleurone grains or protein bodies are spherical membrane-bounded storage particles occurring in the cells of endosperm and cotyledons of seeds. in control mechanisms imposed on structural genes. For example, in its ionized ANSWERS TO PROBLEMS 4. Pedigree. If each female has 7 per litter, how many females need to be bred ? tio and β-carotene. Axoneme The axial basic microtubular structure of cilia and flagella is called axoneme. On a fully active gene about 100 RNA polymerase I enzymes (along with transcription factor I or TFI) are transcribing simultaneously on the rRNA gene. Contents 356 CELL BIOLOGY FERTILIZIN AND ANTIFERTILIZIN The process of fertilization is very specific. Contents 258 GENETICS, HUMAN GENE (1879) in France, Rumpau (1891) in Germany and Bohlin (1897) in Sweden carried out hybridization experiments, very much like Mendel, on different plants and observed the phenomenon of dominance, but Charles Darwin. When the oxygen, produced by photosynthetic bacteria, first began to accumulate in the primitive atmosphere of earth, it would have been highly toxic to most types of cells. The penetration of the sperm in the egg is known as the insemination. In 1882, Flemming named them as fila. Transport vesicles capture a cargo of molecules, e.g., proteins, from the lumen of one compartment as they pinch off from its membrane and then discharge that cargo into another compartment as they fuse with it. Only the base in a triplet codon of a cistron or gene is called deletion mutation. The genetics of plants. The difference between the redox potentials of the two is: + 0.254-(+ 0.030) = + 0.224 V, therefore, $\Delta G^{\circ} = -2$ (96, 406 J/V) (0.224 V) = -43.19 kJ (per mole of each cytochrome). (2) They remove the alkylated guanine. Lewis, therefore, preferred to called them pseudoallelism. The phenomenon as pseudoallelism. The phenomenon of pseudodominance exhibited by deficiency heterozygotes has been utilized for the location of genes on specific chromosomes and in preparing cytological maps in Drosophila, maize, bacteriophage and other organisms. Paper agar and starch are examples of substances which may be used as supporting films. Methods of Sample Preparation for Light Microscopy Cells are transparent and optically homogeneous: so either they are viewed as such by instruments such as phase contrast microscope or to produce necessary contrast, the cells are passed through various steps of slide preparation such as killing, fixation, dehydration, embedding, sectioning, staining and mounting. As there are more genes than the chromosome contains more than one gene. These non-histones differ even between different tissues of the same organism suggesting that they regulate the activity of specific genes. In each loop the DNA exits from the scaffold and returns to an adjacent point. How many base pairs would have to be deleted in a mutational event to eliminate a single amino acid from a protein ? Though mass in Amoeba doubles between divisions, its growth shows a diminishing rate of increase reaching a plateau several hours before mitosis. Plasmids and viruses which are used as carriers of foreign DNAs are referred to as vectors or vehicle DNAs. By interchanging plasmid DNA and viral DNA fragments, several new vectors have been synthesized which carry new genes into bacteria, yeast, insect, plant and animal cells. (ii) Electrical shocks can cause parthenogenesis. The wall of a centriole has nine groups of microtubules arranged in a circle. Secreted by the liver ; thyroglobulin, secreted by the thyroid gland ; immunoglobulins secreted by the plasma cells ; ovoalbumins secreted by the cells of oviduct of hen ; ribonucleases and deoxyribonucleases. Shape The shape of the nucleus normally remains
related with the shape of the cell, but certain nuclei are almost irregular in shape. approaches mitosis, the nucleous first decreases in size and then disappears as the chromosomes condense and all RNA synthesis stops, so that generally there is a stop of the cell, but certain nuclei are almost irregular in shape of the cell, but certain nuclei are almost irregular in shape. no nucleolus in a metaphase cell. Cell cycle can be defined as the entire sequence to some region of the DNA to initiate DNA synthesis. According to recent views, one chromatid of each homologous chromosome of a bivalent may divide transversely by the help of an enzyme the endonuclease which is reported to increase in the nucleus during this stage by Stern and Hotta (1969). If substance C is essential for the production of a normal phenotype and the recessive mutant alleles g1, g2, g3 produce defective enzymes, then a mutant or abnormal phenotype would result from a genotype homozygous recessive at any of the three loci. The occurrence of triploid intersexes from such a cross, clearly established that the autosomes also carry genes for sex determination. 13.9. Segregation for sex in seed obtained from a rare bisexual flower in Asparagus showing monogenic control. There is no clear answer to this question, because there is no single definition of life which will satisfy everyone. To avoid confusion with that of XX-XO and XXXY types of sex determining mechanisms, instead of the X and Y alphabets, Z and W alphabets, Z and W alphabets are generally used respectively. Cutin is also a biological plastic and is made of fatty acids (waxes). Monoploid plants have reduced size of all vegetative and floral parts. The VH and VL regions together form two antibody-combining sites) for specific interactions with homologous antigen molecules. ReFig. Nucleolar organizers. Three or four of these subunits are shared with the B tubules, which in turn shared with the B tubules. several of its subunits with the C tubules. 4.18. (a) If the female is crossed to an ey/ey male, what phenotypic ratio is expected in the offspring ? The Glycogen +P Phosphotylase Glucose-6-phosphate C6H11 O6-P H 20 Phosphohexoisomerase Fructose-6-phosphate C3H5O3—P Triose isomerase Glyceraldehyde-3-phosphate Fructose 1-6 diphosphate C3H5O3—P (×2) Phosphoglyceric dehydrogenase +ATP + NAD '1-3, diphosphoglyceric acid P-C3H6O4—P (×2) (NADH2) 2ADP 3-Phosphoglyceric-1-kinase 2 ATP 3-Phosphoglyceric acid C3H4O4—P (×2) Phosphoglyceric acid C3H4O3 (×2) Fig. According to Weismann the germplasm can form somatoplasm but somatoplasm cannot form germplasm. However, ribosome constitution experiments have shown some homology between 70S and 80S ribosmes, e.g., proteins L7 and L12 of E. Cytochemical Properties of Golgi Apparatus have been histochemically identified by specific staining properties (Thorpe, 1984; Alberts et al., 1989) : 1. J.O. The pods of the amphidiploid form Beasley crossed the old world and American cottons and doubled of Gossypium, the cultivated cotton plant. 6.6. The proceedure of hucleotides in DNA that does not appear in mRNA; probably excised from hnRNA in its processing. (i) Primary cell wall. In such case, the genotypes a BB, aa Bb, AA bb, Aa bb, and aa bb produce one phenotype (Table 4-7). It is uniformly distributed in the grana and acts as the electron carrier. The recessive form of this gene (i.e., presence of recessive females (Xc Xc) and hemizygous recessive males (Xc Y) are unable to distinguish between these two colours (Wilson, 1911). In the mesophyll cells of leaf in the presence of PEP (a 3-carbon acceptor, C6 called phosphoenol pyruvate) to produce a 4-carbon compound, called oxaloacetic acid or OAA (OAA is an intermediate in the Krebs cycle of respiration). Electron transport through PS II and PS I finally results in the reduction of the coenzyme NADP+. The sterilization is the best means to deprive an individual from his power of reproduction without interfering with any of his normal funcitons. Changes in gene arrangement : (a) Rotation of a group of genes 1800 within one chromosome : inversion 10 month old, Onya - Birri, the only albino koala in captivity with his mother. There may be 40 to 80 grana in the matrix of a chloroplast. Since all the 13 protofilaments are aligned parallely with the same polarity, the microtubules are the polar structures having a plus or fast growing end and minus or slow-growing end. Eukaryotic cells. When both the alleles (dominant and recessive) are equally expressed in the hybrid, the phenomenon is known as codominance, e.g., when the red and white cattles are crossed, they produce a roan offspring which possess both red and white hairs on the skin. If one creates two spheres out of one, additional surface would be needed. 14.10). Such a diagrammatic, graphical representation of relative distances between linked genes of a chromosome is called linkage or genetic map. Back cross : F1 Tall Dd Back cross progeny : ½DD Homozygous tall B. There are several features of the initiation process which deserve comment. This allosteric transition of protein molecule blocks its enzymatic activity and prevents overproduction of end products and their intermediate metabolites. 20.2). It indicates that B tubule has different structure than the A tubule, so that, the base of dynein cannot attach to it. This period in history is referred to as classical or formal genetics. This antiger occurs in the plasma membrane of all male tissues and possibly tends to regulate H-Y receptor cells. Point mutation. What is the significance of acetyl-coenzyme A and where does it come from ? Classification. Acetabularia mediterranea cap stalk foot NUCLEO - CYTOPLASMIC INTERRELATIONSHIP The evidences for nucleo-cytoplasmic communication as a factor in cell maintenance and development have been known before the rediscovery of Mendel's "genes". (b) Allopolyploids. Pectin Lignin Glucose Arabinose, xylose, mannose, glucose and galactose Glucuronic acid Coniferyl alcohol (e.g., hydroxyphenyl propane) 5. EVIDENCES FOR RNA AS THE GENETIC MATERIAL OF SOME VIRUSES The demonstration that RNA is the genetic material in RNA-containing viruses came in 1956, when A. This melting is necessary for pairing of the incoming rebonucleotides. Write a short note on the cytoskeleton What are microtubules ? But the white plants because lack chlorophyll pigment, therefore, die to modify the ratio of 1:2:1 into 1:2:1 into 1:2 or 2:1. A1A1 aa X aa A1 a A2 a A1 A2 A1 A2 A1 A2 A1 A2 A1 A2 A1 A1 A1 a (Identical alleles) (Similar al becomes an organism of, perhaps, trillions of cells with diverse and ultimately quite permanent roles to play in the maintenance of the whole. HISTORICAL Chloroplasts were described as early as seventeenth century by Nehemiah Grew and Antonie van Leeuwenhoek. Activation of the Egg Internal fertilization is essential for reproduction on land. 2.4) permits one to use these parameters to separate molecular types. They were found to be DNA sequences that code for enzymes which bring about the insertion of an identical copy of themselves into a new DNA site. This acid tends to bind the ions of Ca2+ and Na+. The presence of the gene is detected only when a mutation occurs in it. Thus, due to inbreeding in each generation the heterozygosity is reduced by 50% and after 10 generation we can expect the total elimination of heterozygosity from the inbred line and production of two homozygous or pure lines. bonds. The photosynthetic pigments (chlorophylls and carotenoids) occur in flattened sacs called lamellae which remain arranged in parallel array. 10.6). They readily go into colloidal suspension. (e) Why is it more different to study the inheritance of quantitative ones such as ABO and Rh blood antigens? What is cytoplasmic matrix? In the topology of this complex the Q-site may be in the middle of the membrane in the hydrophobic area and the cytochrome c-site on the C side. (ii) Physiological effect of polyploidy. In primates including humans, it has been found that IQ (intelligence quotient) is governed by genetics (parentage), environment (adopted parents) and developmental stage (age) of an individual. By his famous experiments on pea plant he concluded that the inheritance is governed by certain factors which occur in the cells of each parent. Crew suggested that sex is a physiological equitable division between anabolic and catabolic individuals. It contains four major RNA bases between species. Thus, the prokaryotic 70S ribosome consists of 53 different proteins Contents RIBOSOMES 285 (20S + 33L = 53 proteins). Neurospora has two sexes exactly equivalent and designated A and a. b-Glucosidase 11. CO2 enters the Calvin cycle (or dark reaction) to produce a molecule of bundlesheath 3-phosphoglyceric acid. 18.3. Diagrammatic summary of mitosis in the higher plant cells. For example, in a multistep catabolic system the availability of the molecule to be degraded commonly determines whether the enzymes in the pathway will be synthesized. For instance, if a gene is responsible for giving rise to a polypeptide chain and the structure of the chain is known, then from the genetic code dictionary, structure of the gene could be easily inferred. Position of histones in nucleic acids. Contents QUANTITATIVE GENETICS (INHERITANCE OF MULTIPLE) Table 5.4. 69 Number of contributing alleles for each type of eye colour of human beings (Source : Burns and Bottino, 1989). According to this model, an operon was defined as a unit of coordinated control of protein synthesis which consisted of (i) an operator gene which controlled the activity of (ii) a number of structural genes which took part in the synthesis of protein(s). spelta, the F1 hybrid was completely fertile. Further, the plant breeders and animal breeders too avoid inbreedings in the individuals due to this reason. symbolized IA1, IA2, IA3, and IA4. F1 heterozygote : Green Gg Gg F2 : 1 GG : 2 Gg or 1 : 2 or 2 : 1. Vitamin K
(Naphtoquinone) intestinal bacteria; liver; fresh green Vegetables (spinach, cabbage, cauliflower). This change somehow generates a pore in the protein that allows the bound glucose to pass through the membrane. The sequence into which a transposable element inserts is called the target sequence. Tyndall's effect. UDP-uronic acid metabolism. MORPHOLOGY Morphologically, the endoplasmic reticulum may occur in the following three forms : 1. Describe the basic structure of chromatin as we understand it. and of cell fusion. The nucleoplasm contains many types of complex proteins. The 55S ribosomes of mammalian mitochondria lack 5S rRNA but contain 21S and 12S rRNA occur in smaller or 25S ribosomal subunit. 3.8). Peroxisomes are found in animal cells and in the leaves of higher plants. Genotypes of the gametes of one sex are entered across the top, those of the other down one side. Flagella are generally used for locomotion of cells, such as the spermatozoon and Euglena (protozoan). The first region contains numerous oligosaccharides, the second region contains keratin sulphate chains and the third region contains chondroitin sulphate chains. Since the classic work of Schimper and Meyer companion sieve area (1883) it has been accell (in section) cepted that chloroplasts multiply by fission, a proFig. Examples of plant and animal cells, tissues and organs containing lysosomes (Source : Sheeler and Bianchi, 1987). Contents CYTOPLASMIC MATRIX 107 particular locus on the chromoCH3 some. plasma Except for sperm, the cilia in mammalian systems are not membrane organelles of locomotion. The 90 and Contents GENETICS, HUMAN GENETICS, HUMAN GENETICS AND EUGENICS 78 very small number of lines which survive give a greatly reduced 100 6 1 forage yield. The exact mechanism of anion transport by the Band 3 protein is still unknown. A phenomenon in which one member of a pair of allelic genes expresses itself as a whole (complete dominance) or in part (incomplete dominance). 15.1 C). The offspring commonly produce an intermediate yield of milk and hang up a fair carcass when slaughtered. The culture produced by females bearX-rays C I B ing an induced lethal P1 mutation contain only females; whereas female + + + bearing irradiated Xchromosomes in which no recessive lethal has + + + C I B been induced yield culC I + B + + + tures containing some F1 wild type males. Organism Number of replicons Average length (kb) Fork movement (bp/min) Bacteria (E.coli) Yeast (S. Relatively little is known about the mechanism by which ionizing radiations cause mutation. Leeuwenhoek was also first to describe the sperm cells of humans, dogs, rabbits, frogs, fish and insects and to observe the movement of blood cells of mammals, birds, amphibians and fish, noting that those of fish and amphibians were oval in shape and contained a central body (the nucleus); while those of humans and other mammals were round. For example, in humans, patients with chronic myelocytic (myologenous) leukemia (a kind of cancer) display an interesting chromosomal abnormality. If the numbers of gene replicas are non-equivalent on the homologus chromosomes, they may cause different types of phenotypic effects over the organisms. Centrioles lack limiting membrane and DNA or RNA and form a spindle of microtubules, the mitotic apparatus during mitosis or meiosis and sometimes get arranged just beneath the plasma membrane to form and bear flagella or ciliated cells (Fulton, 1971). Pontecorvo later preferred to use the term Lewis effect for the pseudoalleles. Theoretically, eight amino acids could be coded by these eight codons. In an interphase nucleolus, called perinucleolar chromatin, and some inside the nucleolus, called intranucleolar chromatin. Crosses of homozygous agouti (c+c+) and albino (cc) individuals produce a uniform agouti F1; interbreeding of the F1 produces an F2 ratio of 3 agouti : 1 albino (Fig. IFs are hair cell of cochlea composed of polypeptides of a surprisingly wide range of sizes (from about 40,000 to 130,000 daltons). Two turns of Calvin cycle result in the production of one molecule of glucose. Mice with ss genotype show variation in spotting pattern—white spots in some are present only on the belly, ranging to those with an entirely white coat with many intermediates. The direction of operation at any given instant depends on the net free-energy change for the coupled processes of proton translocation across the membrane and the synthesis of ATP from ADP and Pi (after Albert et al., 1989). An understanding of gene transmission is a fundamental aspect of areas such as ecology, evolution and taxonomy. In plants, recessive lethal alleles are known which produce albinism, where absence of chlorophyll is lethal (fatal) to them. Other examples of quantitative traits of human beings include height intelligence (I.Q.), hair colour (except for red versus non-red) and eye colour. However, by itself, the Ds factor was not capable of inducing chromosomal basis for heredity. Physical measurement showed that the B R II strain does not kill mouse sample con-tained a + live mouse live mouse highly viscous substance nonencapsulaed having the properties of R II strain DNA. As a result, inner monolayer is cholesterol rigid stiffened planar more fluid than the outer lipid monoregion steroid layer. Most of the proteins that are isolated in the lumen of RER before being transported to the Golgi apparatus, lysosomes, plasma membrane or extracellular space, are glycoproteins (a notable exception is albumin). The code is commaless. Because in such case Y chromosome. Acetylhexosaminidase 10. Following two examples illustrate this fact : 1. Whether expression of gene is measured at the level of the messenger RNA or the protein, genes coding for products such as globin, crystallin, fibroin, ovalbumin, casein and immunoglobulin give every indication of complete repression in all but the specialized tissue characterized by their presence. Such a sex reversed hen can even faCilated male ther chicks which will be expected to show a sex Actual size of male ratio of two females to one male, since in birds the female is the heterogametic sex. According to most recent studies (see Hall, et al., 1974). Table 13.2. Phenotypes Super female tetraploid haploid } Intersex Normal male Super male Number of chromosomes Number of Chromoproteins are a heterogeneous group of conjugated proteins which are in combination with a prosthetic group that is a pigment, e.g., respiratory pigments such as haemoglobin, myoglobin and haemocyanin; catalase, cytochromes, haemerythrins; visual purple or rhodopsin of rods of retina of eye and yellow enzymes or flavoproteins. Write about certain landmark discoveries of this period. trace element) 5. The outer compartment, peri-mitochondrial space or the inter-membrane and inner membrane space between outer membrane. 235 Some common genetic diseases of humans which can be detected by amniocentesis (Source : Suzki et al., 1986). The process of protein synthesis of both mitochondria and bacteria is fundamentally same because in both, the process of protein synthesis can be inhibited by same inhibitor known as chloramphenicol. Duplication or splitting of chromosomes takes place in the late prophase (pachytene stage). Increasing role of genetics to medicine. What is meant by the terms "upstream" and "downstream"? G group : 21 to 22 pairs — Acrocentric Group A consists of longest metacentric chromosomes. X and colchicine was added to the medium to prevent anaphase Y and the replication forks. The membrane is beyond the resolution of the light microscope, rendering a morphological approach of its study quite unfeasible with this amino acids R group is either a hydrogen atom (e.g., glycine, the simplest amino acid) or a hydrophobic aliphatic (e.g., pheylalanine) hydrocarbon. sion mutations genetically. A group : 1 to 3 pairs — Metacentric 2. Classification of Mutation According to the types of chromosomes, the mutations may be of following two kinds : 1. The mechanism by which glucose controls the cAMP concentration is poorly understood; the significant point is that cAMP regulates the activity of the lac operon (and other several operons as well). It can be found in four position: (i) attached to the nucleus as in nerve Sex chromatin cells of certain species; (ii) attached to the nucleor membrane as in cells of epidermis or of the oral mucosa; (iii) free in the nucleoplasm as in neurons after electric stimu- Nucleus Nucleor membrane Cell B C Fig. 12.3. Cross-section of a typical cell nucleoplasm as in neurons after electric stimu- Nucleon showing ultrastructure (after Alberts et al., 1989). In homozygous condition recessive alleles will be able to express their deleterious phenotypic effects on the individual. Recessive Dominant Recessive No effects on the individual. Recessive No effects on the individual. Recessive No effects on the individual Recessive Dominant Domin folding Recessive F Dominant Fig. The growth of the centriole takes place from the distal end, and in the case of basal bodies, it is from this end that cilium is formed. The heterogametic males 2n+XX (i) XX-XO type. The first telophase is sometimes omitted. The procedure of DNA fingerprinting has the following steps : 1. In some hybrids, the growth rate is increased but there occur no increase in size of mature plant. Both chromatids are attached to each other only by the centromere and become separated at the beginning of anaphase, when the sister chromatids of a chromosome migrate to the opposite poles. The α - form of actin is found in fully mature muscle tissue. Somatic or mitotic crossing over occurs at a four strand stage and during this process there is pairing of homologous chromosomes (Fig. For instance, the expressivity of completely penetrant gene for vestigial wings in Drosophila is influenced by the temperature at which the fly develops, with the effect being most obvious at lower
temperature. Signals originating in various glands and/or secretory cells somehow stimulate target tissue or target cells to undergo dramatic changes in their metabolic patterns. This sort of condensation of two amino acid molecules by -NH-CO linkage or peptide bond. Further, since the X-chromosome carries to undergo dramatic changes in their metabolic patterns. much more genetic information in striking contrast to Y chromosome, one might wonder how it is that the female can carry a double dose of these X-linked genes. The distance between the linked genes, whereas the male has only a single dose of these X-linked genes. combinary complex plex associates with 40S subunit to form 43 initiamet-RNA tion complex. The U7 snRNA (56 bases long) is involved in this processing through extensive complementary base pairing with histone hn RNAs. 3. They are found in several different forms including the plastoquinones of chloroplasts. Which double-stranded? In recent years, advances in biotechnology have led to the creation of special genetically engineered strains of bacteria and fungi that carry specific genes from unrelated organisms such as the mean and standard deviation. Type I IF proteins. Each enzyme is a unique molecule catalyzing a specific chemical reaction. If, however, a somatic mutation occurs early during embryonic life, the mutant cells may constitute a large proportion, while the pendular stroke. Freeze-fracture. As is the case with almost all enzymes, the catalytic activity of ribonuclease depends on the maintenance of a particular threedimensional shape. Lipids represent about 50 per cent of the thylakoid membrane: these include those directly involved in photosynthesis (called functional lipids cilla move in a sweeping such as chlorophylls, carotenoids and plastoquinones. Multiplication phase; 2. The sperm nucleus only in two cell stage. The 18S rRNA has the molecular weight 0.6x106 daltons and consists of 2100 nucleotides. F1 progeny had gray bodies and normal long wings (b+vg/bvg+), indicating thereby that these characters are dominant. The cell physiology is the study of life activities, viz., nutrition, metabolism, excitability, growth, reproduction or cell division and differentiation of the cell. How many of these oocytes would be expected to have a chiasma between these two genes ? 4.40. Oxidative Decarboxylation In aerobic organisms, since pyruvic acid still contains a large amount of energy, it must undergo further degradation, but this time inside the mitochondria. Some plasmids may act as sex or fertility factors (F factor) which stimulate bacterial conjugation. Like the Down's syndrome, occurrence of Edward's syndrome is too related with maternal age (i.e., 35 to 45 year old mothers have more chance of giving birth to trisomy-18 infant). Thus, the base of the dynein molecule attaches only to A subfibre, leaving the heads free to make contact with the adjacent B tubules of neighbouring doublet. (c) Photoreactivation. E.coli has been largely used to study growth in laboratory conditions on a well-defined medium. The nullosomic organism has the genomic formula (2n-2). Instead, they must sabotage the biosynthetic machinery of their host cell so that virus-specific proteins and nucleic acids are made, according to viral genetic information. Cylinder Wall The most striking and regular ultrastructural feature of centrioles and basal bodies is the array of nine triplet microtubules equally spaced arround the perimeter of an imaginary cylinder (Fig. raimondii (2n = 26). Heterogametic Females In this type of sex chromosomal determination of sex, the male sex possesses two homomorphic X chromosomes, therefore, is homogametic females in this type of gametes and produces single type of gametes and produces single type of gametes. are synthesized in cells of living layers of the epidermis and form the bulk of the dead layers of stratum corneum. Cytokinesis COOH α-helical regions shared by all intermediate filaments 48 nm 3 nm protofilament = tetramer of two coiled-coil dimer C D E 10 nm Fig. Development of a basal body begins with the formation of a single microtubule in an amorphous mass. The movement of cilia may be under nervous or cytoplasmic control. lysosomes 3. But, the spherosomes of tobacco endosperm tissue (Spichiger, 1969) have been found rich in hydrolytic digestive enzymes and so have been considered as lysosomes. Retron is the equivalent of a functional gene. The offspring of thelytoky could theoretically be either male or female; but normally it produces only diploid females (Fig. In electron microscopy 50S ribosomal subunit showed various shapes depending on structure seen in difcentral dent ferent views such as frontal-maple leaf, latprotuberance eral-kidney shaped or rear view-rounded. By applying this technique microbodies have been observed by electron microscopy and subsequently isolated from various mammalian tissues such as liver, kidney, intestine and brain. The important plant * Episome is an extrachromosomal, circular, transposable, closed DNA molecule which can exist either integrated ito the bacterial chromosome or separately and autonomously in the cytoplasm. Measurements are made using an electrode that has been standard conditions (pH 0.0, 1M(H+), 25° C and 1 atmosphere pressure). The thylakoid membrane contains all the energy generating systems of chloroplasts. 18.5. Developing foetuses of playing the major monozygotic twins. This type of parthenogenesis is known Contents CELL BIOLOGY 364 as artificial parthenogenesis. The transverse binary fission occurs in some protozoans, e.g., Paramecium and some metazoans such as certain coelenterates, turbellarians and annelids. 17.4B). The syngamy is the most common type of sexual reproduction in the plants and animals. Plasma Membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and Cell Wall Isolation and analysis; chemical composition — lipids, proteins, carbohydrates; structure of plasma membrane and cell Wall Isolation and analysis; structure of plasma membrane and cell Wall Isolation of fluid mosaic model of plasma membrane, role of lipid molecules in maintaining fluid property of membrane asymmetry, constraints on the motility of membrane asymmetry, constraints on the motility of membrane asymmetry, constraints on the motility of membrane asymmetry and constraints on the motility of membrane asymmetry a invaginations, microvilli, basement membrane, tight junctions (zonula occludens), gap junctions (nexus); cell coat; cell wall - chemical composition, structure, functions, origin and growth; revision questions. What are the main functions, origin and growth; revision questions. 1. The electron donor (e.g., H2 in the above reaction) and the electron acceptor (e.g., 2H+ in the above reaction) are called a redox couple or half cell. This step requires the presence of an elongation factor EF-G (called translocase) and GTP. The δ matrix side of the inner mitochondrial membrane. Therefore, the research in the field of cytogenetics should be increased so that we can learn more and more about the man. The remaining four subunits are coded by nuclear DNA and made on cytoplasmic ribosomes. In certain cases the oocyte divides meiotically up to the formation of ootid and secondry polocyte. His sketches included numerous bacteria (bacilli, cocci, spirilla and other Monera), protozoa, rotifers, and Hydra. 15.11). According to some estior cristae mates, there are 104 to 105 elementary membrane particles per mitochondrion. Mitotic segregation. The large size of the elephant is due to the larger number of cells present in its body. ARTIFICIAL PARTHENOGENESIS The eggs which always develop into the young individuals by the fertilization sometimes may develop parthenogenetically under certain artificial conditions. In the zygotene stage, the pairing of homologous chromosomes takes place. Schematic diagram of the principal types of cell junctions, as found in the intestinal epiThey differ from the tight junctions in that the thelial cell (after Darnell, et al., 1986). They are called glucose transporter, glucose permease or D-hexose permease. A Balbiani ring of a polytene chromosome. The packaging of secretory materials (e.g., enzymes, mucin, lactoprotein of milk, melanin pigment, etc.) that are to be discharged from the cell. High density lipoproteins (HDL) or alipoproteins; 2. An understanding of how genes act is now
essential prerequisite for such biological fields of study as development, cytology, physiology and morphology. CELL CULTURE For cell biological observations sometimes it is needed to keep the animal and plant cell in living state outside the organism under favourable conditions. In the subsequent mitotic divisions, some form of cytoplasmic segregate the chloroplast types into pure cell lines, thus, producing the variegated phenotype in the progeny individual. Similar organization of ribosomal proteins and RNA is found in 80S ribosomes (Fig. Some animals, especially mammals, are unable to synthesize certain fatty acids and, therefore, require them in their diet. Why the study of genetics is important for human society? In ATP the last O2 phosphate group is linked with ADP by a special bond known as "en- carbohydrate, fat CO2+H2O mitochondrion fules exhaust ergy rich bond" because when the Fig. When two molecules of amino acids are combined then the basic group (-NH2) of one amino acid molecule takes place. However, thickness of the unit membrane has been found to be greater in plasma membrane (10 nm) than in the intracellular membranes of endoplasmic reticulum or Golgi apparatus (i.e., 5 to 7 nm). Translational Control In prokaryotic gene regulation at the translation level, the lifetime of a mRNA molecule may be genetically determined. Such a process of "carbon fixation" or "CO2-fixation" or "CO2mosome has a polarity and therefore, it fibre structure and the centromere with implanted prevents other chromosomal segments to microtubules; B—An inset a higher magnification, be fused with it. Ribosomal Protein structure is defined as the particular sequence of amino acids found in the protein. The cilia may occur on external body surface and may help in the locomotion of such animals as the tip larvae of certain Platyhelminthes, Nemertines, Echinodermata, Mollusca and Annelida. Alternatively, protoplasm can be synthesized with no cell division so that the cells become larger. 1963) and haemoglobin synthesis in man), (b) frameshift mutations (e.g., investigations of Terzaghi et al. Serial number 1. Anaphase A. The universe of the cell too is complex and diverse. 8.5). The techniques of recombinant DNA and gene cloning are most powerful tools ever developed in the field of biology. For example, the early embryo of frog is found to contain the mRNAs for all the 70 ribosomal proteins, and except four of these mRNAs, all are not translated until the midblastula stage when synthesis of rRNAs is switched on in the nucleolus (Pierandrei-Amaldi, 1982). tended down to the molecule of DNA making up the chromosome. What are their characteristics and functions? Following types of the thelytoky have been recognised : (i) Ameiotic parthenogenesis. It is an ion pump or cation exchange pump which is driven by energy extracellular space 2 ADP 1 3 P cytoplasm Na+ P E2 conformation E1 conformation P 6 4 P P Schematic concept of the Na+/K+ ATPase transport cycle. Although these twins were not raised together, they exhibited many similar behavioural traits. White (w) a sex-linked recessive gene which results in bright red eyes when homozygous. (a) Embryos = 1/2 S1 S3 : 1/2 S3 S4 ; (b) None; (c) Embryos = 1/4 S1 S2 :1/4 S1 S4; 1/4 S3 S3; 1/4 S3 S4; Endosperm : 1/4 S3 S3 S2 : 1/4 S3 S3 S2 : 1/4 S3 S3 S4; Endosperms = 1/2 S3S3S4, 15.10. coli promoters, showing the three important regions: mRNA start, Pribnow box (including -10 sequence) and -35 sequence (after Freifelder, reifelder, r 1985). Cytosol is particularly rich in differentiating cells and many fundamental properties of cell are because of this part of the cytoplasm. The technique of isolation of microbodies from animal and plant tissues includes the following steps : 1. Cholesterol inhibits phase transition by preventing hydrocarbon chains from coming together and crystallizing. 13.8). In a region of five to ten bases preceding the coding region is a sequence of seven bases that reads : TATAATG with minor variations. However, other loops include an extended section of chromatin that is not transcribed at all. Formation of proteins. The failure of homologs (at meiosis) or sister chromatids (at mitosis) to separate properly to opposite poles. Likewise, he got genetically pure variety for dwarf pea plants. Here also sex-linked genes follow the "crisscross" pattern but from mother through heterozygous F1 sons to grand-daughters of F2. One long strand corresponds inter band chromonemata Fig. From the speed at which various molecules penetrate the membrane, they predicted the lipid bilayer to be about 6.0 nm in thickness, and each of the protein layer of about 1.0 nm thickness, giving a total thickness, and each of the protein layer of about 4.0 nm. Contents LINKAGE 85 slash line (/) are on one chromosome and those on the right are on the homologous chromosome. Mutations of r+, called rII mutants, can lyse only strain B, and not strain K-12λ. Ribosomes. The chromosomes change their shape and become giant lampbrush chromosomes which are directly related with increased transcription of mRNA molecules and active protein synthesis in the cytoplasm. It may occupy 10 to 20 per cent time of cell cycle. Describe the mode of biogenesis and various functions of peroxisomes in animal cells. Meiosis is normal in females, but crossing over and reduction in chromosome number fail to occur during spermatogenesis in males due to their haploidy (See Fig. WOBBLE HYPOTHESIS To explain the possible cause of degeneracy of tRNA codons, Crick (1966) proposed the wobble hypothesis anticodon (wobble means to sway or move unsteadily). Synthesis of glycerides, e.g., triglycerides, phospholipids, glycolipids and plasmalogens. Mitochondrial matrix which is the liquid (colloidal) area encircled by the inner membrane, contains the soluble enzymes of Krebs cycle which completely oxidize the acetyl-CoA (an end product of cytosolic glycolysis and mitochondrial oxidative decarboxylation) to produce CO2, H2O and hydrogen ions. In higher animals, hormones are synthesized in various specialized secretory cells (i.e., endocrine cells) and are released into the blood stream. Export of RNA and nucleoproteins from nucleus to cytoplasm Some Bedouin women have a smooth ER problem. The F1 males are mated with F1 females. Plant genetics. Interspecific crosses in genera of Solanaceae (e.g., Solanum and Nicotiana) have been employed for the production of both parthenogenetic and androgenetic and androgenetic and androgenetic and androgenetic and androgenetic and and some females. of the spacer DNA may transcribe nuclear RNA molecules. The albino mouse lacks totally in pigments and has white hairs and pink eves. Culture, 5.7). The meiosis maintains a definite and constant number of the chromosomes in the organisms. What is the initiation complex, and what events follow to begin polypeptide synthesis? These are the most modern branches of biology in which the merging of cytology with biochemistry, physico-chemistry and especially macromolecular and colloidal chemistry become increasingly complex. This is called a CIB method in which a special type of female fly is employed which carries a normal X chromosome and an abnormal X chromosome. While both of these crosses are back crosses, only the cross with the recessive parent is known as test cross. S.N. 1. Plasmolysis ocsolutions. In the growth phase, the spermatogonial cells accumulate large amount of nutrition and chromatin material. Genes for tRNA. the Golgi apparatus in the living cell was difficult to observe with the light microscopy, and this led to many controversies regarding its true nature. When the enzyme synthesis is increased; (B) Reverse or back mutations. Recently a sex reversal gene (Sxr) has been discovered in human beings, so that in the presence of this gene XX female individuals may become male. In neutral solutions, Glycerol salts of the fatty acids form small spherical droplets or micelles in which the dissociated carboxyl groups occur at surface and the hydrophobic carbon chains project towards the centre. The collagens (the source of leather, gelatin, glue, etc.) are a family of highly Primary structure Secondary structure Tertiary structure of the basal body and centrioles. CELLULAR BASIS OF IMMUNITY The cells responsible for immune specificity are a class of white blood cells known as lymphocytes. A poly (G) message was found non-functional in vitro, since it attains secondary structure and, thus, could not attach to the ribosomes. Likewise, IR26 strain of rice was developed by geneticists in 1973; it has a wide range of desirable characteristics such as resistance to several viral and fungal diseases and protection from insects such as green leaf hopper, brown hopper and stem borer. Structural non-histone proteins could be involved in organizing the 30-nm 146 bp of DNA lacking B fibres into loops. Contents 8 GENETICS, HUMAN GENETICS AND EUGENICS Seymour Benzer performed extensive investigations on the genetics of T4 bacteriophage of E. OPQ. Two independently segregating dominant genes (A and B) have been found to influence the shape of the capsule in the same way (Table 4-10). Perhaps this is earliest recorded use of a magnifying instrument in a biological study. The A chains are shown by open circles. left handed coiled snails. Contents MENDEL AND HIS WORK 39 roundness of the seed, respectively. Iron Fe2+, Fe3+ Constituent of haemoglobin, myoglobin and cytochromes. Such genes are called to have complete penetrance.

distinct marker enzymes for histochemical markings, such as cytochrome oxidase for inner membrane, monoamine oxidase for outer chamber. Stem length : T, t; D, d Tall × Dwarf or Short Current Chromosome Appearance symbols location* of all F1 hybrids 2.84 : 1 Extensive linkage studies conducted by Lamprecht (1961) have shown that seven genes used by Mendel belonged to only four linkage groups. A nucleotide is composed of nucleoside and phosphoric acid. NADH carries two electrons, taken from glyceraldehyde-3phosphate and contains little energy. following chart : Variation in chromosome number (ploidy) Euploidy (2n-2) Hyperploidy (2n+1 +1) Tetrasomy (2n+2) Contents CHROMOSOMAL MUTATION II 199 REVISION QUESTIONS AND PROBLEMS 1. 11.1. A test of allelism. Enzyme A. t tt Uniparental inheritance. 13.7) and confirmed and christened by P. The entire process involves intervention of two basic organelles : chloroplasts and peroxisomes. The same carrier molecule will often participate in many different biosynthetic reactions in which its group (i.e., acetyl group) is needed, e.g., growing fatty acid. It includes the following four types : 1. This results in an inverted chromosome having segments 1-2-5-4-3-6 (Fig. Artificial parthenogenesis. In certain pathological conditions the lysosomes start to digest the various organelles of the cells and this process is known as autolysis or cellular autophagy. The hormonereceptor protein complexes activate the transcription of specific genes are sets of genes according to following two methods (= hypotheses): 1. The pseudogenes found in many gene families, often presumed to have arisen as cDNA (= complementary DNA) copies of reverse transcribed message. It may be regarded as a hydrogenated carotenee transcription of specific genes are sets of genes according to following two methods (= hypotheses): 1. The pseudogenes found in many gene families, often presumed to have arisen as cDNA (= complementary DNA) copies of reverse transcription of specific genes are sets of genes are sets of genes according to following two methods (= hypotheses): 1. The pseudogenes found in many gene families, often presumed to have arisen as cDNA (= complementary DNA) copies of reverse transcription of specific genes are sets of genes are sets of genes according to following two methods (= hypotheses): 1. The pseudogenes found in many gene families, often presumed to have arisen as cDNA (= complementary DNA) copies of reverse transcription of specific genes are sets of genes according to following two methods (= hypotheses): 1. The pseudogenes found in many gene families, often presumed to have arisen as cDNA (= complementary DNA) copies of reverse transcription of specific genes are sets of genes according to following two methods (= hypotheses): 1. The pseudogenes found in many gene families, often presumed to have arisen as cDNA (= complementary DNA) copies of the pseudogenes found in many gene families, often pseudogenes found in (vitamin A). (b) All "white" because of all colourless (defective) plastids in the eggs of the pistillate parent. In a similar way an unequal crossing over between bar an ultrabar produces (i.e., something which will divide a number without a remainder) of purified DNA preparation are treated with these enzymes, which one would be expected to contain more restriction fragments ? Contents GENETICS, HUMAN GENET used for physical mapping and isolation of genes whose protein products are unknown. Electron micrographs of the plasma membrane showed that it consists of two dark layers), both separated by a lighter area in between (the central clear area of lipid bilayer). Each secondary spermatocyte is haploid and contains x number of chromoThe microscopic structure of the testis showing section through a seminiferous tubule. It is a fluid-mosaic assembly of molecules of lipids (phospholipids and cholesterol), proteins and carbohydrates. In this case, C pairs with G and U pairs with G and U pairs with A. 12.1). Contents 60 GENETICS, HUMAN GENETICS AND EUGENICS Examples of Incomplete Penetrance (i) Polydactyly in man is thought to be produced by a dominant gene P. 5.16). Synthesis of Gene from mRNA (or Enzymatic Synthesis of Gene) initiation of transcription intergenic space (signal for CCA end processing) promoter RNA directed DNA polymerase enzyme, which was discovmature tRNA ered by Temir and Baltimore precursor (1970), can synthesize DNA from tRNA RNA template. Cytoplasmic or Extranuclear Inheritance 1 8 . GENE CONCEPT Gene is a conceptual unit. GTP is cleaved after termination step has occurred which may be essential for the release of eRFI from the ribosome. It has been demonstrated that the sex chromatin is derived only from one of the two X-chromosomes. Contents 254 CELL BIOLOGY constituents of the chromatin of all eukaryotes except fungi, which, therefore, resemble prokaryotes in this respect (see Sheeler and Bianchi, 1987). The intermediate filaments are very heterogeneous from the point of view of their biochemical properties, but by their morphology and localization can be grouped into following nerve four main types (Table 15-1): Hair cell of the cochlea. Development of centriole (or basal body) has been studied in the ciliates Paramecium and Tetrahymena and in tracheal epithelium of Xenopus and chicks. Most mutations are forward type. (c) What is the diploid number of the opposite sex ? genes DEF is duplicated, the sequence of genes in tandem duplication will be ABC. Peptide hormones such as insulin, epinephrine, etc., and steroid hormones such as estrogen, progesterone, testosterone (in higher animals) and ecdysone (in insects). The specific nucleotide sequences at the 5' end may influence its susceptibility to enzymatic digestion. Origins are indicated by O and B - replication started in right-hand replication started in left-hand replication started in right-hand unit; C - replication started in left-hand replication started in right-hand replication started in right-hand replication started in right-hand replication started in left-hand replication started in right-hand replication started in are hydrolysed by the enzyme lipase (glycerol Glyoxysome localization within plant seedlings. Step 3 generates the 5'-P end. Both types of cells have diploid number of chromosomes but each type has its different destiny. Also for maintaining the characteristic membrane must be assembled with precisely the correct moleular topography. Parents Parents + + X X Heterozygous for recessive lethal X Y Normal Gametes + 0 + + + 0 Gametes X X Y Progeny Progeny X X + Normal X Y Fig. (Note: Biotechnology means use of living organisms or processes to modify or make products and to improve plants or animals, see Peter Funk, 1995). 10. Plastids. Second division segregation. The Human life balanced against scientific progress. Yes, if it was incompletely sex-linked and the father carried the normal gene on the homologous portion of his Y chromosome set (euploidy) (a) Loss of an entire set of chromosome set (euploidy) (b) Addition of one or more sets of chromosome set (euploidy) (a) Loss of an entire set of chromosome set (euploidy) (b) Addition of one or more sets of chromosome set (euploidy) (b) Addition of one or more set (euploidy) (b) Addition o (polyploidy). The primary spermatocytes are ready for first meiotic or maturation division. It also contains proton pumps and many permeases; and 3. 2.3). For example, in the cells of ectodermal origin, the Golgi apparatus remains polar and occurs in between the nucleus and the periphery (e.g., thyroid cells, exocrine pancreatic cells and mucus-producing goblet cells from total protein accumulation—the net balance between total protein synthesis and protein degradation. (3) Both forms exhibit G=C pairing. If the sections were not extremely thin, most of the electrons (b) centriole would be scattered and a uniform A comparison of microscope images dark image would result. However, when lactose is provided, all three enzymes are synthesized rapidly and simultaneously as coordinated response to the presence of this substrate. Crisscross inheritance. Kleinsmith, 1975). substance absorbs sufficient energy from the ultraviolet Contents 210 GENETICS, HUMAN GENETICS AND EUGENICS light, some of their electrons are raised to higher energy levels, a state called excitation. is called dextral. A deletion is indicated by a superscript minus
sign, and added segments are indicated by supercript plus sign. But the poly-sugarphosphate backbone is always the same, and it is, therefore, unlikely that these moiteies of DNA molecule carry the genetic informations. Petite. Presence of repressor no transcription ribosome Fig. Case II. 4.4. Theta (θ) configuration of replicating E.coil chromosome eukaryotes by using the technique of autoradiography and obtained by Cairns. So, by such experimental evidences he rejected the Lamarckism and pangenesis theory. SCOPE OF GENETICS Joshua Lederberg Geneticists study all aspects of genes. In 1938, T.M. Sonneborn reported that some races (known as "killers" or killer strain) of the common ciliate protozoan, Paramecium aurelia produce a poisonous substance, called paramecin which is lethal to other individuals called "sensitives". The genetic information must be reproduced and transmitted faithfully from cell to cell or from generation. If already exposed, the previously developed anti-Rh antibodies will agglutinate the donor's RBC. This type of maternal inheritance by plasmagenes of chloroplasts has been also studied in many other higher plants such as barley. Oenothera sp., rice, etc. Brownian movement. Complete linkage in male Drosophila. Glycolysis or Embden-Meyerhof pathways showing the step-wise degradation of glucose to pyruvic acid. For example, acid phosphatase is the principal enzyme which is Fig. A.F. Shull and D.D. Whitney have shown that by increasing metabolic rate in rotifers the occurrence of male individuals increases than females. The single-celled alga, Acetabularia which conliver cell epithelial cell fibroblast sists of a stalk and a cap is exceptionally large-sized and measures up to 10 cm in height. Cytoskeleton is apparently absent from the bacteria; it may have been a significant factor in the evolution of the eukaryotic cells. But in male Drosophila and female silkworm, Bombyx mori (see Swanson, 1957) crossing-over takes place either very rarely or not at all. During G2 phase, synthesis of RNA and proteins continues which is required for cell growth. Moses (1956) has revealed a highly organized structure of filaments called synaptonemal complex in between lateral elements recombination nodule the paired chromosomes of zygotene and pachytene stages in crayfish by electron microscopy. It is heterogametic and produces two types of ova, 50 per cent ova carry the Z chromosomes, while rest 50 per cent ova carry W chromosomes. Extend from each of the nine outer doublets inward to the central pair. We are giving here certain most common terms which are used more frequently in genetics. However, it was difficult to explain why F1 progeny a+/+b was not wild type. X+ X+ X X C Y Normal female Colour-blind male Gametes : (X+) (Xc) (Y) + c F1 : $\frac{1}{2}X X : \frac{1}{2}X + Y$ Normal but carrier female and a normal male 3:1 $\frac{1}{4}XcY =$ Normal but carrier female 3 Normal : 1 Colour-blind or $\frac{1}{4}X + Y =$ Normal male 3:1 $\frac{1}{4}XcY =$ Colour-blind male Parent : Fig. (vi) In Z-DNA, one complete turn of helix is $45A^{\circ}$ long, while in B-DNA it is $34A^{\circ}$ long. Most RNA is never exported from the nucleus. Which of the structural levels play a fundamental direct role in protein functioning? Protein synthesis. H2O2 \rightarrow H2O + 1/2O2 In plant cells, peroxisomes remain associated with ER chloroplasts and mitochondria and are involved in photorespiration. A paternity case involves these facts: the woman is A1, her child is O, and the alleged father is B. Describe different techniques used in vitro from reconstituted chromatin, mainly depended on the source of non-histone proteins (see O'Malley et al., 1977). If a woman heterozygous for colour blind man, what is the probability that their first child will be a colourblind daughter ? Describe the method of karyotyping human chromosomes. Assume the presence in corn of the recessive ds and mp. Similar properties have been reported for the proteins of other operons (Nomura, 1986). Prophase I The first prophase is the longest stage of the meiotic division. In a haploid such as Neurospora, study of linkage, crossing over and chromosome mapping is facilitated due to following reasons : 1. Introduction 3-7 Fact of evolution; evolution compared with ancient history; a preview of evolutionary biology; revision questions. During DNA replication, they are incorporated by DNA in place of the normal DNA bases. The genes S and Y are linked; the ratio is 3 : 1 indicating complete linkage, that is, no crossing over. Develop a formula for determining the length in micrometers of a DNA molecule whose number of deoxyribonucleotide pairs is known. The lysosomes digest the food contents of the phagosomes or pinosomes. coli chromosome DNA ligase recombinant plasmid Fig. Contents 94 GENETICS, HUMAN GENETICS 3. Since, O-nu embryos were able to continue synthesizing 5S rRNA (Miller, 1973), it indicated that these genes were not located in the nucleolar organizer. Diameter (nm) 3. MICROTUBULES Microtubules were fisrt of all observed in the axoplasm of the myelinated nerve fibres by Robertis and Franchi (1953). It gives a pattern that is the reverse of that of Q and G banding. If in a mRNA molecule at a particular point, B Frame CAT CAT GCA TCA TCA addition shift one base pair is replaced by another normal addition, the C Restoration deletion CAT CAT ATG CAT CAT Meaning of one codon containing such + of frame addition normal abnormal abnormal normal an altered base will be changed. The classical case of genetic interaction of two genes is discovered by Bateson and Punnett (1905-1908) in fowls. Incomplete Linkage The linked genes do not always stay together because homologous non-sister chromatids may exchange segments of varying length with one another during meiotic prophase The presence of both SER and RER in the hepatocytes (liver cells) is reflective of the variety of the roles played by the liver in metabolism. (iii) Role of cholesterol in maintaining fluidity of membrane. Among these early investigators of ETS the Nobel Prize recipients were Warburg, Szent-Gyorgyi and Kuhn. Contents CYTOSKELETON : MICROTUBULES, MICROFILAMENTS AND In living cells, the have a central core of scaffold surnucleosomes would be touching each other to form a 10 rounded by a halo made of hoops of nm fibre and not stretched out (to form beads-on-aDNA (Fig. Around 1970s, studies of gene's fine structure were extended to bacteria Salmonella), yeast, mold (Neurospora), wasp (Mormoniella), flies, cotton and maize. Give structural formula of ribose and deoxyribose sugars. The pattern of phenotypes produced by a given genotype under different environmental conditions. Types of heterochromatin. Phytochrometal conditions. Types of heterochromatin. Phytochrometal conditions. Types of heterochromatin. Phytochrometal conditions. known as depurination. 16.4. Copy error mutation due to tautomerization of adenine. The factor (RF1) identifies termination codons UAA and UAG, while factor RF2 recognizes codon UGA. This stage is characterized by a period of frantic activity during which the spindle appears to be trying to kinetochore plus end of microtubules where subunits are added or lost outer kinetochore plate dynein microtubule fibrous corona inner plate interzone outer plate The kinetochore. Both polymerization (=chain elongation) and exonuclease activity of DNA polymerization (=chain elongation) and exo content and very large chromosomes that produce vary beautiful meiotic preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Allium cepa) have particularly large chromosomes that produce fine preparations; among plants, broad beans (Vicia fava) and onion (Vicia fava) and onion (Vicia fava) and onion (Vicia fava) and onion (Vicia fa AND HIS WORK 25 6. Since there are usually many genes of this kind for one quantitative trait, they are named multiple factors, each factor having too small an effect to be traced. Contents INTRODUCTION 7 1982 A. The cisternae are long, flattened, sac-like, unbranched tubules having the diameter of 40 to 50 µm. Such a sex Unfertilized which produces two different type of gametes in terms of sex chro2n n mosomes, is called heterogametic sex.
Cytoplasm; and C. "Individuals of identical phenotype may have different genotypes and vice versa." State whether this statement is true or false and why? Test cross. The European raspberry (Rubus idaeus) has 14 chromosomes. Which processes in protein synthesis require hydrolysis of GTP ? Thus, lactose acts to induce the production of the enzymes needed for its catabolism. They are also called "background mutation" and have been reported in many organisms such as, Oenothera, maize, bread molds, microorganisms (bacteria and viruses), Drosophila, mice, man, etc. The protein complex is moved through the nuclear pore (step 3) and into the nucleoplasm where it interacts with Ran-GTP and dissociates (step 4). In pea plant Mendel found following characters to be dominant or recessive in various pairs of contrasting characters (see Table 3-1). bodied Drosophila fly is crossed with a vestigial-winged, grey-bodied fly, they produced in F1 long-winged grey-bodied Drosophila. Genetic engineers have promised a free agriculture from constraining requirements for fertilizers and pesticides. He is also known to be first to produce a hybrid between two different plant species. Adhering junctions 3. The repeating unit is an $\alpha\beta$ heterodimer which is arranged 'head to tail' within the microtubule, that is $\alpha\beta \rightarrow \alpha\beta \rightarrow \alpha\beta$. Sometimes hypotonic solutions are used prior to squashing to produce swelling of the nucleus and a better separation of the individual chromosomes. (iii) Proteinoplasts. Like the carbohydrates, lipids serve two major roles in cells and tissues : 1. The self-assembly of 30S subunits is highly specific. 14.14). Body part Dominant 1. The ridge and the central protuberance are separated with the help of a valley (Fig. Virus reported) affect the mutability of host's genes. When the F1 hybrids were allowed to be self-fertilized, they produce both coloured (red or purple) and white flowered pea plants in F2 generation in the ratio of three and one (3:1). Contents EUGENICS, EUPHENICS AND GENETIC ENGINEERING 247 type of method is known as eugenics. In it females are reported to be originated by parthenogenesis. annulus Such a process of lignification was required in connection with the transition from aquatic to the terrestrial plasma plant life during organic evolution of plants. However, some of the lowest forms of plant and animal life are found to have several sexes. Nucleolus shows cyclic changes during the cell cycle and is somehow related to cell growth. The 5S rRNA is found not to undergo the processes of tailoring and methylation before it becomes mature (see Good-enough and Levine, 1974). coli-like translational regulation also exists in eukaryotes. Genotype Classical ratio Dominant genes Duplicate genes Duplicate genes interaction A-B- (AA BB, AA Bb, Aa Bb) 9 A-bb (AA bb, Aa bb) 9 Abb) aa B- (aa BB, aa Bb) aa bb 3 3 3 1 1 12 9 9 3 4 6 1 1 15 9 7 13 3 Contents GENETIC INTERACTION AND LETHAL GENES 57 ATAVISM OR REVERSION While we were discussing the cross between two white flowered sweet pea plants we observed that F1 hybrid had purple colour unlike their immediate parents but like their remote ancestors. coli cell conjugated with an F-('female') E. If DNA is to contain hereditary information as they reasoned, and if that information is inscribed as a specific sequence of bases along its polynucleotide chains. These along its polynucleotide chains. cells need to maintain themselves but do not have to grow or undergo a change of state. Electron microscopy of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has shown that RNA polymerase enzyme molecules are attached to the principal axis (DNA) of the loops has attached to the principal axis (DNA) of the loops has attached to the principal axis (DNA) of the loops has attached to the principal axis (DNA) of the loops has attached to the principal axis (DNA) of th mitochondrial functions. 14.2. Chromosome constitution of a translocation heterozygote and Thus, in the latter case, the a translocation heterozygote and Thus, in the structure of a group of protists called foraminifera. Bead theory. Since DNA synthesis always proceeds in 5' to 3' direction, so, on the lagging strand, synthesis takes place discontinuously in pieces, called okazaki fragments (after the name of discoverer R. Arrangement of nuclear pores on nuclear envelope. 15.2). (b) If 10 nucleotides = 34Ao, how long would this chromosome would be in millimeters ? outside 3. CHARACTERS OF MULTIPLE ALLELES The most important and distinguishing features of multiple alleles are summarized below : 1. The cells of the squamous epithelium contain the discoidal nuclei. When the P680 of photosystem II acquires a sufficient quantum of energy, it emits a pair of electrons. These are genes which produce a phenotypic effect that is qualitatively different from that of standard gene, e.g., Bar locus of Drosophila. Character studied Old and recent symbols Appearance of F2 plants F2 ratio 1. McClintock established that such kernel mosaics frequently resulted from breaks at a particular site on chromosome 9. It stains specifically centromeric constitutive heterochromatin. Differences Between Quantitative and Qualitative Genetics The genetical studies of qualitative and quantitative traits are called qualitative genetics, respectively. For example various genetic crosses have shown that in Drosophila, among three mutant sex-linked genes (viz., genes for white eyes, yellow body and cut wings), the genes for white and yellow are always found to have 1% crossing over and similarly, white and cut genes are found to have 20% crossing over. The 50S ribosomal subunit is smaller in size and occurs above the 50S subunit like a cap (Fig. In this mechano-chemical Fig. Sugars associated with the surface of erythrocytes in blood are not proteins but, are mucopoly- type A and type B persons (after Goodenough and Levine, 1974). 1.6 mg (boys) Peas, beans, milk, egg1.4 mg (girls) white, liver, kidney, germinated cereals and pulses, growing green leafy vegetables. A basilisk lizard runs across a pond, putting the Molecules dissolved in water lower its water's surface tension to good use. A promoter sequence which is responsible for constitutive expression of common genes (also called house keeping genes) in all cells, is called generic promoter. 70S 50S core 23S 40S 30S split proteins core 3. The glycolate cycle is thought to bring about the formation of the amino acids-glycine and serine-from the non-phosphorylated intermediates of photosynthetic carbon reduction cycle, i.e., glycerate to serine, or glycolate to glycine and serine in a sequence of reactions which involve chloroplasts, peroxisomes, mitochondria are expected in the F1 and F2 ? (a) 2 females. The modern race horses, for example, are all descendents of three Arabian The animal breeder have employed the inbreeding to stallions imported into England between 1689 produce best races of horses. Polarity of the egg. Further, a deletion can be terminal or inter1 2 3 4 5 6 7 8 9 10 11 12 calary (interstitial). For example, the total number of capsomeres; (2) Turnip yellow mosaic virus or TYMV = 32 capsomeres; (3) Poliovirus = 32 capsomeres; (3) Poliovirus = 32 capsomeres; (3) Poliovirus = 32 capsomeres; (4) polyoma virus and papilloma virus = 72 capsomeres; (5) Reovirus qp 120 coat protein RNA (a) reverse transcriptase protein coat nucleic acid lipid bilayer (b) Virus diversity (a) Adenovirus, (b) HIV (c) T- even bacteriophage. However, to understand the mechanism of segregation more clearly in animals it will be helpful to consider an original experiment of well known genetist T.H. Morgan on Drosophila. (ii) The b-c1 complex. Yes, if the woman is IAi and the man IBi. 13. In 1951, Lehninger proved that oxidative phosphorylation requires electron transport. prophage somehow generates its transposition, but also activates the genes encoding for structural proteins which package its DNA. Sectors of purple and yellow tissue in the endosperm of maize kernels resulting from the presence of the transposable elements Ds and Ac. Contents TRANSPOSABLE GENETIC ELEMENTS 255 MODE OF DISCOVERY OF TRANSPOSABLE ELEMENTS Transposable elements were discovered by Barbara McClintock (1965) through an analysis of genetic instability in maize (corn). The overall polymerization reaction can be written
as follows : n NTP + XTP DNA, $RNA-P \rightarrow Mg2+$ (NMP)n XTP + n PP1 in which XTP represents the first nucleotide at the 5' terminus of the RNA chain. Lastly, in about 2 to 5 per cent cases, the normal chromosome number is present (2n = 46), but the extra chromosome 21 is attached (translocated) to one of the larger autosomesome 21 is attached (translocated) to one of the larger autosomesome number is present (2n = 46). (usually chromosome 14). Such type of theories which advanced the concept of the presence of preformed embryo in the sex cells are known as preformation theories. Thus, G1 involves transcription of three types of RNAs, namely rRNA, tRNA and mRNA; rRNA synthesis is indicated by the appearance of nucleolus in the interphase (G1 phase) nucleus. The outer membrane then invaginates at the partition plane, constricting until there is membrane fusion between the two inner membrane fusion between the two inner membrane walls. A gene called apprepressor which unites with corepressor which unites with corepressor to form a functional repressor molecule. The meiosis often produces haploid gametes or individuals. Cross mt— ss (male) × mt+ sd (female); if chromosomal, 25% of the sexual progeny should be mt— ss, 25% mt+ sd; if cytoplasmic, almost all of the progeny should follow the maternal line (streptomycin dependent) while mating type segregates 1 mt- : 1 mt+. (b) Globular proteins. Different chemical substances have different potentials for donating or accepting electrons. Since the enzyme produces a DNA copy of the viral RNA that is the reverse of transcription, is used. What is a division furrow and contractile ring? One of the leading discoveries, in which the technique of enzymatic synthesis of gene has been utilized, is the synthesis of rat insulin cDNA segments on insulin mRNA isolated from pancreatic islets of Langerhans (Ullrich et al., 1977). Contents CELL GROWTH AND CELL DIVISION 329 Further, the mechanism by which kinetochore of the chromosome moves up the spindle during anaphase A is still unknown. Morerelative to unmethylated C resiover, flowers that developed showed altered morphology. Molecular structure of water. Ultimately, globuli are arranged along plastid membrane and the centre of stroma. INDIRECT EVIDENCES FOR DNA AS THE GENETIC MATERIAL 32 PO4= 35 SO4= phage particles + bacteria grown in replicate (multiply) its RNA molecule. Does amount of DNA has any correlation with the ploidy of the cell? Sex-linked lethals in humans. After this division, the nuclear envelope is formed around the chromosomes of the daughter nuclei. 1972 Mertz and Davis in 1972 demonstrated that cohesive termini of cleaved DNA molecule could be covalently sealed with E.coli DNA ligase and were able to produce recombinant DNA molecules. All biological membranes including the plasma membranes of eukaryotic cells (i.e., membranes of eukaryotic cells (i.e., membranes including the plasma membranes of eukaryotic cells (i.e., membranes including the plasma membranes including the plasma membranes of eukaryotic cells (i.e., membranes including the plasma membranes including the plasma membranes including the plasma membranes of eukaryotic cells (i.e., membranes including the plasma membranes including the plas (i.e., fluid-mosaic) and selective permeability but differing in other functions. (3) There is a maximum rate of glucose transport, i.e., when the concentration gradient results in a corresponding increase in the rate of transport. (ii) Procentric synapsis. Mitochondrial protein synthesis. A+X A+Y Sex determination in Drosophila. According to Howard Flanders and Boyce (1964) dark reactivation includes following stages : (i) An enzyme possibly endonuclease makes a cut in the polynucleotide strand on either side of the dimer which may be formed due to ultraviolet radiation and excises a short, single strand segment of the DNA. Digestion of large extracellular particles. simultaneously. They are often used to examine chromosomes and other relatively thick objects that can be isolated free of debris. On either side of a transposon is a short (less than 10 b.p.) direct repeat. 4:2:2:1 Ratio This phenotypic ratio is obtained when at both gene loci of F1 dihybrids occur the recessive lethal alleles. Homobranchial duplication DEFH = ABC. CHROMATOGRAPHY The chromatography is used to separate the molecules of different substances present together sealed in a solution or cytosol. Spinae. SomePyruvic dehydrogenase + times two enzymes that catalyze sequential reactions form lipoic acid ar enzyme complex and the product of the first enzyme does S La not have to diffuse through the cytoplasm to encounter the S second enzyme. 19. ER protein ribosomes presumptive membrane elements glycosylated protein transcenter the S second enzyme. golgi cis golgi secretory, lysosome glycosylated or processed proteins Fig. 5.14): 1. All genotypes having dominant alleles of both of these genes (A and B) would produce plants with triangular-shaped capsules. The packaging of DNA into a 30-nm chromatin fibre leaves a human chromosome about 0.1 cm long, so there must be several higher orders of folding. The environmental factors and genetical background have some definite effect on the degree of penetrance of a gene. A dihybrid autotetraploid plant of genotype AA as BB bb is self-pollinated. The trait of ability to A B roll one's tongue is also controlled by a dominant allele. Physiology of Cell Cycle and Mitosis A furrow develops. The process in which plasma membrane ingests smaller colloidal particles is known as colloidopexy or ultraphagocytosis, (b) The Didinium's meal is e.g., leucocytes and the macrophalmost over. Male patients are infertile. cytoplasmic ring transporter spokes cytoplasmic filament cytoplasmic particles nuclear ring nuclear lamina (a) A three dimensional representation of a vertebrate nuclear pore complex. SIGNIFICANCE OF QUANTITATIVE GENETICS Quantitative genetics has great agricultural importance and has helped in the cell and are made to express at high level. Though this structure was earlier described as being homologous with internal reticular apparatus, this comparison was later dropped. Contents 104 CELL BIOLOGY and reproduction of cells. The genes are arranged in linear fashion in the chromosomes. Such a high thermal capacity of water has a great moderating effect on environmental temperature changes and is a great protective agent for all life. Various proteins are known that alter the three-dimensional structure of DNA and render it more available for processing which may affect transcription. Granick (1947) described the ultrastructure of grana of chloroplasts. Klug was awarded Nobel Prize in chemistry for providing three-dimensional structure of tRNAs. Rubin and Spradling for the first time introduced Drosophila gene of xanthine dehydrogenase into a P-element (= parental element) which then was microinjected into embryo deficient for this gene. Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 57 DNA ** G Me p ca primary transcript of mRNA release introns MeG * * 3' modification of 3' ends MeG * * AAA 20.4. Genetic organisation of Tn 3 transposon of E.coli. 13.17. It acts paired thylakoid single thylakoid single thylakoid pyrenoids (brown algae) stroma lamella or fret multiple thylakoids grana lamella complex lamella stroma lamella complex lamella or fret multiple thylakoids grana lamella complex lamell along the DNA strand of loop, the fibrils of RNA (i.e., hnRNA) lengthen. mRNA + 30S subunit + f Met tRNA + GTP + initiation factors 50S subunit mRNA AUG AUG P site fMet 30S preinitiation complex Fig. This step produces four molecules of ATP by substrate-level-phosphorylation and involves the following enzymes: phosphoglyceric dehydrogenase (glyceraldehyde phosphate dehydrogenase), phosphoglyceric kinase, phosphoglyceromutase, enolase and pyruvic kinase. In a cellulose molecule successive pyranose rings are rotated 180° relative to one another so that the chain of sugars takes on a "flip-flop" appearance (Fig. Structural proteins which include keratin, the major protein component of hair (cortex), wool, fur, nail, beak, feathers, hooves and cornified layer of skin; and collagen, abundant in skin, bone, tendon, cartilage and other connective tissues. Out to general circulation of these twenty enzymes are the soluble enzymes located in the cytosol and mitochondria. Ph : 2522155 Sultan Bazar, Hyderabad-500 195. Some other modern applications of genetic engineering include — (i) engineering include a shormones or antibiotics; (ii) altering the genotypes of plants as an aid in plant breeding, e.g. formation of insect resistant tomato plants; (iii) altering genotypes of animals to correct their genetic defects, e.g., production of human growth hormones. 21.1. Process of fertilization in animals. Since DNA does not contain sulphur, only protein would be 35 labelled with S. All the cellular membranes have a basic trilaminar unit membrane construction. Water constitutes about 65 to 80 per cent of the matrix. The tail is made up of a thick and hollow mid-piece, a hexagonal base plate or end plate to which are attached six spikes and six long tail fibres. The site of subunit loss can be determined by injecting labelled tubulin into cells during metaphase. Interference and Coincidence In most higher organisms it has been found that one chiasma formation in an immediately adjacent region of the chromatids to bend back upon themselves within certain minimum distances. The glycolipids contain in their molecules the carbohydrates and the lipids. 14.6. Stoffler and Wittman's model of 70S come associated to form the 70S ribosome, ribosome, ribosome, rice., it can convert light energy to chemical energy, much as a solar battery uses light to run a transistor radio. With G banding three major types of chromatin can be recognized— euchromatin, centromeric and intercalary heterochromatin. 14.3. Production of
terminal and interstitial deletion. Mechanism of segregation The mechanism of segregation in above mentioned monohybrid cross between red and white flowered pea plants can be understood by assuming that the homozygous red flowered pea plant has the allele RR for redness and white flowered pea plant has the alleles rr for whiteness. In syngamy (Gr., syn=together; gam=marriage) the fusion of two gametes takes palce completely and permanently. Minerals. Some quaternary proteins consist of identical subunits (e.g., the enzyme β-galactosidase consist of four identical polypeptide chains). The two strands of this radioactively labelled DNA are separated. A— A tropocollagen molecule (collagen or superhelix) with three intertwined propeptides at their N- and C- terminus. The main features of the initiation codon, amino acid activation, transfer of activated amino acid to tRNA and binding of acylated tRNA bearing the first amino acid. It is generally believed that most naturally occurring polyploids. The short legged breed of sheep was known as Ancon breed. It is found that the egg contains a chemical substance known as fertilizin (Lillie, 1919). 14.2 have been shown translocation heterozygote and translocation homozygote. Both types of coilings are produced by two different types of genetically controlled cleavage, another, as shown in following figure : Light micrograph of a living leaf cell containing a number of chloroplasts. Fat solvents, e.g., toulene, ether, alcohol, benzene and acetone. (e) Leaders, spacers and the unnamed regions following the last stop codon of a mRNA are untranslated regions. These membranous entities were coined the term "microsomes" by Claude in 1940, and the relationship between microsomes and the elements of endoplasmic reticulum in the intract cell was established by Palade and Siekevitz in 1956. This laid the foundation for work on the intragenetic recombination leading to the resolution of fine structure of gene. The Y-linked type sex-linked inheritance is performed by those genes which are localized in the non-homologous section of Y chromosome, and that have no alleles in X-chromosome. 17.9. Conjugation in Paramecium and the killer trait. (e) Transcriptional regulation by protein A24. (ii) Preface T PREFACE gy he multicoloured edition of the textbook of Cell Biology gy,, Genetics, Molecular Bigy olution gy olo Evo Ecolo ology gy, Evolution and Ecology is the outcome of sincere and combined efforts of the authors and editors (namely Shishir Bhatnagar, Shubha Pradhan, Malini Kothiyal) and young but talented persons of DTP of S.Chand & Company Ltd. coli and translation of the nascent mRNA. Formating of RNA primer on lagIn bacteria, two different activity of the authors and editors (namely Shishir Bhatnagar, Shubha Pradhan, Malini Kothiyal) and young but talented persons of DTP of S.Chand & Company Ltd. coli and translation of the nascent mRNA. enzymes are known to synthesize primer RNA oligonucleotides - RNA polymerase (on the leading strand) and DNA primase (on the lagging strand). Chromoplasts are of following two types : (i) Phaeoplast. Otto Warburg (1883-1970), who is considered as 'the father of respirometry', in 1910 isolated mitochondria ("large granules") by low-speed centrifugation of tissues disrupted by grinding. Six kinds of gametes could be produced : AA1, A2, AA2, A1, A1 A2 and A. These mitochondria along with the enzymes of plasma membrane for the active transportation of solutes. The non-vital stains fall into two main classses acid stains such as eosin, orange G, aniline blue and fast green, all of which combine with basic molecules such as proteins of the fixed cells; and basic fuchspecific for DNA. Here, the examples of incomplete linkage have been considered only for Drosophila and maize. It determines the shape of plant cell and prevents it from desiccation. 16? a ring of 12 chromosome Morphology such as isochromosomes, ring chromosomes and Robertsonian translocation. Write short notes on the following : (a) axoneme ; (b) sterocilia ; (c) ciliary necklace ; (d) axostyle ; (e) sliding filament hypothesis ; (f) Kartagenre's syndrome Contents 318 CELL BIOLOGY C H A P T E R 18 Cell Growth and Cell Division (a) (Cell Cycle, Mitosis and Meiosis) (b) G rowth—an increase in size or mass of a developing/ living system— is an irreversible process that occurs at all organizational levels. Southern blotting technique. Some polypeptide chains are subject to posttranslational modification before they assume their biologically active form. The dipioid or ovum develops into a parthenogenetic diploid individual. If meiotic chromosomes in such a b c d e f g h heterozygotes are examined, the region of deletion can be detected by the failure of the corresponde d e f g h ab e f g h ing segment on the normal chromosome to pair properly; so a terminal deletion interstitial deletion interstitial deletion interstitial deletion interstitial deletion for the corresponde d e f g h ab e TF IIIB loci involved in switching of mating types. Schematic drawing showing anion transport through the erythrocyte membrane in the capillaries and in the lungs. (a) What is the genotype of the woman ? 10.8). the milkweed bug, Lygaeus turicicus found same number of chromosome in both the sexes, (i.e., 14). The common cultivated oat (Avena sativa) appears to be a hexaploid in the same series. Individuals with a dominant lethal allele die before they can leave progeny. Photosynthesis 1. During the 1960s, it was discovered that the two major classes of immune responses are mediated by different classes of lymphocytes and T lymphocytes. After shedding tially to perinuclear endosomes, endolysosomes their clathrin-coats the endocytic and lysosomes (Alberts et al., 1989). This biosynthetic pathway has the following steps : Acetate - Cholesterol - Progesterone (Cytosol) (SER) (Mitochondria) 11- Deoxycortisterone Cortisol (SER) (Mitochondria) 4. In the mitochondria of osteoblasts present in tissues undergoPyruvic acid (c 3) + ing calcification large amount Intermembrane H P i space 2+ of Ca and phosphate (PO4⁻) Summary of the major activities during aerobic tend to accumulate. These plant proteins are soluble in 70 to 80 per cent alcohol, e.g., gliadin of wheat and zein of corn. What is a lysogenic phage ? Contraction. phenics and genetic engineering) for the improvement of human race. In eukaryotes also, the initiating tRNA molecule is known as copy DNA A A A AA3' 5' or cDNA (also called end of cDNA 3' T T T T T5' reverse complementary DNA). Phase Reversal Cytosol (cytoplasmic matrix) like many colloidal systems, shows the property of phase reversal. A aY XAX XAXA (iii) None of the sons of an affected male will Fig. Contents PLASMA MEMBRANE AND CELL WALL 113 ISOLATION AND ANALYSIS The plasma membrane is so thin that it cannot be observed by the light microscope. All of these components of the ribosomes migrate to the nucleolus, where they are assembled into two types of ribosomes migrate to the nucleolus, where they are assembled into two types of homologous chromosomes is started and chiasmata are first seen. Discuss variation in mutation rates and frequencies at different loci within an organism. The flow of fluid between the cells is indicated by arrows. Describe different types of sexual reproduction. Contents 14 GENETICS, HUMAN GENETICS AND EUGENICS Codominance. 10.17). While the tonofil aments provide the intracellular mechanical support, the cellular adhesion at the desmosome depends mainly on the extracellular coating material. While, outbreeding provides an opportunity for the accumulation of good traits of different races in one individual or line. The mitochondria of the sperma human sperm. Forms of bacteria. Thus, the first code word to be deciphered was UUU. A gene in corn plant called iojap (ij) has been mapped by M. A fully (completely) dominant lethal allele kills both in homozygous states. For instance, in some cases the phenotypes of heterozygous states. many ribosomes are aggregated due to common messenger RNA and form the polyribosomes or polysomes. he ability of eukaryotic cells to adopt a variety of shapes and to carry out coordinated and directed move ments depends on the same line are from the same generation, and individuals in each generation are numbered in sequence (such as II.1, II.2, II.3, and so on). Often lack of one base either causes breaks or causes pairing mistakes. Somatic-cell genetics, β-oxidation. Contents 154 GENETICS, HUMAN GENETICS AND EUGENICS TYPES OF SEX CHROMOSOMAL MECHANISM OF SEX DETERMINATION In dioecious diploidic organisms following two systems of sex chromosomal determination of sex have been recognized: (a) Heterogametic males; (b) Heterogametic females. These receptors react with specific antigens on the surface of other cells. The set have been recognized: (a) Heterogametic females. These receptors react with specific antigens on the surface of other cells. protons and two electrons) at a time. The controversy about the assignment of genetic role either to chromosomal DNA, existed up to 1949 when A. 8.1). coli and other prokaryotes (see Table 4-1), of which DNA polymerase I and II are meant for actual DNA, replication. The F1 heterozygotes or hybrids were found to be long winged. The study of the mode of gene transmission from generation is broadly called transmission genetics; the study of structure and function of the gene forms the molecular biology, and the study of structure and function of the gene forms the molecular biology. bearing chromatin has an appearance of a necklace in which several beads occur on a string. In contrast to the cilia, the flagella exhibit undulant motion and beat independently. The lysosomes of certain cells such as sperms discharge their enzymes outside the cell during the process of fertilization. 121 (ii) Role of unE half E = exterior saturated fats in inP = protoplasm creasing membrane F = fracure face carbohydrate chain
fluidity. Each cilium moves with a whip-like motion and its beat may be divided into two phases : 1. The base of the loop might be arranged on a helical coiled path (e.g., Trillium and Tradescantia). The signal peptide is usually located at the amino terminus and is cleaved off after import (Fig. The human LDL receptor is a single-pass endolysosome transmembrane glycoprotein which stick out vesicular transport carrying newlyor maturation from cytoplasmic side of plasma made lysosomal membrane to form the coated-proproteins tein-binding site. Monolayer technique. Chemical composition of chloroplasts of higher plants. Negative and positive regulation are not mutually exclusive, and some systems are both positively and negatively regulated, utilizing two regulators to respond to different conditions in the cell. Liposomes are small spherical bodies (25 nm to 1 µm in diameter) whose surface is formed by a bilayer of phospholipid molecules enclosing a small volume of the aqueous medium. Donkey stallions have been imported by the Indian army from Europe for breeding mules. Mu phage is unique also in transposing much often than other transposons, providing nearly a hundred new copies of Mu during its hour-long life-cycle. A discredited model of inheritance suggesting that the characteristics of individual result from the smooth blending of fluid-like influences from its parents. Expression and transfer vectors, in the form of a number of viruses are now available to achieve this goal. ISOLATION TECHNIQUES The number of nuclei can be measured easD1 D2 D3 D4 ily in a chamber similar to that used for blood Fig. The machine ranging in length from 5 to 20 nuclepumps a precise amount of one of four solutions of the bases of DNA otides should first be synthesized. Do inversions always suppress crossing-over? Message degradation rates are significant. The abnormal characters occur unusually and can be tabulated as follows : Table 3.5. Abnormal human traits. Chambon, P. The structure of gene could be inferred from its product. 5.24. However, certain suppressor genes may decrease the rate of mutation. If it was stretched out, the DNA double-helix in each human chromosome would Histone octamer span the cell nucleus thousands of time. Grana are stacks of membrane-bounded, flattened discoid sacs, arranged like neat piles of coins. The process is reversed in the lungs : HCO3--diffuses into the erythrocyte in exchange for a Cl---. formed. We have still poor information about the A:T mechanism of induction, idenBUk = 5-Bromouracil keto form tification and characterization of transversion mutations. Permissive growth which permits an animal virus to multiply lytically and kill the host cell. Glycophorin A, an integral protein with a single transmembrane domain. KINDS OF MUTATIONS There exists a lot of controversy about the possible kinds of mutations among geneticists. c. The bands on the autoradiogram can be used for getting the DNA sequence. Extra-cellular Digestion by Plants Plant cells are generally unable to engulf large particles, presumably because of the restrictions imposed on the cell by cell wall. Later, it was shown (Tomas, 1980) that mRNA bands can be blotted directly onto nitrocellulose membrane, a technique which has been widely adopted. primase (Dna G); 3. For example, some steroids are hormones (e.g., sex hormones such as estrogen, progesterone, testosterone) and affect cellular activities by influencing gene expression. Johannsen in 1903 for the true breeding self-fertilized plants. An icosahedral capsid comprises both penta-meres (i.e., capsomeres containing 5 structural units) and hexameres (i.e., capsomeres having 6 structural units). Infantile amaurotic idiocy. Contents 232 GENETICS, HUMAN GENETICS AND EUGENICS heterozygotes for autosomal recessive PEDIGREE ANALYSIS Since, in human beings controlled crosses cannot be made, so human gecarrier of sex-linked female neticists have to resort to a recessive scrutiny of established matings in the hope that indeath mating formative matings in the hope that indeath mating forma ratios: Genotype Genotypic ratio R1 R1 R2 r2 r2 r1 r1 R2 r2 r1 r1 R2 r2 r2 r2 r1 r1 r1 r1 r1 r2 r2 r1 bacterium, Diplococcus pneumoniae grown on nutrient agar, have a smooth (S) glistering appearance owing to the presence of a type specific, polysaccharide (a polymer of glucose and glucuronic acid) capsule. In the mating of both parents by the union of these eggs and sperms, two kinds of F1 hybrids are produced. Similarly, phage proteins were labelled with the help of 35SO4. Thus, hormones serve to coordinate the various activities CH3 concerned with a particular function, e.g., the hormone ecdyosone CH3 controls moulting and metamorCH3 phosis in insects (Beermann, 1965). D D Sturtevant, 1923). Once the ribosome "recognizes" the signal the ribosome becomes attached to the membrane of ER and the polypeptide penetrates. It expresses good qualities of the races and masked the deleterious recessive alleles. Note that the AA XXY female indicate that the presence of a Y chromosome does not determine maleness itself, though males without it (AAXO) are sterile. Included in this group are starch (plant cells and bacteria), glycogen (animal cells), inulin Starch is an energy-storage polysaccharide made of glucose subunits. The plasma membrane chemically comprises molecules of the proteolytic enzymes increase. hydrogen-bonded to the DNA. S19 S19 5S rRNA site L7/L (4 molecules) COMPARISON OF 70S AND 80S RIBOSOMES Eukaryotic 80S ribosomes in the following respects : (1) they are considerbly larger; (2) they contain a large number of proteins (70-80 types of proteins instead of 53) ; (3) they have four types of RNA molecules instead of three types; (4) their proteins and nucleic acids are large-sized; (5) the RNA-protein ratio is near to 1 : 1 instead of 2 : 1 and (6) several antibiotics, such as chloramphenicol, inhibits bacterial but not eukaryotic ribosomes (this is the basis of the use of many antibiotics, such as chloramphenicol, inhibits bacterial but not eukaryotic ribosomes (this is the basis of the use of many antibiotics, such as chloramphenicol, inhibits bacterial but not eukaryotic ribosomes (this is the basis of the use of many antibiotics, such as chloramphenicol, inhibits bacterial but not eukaryotic ribosomes (this is the basis of the use of many antibiotics). chromosomes were paired, but the chromosome identified as the homologue to the X chromosome was distinctly smaller Y chromosome. Observed and named phagocytosis. Write short notes on the following : (i) cDNA library ; (ii) genomic library ; (ii) genomic library ; (iii) Southern blotting technique : (iv) complementary DNA (cDNA); (v) gene sequencing ; (vi) restriction enzyme; (vii) northern blotting technique; (viii) PCR; (ix) gene tagging; and (x) DNA fingerprinting. In addition to processing, methylation and inclusion of other "unusual" intercalary bases takes place after transcription, as does the addition to processing, methylation and inclusion of other "unusual" intercalary bases takes place after transcription, as does the addition to processing, methylation and inclusion of other "unusual" intercalary bases takes place after transcription, as does the addition to processing, methylation and inclusion of other "unusual" intercalary bases takes place after transcription, as does the addition of the 3' terminal -C-C-A. ATP synthetase complexes are located in stacked membrane (grana). 15.7). toxicity of the poisons such as cyanide and azide is due to their ability to bind tightly to this complex and thereby block all electron transport. Entry is made possible by a hole punched in the bacterial cell wall, either by contraction of outer sheath of tail or by the action of enzymes carried by phage tail, or both. The gross mutations occur due to rearrangements of genes within the ganome and may be of the following types : 1. Obtained a complete carrot plant from a single carrot root cell by tissue culture technique. The protein "bearing" serves to seal the outer membrane of the cell wall as the rotating rod passes through it. Thus, at the level of genome (i.e., DNA), the following five modes of regulation are operative: Contents REGULATION OF GENE ACTION 101 (i) Situations of total genetic shutdown. Dioecious Separate female (O) and male (O) flower on different plants. years. In consequence, in place of a particular Fig. (iii) Clathrin-coated vesicles are spherical protuberances, about 50 µm in diameter and with a rough surface. al binary fission in Euglena. The primary structure of several of these proteins has been elucidated. SEX-LIMITED GENES Sex-limited genes are autosomal genes whose phenotypic expression is determined by the presence or absence of one of the sex hormones. Describe this phenomenon by considering the exam le of numan peings The gene L+ for normal development of wing is called the normal or wild type allele of the gene L and usually symbolized as L+, while the mutated gene L and usually symbolized as L+, while the mutated gene L and usually symbolized as L+, while the mutated gene L. Lethal genes may be dominant, incompletely dominant, or recessive. The contents of the liposomes can enter the target cells by two routes : 1. Enzymatic action either by some mitochondrial enzymes (see Grant, 1978), cytosolic MPF kinase (see Alberts, et al., 1989) or nuclear RNA (or ribozyme ; Burns and Bottino, 1989). Further exposition of the genetic code took place by using synthetic messenger RNAs containing two kinds of bases. In other cases, such as albinism, even though the metabolic block leading to an In modern healthcare the emphasis is on abnormality is known, but, it is not possible to correct it. Such a cartwheel configuration determines the proximal end of a centriole and, thus, provides a structural Contents 306 CELL BIOLOGY and functional polarity to it. 4.38. In leucocytes, the mitochondria remain arranged radially with
respect to the centrioles. The aminoacyl adenylate remains bounded with enzyme until it collides with the specific tRNA. Write short notes on the following : (i) Transcription factors ; (ii) Three-dimensional structure of ribosome. However, since they do not form gametes comparable to those of higher organisms, the term monoploid would seem to be more appropriate (see Stansfield, 1986). Describe the process of cell plate formation. Suppose that in each of these cases one of the dihybrid parents is testcrossed (instead of being mated to another dihybrid individual). However, the linear order of linked genes is identical in both maps. In 1954, W. The hub and cartwheel are added in the centre. A model explaining the mode of orientation of newly deposited cellulose microfibrils according to orientation of newly deposited cellulose microfibrils according t Schematic diagram of some of many orders of chromatin packing which may give the highly condensed metaphase chromosome (after Alberts et al., 1989). W.V.Iterson (1969) has placed PPLO in the group Mycoplasmatceae of bacteria. Carbohydrates are present only in the plasma mambrane. The Robertsonian translocation is found to have a role in the evolution of human beings. Explain why phenotypically identical, or at least very similar, parents may produce very different kinds of offspring. The cell is an accumulation of living substance or protoplasm which is limited in space by an outer membrane and possesses a nucleus. Patient therapy include the following steps : (1) identification of a defective gene; (2) isolation or synthesis of normal healthy gene; (3) isolation of cells of the tissue, where the normal healthy gene into the cell. The biological and psychological investigation have revealed that the aged persons often lack in necessary amount of emotional warmth for the sexual activities and moreover, their germplasm also lost its vigour. A third region (sometimes absent) is a sequence of A.T pairs that yields in the RNA a sequence of A.T pairs that yields in the RNA a sequence of A.T pairs that yields in the RNA a sequence of six to eight uracils (U) often followed by adenine. invertebrates, septate junctions perlamina form the functions similar to tight junctions. As illustrated in Figure 10.13, the Krebs cycle involves the condensation of the acetyl group with oxaloacetic acid (6-carbon compound). Conjugation. The 28S rRNA, 5.8 S and 5S rRNA occur in 60S ribosomal subunit, while 18S rRNA occurs in 40S ribosomal subunit of 80S ribosomes of eukaryotes. Distinguish between positive eugenics and negative eugenics. DNA of chloroplast of Chlamydomonas represents non-chromosomal genetic system and has been found to be related with cytoplasmic heredity. Light reaction occurs in thylakoid membranes. The tendency of both dominant or both recessive alleles to repel each other, so that the gametes of genotypes of R ro and r Ro are formed more frequently, was termed repulsion. For example the following two crosses are reciprocal crosses : phenotype A (e.g., Tall) & × phenotype A (e.g. of crossing plants showing contrasting characters is called F1 generation. In such case, the genotype AA BB, AA Bb cell's dry weight. Recent electron microscopic studmembrane cortex ies have found that a nuclear pore has far more complex. The size (molecular weight), shape, and function of proteins are determined by the number, type and distribution of the amino acids present in the molecule. Lysosomes also regularly engulf bits of cytosol (cytoplasmic matrix) which is degraded by a process, called microautophagy. The crossing over, thus, includes the breaking of chromatid segments, their transposition and fusion. These Fig. It occurs as an energy reserve in the form of spherical droplets in certain sulphur bacteria. This may result in alignment of different tRNA molecules on mRNA (during protein synthesis). The latter are very important as they are firm-footed animals that can carry heavy loads on steep Himalayan mountain terrain. Tissues or cells multiplying by asexual division, grown for experimentation. The technique can be improved by determining the so-called centromeric index, which is the ratio of the lengths of the long and short arms of the chromosome. (vi) Universality of the code, i.e., the code being essentially the same for different organisms. Translational control may involve the following mechanisms : 1. The frequency by which a chiasmata occurs between any two genetic loci has also a characteristic probability INHERITANCE OF X-Y-LINKED GENES The genes which occur in homologous section of X and Y chromosome have inheritance like the autosomal genes. intermediate filaments plaque containing protein plasma membrane BP 180 cytoplasm basement membrane anchoring filament (laminin-5) extracellular space collagen fibers type vii collagen fibrils Hemidesmosomes. Reactions that involve the movement of electrons between reductants and oxidants are called redox reactions. This localized unwinding moves along the molecule followed by recoiling of the helix behind the newly synthesized RNA. Vitamin B12 (Cyanocobalamin) 0.2-1.0 µ gm Liver, kidney, meat, Acts as coenzyme 1. Many other examples could be quoted, the main point is that because a typical eukaryotes are not the same. a a 2. Axoneme component (periodicity along axoneme) 1. One example of this is the condition known as phenylketonuria or pku, determined by an autosomal recessive gene. oms in crystal. Molecules have four nucleotides as deoxyguanosine monophosphate, deoxyguanosine monophosphate 50,000 progeny, 10 wild-type individuals were recovered, the rest of the progeny showing a narrow eye phenotype. In its molecule, strands of protein, called core protein, extend radially from a long, central hyaluronic acid molecule. In some types of cells such as erythrocytes, the calcium pumps are located in the plasma membrane and funcCI— HCO-3 tion to transport Ca2+ ions out of the cell. These enzymes act on the following bonds- ester, glycosyl, ether, peptide, other C-N bonds, acid anhydride, C-C, halide and P-N bonds. Hyaluronic acid. coli contain Polyribosome in action. Different forms of bacteria. The abrupt appearance of these diffusible factors in the cytoplasm are landmark events in the cell cycle. Common hexaploid wheat and tetraploid cotton furnish two such examples. Explain Mitchell's chemiosmotic coupling theory. The term 'nucleosome' was coined by P. Males : 1/2 B/b s/S, Barred, Non-silky; 1/2B/b s/s, Barred, Silky; Females : 1/2 b/Y s/S, Black, Non-silky, 1/2 b/Y s/S, Black, Silky. Thus, endoplasmic reticulum is the site of biogenesis of cellular membranes. AA, Aa BB, Bb B 3. Thus, 'housekeeping' genes may be 'left on' for much of the life of the cell when transcription of even the most essential housekeeping genes ceases (i.e., during mitosis). (a) XX; (b) XY; (c) XY; (d) XX. 12.12. When a homozygous P1 Gametes Andalusian fowl with splashed white feathers is crossed with a homozygous fowl with splashed white feathers. The lysosomal lumen is maintained at an acidic pH (around 5) by an ATP-driven proton pump in the membrane. Neither the gears of a watch nor the molecules in protoplasm can interact in any way that is contrary to universal physical laws. Therefore, the 16 individuals of F2 have the ratio of 9:3:3:1 (Fig. 14.3. Diagram of the subunit structure of the ribosome and the influence of Mg++ions. Fisher rejected the Wiener's concept of multiple allelism for R gene, instead of it, he proposed that a series of at least three pairs of pseudoalleles remain so closely linked with each other that they are usually inherited as a block. Firstly they are most common plastids of many plant cells and secondly they perform the photosynthetic activity of greatest biological importance. Table 4-11. Kinds of Meiosis Meiosis occurs in the germ cells of sexually reproducing organisms. The petite mutants can be segregational, i.e., they follow mendelian segregation and, therefore, presumably controlled by chromosomal genes. 12.8. Three different regions of the nucleolus and their involvement in nucleoprotein). Chromosomal Mutation-II (Cytogenetics : Changes in Chromosome Number) 1 6 . Protoplasm. For example, if we start with a population containing 100 heterozygous individuals (Aa) as shown in figure (Fig. Horse 5. (Source : Gardner, Simmons and Snustad, 1991). In 1949, Pauling and his coworkers reported that the formation of an abnormal haemoglobin (HbA or adult haemoglobin) was the cause of this hereditary disease. This is the controlled excision of large intervening sequences or introns from the transcript and rejoining of the remaining fragments, called coding sequences or exons, together to produce the finished mRNA. Synthesis and increase rapidly during one phase of the cycle, e.g., enzymes involved in DNA synthesis, such as thymidine kinase do show a stepwise pattern of its synthesis. Both of these techniques demonstrated that nuclei contain a constant amount of DNA. Typically, however, Golgi apparatus appears as a complex array of interconnecting tubules, vesicles and cisternae. Contents PLASTIDS 229 These three complexes are related to the electron transport and are linked by mobile electron carriers (i.e., plastoquinone, plastocyanin and ferredoxin). They are very hydrophobic and high in molecular weight (23,000 - 40,000 daltons). The term 'pure line' was coined by W. Within the cytoplasm of most animal cells is an extensive network (reticulum) of membrane-limited channels, collectively called endoplasmic reticulum (or ER) The cells are treated with hypotonic solutions (to be discussed elsewhere in the chapter) that due to endosmosis produce swelling and then loss of the heamoglobin content (i.e., haemolysis). The enzymatic synthesis of RNA; 2. Manganese Mn2+ Cofactor of certain enzymes (e.g., several kinases, isocitric decarboxylase). Contents CELL BIOLOGY 154 C H A P T E R 6 Endoplasmic Reticulum (ER) T he cytoplasmic
matrix is traversed by a complex network of inter-connecting membrane bound vacu oles or cavities. Ph : 2226801, 2284815 Blackie House, 103/5, Walchand Hirachand Marg , Opp. In most cases, each mutation was due to a change in a single gene. 1961 M.W. Nirenberg and J.H. Matthaei cracked the messenger RNA code. Likewise, the elongation of the cells during induction of the lens placode in the eye is also accompanied by the appearance of numerous microtubules. The H1 histone molecule has an evolutionarily conserved globular core or central region linked to extended amino-terminal and carboxyl-terminal "arms", whose amino acid sequence has evolved much more rapidly. Monomer units 24 – 25 α- and β- tubulin 4. The chloroplasts generally measure 2–3µm in hickness and 5–10µm in diameter (e.g., Chlamydomonas). This large translation unit is called a polyribosome or simply a polysome. Zinc Zn2+ Cofactor of certain enzymes (e.g., carbonic anhydrase, carboxypeptidase). (iii) Kappa particles. (d) Why are sex-linked lethal mutations easiar to detect than autosomal lethals? Ernst Haeckel, noting that sperm consisted largely of nuclear material, postulated that the nucleus is responsible for heredity. Thus, the cell wall is a rigid and protective layer around the plasma membrane which provides the mechanical support to Contents PLASMA MEMBRANE AND CELL WALL 147 the cell. Some tissues such as liver, contain occasional cells that are polyploid and their nuclei have a correspondingly higher DNA content (4C or 8C) (see Table 13-2). The chromatin comparatively contains large amount of these minerals than the nucleoplasm. Dominant Epistasis (12:3:1) When out of two genes, the dominant allele (e.g., A) of one gene masked the activity of alleles of another gene (e.g., B) and expressed itself phenotypically, then A gene locus is said to be epistatic to the B gene locus (Table 4-1). When the seeds germinate, the proteins are hydrolyzed and the amino acids are mobilized to form a food supply for the developing embryo. They also serve as antigenic determinants and receptor sites. If, in addition to genes A and C indicated above, a third marker gene B is located in fairly close proximity in the same linkage group, all three markers may be used together in conducting a more precise analysis of the map distance and the relative position of the three points. Sometimes the chromosomes bear round elongated or knob-like appendages known as satellites. Affinity chromatography (used for separation of immunoglobulins, cellular enzymes, mRNAs). 10.4). For example, when cells are left for a long time in colchicine (drug which arrests cells in metaphase), the lamins assemble around individual chromosomes, which then surrounded by nuclear envelopes give rise to micronuclei containing only one chromosome. Haemophilia, 4.11 will occur. The keratins are most complex class of IF proteins. Contents CYTOSKELETON : MICROFILAMENTS AND In the bone marrow and in cells derived from it, is B Shift A B C D E F A B C D E F A B C D E F M N O M N O B C P Q A D E F P Q C Reciprocal translocation M M A N N B C O O D P P E Q Q F Fig. When nuclei are very core particle gently lysed onto an electron microscopy grid, most of the blue green algae is based on photosynthesis, therefore, the cells of them contain the photosynthetic pigment, viz., the chlorophyll and carotenoid. When this balance is disturbed, the sex of individual deviate from normal female. Membrane flow may also be an important mechanism for carrying particles, molecules and ions into and out of the cells. In fact, the degree of RBC agglutination depends upon the amount of anti-Rh antibodies present. Recall that the endosperm is triploid, being produced by the union of two maternal nucleis and one paternal nucleus. For example, 1 1 1 3 3 Secondary haploid chromosome number of barley is 7, con- trisomic sequently in it seven trisomics are possible. This protein contains a pigment that is responsive to light and can exist in two interconvertible forms : an inactive form produced by red light. This is not due to inadequate supply of mRNA but of a limitation of an as-yet-unidentified element, called the recruitment factor which apparently interferes with formation of the ribosome-mRNA complex. However, some of these are synthesized by free ribosomes in the cytosol (cytoplasmic matrix) and then are inserted into the membrane. A diagrammatic representation of a karyotype (or morphological characteristics of the chromosomes) of a species is called Photograph of a cluster of mitotic chromosomes. These particles can be seen in the electron micrographs of freeze-fractured cilium (see Fumi Suzuki). Plants of genotype NN and Nn have mixed pistillate and staminate flowers in the Contents DETERMINATION OF SEX AND SEX DIFFERENTIATION 169 inflorescence. Flemming (1882)

investigated the process of mitosis. These fine tubules are present in regions rich in glycogen and can be observed as dense particles, called glycosomes, in the matrix. In particular, they can sequester substances that are potentially harmful for the plant cell, if they are present in bulk in the cytoplasm. So cis-trans effect is a type of position effect of the genes with respect to each other rather than their presence or absence determines the end result (Gardner, 1968). Such a low sodium concentration signal (NLS) binds to the heterodimeric receptor (importin α/β) (step 1) forming a complex that associates with a cytoplasmic filament (step 2). This gene was 207 base pairs long DNA corresponding to the precursor tRNA and (iii) 25 base pairs long DNA corresponding to 16 base pairs adjoining CCA end of tRNA and the remainder, a modified sequence including Table 9.1. Base sequences and lengths of the single-stranded oligonucleotides synthesized for the construction of yeast alanine tRNA gene. In 1717, Fairchild miniature of the adult head tail Fig. Homozygous recessive individuals for these genes are yellow bodied and with bent blunted bristles. Chloroplasts have diverse shapes in green algae but are round, oval or discoid in shape in higher plants. A-3' -OH + discarded introns MeG * * Fig. The metabolic rate of the zygote increases greatly. Fig 3.8. A short hand system of representation of a polynucleotide with four nucleotides. However, these amino acids are frequently altered or removed later by the activity of a hydrolytic enzyme (this is called processing). A barred male chicken contains two genes for barring because it has two sex chromosomes (ZZ). In these cases, many sperms enter in the egg but the pronucleus of only one sperm unites with the pronucleus of the egg and rest are degenerated soon. Rat liver chromatin has been used as a model for chromatin. Thus, X/Y ratios of 0.5, 1.0 and 1.5 are found in plants having only staminate flowers; in plants whose X/Y ratio is 2.0 to 3.0, occasional perfect flowers occur among otherwise all staminate flowers; in plants whose X/Y ratio is 2.0 to 3.0, occasional perfect flowers. Zones of Exclusion A Golgi body or Golgi apparatus is surrounded by a differentiated region of cytoplasm where ribosomes, glycogen, and organelles such as mitochondria and chloroplasts are scarce or absent. Experimental Evidence in Support of Fluid Mosaic Model of Plasma membrane: A. 4. 18.1). G 5' These are the P f a m i l i a r deoxynucleo- Fig. When a dog receives two doses of the e allele, it will be yellow; ee masks the effects of the black-coat gene. This generalization often leads to one of the most fundamental and obvious statement that the cell is the microscopic structural and functional unit of the living organisms. Glyoxylate cycle. When the red mutants were propagated vegetatively, some white cells frequently reappeared. SC helps to stabilize the pairing of homololateral gous chromosomes and to facilitate elements the cytogenetical activity, called recombination or crossing over (occurring during pachynema). Thus far, only a small number of human genes (Table 19-1) have been isolated and cloned for possible use in gene thereapy experiments. 6.4) Contents GENETIC CODE 73 4. Yes, they are linked. Mussels produce the world's best underwater adhesive from a mix of proteins. or the study of inheritance in any species genetically identical, (2) to mate members of different isogenic strains, standard stocks whose members are genetically identical, (2) to mate members of different isogenic strains, standard stocks whose members are genetically identical, (2) to mate members of different isogenic strains, standard stocks whose members are genetically identical, (2) to mate members of different isogenic strains, standard stocks whose members are genetically identical, (2) to mate members are genetically identical, (3) to raise the offspring under carefully controlled conditions. In plants, the phenotype of male sterility is found to be controlled either by nuclear genes or plasmagenes (cytoplasm) or by both. Thus, in bacteria a single gene transcript containing the sequences of 16S, 23S and 5S rRNAs, is synthesized by a rRNA operon and this larger molecule is thought to undergo both tailoring and chemical modifications before each rRNA molecule assumes its mature form. The formal name for this family of mobile genes is transposable elements, and their movement is called transposition. Cure for inherited anemia. Mode of Transport Across Plasma Membrane The plasma membrane acts as a semipermeable barrier between the cell and the extracellular environment. Which of these represent(s) degeneracy, which missense, and which nonsense? 14.7). Thus, Golgi apparatus is a centre of reception, finishing, packaging, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring, and including a 10% list of materials in animal and plant cells: 1. Assuming that the average litter size is seven offspring a seve safety factor to ensure the recovery of the needed number of females that need to be bred. They are present in all photosynthetic cells of higher plants in etiolated leaf tissue, in coleoptiles and hypocotyls, in tobacco stem and callus, in ripening pear fruits and also in Euglenophyta, Protozoa, brown algae, fungi, liverworts, mosses and ferns. In 1910, first white eye mutant was detected in Drosophila by this team of workers and it is first reported case of sex linkage. Pollen with the rigens complex are inhibited. The monosaccharides are inhibited. microbeam causes an influx of Ca2+ which binds to calmodulin. Each doublet contains one complete microtubule, called the A subfibre, containing all the 13 protofilaments. The endosymbiont DNA molecule of the microtubule, called the A subfibre, containing all the 13 protofilaments. Dominance and Epistasis The phenomenon of dominance involves intra-allelic gene suppression, or the masking effect which one allele at the same locus, while the phenomenon of another allele at the same locus has upon the expression of another allele has upon the expression of anoth That is why this series is called an electron cascade of falling water. (b) The 3'-OH end. These include mild or moderate mental (a) (b) (a) Karyotype of a Down's syndrome child. Human females have the Barr body in the nuclei of their body cells in higher proportion than males and are, therefore, referred to as sex chromatin positive The first gene to be isolated was the lac operon of E.coli by Shapiro and his colleagues in 1969. The most important homopolysaccharides of the matrix are the starch, glycogen, paramylum and cellulose. For example, suppose we have to combine following three map segments. Casein phosphokinases Phosphorylation of casein G. 10.18B). Cell wall glycoproteins are tightly woven into the texture of the wall to complete the structure of matrix. In cultured fibroblasts, centriole doubling begins at around the time that DNA synthesis begins (interphase). CH CH3 2 Dolicol phosphate is a polyisoprenoid (i.e., long chain polymer of isoprene) and CH HC is used to carry activated sugars in the N membrane-associated synthesis of glycoCH3 proteins and some polysaccharides. The Blender Experiment An elegant confirmation of the genetic nature of DNA came from an experiment with E.coli phage T2. The coupling factor has two surface of principal components : membrane y (a) F0-complex. This region surrounds the fibrillar centre and RNA synthesis progresses in this region. Replication factor C (or RF-C) and PCNA (cyclin) help in switching of DNA polymerases so that pol α is replaced by pol δ which then continuously synthesized DNA on the leading strand. State whether each of the following is true or false: (a) In the synthesis of DNA the covalent bond forms in between a 3'-OH and 5'-P group. Okazaki, 1968). The following cell organelles are derived from special assemblies of microtubules : (1) Cilia and flagella. 16.9. Formation of a dimer of the following types : Contents 86 CELL BIOLOGY (i) Phospholipids (or Glycerophos-phatides). The simple lipids are alcohol esters of fatty acids : Lipase Triglyceride ————→ Glycerol + 3 Fatty acids. Further, there are present three types of actins— α, β and γ. Contents 130 GENETICS, HUMAN GENETI the mitochondria are found to contain 65 to 70 per cent proteins, 25 to 30 per cent RNA and small amount of the DNA. 9.3. Methods of construction of gene library. This electron is replaced by an electron from PS II and this flow of electron continues as long as the light is available. BIOGENESIS OF RIBOSOMES Ribosomes are not self-replicating particles. Poly(U) was a good choice for other reasons : it binds well to ribosomes and, as it turned out, the product protein was insoluble and easy to isolate. When such non-disjunction takes place during the second meiotic division then XX, and XY and O sperms result. They are also idenmembrane tified as F1 particles or F0-F1 particles matrix or M and are meant for ATP synthesis (phosDNA face of cristae phorylation) and also for ATP oxidation membrane (i.e., acting as ATP synthetase and ATouter membrane (i.e., acting as ATP synthesis). If the mutant allele has developed from the wild form of allele can mutate in more than one way. In Drosophila various sublethal and sex-linked lethal genes have been reported. The midbody contains the remains of the two sets of polar microtubules, packed tightly together with dense matrix material. Acid deoxyribonuclease Substrate Various proteins and peptides RNA DNA Contents 178 CELL BIOLOGY Enzyme C. (2) The tRNA molecules are transcribed continuously and more quickly by tRNA genes than other RNAs because they are needed in plentiful amounts. (b) Polygenic or polycistronic mRNA. Lytic cycle of a virulent phage. This technique has provided an important new tool in the age-old struggle to keep insects away of human crops and habitations. In vitro polymerization evidently involves two distinct phases, one of initiation and the other of elongation. As we have already discussed earlier that only 45 per cent is either lost as heat or used to regulate body temperature of warm-blooded animals. However, according to King (1986), in vitro assembly of microtubules can occur in the presence of low calcium concentration, MAPs, GTP, and a level of free tubulin monomers above a threshold concentration, xylose). simultaneously. It contains about 50 per cent of the proteins of the chloroplast, most of which are soluble type. REVISION QUESTIONS AND PROBLEMS 1. Unlike the compound light microscope, in which image formation depends primarily upon differences in light absorption, the electron mircroscope forms images as a result of differences in the way electrons are scattered by various regions of the object. Are they written in articulated or coded language on DNA molecule? But they do not occur in the ova of man, rat, guinea pig, gastropod molluscs, urodele amphibians, insects and birds. When out of two contrasting characters or traits only one expresses or appears in a generation. (i) Pinocytosis. Similarities such as this suggest that most mutations disrupt the functions of microtubules and are eliminated by selection (see King, 1986). Protein Molecular weight Number 64,500 4 1. Most genes have their multiple effects and are called pleiotropic genes. About 50 per cent non-histories of chromatin have been found to be structural proteins and include such proteins as actin, and α-and β-tubulins and myosin. In Drosophila, certain recessive lethal genes like curly wings (Cy), plum eyes (Pm) and stubbles (Sb) influence the viability of the flies when present in homozygous condition. One active wild type allele can often cause enough enzyme to be produced so that normal or nearly normal phenotypes result (dominance). If a carbon atom is present in a molecule which has four different chemical groups bonded to it, the groups can be arranged in two distinct spatial arrangements about the carbon atom (such a carbon atom is often called asymmetric carbon atom). In DNA replication an enzyme (or enzyme complex) matches up complementary deoxyribonucleoside triphosphates with a DNA template according to Watson-Crick pairing rules and the bases are polymerized to form a daughter DNA molecule. Transparent immersion oils used in today's microscopes (i.e., oil immersion lens) have n up to about 1.6. Still 1.6 is big improvement over air or water (n=1). It linked the two photosystems—PS I and PS II. All of these were considered, on the basis of F2 ratios, to form a multiple series, wild being dominant to all others and white recessive to all-w+ > wco > wbl > we > wch > wa > wbf > wt > wp > wi > w. When this culture is trypsinized and re-plated in a fresh medium then resultant culture is called secondary culture. This relatively site high molecular weight enzyme is also called cytoplas3 mic polymerase or large polymerase. Triticum aestivum (Hexploid rye; 2n = 26) X Secale cereale (Diploid rye; 2n = 26) X Secale cereale evidence to the mechanism controlling the lac operon, but was separated from that of the operator, gene order being i-o-z-y-a. repressor binds to the operator i mRNA Gene i is 1111 base pairs and prevents transcription of z, y and a gene long and is transcribed separately from the genes of the lac operon as a repressor monocistronic mRNA which is translated on the C i p o z y a ribosomes into repressor protein. Sanger discovered a peculiar aminoacyltRNA in E.coli, called N-formyl- methionyl - tRNA and suggested that this molecule may play a role in the special mechanism of chain elongation. While C-3 pathway requires 18 ATP ATP molecules of one molecules of one molecules of one molecules, the C-4 pathway requires 30 ATP molecules (12 ATP more than the C-3 cycle). Flowers may form on any Correns reported that flowers on green branches branch (variegated, green, or white), and produced only green offsprings, regardless of these flowers may be used in crosses. By workanticodon X X ing on these lines, R. globular (=F-actin) transition is the basis of the classical sol-gel transition i interfered with by penicillins and cephalosporins. Proleptotene or Prolepto-nema. However, these proteins are not true conjugated proteins are not true conjugated proteins since the nucleic acid involved cannot be regarded as prosthetic groups. And the phenotypic expression of a gene may be modified when it is translocated to a new position in the genome. They are composed of either jelly-coats in amphibians or chitinous shells in insects, ascidians and cyclostomes. 8.10). This allows the cell to maintain a constant internal environment (homeostasis). All tRNA molecules have a tertiary structure, the details for which are now known and Mg2+ ion concentration is important for its stabilization. Synthesized Allopolyploids To find out the origin of naturally occurring allopolyploids some cytogeneticists produced certain allopolyploids in laboratory by employing artificial means. The father is in the center, with one son on each side. Mass (dalton) Functions 8,100 Stimulates activity of IF2 and IF3; increases the affinity of the 30S subunit for other factors. Sometimes, mitochondria and plastids are observed inside the vacuole suggesting autophagy in plants (Swanson and Webster, 1989). Matile (1975) has divided vacuoles of plants into following three types: 1. In 1807, Mirbel stated that all plant tissues were composed of cells. oxidized. Instead, they are brought to the ribosome by their appropriate tRNA. Germinal or Meiotic Crossing Over Usually the crossing over occurs in germinal cells during the gametogenesis in which the meiotic cell division takes place. Contents GENETICS, HUMAN GENETICS AND EUGENICS 126 Seed parent a b c d 1 4 S S S1 S2 S1 S3 S2 S3 Pollen parent S3 S4 S1 S2 S2 S4 S3 S4 14. Besides these primary sexual characters, the male and female sexes differ from each other in many somatic characters known as second- Contents 152 GENETICS, HUMAN GENETICS Contents CILIA AND FLAGELLA 317 absence of inner and outer dynein arms on the peripheral doublets of both cilia and flagella. Carrier of a sex-linked recessive gene is designated by a black dot in the middle of the symbol. Each virus particle is elongated, cigarette-like in shape having the length of 3000A0 (300 nm) protein coat nucleic acid and diameter of 160 A0 (16 nm; see De Robertis and De Robertis, Jr., 1987). Contents GENETIC ENGINEERING 113 oligonucleotide or a related gene which identifies the corresponding recombinant DNA. On the basis of structure of cell wall and its stainability with the Gram stain, the following two types of bacteria have been recognized : Gram positive and Gram negative bacteria. An inversion heterozygote has the abnormal order (abfedcgh). might view the chloroplast as a greatly enlarged mitochondrial particles in the matrix space. Weismann in 1892 postulated the theory of germplasm to explain heredity. Such polyspermic fertilization is known as physiological polyspermy. David Baltimore (1938-). Life cycle of a higher animal (human being). Pseudomonas is a gram negative heterotrophic aerobic form which can decompose (biodegrade) a wide variety of organic compounds such as hydrocarbons. Wiener postulated a number of (at least eight) multiple alleles at a single locus. Electron Microscopy The electron microscopy (Fig. Morgan's Views on Linkage Morgan stated that the pairs of genes from heterozygous parent tend to enter in the same gametes and remain together, whereas same genes from heterozygous parent tend to remain together and to remain together. 345 1 Contents CHEMICAL NATURE OF GENETIC MATERIALS (i.e., DNA AND RNA) 19 Molar Ratios of Nitrogen Bases in DNA Molecule When many samples of DNA were isolated, purified and analysed by various techniques, such as paper chromatography, etc., it was found by Hotchkiss and Chargaff in 1948 that contrary to Levene's (1920's) tetranucleotide theory which considered DNA as a monotonous polymer having four DNA bases in approximately equal molar proportions. The neurofilaments in the nerve cell axons probably resist stresses caused by the motion of the animal, which would otherwise break these long, thin cylinders of cytoplasm. For example, succulent plants open their stomata and take up carbon dioxide at night (when transpiration losses are less than in the day) and convert it to malic acid. In cloning, the plasmid or phage chromosome used to carry the cloned DNA segment. INHERITANCE OF Y-LINKED GENES Genes in the non-homologous region of the Y chromosome pass directly from male to male (Fig. For example, except for tryptophan and methionine, which have more than one codon. deficiency or deletion which involves loss of a broken part of a chromosome; 2. The genetic informations for polypeptide synthesis are initially dictated by the disposition of nitrogen bases in DNA molecule and are copied down by the process of transcription. When SR spirochaetes infect the eggs of the host and when these eggs are F1 fertilized, virtually all XY zygotes are S killed early in embroyonic developback ment and XX zygotes survive. In eukaryotes all mRNA is monocistronic. The spore being metabolically inert can survive an unsuitable temperature, pH and drought. Collagen. They change a nucleotide but not the same chromosome. The term forward genetics has been used for genes which are mapped on the basis of phenotype (or gene product or protein), using the technique of classical genetics. Further, the binding of spectrin cytoskeleton to the cytosolic face of the erythrocyte's plasma membrane depends on a large intracellular attachment protein, called ankyrin (or α chain COOH band 2.1 protein; 210,000 H2N dalton M.W.). (a) Define and explain Mendel's law of segregation ? (a) 50 per cent, with results indistinguishable from independent assortment. HO DNA template strand HO 5' 5' (7) Only ribonucleoside 5'- Fig 5.1. Mechanism of the chain-elongation reaction catalyzed by RNA polymerase. In this way the synthesis of protein chain follows in the correct sequence. Thus, the shape of the cell may be variable (i.e., frequently changing the shape) or fixed. Such cell surface differentiations may include microvilli, invagination, basement membrane and many types of cell-to-cell interconnections or junctions (Table 5-4). 15.12. 8.6.
Active operator (Transcription occurs) Active repressor + operator \downarrow Inactive operator (Transcription does not occur) spacer spacer enzyme production Trp operon of E.coli. Some of these hemicellulose molecules (e.g., rhamnogalacturonans) through short neutral pectin molecules (e.g., arabinogalactans). Asexual reproduction by the fission. Why do the distances on the two maps not always correspond ? Protein 1. After fracture, the sample is left in the vacuum long enough to allow some water to evaporate from the exposed surfaces, a process called freeze etching. Chondroitin sulphate is a repeating disaccharide consisting of alternating glucuronic acid and sulphated N-acetyl galactosamine residues. Many transposons can insert at virtually any position in the host chromosome or into a plasmid. Chromosome) Structural changes in chromosomes - deletion (or deficiency), duplication, inversion, translocation, variation in chromosome morphology; revision questions and problems, answers to problems. Name two porphyrins and give their functions. Thyroid gland 9. Chemically, proteins are polymers of amino acids. Forty five of them have given clear-cut results. At high concentration of Mg++ ions in the matrix, the two ribosomes (called monosomes) become associated with each other and known as the dimer. allele results in a number of related changes, then such changes are collectively called syndrome. tubular form or tubules. Type III Vimentin (53,000) Desmin (52,000) Glial fibrillar acidic protein (glial filaments; 45,000) Synemin (230,000) Neurofilament proteins (about 130,000, 100,000 and 60,000) 4. Further, the number of cells may be fixed in some multicellular organisms. Exocytosis. The phenomenon of the parthenogenesis occurs in different groups of the animals as in certain insects (Hymenoptera, Homoptera, Roleoptera), crustaceans, rotifers and also in some vertebrates such as several desert lizards, turkeys and some mammals. (a) Untranslated sequences that interrupt the coding se F1 hybrid the character of tallness dominates or conceals the character of dwarfness and so the character of dwarfness could not express itself in F1 generation. pore complexes have an eight-fold or octagonal symmetry. However, J. What is the structural basis for the unique properties of the water molecule ? Lipid containing proteins are called lipoproteins. This proved that specificity of virus proteins was determined by RNA alone and that proteins carried out by Seymour Benzer (1950, 1962) with the term cistron. Similarly in carrot roots, chromoplasts are derived from leucoplasts as is clear from the fact that the roots have no colour in the beginning but become coloured at a later stage. A white-eyed male heterozygous for scarlet was crossed to a scarlet-eyed female heterozygous for white. ATP ADP + Pi Proton pumps also 2 K+ occur in mitochondria and chloroplasts where they Fig. If one or both gene loci have incompletely dominant alleles, or codominant alleles, or codominant alleles, or codominant alleles, the dihybrid ratio becomes modified variously, such as follows : Table 3.7. Genotypic and phenotypic ratios of a trihybrid cross in between a yellow, round, tall (YY RR TT) and a green, wrinkled, dwarf (yy,rr,tt) pea plant : Genotype Genotypic ratio Phenotype YYRRTT YYR ratio Yellow, Round, Tall 27 Yellow, Wrinkled, Tall 9 Green, Round, Tall 9 Yellow, Round, Dwarf 3 Green, Wrinkled, Tall 3 Yellow, Wrinkled, Dwarf 3 Green, Wrinkled, Tall 3 Yellow, Wrinkled, Tall 9 construction of such a regular helix that though is composed of two polynucleotide chains containing an arbitrary sequence of nucleotide bases every 3.4A^o along their length, it would, nevertheless, have a constant diameter of 20A^o. For example, Gall et al., (1981) found that in the American newt Notophthalmus viridescens, clusters of the five histone genes are tandemly repeated in the genome but separated by about 50,000 base pairs of repeats of a 225-base pair satellite DNA. Water Protein Fat Carbohydrate Other organic Inorganic Percentage 65 18 10 5 1 1 INORGANIC COMPOUNDS The inorganic compounds are those compounds which normally found in the bulk of the physical non-living universe, such as elements, metals, and their compounds such as water, salts and variety of electrolytes and non-electrolytes. Determine which of the three paramecial phenotypes (killer, unstable, or sensitive) is produced by the following combinations of genotype and cytoplasmic state. The ejected electrons move at high lectrons free from their respective atoms and when their energy is dissipated, become attach to other atoms and convert the ion into negatively charged ions. The cells of higher terrestrial animals. This is a silent the protein sequence unchanged. A variety of cells such as mammalian red blood cell (erythrocytes), medullated nerve fibres, Ehrlich mouse ascites tumor cells, liver cells, striated muscle, Amoeba proteus, sea urchin eggs and bacteria, have been used in studying the ultra-structure of the plasma membrane. Answer each of the following questions as briefly as possible: (a) Which type of mutation, one induced by a base analog or one induced by proflavine, would you expect to be more deleterious to an organism and why? LINKAGE GROUPS All the linked genes of a chromosome form a linkage group. The rate of all chemical reactions are influenced by temperature. Insertion Sequences (IS) or Simple Transposons A single purple flower has appeared in the middle of this double pink African violet as The insertion sequences (IS) are shorter (800 to the result of a 'jumping gene'. Two third of F2 agouti are found to be heterozygous by testcrosses. These agents may be contributing to inherited disease, but they almost certainly are contributing to inherited disease, but they almost certainly are contributing to inherited disease. to the incidence of cancer (which is a genetic disease of the somatic or body cells). This step involves the hydrolysis of ATP to ADP + Pi. In the last step, the arm returns to the rigor position and displacement of the doublets results (Fig. Golgi derived vesicles containing cell wall precursors, especially pectin, are guided inward along these oriented microtubules until they reach the phragmoplast, where they fuse with one another to form the cell plate (Fig. Sometimes, this cap also includes methylated ribose) -3'-P— in which P and PPP refer to mono- and triphosphate groups, respectively. Another cilidiatom ate, Paramecium diatom ceratium caudatum is from 150 to 300 µm (0.15 to 0.3 mm) in length. Three plant breeders, namely Hugo de vries (Holland), Karl Correns (Germany) and Erich Tschermak (Austria), rediscovered the Mendel's laws in 1900. The donor's TEM of E.coli bacteria conjugating. (1) 1:2:1; (2) 1:1:2; (3) 1:3; (4) 3:1 (5) 2: 1: 1; (6) 1: 1: 1: 1; (7) 3: 1. What are they? During early electron microscopic studies, rounded dense bodies were observed in rat liver cells. Banding Techniques Recently banding techniques reveals structural details of chromosomes. In diploid zygote meiosis (2n) higher plants, however, the reFig. Type IV collagen molecules assemble to form a sheet-like meshwork that conα-helix stitutes a major part of all basal laminae (Martin et al., 1985, Burgeson, 1988). The freemartin has external female genitalia but internal sex organs are more or less like those of male. The pendulus type of ciliary movement is carried out in a single plane. In man the baldness may occur due to disease radiation or thyroid defects but in some families balldness is found to be inherited trait. In 1968, Barry Commoner suggested a circular flow of information, i.e., DNA translates into proteins, proteins synthesize RNA and RNA synthesizes DNA, as has been illustrated in following figure : DNA RNA Proteins Later on, Temin (1970) reported the existence of an enzyme "RNA dependent DNA polymerase" (inverse transcriptase) which could synthesize DNA from a single stranded RNA template. The lozenge gene of Drosophila provides a good example of small molecules such as water, sucrose and K+. These F1 barred male and a homozygous barred male (i.e., 3 Barred : 1 Nonbarred). strain B as well as another E. Similarly, resultant electrochemical proton gradiThe structure of the ATP
synthase. Esterases, 5. 5.30. According to this theory the body of organisms contain two types of cells namely somatic cells and reproductive cells. The relationship between sex chromatin and sex chromatin their phenotypic effects during Contents CYTOPLASMIC OR EXTRA-NUCLEAR INHERITANCE 219 early cleavage and blastulation when there occur little or no transcription since, maternal and paternal genes of zygote remain engaged in mitotic replication or duplication or duplication since, maternal and paternal genes of zygote remain engaged in mitotic replication or duplication or duplication or duplication since, maternal and paternal genes of zygote remain engaged in mitotic replication or duplication or duplication or duplication since, maternal and paternal genes of zygote remain engaged in mitotic replication or duplication or duplication or duplication since, maternal and paternal genes of zygote remain engaged in mitotic replication or duplication or duplication or duplication or duplication since, maternal and paternal genes of zygote remain engaged in mitotic replication or duplication or dup secondary cell wall, cellulose microfibrils are laid down in layers, the microfibrils of each layer running roughly parallel Fig. Certian important hydrolase enzymes are the proteases, nucleases and phosphorylases. CH2 CH The carotenoids are the proteases, esterases, phosphatases, nucleases and phosphorylases. plant cells. The lipid contents of the mitochondria are composed of 90 per cent phospholipids (lecithin and cephalin), 5 per cent or less cholesterol and 5 per cent or less cholesterol and 5 per cent free fatty acids and triglycerides. Contents 342 CELL BIOLOGY C H A P T E R 19 Reproduction T his is the inherent property of the living organisms to continue their race by the mechanism of reproduction. Column chromatography is important for the separations of mixtures of proteins, that is, for the isolation of enzymes such as cytochrome C or RNA polymerase. An important feature of initiation of polypeptide synthesis is the use of specific initiation of polypeptide synthesis is the use of specific initiation of enzymes such as cytochrome C or RNA polymerase. An important feature of initiation of polypeptide synthesis is the use of specific initiation of polypeptide synthesis is the use of specific initiation of enzymes such as cytochrome C or RNA polymerase. F1 hybrids in F2 produce the white and coloured offsprings in the ratio of 13 : 3, as have been illustrated in Fig. The appearance of 9 : 7 ratio instead of 9 : 3 : 1 ratio from the cross of two white flowers CC ee X F1 Male gametes \rightarrow CE Ce cE cc Ee purple : 7/16 white or 9 : 7. One gene locus has a dominant epistatic inhibitor allele (I) of coat colour pigment (see Table 4-2). Nucleus. The genes for bent wings (bt) and shaven bristles (svn) of the fourth chromosome mutant of Drosophila melanogaster exhibit complete linkage. RNA serves as a primer. Inbreeding coefficient. A crossing over in 4 the inverted region of a heterozygous + B/B paracentric inversion produces a dicentric chromosome (possessing two 3 5 centromeres) which forms a bridge from one pole to the other during first anaphase. TEM of mammalian SER tubular form of ER TEM of mammalian SER tubular form of ER TEM of mammalian SER tubular forms a bridge from one pole to the other during first anaphase. (1910) and Fricke (1925) found that the intact cell had low electrical conductivity, indicating the presence of a lipid layer around it. While Darlington tried to explain the cause of synapsis by proposing his precocity theory, Moses identified a factor in the formation of synaptonemal complex which aids in synapsis. Termination of Eukaryotic Transcription In eukaryotes, the actual termination of RNA polymerase II activity during transcription may take place through termination sites similar to those found in prokaryotes. The net energy yield of chain reactions of glycolysis is the production of two ATP molecules from one molecule of glucose. MODELS OF DNA REPLICATION The following three models have been proposed for DNA replication in different organisms: 1. Likewise, by condensation of few or many amino acids by the peptide bonds the oligopeptides and polypeptides are formed respectively. d. Thus, phage Mu was originally known for its mutagenic properties. Thus, via receptor-mediated coated-vesicles, the ligands are delivered to the peripheral endosomes which slowly move inward to become perinuclear endosomes. specific fashion, β-sheets disulphide bonds thereby imparting certain steric (i.e., three-dimensional) The tertiary structure of lysozyme, an properties to the protein. REGULATION OF GENE ACTION IN EUKARYOTES In eukaryotes the following two kinds of controls or regulations of gene expression occur : 1. Nucleolus is the site where ribosomes are manufactured. The process of glycogenesis) occurs in the cytosol (in glycosomes). Similarly, 1200 nucleotides of "satellite" tobacco necrosis virus direct the synthesis of coat protein Direction of reading Fig. (b) The karyotype of an infant with Patau syndrome. The cytosol of bacteria is often differentiated into two distinct areas : a less electron dense nuclear area and a very dense area (or dark region). e.g., h antigen of Bombay phenotype. They reproduce three children, a polydactylous son, and a normal son (generation II). Further medically oriented investigations on man have provided detailed informations about biochemistry, morphology, anatomy and physiology to geneticists and they have made use of these in human genetics. (i) Changes in the nucleus. (iii) Tertiary cell wall. When ionizing radiations pass through Fig. All such poly-X females are mentally retarded and sterile showing abnormal sexual development. each other, their nuclear envelopes are dissolved. (2) Processing of rRNAs inside nucleolus. Describe the Britten-Davidson's model of regulation of gene activity in eukaryotes. In Drosophila several other complex loci have been demonstrated which include the following loci : bx (bithorax), sb (stubble bristles), N (notch wing), g (garnet eye colour), sn (singed bristles), dp (dumpy wing) and s (star). Meves 1905 J.B.Farmer J.E.Moore Contents INTRODUCTION 11 Year Name of contributor Cell biological contributor Cell biological contributor 1906 M.Tswett C.Golgi and S.R. Cajal R.G. Harrison Invented column chromatography. Fragment C included nucleotide residues 46-77 with single stranded region 46-50. In the cleavage process about 50 per cent of the precursor RNA is degraded. conditions of fossils, types of f CELL BIOLOGY chains of the lipids and electrostatic forces between the protein and the "head" of the lipid molecules, were thought to maintain the stability of the membrane. CODON ASSIGNMENT (Cracking the Code or Deciphering the Code) The genetic code has been cracked or deciphered by the following kinds of approaches : A. (For details of freeze-fracture technique, see Chapter 2). Further, after isolation and purification of mRNA from the cultured rat pituitary cells, Seeberg et al. nucleotides, n ro), besides getting the 1:1:1:1 test cross ratio, they received phenotypic ratio of 7:1:1:7 as has been illustrated : Parent : Blue or purple long (Rr Ro ro) Blue or purple Long Red Round Blue or purple long (Rr Ro ro) All blue or purple long (Rr Ro ro) All blue or purple long (Rr Ro ro) Blue or purple Long Red Round Blue or purple long (Rr Ro ro) Blue or purple long (ro) $\times = =$ Red Round (rr ro ro) 192 182 23 30 427 Test cross ratio : 7 Blue or purple Round : 1 Red Long : 7 Red Round or 7 : 1 : 1 : 7. Describe various models of plasma membrane and explain which of these models is dynamic and why? An important example of translational regulation is that of informosomes or masked mRNA. Rice 4. Transferases. It was detected quite early that there was little connection between the morphological complexity of eukaryotic organisms and their DNA content. Insertion sequences (IS) IS 1 IS 2 IS10-R B. Describe different types of complex transposons of the eukaryotes. 1958 G. Lake (1981). The RNA molecule is antiparallel to the DNA strand 5' 5' triphosphate 3' 3' triphosphate being copied. Microbodies use molecular oxygen like them, they contain flavin-linked oxides and catalases for the hydrogen peroxide metabolism and also enzymes for fatty acid metabolism. Schwann studied both plant and animal tissues and his work with the connective tissues such as bone and cartilage led him to modify the evolving cell theory to include the idea that living things are composed of both cells. DNA/RNA probes have been commercially exploited in the diagnosis of infectious diseases, a variety of microbiological tests, identification of food contaminants and in forensic tests (e.g., fingerprinting of murderers and rapists). (v) The angle of twist (rotation) per repeating unit (dinucleotide) in Z-DNA is 60° than the 36° of mononucleotide in B-DNA. nate a different amino acid and may result in the produc- Contents 204 GENETICS, HUMAN GENETICS AND EUGENICS tion of a protein with a single amino acid substitution. It is found in cartilage, bone, skin, notochord, aorta and umbilical cord. Transport through plasmomembrane lining the cytosolic the plasmodesmata is also desmata plasmodesmata is also desmata plasmodesmata. involve Ca2+ Fig. Nucleus being the heart of every type of eukaryotic cell, contains the genes, the hereditary units. 11.6). These are photosynthetic bacteria. Chromatophores vary in form as vesicles, tubes, bundled tubes, stacks, or thylakoids (as in cyanobacteria). It contains substantial amounts of carbohydrate material, particularly sialic acid. four monomeric ribotids or ribonucleotids. The cell wall of bacteria differs chemically from the cell wall of plants in mRNA that it contains proteins, lipids and polysaccharides. (or disjunction) and in it functional meiospores (in higher plants) or gametes (animals) will be produced because the
meiotic products will have a full gene complement. Euchromatin (ii) Sex chromosomes. Sugars formed in cells Calvin cycle are transported into the phloem. Lyon (1925—) Thus, in normal female only one active X chromosome is present. The sedimentation coefficient of ribosomal subunits, rRNAs and number of ribosomal proteins of certain representative organisms have been tabulated in Table 14.1. It is thought that each ribosomal subunit contains a highly folded ribonucleic acid filament to which the various proteins adhere (Hart, 1965). In this technique, a DNA molecule is cut into discrete fragments by a restriction enzyme. Ciliary necklace. External membrane which is a lipid bilayer traversed by numerous porin channels that allow the diffusion of solutes. However, the diploid number of tobacco is 48, cattle 60, the garden pea 14, the fruit fly 8, etc. Chemical formula of Uracil. CENTRAL DOGMA AND CENTRAL DOGMA biology, which postulates that genetic information flows from nucleic acids to protein. Many viruses have spherical, cubical or polygonal shape which is basically icosahedral or 20-sided. However, in some snails the coiling of shell may be counter clockwise or sinistral. It is found in cartilage and cornea. Thus, to CELL EXTERIOR Transverse diffusion (flip-flop) maintain fluidity of the membrane, cells of organ(~105sec) isms living at low temperatures have high proportions of unsaturated fatty acids in their membranes, than do cells at higher temperatures. And thus, the different linkage groups of a species can be worked out. Replication of DNA 5. Such crosses because involved crossing over Contents 108 GENETICS, HUMAN GENETICS at two points, so called two points, so called two point test crosses. These enzymes are known as isoenzymes are known as isoenzymes. For instance, in case of maize it was demonstrated that the ear size is controlled by multiple factors. mitochondrial space into two distinct chambers : 1. At higher ploidy level, such as autooctoploids, the Decaploid (90) adverse effects become highly pronounced and lead to the death of the plants. Nuclear membrane which is continuous with rough ER. The reactions which involve in the oxidation of glucose into CO2 and water are known to form the metabolic pathways and they can be grouped under the following heads : endergonic processes ATP mechanical energy (cyclosis, contractility, cell division) anaerobic glycolysis active transport oxidative phosphorylation nerve conduction and transmission ADP bioluminescence heat Fig. Nondisjunction of chromosome pair 21 during oogenesis is the main cause of occurrence of trisomy-21. odon of tRNA is CAA. Figure 6.4 shows the decline in size and vigour due to inbreeding in maize; here, the inheritance of two quantitative traits namely plant height and grain yield of three lines are shown for 30 generations of inbreeding. Plasmids. The genotype in such a clone would be -CC, where the dash indicates loss of the CI allele. Type I Acidic keratins (40,000-70,000) Neutral or basic keratins (40,000-70,000) Neutral or basic keratins (40,000-70,000) Epithelial cells and epidermal derivatives such as hair and nail 2. 15.6. Artificial synthesis of hexaploid wheat. (c) Extra-nuclear inheritance by mitochondria. The cell wall, therefore, consists of concentrically arranged lamellae, with the oldest on the outside (Brown, 1985). On April 5, 1854, he wrote a letter to Vienna Zoological-Botanical Society about damage by pea-weevil, Bruchus pisi and, thus, showed his interest in peas. Likewise, if five pairs of alleles were segregating, we expect (1/4)5 = 1/1024 of the F2 to be as extreme as one parent or the other. Describe the symbiotic origin theory of the peroxisomes. In maize and many other plants, cytoplasmic control of male sterility is known. Outer covering. These inducers usually disturb the mitotic or meiotic spindle and cause nonsegregation of already duplicated chromosomes, during cell divisions. Each capsomere contains about 158 amino acids and has a molecular weight of 18000 daltons. The plasma membrane maintains a balance between the osmotic pressure of the intra-cellular fluids. The in vivo Codon Assignment The cell free protein synthetic systems, though have proved of great significance in decipherment of the genetic code, but they could not tell us whether the genetic code so deciphered is used in the living systems also. (b) UAC (c) By definition, anticodons occur only in tRNA. 6.1. Two faces of membranes of endomembrane system. Body part Character Dominant Recessive 1. (a) Describe what is meant by outbreeding. Poly (A) is added to the newly cleavage soon after generated end by an enzyme, called poly AAUAAA (A) polymerase, utilizing ATP as a substrate. Those who have this disease are homozygous for a mutation that destroys violet for inducing mutations is about 2,600 A°. Larger molecules and particles may pass through the membrane by formation of small pockets and vesicles that traverse the envelope and empty on the other side. (ii) Effects of autopolyploidy. According to this model (Fig. Some important and common mechanisms of sex determination are following : A. The proacrosomal granule attaches with the anterior end of the nucleus and enlarges into the acrosome. Enumerate the differences between DNA and RNA. The fact suggested that it is DNA and not protein which is the hereditary chemical. 12.13. A wide variety of drugs (e.g., phenobarbital), when administrated to animals, they bring about the proliferation of the ER membranes (first RER and then SER) and/or enhanced activity of enzymes related to detoxification (Thorpe, 1984). In some bacteria, the cell wall is surrounded by an additional slime or gel layer called capsule. How many different mRNAs could specify the amino acid sequence met-phe-ser-pro? Shape The shape of the chromosomes is changeable from phase to phase in the continuous process of the cell growth and cell division. Contents 54 MOLECULAR BIOLOGY B. (region I) 8% Single crossovers between B and C. 17.5. Axostyle of Metamonadida flagellate. Nucleus as opposed to the nucleus as opposed to the prokaryotic cells, i.e., this is the true nucleus as opposed to the nucleus as opposed to the nucleus as opposed to the nucleus as the main distinguishing feature of eukaryotic cells (see Chapter 3). Size of the cells of the unicellular organisms is larger than a typical multicellular organism's cells. In the reciprocal Ij/Ij duces flowers which are pollinated. In 1960s they continue to be object of considerable research. The UAG was the first termination codon to be discovered by Sidney Brenner (1965). 13. What is the cell division ? MUTATION RATE The frequency with which genes mutate spontaneously is called mutations which have dominant phenotypic expression are called dominant mutations. Define the terms : cell cycle and mitosis. (v) Histocompatibility. 2.5. Cell fractionation. Some RNA is capped and tailed. Most lysosomal enzymes act in an acid medium. Acid ribonuclease 5. What phenotypic ratio is expected in the progeny of each testcrosses? The capsomeres are closely packed and arranged in a helical manner around the RNA helix, forming a hollow cylinder. In 1950, Callan and Tomlin, first observed the nucleopores in the nu as gemmules. As they move about in the mitochondria flagellar axoneme myofibril cardiac muscle Fig. DNA of chromatin represent the following two phenomena : The C-value. HISTORY OF CELL BIOLOGY Ancient Greek philosophers such as Aristotle (384 - 322 B.C.) and Paracelsus concluded that "all animals and plants, however, complicated, are constituted of a few elements which are repeated in each of them." They were referring to the macroscopic structures of an organism such as roots, leaves and flowers common to different plants, or segments and organs that are repeated in the animal kingdom. The presence of an unpaired X chromosome deFig. The tRNAf Met molecule is first acylated (or charged) with methionine and an enzyme (found only in prokaryotes) adds a formyl group to the amino group of the methionine. Rolling circle replication. Twenty four of these are considered essential for life (called essential for life (called essential for life (called essential for life), while others are present in cytosol only because they exist in the environment with which the organism interacts. Similar organisms were later isolated from other DNA animals such as sheep, goats, dogs, rats, mice and human beings and were named as pleuropneumonia like organisms (PPLO). Secondary membranes envelop the nucleus and other internal organelles and to a great extent they pervade the cytoplasm as the endoplasmic reticulum. For example, the sarcoplasmic reticulum transmits impulses from the surface membrane into the deep region of the muscle fibres. It occurs mostly in the green algae and higher plants. Contents CYTOPLASMIC OR EXTRA-NUCLEAR INHERITANCE Table 17-1. Sex-linked Inheritance 1 3. Compound lipids. 4.14. membrane There are flagella all over the E. In muscle and nerve cells a high order of difference exists between intracellular K+ and extracellular Na+. Write short notes on the following : (ii) X-ray diffraction analysis; (vii) Chromatography; (ii) Scanning electrophoresis. Moreover, H.J. Muller has suggested that such persons not only should increase their family size but through artificial insemination, the amino group (NH2) of a DNA base is replaced by hydroxyl (OH) group by the chemical mutagen. But, sometimes due to certain accidents or irregularities at the time of cell division, crossing over or fertilization some alterations in the morphology and number of chromosomes take place. outcome of 50 years of research of M. For example, an increase of 10°C temperature increases the mutation rate two or three fold. This theory was proposed by John Belling (1928) while studying meiosis in some plant species. (Note : For cytokinesis in plants see Chapter 5). Write short notes on the following : (i)
Amniocentesis ; (ii) Monozygotic twinsplant species. ; (ii) Brachydactyly; (iv) Albinism; (v) Phenylketonuria; (vi) Sickle-cell anaemia; (vii) Human chromosomes; (viii) Turner's syndrome. In fact, neutral petites have been found lacking in mt DNA. Many glycosomes attached to the membranes of SER have been observed by electron microscopy in the liver and conduction fibre of heart. Illustrate these using the branching method. gote having 32 chromosomes and developing into a female) or an unfertilized egg (a haploid zygote having 16 chromosomes and developing into a male). 13.10). 15.7. A current model to explain the mode of assembly of a 10-nm thick intermediate filament (after Alberts et al., 1989) Classification of Mutation According to Magnitude of Phenotypic Effect According to their phenotypic effects following kinds of mutations may occur: 1. The cells of the higher plants have 20 to 40 chloroplasts. dergo tailoring, maturation, and molecular folding to form functional secondary or tertiary protein molecules. It has been demonstrated that in homogametic Nucleolus Nucleolus XX female individuals, one XFig. The correlation between overall cell growth regulation. It is characterized by lack of antihaemophilic globulin (Factor VIII). The DNA of 30The 30nm-fibre nm solenoid has a packing that is about 40-fold. In the same year, he began experiments with other plant species. For example, during cell cycle the enzymes exhibit the following three patterns of their synthesis: 1. Although it is difficult to estimate how many different genes exist in the human genome, there are probably not more than 20,000 to 30,000 genes (Note According to a most recent estimate, there are 100,000 genes in human genome, see Deviah, 1994). The X-linked type sex-linked inheritance is performed by those genes which are localized in the nonhomologous sections of X-chromosome, and that have no corresponding allele in Y chromosome. Likewise, preceding ossification (bone formation) plasts release cathepsin D enzyme to break down the connective tissue (Dingle, 1973). Prophase II In the prophase second, each centriole divides into two and, thus, two pairs of centrioles are Contents 338 CELL BIOLOGY centromere chromatids C1 daughter cells A1 - PROPHASE B1 - ANAPHASE C2 chromosome chromatids D1 daughter cells A2 - PROPHASE B2 - ANAPHASE D2 Fig. The cells of those organs which are actively engaged in the synthesis of proteins such as acinar cells, goblet cells and cells of some endocrine glands are found to contain rough endoplasmic reticulum (RER) which is highly developed. Glycosyl transferase and thiamine pyrophosphatase can be localized cytochemically in Contents GOLGI APPARATUS 171 the trans cisternae of Golgi apparatus. Pure line (pure breeding line). Such a phospholipid asymmetry is ring generated in smooth ER. (iv) DNA methylase. coli cell contains 10,000 ribosomes, forming 25 per cent of the total mass of the bacterial cell. lipases phosphatase The location of the lysosomes in the cell sulphatase can also be pinpointed by various histochemiphospholipase cal or cytochemical methods. Protein glycosylation. The electron lost by P 680 is ultimately accepted by P700 of photosystem I. 9.12). Each character of a pair of contrasting characters is represented by an allele. Endrizzi and his coworkers and in tobacco (2n = 48) by E.R. Clausen and D.R. Cameron. 10.20. The smooth endoplasmic reticulum is generally found in adipose cells, interstitial cells, glycogen storing cells of the liver, conduction fibres of heart, spermatocytes and leucocytes. he cilia (L., Little whip) are microscopic, contractile and filamentous processes of the cytoplasm which create food currents, act as sensory organs and perform many mechanical functions of the cell. The VH and VL regions together form antibody-combining site for specific interaction with a homologous antigen molecule. It was shown that the cell free flagella can be caused to move by adding an energy source such as ATP. Later on, in maize the following four types of male sterile cytoplasms (T, C and S). In aphids, parthenogenesis is a means of rapid breeding; the females reproduce by diploid parthenogenesis during summer. in by endocytosis (such as phagothe products of digescytosis, endocytosis, endocytosis, endocytosis and pinocytotion are absorbed into the cell or organism. But, in its rare (enol) state, 5BU behaves similar to the tautomer of thymine and pairs with guanine. Such cases of sex reversals have also been observed in amphibians (e.g., in salamander by E. The termination of growing polypeptide chain occurs when a termination codon comes to occupy the 'A' site. glucose into glycogen are regulated HO by the hormone insulin which is Fig. Nucleic Acids are the complex macromolecular organic compounds of immense biological importance. (b) State, giving evidence, whether or not segregation can occur at either of the meiotic division ? However, at the outset one point should be clear Contents 78 MOLECULAR BIOLOGY that the genetic information of mRNA is unidirectionally read beginning at the 5'- hydroxyl end by one or more ribosomes (polysomes) and that the 5'-end of the mRNA correspond to the N-terminal amino acid in the completed protein. 10.5. A mitochondrion in sectional view to show their outer surface (Fig.10.6). sin, etc., all of which combine with nucleic acids and other acidic molecules of the fixed cells. Male haploidy or haplodiploidy mechanism; 4. Naegeli and Kerner knew of the Mendel's paper but they did not review it or discuss it, perhaps because they considered him an outsider and amateur. For example, in man the mutation disease aniridia (absence of iris of eyes) occurs due to a dominant mutant gene. Thus, ER mem- microsomes free ribosomes branes contain more proteins, both Fig. Effects of environment on penetrance. Each phospholipid molecule, therefore, has hydrophobic or water-insoluble tail which is composed of two fatty acid chains and a hydrophilic or water-soluble polar head group, where the phosphate is located. The lambda consist of ribonucleoprophage can multiply by either a lytic or a lysogenic pathway in teins in their organizathe E.coli bacterium (after Alberts et al., 1989). L µm = 3.4 × 10-4 P, where L µm represents the length in micrometers, and P represents the number of nucleotide pairs. They are synthesized by plant tissues and are located in the chloroplast lamellae to help in light absorption during photosynthesis. For example, the addition of histone proteins to the loops to retract into the chromosomes stops the synthesis of RNA on the loops and causes the loops and causes the loops to retract into the chromosomes stops the synthesis of RNA on the loops and causes the loops to retract into the chromosomes (see Ambrose and Easty, 1979). The main function of LH complex is to capture solar energy. The nuclear region is surrounded by numerous (50 to 100) 70S type ribosomes existing either freely or in the polysomes (Fig. The alleles (ii) occur on the epistatic locus, i.e., ii BB or ii Bb produces black and ii bb produces brown individuals. Chemical formula of guanine. Draw the configurations, you would observe in salivary gland chromosomes due to either a deficiency or a duplication. This allows the escaping of intact viral particle into the cytosol of the host. The in vitro codon Assignment 1. The first to form is a bipolar mitotic spinde, composed of microtubules and their associated proteins ; it is meant for poleward migration of daughter chromosomes during mitosis. fragmentation by restriction enzyme or mechanical shearing vector DNA random DNA fragments 5. 25 to 0.1 µm. An antibiotic is a microbial product of low molecular weight that specifically interferes with the growth of microorganisms when it is present in exceedingly small amounts. Short life cycle. The anterior one is known as the proximal centriole and the posterior one is known as the distal centriole. Hydroxylation of cytosine, which then subsequently pair with adenine. When two such auria plants are crossed, the F1 progeny has identical phenotypic and genotypic ratio of Snapdragons. The normal colour of the eye in both invertebrates is dark due to the dominant gene K directs the production of a hormone-like substance called kynurenine which is involved in the pigment synthesis. This becomes clear from Morgan's experimental results from Drosophila. The process of termination of DNA replication requires the product of tus gene (Tus protein) which recognizes ter or termination sites. 6.3. Increase in percentage of homozygosity under various to occur due to following four feasystems of inbreeding. Recently human geneticists have devised folSoon after birth, babies have the Guthrie lowing two eugenically sound methods (i.e., eutest which screens for phenylketonuria. Occasionally ring chromosomes are encountered in higher organisms. Cutting reaction in which phosphodiester bond cleavage occurs by an endonuclease and this step does not require ATP. 1991 Dr. Lalji Singh at CCMB, Hyderabad has developed a new technique of DNA fingerprinting by using BKM-DNA probe (BKM = banded krait minor satellite). First of all the nucleus is followed by the division of the nucleus divides by amitotic or mitotic division and the division of the nucleus is followed by the division of the nucleus divides by amitotic or mitotic division and the division of the nucleus divides by amitotic division and the division of the nucleus divides by amitotic division of the nucleus divides by amitotic division divides by amitotic division divides divides by amitotic division divides di di divides divides divides divides divides divides divides div acetyl-CoA without carbon loss. Viroids form a class of subviral pathogens which cytosol cause infections and diseases in many plants and also in animals (see Sheeler and Bianchi, 1987). For this reason they are useful in raising hybrid seeds, especially on large scale. Table 14.1.
Comparison of genotypes for bar eye in Drosophila females showing position effects of 16A segment (Source : Burns and Bottino, 1989). solubility mechanism. Describe the process of oogenesis. Ion-exchange chromatography (used for separation of proteins, RNA and DNA). In contrast to the often polycistronic mRNA of bacteria, the mRNA of eukaryotes are monocistronic, containing the coding sequence only for one polypeptide. In female all chromosomes were paired and the homologues were equal in size. Contents MULTIPLE ALLELES 115 C H A P T E R 10 Multiple Alleles S When transfusing blood, the blood groups of donor and recipient must be matched. McClintock (1951) guessed that in such mosaics, the inhibitory CI allele had been lost sometime during endosperm development, leading to a clone of tissue that was capable of producing pigment. with nitrous acid) and made into the reactive paper and, therefore, becomes available for hybridization with radiolabelled DNA probes. In mRNAs of most histone proteins, no polyadenylation occurs at 3' ends, so that 3' ends are processed without addition of poly (A). Plant cells lack centrosome and centrioles. Possible singlet, doublet and triplet codes of mRNA. In eukaryotic cells the ribosomes either occur freely in the cytoplasm or remain attached to the outer surface of the membrane of endoplasmic reticulum. Human egg is much larger than the sperm ? They are selfreplicating organelles containing a protein-synthesizing capacity comparable to that of mitochondria. (iii) Effect on fertility of polyploidy. Merino sheep were taken to South Africa and in 1796 they were introduced into Australia which has since become the world's largest producer of fine wool. Higher plants also secrete hydrolases, a notable example to that of mitochondria. being the insectivorous pitcher plants, which produce a proteinase-containing liquid in which victims are trapped and digested. Nucleolus and cell growth. The nutrient polysaccharides serve as reserves of monosaccharides and are in continuous metabolic turnover. In the process of the strobilation several transverse fissions occur simultaneously and giving rise to a number of individuals which often do not separate from each other immediately. Using evidence from various electron micrographs, Robertson in 1960, proposed the unit memb-rane hypothesis (Fig 5.4). Of the pH (H +) 686,000 calories contained in a mole of glucose, gradient H+ - 2H less than 10 per cent (i.e., 58,000 calories) can be (OH — - higher released by anaerobic glycolysis. (b) Cytoplasmic male sterility (CMS). Let A represent a haploid set of autosomes. The main function of chloroplasts is photosynthesis, while that of mitochondria is oxidative phosphorylation. The striated fibres of rootlets are comFig. The condition in heterozygotes where the phenotype is intermediate between the two homozygotes. As digestion proceeds, it becomes increasingly difficult to identify the nature of the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe the original secondary lysosome (i.e., heterophagosome) and the more general term digestive vacuole is used to describe t epoxides, dimethyl and diethyl sulphonate, methyl and ethyl methanesulphonate (MMS and EMS) and nitrosoguanadine (NG) also have direct mutagenic effect on the DNA molecule. All kinds of true cells share the following three basic characteristics: 1. Describe the phenomenon of linkage by giving suitable examples. That is, it is composed of a bilayer sheet of phospholipid molecules with their polar heads on the surfaces Pictures showing bacterial membrane -- blue in coci (left) and fine red outline in bacillus (right). Maternal inheritance. Binding with antibody (called antitoxin) inactivates viruses and bacterial toxins (such as tetanus or botulism toxins) by blocking their ability to bind to receptors on the target cells. They have a role in axoplasmic transport of proteins, glycoproteins and enzymes. 4.33. Contents 140 GENETICS, HUMAN GENETICS, HUMAN GENETICS, HUMAN GENETICS, end the germinal cells. The acidic environment of plasma membrane the endosome causes dissociation of ligands from their receptors. 5.16): 1. What properties do all known DNA polymerase share? The rate of migration of a molecule in an electric field is determined by its size and the number of charged groups per molecule. plasma membrane bacterium phagosome Golgi apparatus phagocytosis hydrolases and membrane protein transport phagolysosome endocytosis endosome endoplasmic reticulum endolysosome autophagolysosome autophagolysosome (intermediate compartment) lysosome mitochondrion autophagolysosome autophagolysosome autophagolysosome autophagolysosome endocytosis hydrolases and membrane protein transport phagolysosome autophagolysosome cytoplasm decreases; the chromosomes resume their long, slender, extended form as their coils relax; and RNA- synthesis restarts causing the nucleolus to reappear. During the union both individuals known as conjugants exchange certain amount of nuclear (DNA) material and after which conjugants are separated. Later on, these plants were known to be apomictic (i.e., parthenogenetic) or capable of reproduction without fertilization, 13.6). In mice pie bald spotting pattern (or white spotting) of coat is governed by homozygous recessive alleles s. 18.5). Epistatic alleles Hypostastic alleles Phenotypic expression of allele 1. The environmental conditions have considerable effect on the phenotypic expression of poly- genes for the quantitative traits. The name and structural formulae of the amino acids that regularly occur in proteins are given in Table 4-4. The lines of these particles produce desmosome the sealing and for this reason have been hemidesnamed sealing strands. E DNA and have great interest for the cell biologists. Ultrastructure of primary cell wall showing inter- plasmodemata. Singlet code (4 words) AAA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU GAC ACU GCA GCC GCU AAA AG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG ACC ACU AUA AAG AAC AAU AGA AGG AGC AGU ACA ACG G GA GG GC GU GUA GUG GUC GUU C CA CG CC CU CAA CAG CAC CAU U UA UG UC UU CGA CGG CGC CGU CCA CCG CCC CCU CUA CUG UCC UCU UAA UAG UAC UAU UGA UCG UCC UCU UUA UUG UUC UUU Contents 68 MOLECULAR BIOLOGY The first experimental evidence in support to the concept of triplet code is provided by Crick and coworkers in 1961. If this event happens during first cleavage (or mitotic division) of the zygote, then one of the two blastomeres will have XX XO this X chromosome will be lost female male Fig. An antagonist of the inhibitor, called an inducer, is needed to allow initiation of transcription. Gaulian and Kornberg isolated, purified and utilized DNA polymerase of E. Polarity. These two sequences, thus, function as signals for N-linked glycosylation. Wild type = .6681 or 66.81% 2. following facts—(1) The tRNA molecules are Contents NON-GENETIC RIBONUCLEIC ACID (RNA) AND TRANSCRIPTION 63 I II 4 RNase D removes these two bases PPP- 5' 3 RNase P cut 5 4tU 2mG 5 G A C GC UA GC GC GC 1 endonuclease UC 7 bases approximately 170 bases CCA 2 RNase D removes these end nucleotides one by one U U 3'-OH U 5 ψ 5 U ψ 5 A 2ipA Fig. The movements of electrons between cellular reductants and oxidants represent a form of energy transfer in cells. Therefore A has 50 per cent + 37.5 per cent = 87.5 per cent = 87.5 per cent of B's genes. Males produce haploid gametes through normal meiosis which fuse to form diploid zygotes that emerge again in the spring as parthenogenetic females. The amyloplasts (L., amyl=starch; Gr., plast=living) are those leucoplasts which synthesize and store the starch. This unit time is Contents 368 CELL BIOLOGY ph as e ph as e ex po ne nti al ath Log No. of cells de called the generation time. The amino-terminal region of H3 and H4 histones may
also undergo acetylation, which is often correlated with great amount of transcription. Table 9-2. Diagram showing relationship betwen and allows conservation of water. (5) The tissues become stiffer, making their sectioning easier. Plant that germinate from single cross seeds are usually vigorous hybrids with large cobs and many kernels. The O two NADH molecules (which are generated during glycoCH3 -C-COOH lysis) cannot penetrate directly into the mitochondria, so Pyruvic their electrons are transferred to dihydroxyacetone phose phate, which shuttles them into the mitochondria. Required for the formation of prothrombin (an essential component of bloodclotting). However, the extensive chemical analysis of chromosomes of different organisms have revealed that chromosomes contain proteins and nucleic acids (DNA and RNA), and it was thought that genes might have either proteins or nucleic acids as their component molecules. Evidently, activation of the histore kinase enzyme that is mRNA mRNA responsible for H1 phosphorylation may chromosomal chromosomal DNA be the first step in the proteins proteins chain of events that leads to eventual chrononhistone nonhistone stones proteins proteins and vision. Table 5.2. Expansion of binomial (1/2+1/2)n using different values of n (number of alleles) with the help

of Pascal's triangle. Thus, NA spikes cause the viruses to desorb from the host cell and make them free to infect other host cells. If wild gene g3+ becomes mutant, the conversion of metabolite B to C does not occur and substance A will accumulate. But the ootid and the secondary polocyte unite together to form a diploid egg which develops into a new individual, e.g., Artemia salina (Crustacea) and various other organisms. Table 6-1. The cell wall of Gram positive bacteria is thicker, amorphous, homogeneous and single layered. In mice, also, 40 per cent liver cells are tetraploids, and about 5 per cent are octoploids. Chromosomes play most important role in inheritance. Structure While describing the structure of the chromosomes during various phases of cell cycle, cell biologists have introduced many terms for their various regulation of translation, because, the protein blocks translation by binding to its own mRNA. Giving suitable examples, discuss how did our concept of allelomorphism change during the cell cycle explains this fact very clearly. It may be either morphological or physiological in nature. Here, malic acid undrgoes decarboxylation to produce pyruvic acid (3C) and CO2. (a) TTCAGAGAACTT AAGTCTCTTGAA (b) CCTGAGAGGTCC GGACTCTCCAGG The genome of E. DNA polymerization. H.G. Khorana. The artificial parthenogenesis has been induced by above mentioned physical and chemical means by various workers in the eggs of most echinoderms, molluscs. annelids, amphibians, birds and mammals. In E. 12.12). Some other amino acids such as phenylalanine, tyrosine, tryptophan, lysine and leucine form acetyl-CoA directly without first forming the pyruvic acid. In other words, many scientists believed that structure observed during numerous microscopy procedures and termed the Golgi, did not actually exist in the living cells (see Berns, 1983). In 1950s another technique, namely ultracentrifugal analysis was employed to study the ribosomes. Here, the abnormal gene is suppressed in heterozygous individual, it is called recessive inheritance. The secondary egg membranes are secreted by the ovarian tissues around the primary egg membranes. The four blood types have different O agglutinizing properties. Likewise the polyploid cells contain larger nuclei than the diploid cells. These genes are transcribed uniquely by RNA polymerase I for the larger ribosomal RNA or by RNA polymerase I for the larger ribosomal RNA or by RNA polymerase I for the larger nuclei than the diploid cells. small region of chromosome showing two of them, one for each chromasister chromatids tid. Introns removal and splicing together of the remaining exons during processing of hn RNA must be absolutely precise. The infected bacteria were immediately agitated in a waring blender. Among 444 F2 plants, none was found to have flowers either as long or as short as the average of the parental varieties. Some coenzymes have a central role in mitochondrial function. Further, ionizing radiations cause breaks in polysugar phosphate backbone of DNA and, thus, causing chromosomal mutations such as break, deletion, addition, inversion and translocation. Gas vacuoles are gasNostoc - a cyanobacteria. Thus, in such vesicular transport, the transported proteins do not cross any membrane and they are transferred from lumen to lumen). the underlying nuclear lamina of lamin proteins and ; 3. This defect is known as deuteranopia or deutan colour blindness. During cytokinesis, the cytoplasm divides by a process, called cleavage. The reticular layer is a process of the cytoplasm divides by a process of the cytoplasm divides by a process. synthesized by underlying connective tissue into which it is merged (Wheater et al., 1979). The very large size of the genomes of the higher eukaryotes certainly indicates that much of the DNA is redundant (= repetitious) and probably not utilized as coding or regulatory sequence. (iii) Pentoses contain five carbon atoms in their molecules, e.g., ribose, ribulose, deoxyribose, arabinose and xylulose. When any two of the mutant multiple alleles are crossed, the phenotype is mutant type and not the wild type. Contents GENETICS, HUMAN GENETICS AND EUGENICS 106 C H A P T E R 9 Genetic and Cytological Mapping of Chromosomes O ur discussion of linkage and crossing over has made clear so far, that 1. Contents 56 MOLECULAR BIOLOGY In bacteria, the process of transcription of mRNA is simultaneous with translation, i.e., as soon as the mRNA is being transcribed by RNA polymerases the ribosomes become attached to the mRNA is being transcription of mRNA is simultaneous with translation, i.e., as soon as the mRNA is being transcription of mRNA is simultaneous with translation, i.e., as soon as the mRNA is being transcription of mRNA is simultaneous with translation, i.e., as soon as the mRNA is being transcription of mRNA is simultaneous with translation, i.e., as soon as the mRNA is being transcription of mRNA is being transcription of mRNA is being transcription of mRNA is simultaneous with translation, i.e., as soon as the mRNA is being transcription of m not multiply in a lytic insertion of Mu way. In 1902, A B A b these investigators recognised inindependependently that the behaviour of chromosomes at meiosis : genes a b a B anaphase I are in pairs (so are chromosomes); the members of a gene pair segreFig. On the other hand, lipid molecules readily exchange places with their neighbours within a monolayer (~ 107 times a second). Liver Kidney Nerve cells Brain Intestinal epithelium Lung epithelium Macrophages (of spleen, bone marrow, liver and connective tissue) 8. This type of electron microscope is called transmission electron microscope (TEM). The 23S and 5S rRNA occur in the larger 50S ribosomal subunit, while the 16S rRNA occurs in the smaller 30S ribosomal subunit, while the 16S rRNA occurs in the smaller 30S ribosomal subunit. 7.3. A model of formation of Golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of Golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of stack of cisternae (C and D), formation of stack of cisternae (C and D), formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of golgi apparatus from endoplasmic reticulum (A—C) and subsequent developmental stages : formation of secretory vesicles (E) division (F,G) (after Sheeler and Bianchi, 1987). Contents 22 GENETICS, HUMAN GENETICS AND EUGENICS C H A P T E R 3 Mendel and His Work J ohann Mendel was the pioneer of classical geneticists. Sexual system Table 3-2. Since the lampbrush chromosomes are found in the prolonged A chiasma diplotene stage of meiotic prophase I, they are present in the form of bivalents in which the maternal and loop paternal chromosomes are held tochromomere gether by chiasmata, at those sites region of where crossing over has previously axis single occurred (Fig. The person which contains the recessive gene for haemophillia lacks in normal clotting substance end of the maternal and loop paternal chromosomes are held tochromomere gether by chiasmata, at those sites region of where crossing over has previously axis single occurred (Fig. The person which contains the recessive gene for haemophillia lacks in normal clotting substance end of the maternal and loop paternal chromosomes are held tochromosomes are held tochromosome (thromboplastin) in blood so minor injuries cause continuous bleeding and ultimate death of the person due to haemorrhages. The slow recovery cilium prior to the next effective stroke (after Dyson, 1978). According to this theory two over. The fusion of an enzyme known as ligase (Stern and Hotta, 1969). This system maintains the vital dye in its oxidized (coloured) state. F1 plasma membrane. 15.2) and are protected from disassembly by the capping proteins (see Alberts et al., 1989). Coefficient of relationship (R). (a) All green progeny because of chloroplast containing eggs from the pistillate parent. C P P The first are A T deoxynucleoside P OH triphosphates. Coe (1943) demonstrated in mollusc genus Crepidula that its every zygote contains all the genes which are necesOc Oc sary for the development Oc of male and female reproductive systems. (3) The gap may also produce a deletion, causing mutation. Lethal mutations result in the death of the cells or organisms in which they occur. Describe various functions of Golgi apparatus in the cells. Contents LINKAGE 87 The 7:1:1:7 test cross ratio clearly indicated that there was a tendency in the dominant alleles (R Ro) to pass together to the same gamete. If you had a
plant with 4n complement. (ii) Non-electrolytes. (b) What proportion of the diploid offspring will be eyeless? Let us closely examine the Hammerling's classical nuclear transplantation experiments : Hammerling's expe-riment. Contents 46 MOLECULAR BIOLOGY 4. Particulate theories. When bacteria are growing in culture medium containing glucose, the cAMP concentration in the cells is quite low. When two genotypes produce the same phenotype due to different environments, then each one is called the phenocopy of the other, because they differ genotypically. The entire process of digestion is carried out within the lysosome. The cells of the mesoblastic origin are collectively known as the cells of macrophagic or The process of engulfment by a reticuloendothelial system 73 Cellular functions of certain ions. Give an account of artificial parthenogenesis. For example, in Drosophila melanogaster there are about 5000 bands and 5000 Contents 274 CELL BIOLOGY short region of DNA double helix 2nm 'beads-on-a string' form of chromatin fibre of packed nucleosomes 30nm section of chromosome. in an extended form 300nm densed section of metaphase chromosome 700nm entire metaphase chromosome 1400nm Fig. The nucleus consists of the following three structures : 1. 301 with at least 19 distinct forms in human epithelia and 8 more in the keratins of hair and nails. Thus, each lateral loop is covered by a matrix (Fig. The average of the F1 hybrids form these two varieties was of intermediate length. Asexual genetics, involving study of somatic mutation, assortment, and crossing-over, Sickle-cell anaemia. In the plasma membrane of newly formed curs once a month for any indiheterokaryon, the mouse and human proteins are initially confined to their own halves, but they intervidual lipid molecule. In a way, thus, viruses are cellular parasites that cannot reproduce by itself. short generation site (promoter) 5S rRNA and a fixed termination site, the made transcripts adopt the characteristic 5' 3' 5' 3' 5' 3' has a fixed initiation site (promoter) 5S rRNA and a fixed termination site (promoter) 5S r leaf" conincorporated into small incorporated into large figuration (Fig. 13.8. A nucleosome (after after contracting 40-fold in the 30-nm fibre, they would be Thorpe, 1984) only about 0.6µm long, a length consistent with the diameter of metaphase chromosome (1µm). These organisms are estimated to have an evolutionary history of at least 600 million years, during which they diverged structurally. Contents 296 CELL BIOLOGY Microtubule-Associated Proteins (MAPs) Recently, a number of proteins are called microtubule-associated proteins or MAPs. The following two major classes of MAPs have been isolated from brain in association with microtubules : 1. Each of these A chromosomes contains maternal and paternal homologues in somatic pairing which lacks in the sex chromosomes of male fruit flies. When the extracted proteins of the plasma membrane of human erythrocytes (RBC) are studied by SDS polyacrylamide-gel electrophoresis (SDS = sodium dodecyl sulphate; a detergent), approximately 15 major protein bands are detected, varying in molecular weight from 15,000 to 25,000. Mode of action of complementary genes. Both of these proteins have a distinct, though closely related, amino acid sequences and are thought to have evolved from a single ancestral protein. The genic balance theory of Bridges has been supported by the following two findings : 1. 14.6). In certain cases as in Nereis, the tail and middle piece of the sperm remain outside the egg and only the head and centrosome enter in the egg. In such inherited baldness the hairs gradually become thin on head top, leaving ultimately a fringe of hair low on the head and commonly known as pattern baldness. Such substances are characterized by having the same index of refraction in all directions. Contents MENDEL AND HIS WORK 33 letters indicate that each allele can express itself to some degree even when in the presence of its alternative allele (heterozygous). The symbiotic origin of the chloroplast. A bacterial flagellum consists of a helical tube containing a single type of protein subunit, called flagellin. 4.1 D). Ciliary Rootlets In some cells, from the basal ends of the basal ends of the basal bodies originate the ciliary rootlets which are of following two types : Fig. The anticodon loop consists of seven unpaired bases, the third, the fourth and the fifth of which (from the 3' end of the molecule) constitute the anticodon. 4.19). Contents GROWTH 365 C H A P T E R 23 Growth G Living beings grow both in body mass and height. are then called linkage by Morgan. Preparation of a specimen for observation in the electron microscope. CC, Cc AA, Aa a AA, Aa c A 3. It is composed of an outer A and an inner layer of protein. This stain adheres well to lipids, especially phospholipids and unsaturated fats. What were the genotypes of the parents? On the basis of the results of his experiments Mendel recognized the phenomenon of dominance and formulated following two laws : 1. The first stage in nuclear division involves duplication of this attachment, followed by a progressive bidirectional replication of DNA by two replication of DNA by two replication forks. Table 15.1. Characteristics of four types of intermediate filament proteins (Source : Alberts et al., 1989). The following physical means cause the parthenogenesis : (i) Temperature. In 1950, Roper found that crosses between different biotin requiring mutants of Aspergillus can yield wild type recombinants. Electron Microscopy Osmium tetroxide, potassium permanganate, formalin, glutaraldehyde. Thus, living cells which are wet cannot be viewed in electron microscope. The recent studies of mitochondria in these cytoplasm revealed that the factors responsible for cytoplasmic male sterility are located in mitochondrial DNA (mt DNA) and mt DNA of N, T, C and S cytoplasms are found to be different. For example, in the cell K+ and Mg++ can be high, and Na+ and Cl— high outside the cell. Human lymphocytes Leopard frog embryo Human embryonic lung African green monkey kidney Newt heart Xenopus laevis oocyte Triturus alpestris oocyte Pore density µm2) (Pores/µ Pores per nucleus 3.2 5.6 8.5 8.6 7.6 51 50 405 1729 2788 4277 12,707 37.7 x 106 57 manner that allows the protein to perform mechanical work. Studies with radioactive precursors have indicated that the newly synthesized phospholipids are rapidly transferred to other cellular membranes by the help of specific cytosolic enzymes, called phospholipid exchange proteins. Myelin (Nerve cell) Plasma membrane : (i) Mouse liver (ii) Amoeba (iii) Human erythrocyte Spinach chloroplast lamellae Mitochondrial inner membrane Protein Lipid Carbohydrate 18 79 3 44 54 52 70 76 52 42 40 30 24 4 4 8 0 0 1. Histores play a crucial role in packing this very long DNA molecule in an orderly way (i.e., nucleosome) into nucleus only a few micrometres in diameter. 14.1. Structural changes in chromosome (after Savage, 1969). Von Baer (1828) made discovery of the mammalian egg. The clover U X leaf model of tRNA, so, it gained general acceptance. For such experiments, human red blood cells or erythrocytes have been selected by E. Man has 23 pairs of chromosomes and 23 linkage groups. What kind of evidence indicates (1) that DNA can reproduce itself and (2) that nucleotides occur in matched pairs in DNA molecule? 2.1). Keratin sulphate, like hyaluronic acid, is a repeating disaccharide forming an unbranched chain. The immune response appears to be of rather recent evolutionary origin, because antibodies production is the characteristic only of vertebrates. Number of contributing alleles Eye colours found in human beings. From any such unstable Uncommon tautomer H Cytosine N H N N H N N CH3 O provided by an electrochemical gradient, into the chemical energy of ATP. and children (sex unspecified) 1 boy; 1 girl A member of a family who (in order of birth) first comes to the attention of a geneticist is called the propositus. CHEMICAL COMPOSITION OF NON-GENETIC RIBONUCLEIC ACID (RNA) Chemically, the non-genetic RNA is closely related with DNA. After union, the two parts of the ribosome hold between them the ribbon of mRNA with its attached N-formylmethionine tRNA. (b) The affected males pass the condition on to all of their daughters but to none of their sons (Fig. In unsaturated fatty acids, at least two but usually no more than six of the carbon atoms of the hydrocarbon chain are linked together by double bonds (- C = C -), e.g., oleic acid, linoleic, arachidonic acids. Likewise, in tRNA genes, box A and box B are located at +8 to +30 and +51 to +72 sequences, respectively. Thus, identical genes and they are like one person walking around in two bodies. What are the different types of gametes expected to be formed? Contents DETERMINATION OF SEX AND SEX DIFFERENTIATION 163 4. Like mitochondria, each chlorophyll pigment. Contents 302 CELL BIOLOGY General Structure of IFs Despite the large differences in their size, all cytoplasmic IF proteins are encoded by members of the same multigene family. Let us assume that gene A is in the middle (e.g., B-A-C) : B 12 B 7 A A 5 C C In this case because, the distances between B-C are not equitable, genes A cannot be in the middle. called siamese twins. The DNA and RNA have almost similar chemical compositions except a few differences. However, due to recent investigations of Gall and coworkers (1962, 1983) the structure of these exceptionally large-sized chromosomes has been interpreted in chromonemata loop inter band giant chromosome mRNA chromonemata dark band Balbiani ring Fig. 10.4. A longitudinally cut mitochondrion showing fibroblasts, nerve axons and most plant tisits internal structure. A battery of post natal chemical tests can detect problems in the newborn infants, so that some corrective methods can be applied immediately to lessen the impact of many genetic diseases. Both cells pass
through a short resting phase of interphase. Contents 188 GENETICS, HUMAN GENETICS AND EUGENICS Types of polyploidy. It seems that the adjacent peripheral doublets can actively slide against each other once they B have been freed of their lateral crossA links (such as those made of nexin). EFGH You find the following aberrations in this chromosomes; for each identify the specific kind of aberration: (a) ABCD. Pigment system I or photosystem I (PS I) units occur in the thylakoid membrane in the form of small and densely packed particles. Hybrid. Ultrastructure of plant cell). Similarly, a cDNA molecule has been synthesized on mRNA which codes for the human chorionic somatomammotropin (HCS), a placental lactogen (Shine et al., 1977). These eggs on normal fertilization produce the following results : The metafemales (AA XXX) are weak and seldom live beyond the pupal stage; the AAOY individual die in the egg stage. H.J. Muller and L.J. Stadler independently discovered that X-rays induce mutations. When Ca2+ is added to a solution of pectin molecules, it cross-links them to produce a semirigid gel. Contents PLASTIDS an autotrophic host cell. If the ascospores are removed one by one from the ascus in linear order and each is grown as a separate culture, a linear ratio of 4 colonial : 4 wild type indicates that a first division segregation occurred, i.e., during first meiotic anaphase both of the c + chromatids moved to one pole and both of the c + chromatids moved to the other pole. In alfalfa, upon selfing many sub-vital and lethal types appear and the rate of deterioration of general vigour and productivity is alarming. In mitochondria, the flavin dehydrogenase donates its electrons to the respiratory chain. These intrachloroplastic membranes are the thylakoids which, in certain regions, pile closely to form the grana. In order of increasing amount of melanin pigmentation, these eye colours can be designated as light blue, medium blue, dark blue, grey, green, hazel, light brown, medium brown and dark brown. Contents C H A P T E R 15 Chromosomes Number) E Orangutans have 24 pairs of chromosomes. 8.8). Thus, by shadow casting, shape and profile of a particle can be discerned. Therefore, the mutant dominant lethal is removed from the population in the same generation in which it arose. Cite evidence for the statement that the gonads of vertebrates are potentially dual in function. They used strains in which ultrabar or bar locus is flanked by the marker genes f (forked bristles) and fu (fused wing veins), i.e., the gene B is 57.0 crossover units from the centromere; the marker gene f is proximally situated at 56.7 and other marker gene fu is distally situated at 59.5. These three genes are so closed together that only one crossing over is normally possible in this region at a time. AA, Aa, aa 3. This type of random genetic changes can also be caused by Ecology Sociology such environmental agents as fallout from nuclear weapons, radioactive contamination from nuclear reactors, and radiation from various X-ray maPhilosophy chines. (ii) Receptor-mediated endocytosis. A more direct evidence for a triplet code came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide chain of 30 amino acids of a growing 5' AGT CAGE came from the finding that a piece of mRNA containing 90 nucleotides, corresponded to a polypeptide came from the finding that a piece of mRNA contain of 30 amino acids of a growing 5' AGT CAGE came from the f TCA GTC AGT CAC TAG CTC 3' haemoglobin molecule. 12.6. Various avenues for transport of material from the nucleus to the cytosol (cytoplasmic matrix) (after synthetase, nucleoside triphosSheeler and Bianchi, 1987). Other quaternary proteins, such as haemoglobin, consists of non-identical subunits and are called heteropolymers. Electron microscopy of such ER preparations reveals that the membranes disrupt to form closed vesicles (~100 nm diameter) of either a rough or a smooth form. The symptoms of this syndrome result from the immobility of cilia in the respiratory tract and of the flagella in the respiratory tract and of the syndrome result from the immobility of cilia in the respiratory tract and of the flagella in the respiratory tract and of the syndrome result from the immobility of cilia in the respiratory tract and of the flagella in the respiratory tract and of the syndrome result from the immobility of cilia in the respiratory tract and of the flagella in the syndrome result from the immobility of cilia in the respiratory tract and of the flagella in the respective tract and of the flagella in the respiratory tract and of the flagella in the : mutation and recombination. Yeast growth kinetics emphasises various features common to the growth of cells that absorb nutrients through their surface : (1) growth rate is constant between divisions, and doubles immediately after; (2) cell mass doubles between divisions, (3) mass increase is correlated with a nuclear change rather than cytoplasmic; (4) there is no lag period - linear growth begins immediately after division. How many chromosomes does the common oat possess? According to Morrison (1966) the new mitochondria might have been originated from the endoplasmic reticulum or plasma membrane(Fig.10.20). Consequently, the fingers and toes become abnormally short. To perform such specialized functions are inevitable in the plasma membrane of such cells. Thus, there would be formed two kinds of DNA molecules, one that is identical to the original DNA and another that has undergone a base pair substitution of G-C for A-T. Length of chromosome ; 3. coli trap operon at which tRNA. These genes are tandemly repeated or reiterated along the DNA molecule (in a head to tail arrangement) and are separated from each other by stretches of spacer DNA, which is not transcribed. In this case the F1 is Red probably segregating for three pairs of genes Medium red and only the genotype r1r1 r2r2 r3r3 produce F1 white. EXAMPLES OF QUANTITATIVE INHERITANCE 1. TMV is the most extensively studied plant virus. The chloroplasts contain 20-30 per cent lipids of its dry weight. One of the most extensively studied in such a way that 50 per cent of target base is destroyed, so that fragments of different sizes having 32 P are produced. A cross between two animals differing in spot pattern produces F1 individuals which are intermediate between the double trisomic is destroyed. resulted. outer There is a single flagellum at membrane one pole of the cell. For example, haemoglobin production is highly dependent on the availability of haem to complex with globin protein subunits and may be deficient in cases of irondependent on the availability of haem to complex with globin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production is highly dependent on the availability of haemoglobin production production is highly dependent on the availability dependent on the
availability of h oxidase of yeast showsite exchange proteins; the imported lipids then receptor ing topographical relationship of its seven move into the inner membrane, presumably at subunits and its relation with cytochrome c contact sites. Each nodule marks the site of a large multienzyme 'recombination machine' which brings local regions of DNA on maternal and paternal chromatids together across the 100-nm wide synaptonemal complex. The DNA-dependent M-phase delaying factor that is present in S-phase cytoplasm and inhibits the process leading to onset of MPF production. Chromosomes "caught in the act" of replication gave rise to what are called theta Contents REPLICATION OF DNA configurations because they have the appearance of the Greek letter theta (i.e., q fig. Thus, a mating between two heterozygous for either gene A or a and half of the population heterozygous like the parent but the overall frequencies of A and a remain unchanged : Aa X Aa 1 AA : 2 Aa : 1 aa B D Thus, inbreeding brings about the recessive gene to appear in a homozyE gous state (aa). He made a cross between fruit flies having mutant recessive alleles for purple eye colour and vestigial wings (pr vg/pr vg) (for details see Suzuki et al., 1986; Burns and Bottino, 1989). The homologous chromosomes which come from the mother Contents 334 CELL BIOLOGY (by ova) and father (by sperm) are attracted towards each other and their pairing takes place. The cloned foreign DNA fragment expresses normally as in parent cell. Figure 6.1 shows a pedigree in which close line breeding to B has been practiced so that A possesses more than 50 per cent of B's genes. In fungi, Neurospora crassa a number of mutations of mitochondria are inherited via the female parent. If the map distance between the gene loci B and C is 12 centimorgan, then 12% of gametes of genotype BC/bc should be crossover types, i.e., 6% bC. Likewise, in tic cells mRNAs with a life time of days have been detected. Diagram showing how multiple alleles control self-sterility in certain plants. (2) Chromatophores. Table 3-3. In fact. IS carry the genetic information necessary for their transposition (i.e., the gene for the enzyme transposase) (Fig. Each segment is a te synthesis of a different single mRNA. Under each facing plasma membrane of the spot desmosome, there is a discoidal intracellular plaque, 15 to 20 nm thick, having non-glycosylated proteins such as desmoplakins I, II, and III (Muellar and Franke, 1983). The asexual reproduction usually includes amitotic or mitotic division of the body (somatic) cells, therefore, it is also known as somatogenic or blastogenic reproduction. The process of phagocytosis occurs in most protozoans and certain cells of multicellular organisms. Contents 136 CELL BIOLOGY ticles phagocytotically the process is known as chromopexy, e.g., some mesoblasitc cells. It soon became clear that ribosomes contain three or four kinds of RNA and scores of proteins. chromosome, while genes controlling spermatogenesis occur on the long arm of Y-chromoF1 some. An antigen can be a protein, lipid, carbohydrate or any other molecule. Table 8-2. The longest of these operons contains genes for 11 ribosomal proteins. 2.7. Reconstruction of virus, showing that reconstructed viruAs gives progeny which resembles the virus from capable of RNA replication. The recessive genes a and b are allelic, each producing a narrow eye phenotype in Drosophila when homozygous. The translocation A B C D Meiosis in a pericentric inversion heterozygote Contents CHROMOSOMAL MUTATION-I 179 homozygotes may have normal meiosis and in A B C D E Meiosis in paracentric fact, are difficult to deinversion heterozygote tect cytologically unless A D C B E morphologically unless A D C B E morphologically dissimilar chromosomes are inpairing volved, or banding patcrossover loop terns differ markedly. In 1892, he described spermatogenesis and oogenesis. phenotypic expressions) of a single gene is called pleiotropism. In the thylakoid membrane PS I and PS II are probably arranged near one another forming the so-called Z-scheme (Hill and Bendall, 1960) because they are functionally related ; excitation energy sunburst through the leaves of a fern depicts the harvesting of originating in one can be shunted to the A light energy by photosynthesis, the ultimate source of energy for other system. cilia and flagella, 2. Acid hydrolases are released from osteoclasts and break down bone for the reabsorption; these cells also secrete lactic acid which makes the local pH enough for optimal enzyme activity. For example, azaserine (an potent alkylating agent) inhibits purine synthesis and urethane (a mild alkylating agent) is an inhibitor of pyrimidine synthesis. Polyandry. The positively-charged atom is called ion. mRNA chromosome puff dark band interbands per genome and lipids of matrix have less surface tension, therefore, occur at the surface and form the membrane, while the chemical substances such as NaCl have high surface tension, therefore, occur in deeper part of the matrix. In Contents INTRODUCTION 7 1926, his book 'The Theory of the Gene' was published and he got Nobel prize in 1934. (ii) Glycoproteins (or glycosaminoglycans or mucopolysaccharides). A—The relationship of the axostyle with the cell body; B—Schematic bending. K. They are classified and named according to the number of carbon atoms in their molecules as follows : (i) Trioses contain three carbon atoms in their molecules, e.g., glyceraldehyde and dihydroxy acetone. Some enzymes which are concerned with later covalent modifications of the polysaccharides, are found in the cell wall itself. These diseases are spread mainly by insects such as aphids, leaf hoppers and beetles. The linear sequence of amino acids forms the primary structure; at least some portion of many proteins have a secondary structure in the form of an alpha helix. RNA is processed to remove intron sequences. There is more efficient functioning of these materials to synthesize proteins when oriented on a membrane surface than when they are simply in solution, mainly because chemical combinations between molecules can be accomplished in specific geometric patterns. leading strand template DNA polymerase on leading strand next Okazaki fragment will start here DNA polymerase just finishing an Okazaki fragment on lagging strand template Fig. Cytological basis of crossing over was first described by the Belgian cytologist F.A. Janssens in 1911. DEFGH = A... Ovalbumin 2. (a) Female : c/c +/s; (b) Male : +/Y s/s; (c) Progeny males : c/Y +/s and c/Y s/s; Progeny females : c/+ s/+ and c/Y s/s; (c) Progeny females : c/+ s/+ and c/Y s/s; (c) Progeny males : c/Y +/s and c/Y s/s; (c) Progeny females : c/Y +/s and c/Y s/s; (c) Progeny males : c/Y +/s and c/Y s/s; (c) Progeny females : c the cells are typically composed of plasma membrane, cytoplasm and its organelles, viz., mitochondria, endoplasmic reticulum, ribosomes, Golgi membranes. The paired homologous chromosomes are joined by a roughly 0.2-µm thick, protein-containing framework called a synaptonemal complex (SC). In 1868 the well known naturalist Charles Darwin has given his famous theory of pangenesis which exclusively depends on the particulate theory. Relative amounts of nitrogen bases in different samples of DNA (Chargaff and Davidson, 1955). If the material is isotropic, polarized light is propagated through it with the same velocity, independent Contents TECHNIQUES IN CELL BIOLOGY 19 of the impinging direction. Thus, by copying eukaryotic purified mRNA, several genes have been artificially synthesized. According to the size, the following two types of mRNA molecules can be recognized. In Neurospora, for example, the products of a single meiosis can be recovered and examined. Thus, the dominant and recessive alleles remain together for long time without contaminating or mixing with one another and segregate during gametogenesis. Extracellula Materials In certain cells, outside the cell coat proper and the fuzzy layer exist the extracellular materials, e.g., jelly coat of eggs of fishes and amphibians, the basal laminae of epithelia, the matrix material in which cartilage and bone cells are embedded and the cell wall of plant cells. Both types
of these chromosomal aberrations are unstable. Contents CELL 41 Usually, the animal viruses are released viral nucleic acid from the host cell by rupturing (lysis) and subsequent death of host cells. Stern (1936) observed that Drosophila females which are heterozygous for sex-linked recessive genes, yellow body colour (Y) and singed (=burned or scorched) hairs and Demonstration of sister chromatid exchanges in bristles (sn), are phenotypically like wild types mitotic chromosomes. 65 The reactions are identical, however, substrates are different, i.e., DNA polymerase joins deoxynucleotides and RNA polymerase joins ribonucleotides. How the sex is determined in human beings ? Examples. Contents 236 GENETICS, HUMAN GENETICS AND EUGENICS Twins are useful in detecting the relative effectplacenta tiveness of heredity uterus and environment upon the expression placenta of a disease or trait. In the Homologous chromosomes Leptotene Contents CELL GROWTH AND CELL DIVISION 335 middle of the centriole pachynema stage each homologous chromosome some spilts lengthwise nucleolus to form two chromatids. Ph : 2723901 z 104, Citicentre Ashok, Govind Mitra Road, Patna-800 004. coli cells contain five species of tRNA for leucine amino acid. ATP synthetase. Table 2-2. PHENOMENON OF DOMINANCE A mendelian trait wrinkled and round seeds. 3.3). (2) High affinity Ca2+- binding protein which binds Ca2+ ions inside and round seeds. 3.3). the sarcoplasmic reticulum vesicles and decreases the amount of energy needed to pump Ca2+ ions into it from the cytosol. Histones which are quite similar in all plants and animals. to nuclease and ligase activities. Eclipse period, during which synthesis of new phage DNA and protein coats takes place. Hold adjacent microtubule doublets together. (ii) Helix-destabilizing strand. The genetic makeup or constitution of an individual, with reference to the traits under consideration, usually expressed by a symbol, e.g., +, DD (tall), dd (short), etc. These genes, whether dominant or recessive, show their effects in the male phenotype. According to this model a daughter chromosome is formed by alternate use of recipient and donor chromosome material as a kind of model or template. Mendel while explaining the results of his monohybrid and dihybrid crosses, first of all conceived of the genes as particulate units and referred them by various names such as hereditary factors or hereditary elements (or Merkmal). This type of mutation occurs in autosomal chromosomes. 12.14). Contents 12 MOLECULAR BIOLOGY with materials, known to contain DNA-depolymerizing activity (DNAase enzyme), inactivated the transforming principle.) For example, kidney or liver cells are about the same size in the bull, horse and mouse. The gene for Himalayan coat is represented by ch. By one of the method we can deal with the already existing human beings. Oishi and D. 23 Light Microscopy On a glass slide with an egg albumin adhesive. Electrolytes and non-electrolytes and non-electrolytes and non-electrolytes and non-electrolytes and set by the synthesis of both electrolytes. Monod in 1961, on the basis of their study on the inducible system for the synthesis of both electrolytes and non-electrolytes. E.coli, proposed a model in order to explain the induction or repression of enzyme synthesis. Table 10-2 has enlisted some of the basic differences between these two transducing systems. Gibbons (1963). Examine meiotic cells cytologically. An inhibitor of pigment production in onion bulbs (I-) shows dominant epistasis over another locus, the genotype ii R- producing red bulbs and ii rr producing yellow bulbs. The last Russian czar and his family. In the sperms of certain animals an acrosome and the nucleus. In 1940 and later, Oliver and his student Green conducted experiments using different mutants and heterozygotes at the locus lozenge (lz). Contents CHROMOSOMAL MUTATION-I 171 (b) Exchange of parts between chromosomes of different pairs : translocation. Such Ca2+ cross-links are thought to help hold cell-wall component together. Because of their negative charge, pectins are highly hydrated and intensely bind cations. The nucleus becomes large due to the increased amount of the nucleoplasm and is called germinal vesicle. membrane In the resting condition (steady state) both Na+ and K+ channels are closed. A C B D There is plenty of cytological evidence to prove that such evolutionary crossover mechanisms. The enzyme represents a very complex pattern of enzymes and products. Thus, two double helical molecules, identical with each other, are formed. In animal cells, net membrane biosynthesis increases just before cell division (mitosis). Over a period of time and fix embed cells in cells sufficient radioactive emissions occur to wax or plastic. 14. Whole mounts. Further, when they crossed blue or purple long (Rr Ro ro). This will produce a T-A To C-G transition. Such chromosomes comprising wholly constitutive heterochromatin occur in corn, many phytoparasitic insects and salamanders. From the analysis of 1 2 pedigree of polydactyly, one fact becomes clear that polydactylous trait is dominant on ll the normal pentadactylous 1 2 3 4 5 trait which is recessive. β - oxidation of palmitic acid produces in total 8 mol of acetyl - CoA, each of which on oxidation by Krebs cycle produces 12ATP molecules; thus, making 8 × 12 = 96ATP molecules via this route. Based on their shape, bacteria are classified into the following groups : (1) Cocci (singular coccus). Proposed that chromosomes contain the units of heredity. The dominance hierarchy is MR > M> m. The bar gene of Drosophila is dominant and located on the X chromosome. mitochondrial vesicles are able to per- Contents 196 CELL BIOLOGY form respiratory chain phosphorylation. 10.10). A small segment of a chitin molecules. In other words, introns are used as a means of identifying or ticketing the molecules, such as growth regulating substances—auxins, cytokinins and gibberellins—have molecular weights of less than 500 daltons. According to their position in the plasma membrane, the proteins and peripheral or extrasic proteins, both of which may be either ectoproteins, lying or exposing to external or extracytoplasmic surface of the plasma membrane or endoproteins, lying or sticking out at the inner or cytoplasmic surface of the plasma membrane. This was interpreted as showing semiconservative mode of duplication. The protein porα1 tion of the haemoglobin molecule, called globin, is α2 composed of four polypeptide chains, each of which is also globular in shape. plant is connected to its living neighbours by fine cytoplasmic channels, each of which is called a plasmodesmat (Gr., desmos = ribbon, ligament; plural, plasmodesmata) which pass through the acidic pectin Ca2+ bridges between intervening cell walls. Thus, being basic, histones bind tightly to DNA which is an acid. These vacuoles or cavities often remain concentratecousties often remain concentratecousties of the concentratecoust in the endoplasmic portion of the cytoplasm; therefore, known as endoplasmic reticulum, a name derived from the fact that in the light microscope it looks like a "net in the cytoplasm." (Eighteenth-century European ladies carried purses of netting ribosome called reticules). originally absent, develop subsequently. During tailoring of larger rRNA molecule, 16S rRNA sequence is first of all cleaved off and is separated from the 23S and 5S sequences. If a desirable mutation occurred in a branch of triploid tree, how would you establish an orchard of trees with this mutation. (b) Cytoplasmic organelles. Got Nobel Prize for his studies on the chemistry of proteins and for development of electrophoresis. It is not made by or specified by the virus itself but is derived from the plasma membrane of the host cell (i.e., animal cell). (iii) Phase 3 : Regeneration of RuBP. They have a fine granular structure internally which is rich in lipids and proteins. 4.5. Taylor and Wood's experiment on Vicia faba root tips using initiate within the helix. Plant cells contain many freely distributed sub-units of Golgi apparatus, called dictyosomes, secreting cellulose and Basal Bodies C ytoplasm of some eukaryotic cells contains two cylin drical, rod-shaped, microtubular structures, called cen trioles, near the nucleus. Ruth Sager, who is pioneer on nonchromosomal genes, was able to prepare genetic map of Chlamydomonas chloroplast. showing X-linked inheritance in Drosophila. Pairing or synapsis occurs between the homologous chromosomes. (ii) Centrolecithal (d) In mammalian females, one of the two X chromosomes present in somatic cells undergoes condensation in early embryonic stages to become heterochromatic sex chromatin or Barr body (Dosage compensation). the correct conclusions. This type of growth results due to the rise in the number of cells constituting the body. The exciting potential of this technique lies in the possibility of correcting genetic defects—for example, restoring the ability of a diabetic individual to make insulin or correcting immunological dificiencies. Contents 240 CELL BIOLOGY Structure and Function Chromoplasts appear to be products of degeneration or disintegration of chloroplasts. If 0.14% of the genome forms hybrid double helices with RNA complementary to one strand of DNA, estimate the number of genetics, outlining the newer areas of study in this subject. However, there is now evidence suggesting that new peroxisomes always arise from preexisting ones, being formed by growth and fission of old organelles similar to mitochondria and chloroplasts. porous membrane DIALYSIS It is a sensitive method for separating lower molecules in plants, the best characterized is the large (1,24,000 dalton) protein, called phytochrome. They called them neurotubules. The eukaryotic cells have four kinds of rRNA molecules, namely 28S rRNA (the sedimentation constant varies between 25S and 30S depending on the species), 18S
rRNA, 5.8 S and 5S rRNA. In thin electron microscopic sections, the kinetochore shows a trilaminar structure, i.e., a 10 nm thick dense outer proteinaceous layer, a middle layer of low density and a dense inner layer tightly bound to the centromere (Fig. To this control region of gene remains attached a special protein, called transcription factor IIIA or TF III A which permits RNA polymerase III enzyme to recognize the promoter of a 5S rRNA gene (i.e., TF III A initiates the synthesis of 5S rRNA). A cross of chicken with a rose comb to one with a single comb produces ³/₄ rose and ¹/₄ single, showing dominance of rose over single. Contents CELL BIOLOGY 292 (iii) 45S RNA has a lifetime of about 15 minutes and is then cleaved into smaller components as follows : 45 S 32 S 28 S + 5.8 S 20 S 18 S 41S (iv) 20S RNA is rapidly processed in 18S rRNA and probably due to this reason the small ribosomal subunits. Finally these electorns reach NADP coenzyme, each molecules of NADPH from one molecule of H2O used in PS II : Thylakoid lamella Thylakoid lame chromosomes) female Drosophila (3A:3X) to diploid males (2A:XY). Then there develops a sort of strain on one chromatid. The fertilized eggs become females (fertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertilized eggs become females (fertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertilized eggs become females (fertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertilized eggs become females (fertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertilized eggs become females (fertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertilized eggs become females (fertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertilized eggs become females (fertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertilized eggs become females (fertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertile queens or sterile workers depending up on the amount of royal jelly the developing young receives); the unfertile queens of the amount of royal jelly the developing young receives (fertile queens of the amount of royal jelly the developing young receives); the unfertile queens of the amount of royal jelly the developing young receives (fertile queens of the amount of the amount of the amount of the am thick, gummy, mucilaginous and is secreted by the plasma membrane. Contents 344 CELL BIOLOGY flagellum fission nucleus dividing muscle. Tubule A has 13 protofilaments, while tubules B and C have only 10 protofilaments each. The mitosis helps the cell in maintaining proper size. Most cholesterol is transported in the peripheral endosome blood in the form of particles of lowdensity proteins or LDL. Contents CELL BIOLOGY 114 CHEMICAL COMPOSITION Chemically, plasma membrane and other membranes of different organelles are found to contain proteins, lipids and carbohydrates, but in different ratios (Table 5-1). 5.3. The structure of plasma membrane as observed A-at low magnification of electron microscope; B- at high magnification of electron m lipopolysaccharides (LPS). In simple diffusion, transport across the membrane takes place unaided, i.e., molecules of gases such as oxygen and carbon dioxide and small molecules (e.g., ethanol) enter the cell by crossing the plasma membrane without the help of any permease. The X-linked recessive mutations are more easily studied in appropriate organisms than are autosomal ones. Hershey and Chase then allowed both kinds of labelled phage particles to infect E. They produce rather viscous mucus, particularly in the gut, pancreas and lungs. The protoplasm which is filled in the nucleus is called cytoplasm. Contents GENE MUTATION 207 (b) Alteration during Replication of Nucleic Acid 1. ANSWERS TO PROBLEMS 8. Surface tension. Both the subunits remain separated by a narrow cleft (Fig. Contents 350 CELL BIOLOGY chromatin material beGolgi complex Golgi complex Golgi complex Golgi complex for a narrow cleft (Fig. Contents 350 CELL BIOLOGY chromatin material beGolgi complex Golgi comple (HA = NH2. Nucleolus is not bounded by any limiting membrane; calcium ions are supposed to maintain its intact organization. Among these techniques, the most important ones are distant hybridization and anther culture. Further, for getting the exact results in the breeding experiments, it was necessary for Mendel to rear genetically pure variety of pea plants for a single character. Microtubules are added one at a time until there is an equally spaced ring of nine. The present name chromosome (Gr., chrom= colour, soma=body) was coined by W. A system of elastic protein filaments might connect the kinetochore to the pole and pull the kinetochore steadily poleward. His health progressively degenerated and he became far too obese and began to suffer from dropsy due to heart and kidney failure. Mutation has a significant role to play in the origin of species or evolution. However, the development of molecular biology had to await the understanding that the most advantageous approaches would be made by studying "simple" systems such as bacteria and bacteriophages which yield information about the basic biological processes more readily than animal cells. The term protein was coined by Dutch chemist G.J. Mulder (1802—1880) and is derived from Greek word proteios, which means "of the first rank". scattered even by gas mol(b) A false - colour TEM photo showing centrioles ecules and so the electron beam must (c) A false colour SEM photo of a Paramecium. During the process of crossing over, two non-sister chromatids first break at the corresponding points due to the activity of a nuclear enzyme known as endonuclease (Stern and Hotta, 1969) 8.6. Three steps of Belling's duplication theory. Joshua Laderberg (1946) first demonstrated the phenomenon of recombination in the bacteria E.coli. Table 10-5 Functional pollen produced and progeny resulting from crosses of different genotypes of self-sterility alleles (Source: Singleton, 1967). Although he was unaware of the structure and function of nuclein, he submitted his findings for publication. Base-pairing between the Shine-Dalgarno sequence (in box) in the mRNA and the complementary region (underlined) near the 3' terminus of 16S rRNA. Stains are the chemicals that can selectively attach to particular molecules of particular sequence (in box) in the mRNA and the complementary region (underlined) near the 3' terminus of 16S rRNA. Stains are the chemicals that can selectively attach to particular molecules of particular sequence (in box) in the mRNA and the complementary region (underlined) near the 3' terminus of 16S rRNA. parts of the cell. It is also involved in the formation of certain cellular organelles such as plasma membrane, lysosomes, acrosome of spermatozoa and cortical granules of a variety of oocytes. (ii) Trisaccharides contain three monomers, e.g., reffinose, mannotriose, rabinose, rabinose by free bleeding even from slight wounds because of the lack of clot forming substances. In Xenopus chromosomes, the genes for 5S rRNA are found located at the telomeres. Light regulates many processes in plants. It is suspected that structural rearrangements of chromosomes may lead to reproductive isolation and the formation of new species. (a) IA i; (b) IB i; (c) IA i. (a) Exonuclease enzymes. Nature seems to have evolved plasmid as an efficient way of exchanging gene between bacterial cells (see Nossal and Coppel, 1989). The patterns of bands obtained on the film is 100 per cent unique for each person, except for identical twins who would have the same pattern. Hippocrates (400 B.C.) believed that the reproductive material is handed over from all parts of the body of an individual, so that the characters are directly handed over to the immediate health of the cell than the plasma membrane. (iii) Male sterility in plants. The kinetochore hydrolyzes ATP to move along its attached microtubule, with the plus end of the microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubules of centrioles and basal bodies contain the structural protein, tubulin, along with lipid molecules (Fulton, 1971). Concerned with population of organisms (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL
COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION The microtubule depolymerizing as it becomes exposed (Fig. CHEMICAL COMPOSITION consisting of all possible kinds of matings. In human beings and other animals sex differentiation occurs in the following steps : 1. Cross-overs had presumably occured, placing lzg and lzs on the same homologue lzglzs/++ and each in heterozygous condition. spinning out of one side of a chromomere and returning to a condensed state on the other side. Unique physical properties of water and their biological utility. Plasma membrane contains about 50 per cent protein. Male sterile lines can bear seeds only after cross-pollination. The nucleus, thus, controls different metabolic as well as hereditary activities of the cell. Involved in intestinal absorption of calcium and phosphorus and in calcium metabolism and bone formation. According to the chemical nature of the substrate the enzymes have also been classified as follows: 1. In the termination stage the completed polypeptide or protein is dissociated from the synthetic machinery and the ribosomes are released to begin another cycle of synthesis. (iv) Dialysing plasma membranes. The size of the chloroplasts varies from species to species to species. In mice various types of epistatic genetic interactions have been Contents GENETICS, HUMAN GENETICS 50 reported. Civilizations itself become possible when nomadic tribes learned to domesticate plants and animals. They are required in minute amounts for normal growth, functioning O H Fig. They are called identical genes are homozygous at the locus. The fertilization initiates the egg to start cleavage and embryogenesis. H2N histone H1 + GIANT CHROMOSOMES Some cells at certain particular stages contain large nuclei with giant or large-sized chromosomes. Give a brief account of the experiments which helped in deciphering the genetic code. Thus the meiosis is a peculiar taxonomic, genetical and evolutionary process. duplications and other curious configurations. The nucleoplasm also contains several inorganic compounds such as phosphorus, potassium, sodium, calcium and magnesium. Yanofsky (1967) have shown that Benzer's muton is equivalent to a single nucleotide and his recon to the distance separating two adjacent nucleotides. The single stranded regions of probe are removed by nuclease (e.g. mung bean nuclease or S-1 nuclease), so that quantitative estimation of hybridized mRNA can also be made. The deciphering of the genetic code was made possible by the use of synthetic (or artificial) polynucleotides. Changes in gene activities cause this metamorphosis. These teins are produced in such small quantities in humans that the cost of their extraction and purification from tissues has been very expensive, thus, limiting their medical use in prophylaxis (prevention) and therapeutics (treatment) of disease. Ribosomal RNAs The 70S ribosomes contain three ty pes of rRNA, viz., 23S rRNA, 16S rRNA, 5S rRNA Table 4-6. Supplementary genes. When the number of chloroplasts is inadequate, it is increased by division; when excessive, it is reduced by degeneration. Some enzymes cut straight across the molecule at the symmetrical axis producing blunt ends. Because of this popositive larity, water can bind elecHydrogen B A trostatically to both positively and negatively H charged groups in the proH tein. Genic balance mechanism; 3. (c) Green, variegated, and "white" in irregular ratio, reflecting the three kinds of eggs produced by the pistillate parent. The human males are called sex chromatin negative. These mannose 6-phosphate (M6P) groups are recognized by M6P-receptors (which are transmembrane proteins) in the trans Golgi network that segregates the hydrolases and helps to package them into budding clathrin-coated vesicles which quickly lose their coats. Grasshopper (neuroblasts) 3. How the polypeptide chain gets through the lipid bilayer is not so clear, but it is quite reasonable to propose that the membrane proteins serving as ribosomal receptors also has a very fine channel through its core that opens into the cisterna of the rough ER. Enzymes : class and types Function A. A-Diagrammatic representation of formation of unequal cross-over; B-Cytological representation (after Suzuki, et al., 1986). TFIIB D-B complex RNA polymerase II TFIIE/F TFIID TFIIB binding sites RNA polymerase II Fig. (b) A primary transcript is a complementary copy of a DNA strand. Summary of various steps of production of mRNA, histone octamer 2 turns of DNA per nucleosome some has two scaffolds, one for each chromatid, and they are connected together at the centromere region. Let us assume that gene C is in the middle (e.g., A-C-B). Mutations either in this gene or in the operator cause constitutive initiation of transcription of tran reasons: (1) the increased resolving power of instrumental analysis due to the introduction Table 1-2. 5.15. Discovered the larval salivary gland chromosomes) in Chironomus. Hybrids between these two species are sterile F1 individuals. make enough of the vitamin D to maintain strong, healthy 5. The mu particles are composed of DNA, RNA and other substances and are symbionts. 11.7. Photosynthetic light reaction showing major events occurring in photosystem I and photosystem I and photosystem I and photosystem I. of chloroplasts. The testes of the vertebrates are composed of many seminiferous tubules which are lined by the cells of germinal epithelium. 18.2 and Fig. Thus, c allele exhibits a lethal effect when homozygous and a distinctive phenotypic effect (e.g., auria) when heterozygous. young animal, at any Contents MOLECULAR BIOLOGY 128 rate for a short time after birth. When the chiasmata occur at two points in the same chromosome, the phenomenon is known as double crossing over. Kossel's work and later investigations of Ascoli, Levine and Jones during the first quarter of the 1900s disclosed the two kinds of nucleic acid (DNA) and ribonucleic acid (DNA). During early 1990s, in the routine exercise of patient therapy any gene is isolated and this isolated and the cell or be carried by a virus (vector) to which it is linked by recombinant DNA technique. For example, DNA of sperm is highly methylated, as in the DNA of the oocyte-specific 5S rRNA genes in adult globin, ovalbumin, and immunoglobulin are under methylated in tissues, whereas the sites around the coding regions of genes such as adult globin, ovalbumin, and immunoglobulin are under methylated in tissues in which they are expressed but are largely methylated in other cells in which they are not expressed. Usually the nucleus remains located in the centre. 1968 R.W. Holley ; H.G. Khorana and M.W. Nirenberg got Nobel Prize for deciphering the genetic code. tene chromosomes of Drosophila, Contents CHROMOSOMAL MUTATION-I 173 where the homologs exist in permanent state of bulge pairing (Fig. The word filial is derived from the Latin word filin, meaning the son. Glycogenolysis and blood glucose homeostasis. SYMBOLS IN GENETICS An organism with diploid (2n) cells has paired chromosomes and out of two vaculoes of the apparatus become large and occupy the place between the tubules of Golgi apparatus. Its dominant allele y+ produces will type body colour. Contents MOLECULAR BIOLOGY 66 C H A P T E R 6 Genetic Code A s DNA is a genetic information to generation to generation. Between the separating centrioles forms a spindle. The S is related with the size and molecular weight of the ribosomal particles. A four-o'clock plant with three kinds of branches (green, variegated and "white") is used in a breeding experiment. Mucin 12. Usually the phepropositus notype of the propositus is dizygotic twins exceptional in some way— for example, a dwarf. UDP-glucose dephosphorylation. Growth of Cell Biology during 19th Century witnessed various cell biological inventions and formulations of various landmark theories such as cell theory and protoplasm theory. consists of the following two steps: 1. The lac repressor, shown in violet, binds to two DNA regions (red) and immediately upstream from the CRP binding site, within the loop is the CRP binding site (medium binding site, within the loop is the CRP binding site, within the loop is the CRP binding site (medium binding site, within the loop is the CRP binding site (medium binding site). that is present only in M-phase cytoplasm and causes chromosome condensation (Johanson and Rao, 1970). According to this hypothesis, adaptor molecules intervene between nucleic acid and amino acids during translation. Ultrastructure of a typical animal cell as seen in the electron microscope. Likewise, L8 was shown to be an aggregate of proteins L7, L12 and L10; thus, the correct number of L proteins is 33. F -F particles are 01 perimiregularly spaced at intervals of 10 nm on tochondrial inner membrane. Pea (root tip) 4. 20.1. Spermatogenesis and oogenesis. distinguished separately. Ecology. The chromosomes occur in the form of diffused, long, coiled and M Fig. Hydrogen bonds, ionic bonds and possibly disulphide bonds may also participate in forming quaternary structures. Bridges speculated that these unusual progeny are due to a failure of the X chromosomes in an XX female to disjoin during meiosis I of oogenesis. Chemically, nucleolus contains DNA of nucleolar organizer, four types of rRNAs, 70 types of rRNAs, 70 types of ribosomal
proteins, nucleolar RNA binding proteins (e.g., nucleolin) organizer and RNA splicing nucleoproteins (U1, U2.....U12). The biosynthesis of the bile acids quent release of glucose. This allows dividing a long DNA molecule into fragments that can be separated from each other by size with the technique of gel electrophoresis (e.g., agarose or polyacrylamide gel electrophoresis, pulsed field gel electrophoresis or PFGE). These numbers are the multiples of 7. AA XvY 5. ORIENTATION The mitochondria have definite orientation. Recently, role of DNA polymerase E in DNA replication has been stressed upon, so that three DNA polymerases (a β and ε) are now known to be involved in eukaryotic DNA replication. Endoplasmic reticulum, endoplasmic reticulum, endoplasmic reticulum, rough endoplasmic reticulum, rough endoplasmic reticulum, rough endoplasmic reticulum, reticulum, endoplasmic reticulum, rough endoplasmic reticulum, reticulu ER membranes ; origin of endoplasmic reticulum ; functions of endoplasmic reticulum ; inherited in simple Mendelian fashion to give a 3 : 1 monohybrid ratio (Fig. elongation : and 3. The B chains are attached directly to C chain and bear one or more A chains, 1943 1944 1945 Williams and Wyckoff C.F. Robinow K.R.Porter F.A. Lipman 1947 1948 C.F.Cori and G.T.Cori A.Tiselius 1948 C.de Duve 1952 1953 1954 Grigg and Hodge G.E. Palade A. Tertiary egg membranes. Thus, in 4% cases crossing over has occurred between linked genes. When the gamete nuclei of the same cell unite together to form new individuals this phenomenon is known as the automixis. The giant chromosomes are the polytene and lampbrush chromosomes. In both of these cases, these hormone- receptor protein complexes would function as positive regulators (or "activators") of transcription much like the CAP-cAMP complexes in prokaryotes. For example, a water molecule weighs 18 daltons, see De Robertis 70S 80S 28S 23S et al., 1970). Tetrad. Describe the kinds of observations that would lead you to suspect that a certain human character was controlled by polygenes. The lipids are composed of 50 per cent fats, 20 per cent sterols, 16 per cent waxes and 7 to 20 per cent many cellular activities such as exocytosis, endocytosis, secretion, cell motility, cell growth, fertilization and cell division. The specimen is visualized through the holes of screen. In fact, Sager now refers to the mt+ mating type as the female, using this analogy. If not, why not ? Hence, heterozygote genotype gives rise to a phenotype distinctly different from either of the Pink homozygous genotypes. It is called first gap phase, since it a phenotype distinctly different from either of the Pink homozygous genotypes. It is called first gap phase, since no DNA synthesis takes place during this stage; currently, G1 is also called first growth phase, since it a phenotype distinctly different from either of the Pink homozygous genotypes. It is called first gap phase, since no DNA synthesis takes place during this stage; currently, G1 is also called first growth phase, since it a phenotype distinctly different from either of the Pink homozygous genotypes. It is called first gap phase, since it a phenotype distinctly different from either of the Pink homozygous genotypes. It is called first gap phase, since no DNA synthesis takes place during this stage; currently, G1 is also called first growth phase, since it a phenotype distinctly different from either of the Pink homozygous genotypes. It is called first gap phase, since no DNA synthesis takes place during this stage; currently, G1 is also called first growth phase, since it a phenotype distinctly different from either of the Pink homozygous genotypes. It is called first gap phase, since no DNA synthesis takes place during this stage; currently, G1 is also called first gap phase. involves synthesis of RNA, proteins and membranes which leads to the growth of nucleus and cytoplasm of each daughter cell towards their mature size (see Maclean and Hall, 1987). The chromosomes with deletions can never revert to a normal condition. Production of gonadal hormone continues to increase until secondary sex characters appear at puberty. A—The structure of asparagine-linked oligosaccharide. The production of milk is, therefore, limited to variable expression only in the female sex. The non-genetic RNAs except tRNA of prokaryotes and eukaryotes, also have single stranded RNA molecules. Some Drosophila flies are known to be very sensitive to carbon dioxide gas, rapidly becoming anesthetized under its influence. DERIVATIVES OF CILIA The cilia are modified into a variety of structures such as the rods and cones of the retina, crown cell of saccus vasculosus of third ventricle of fishes, primitive sensory cells of the retina, crown cell of saccus vasculosus of the rots and cones of the retina, crown cell of saccus vasculosus of the rots and cones of the rots an DNA is first dried and then exposed to a solution of 32P labelled mRNA called molecular probe from the gene to be isolated. In contrast, mammalian cultured cells contain 10 million ribosomes per cell, each of which is about twice as large as a prokaryotic ribosome. The method of thin sectioning is used to study morphology of cell. This structure opens into either a ring or a figure of 8, both comprising four chromoA B C D E somes (Fig. thaliana is often nicknamed as Drosophila melanogaster (an insect) and Caenorhabditis elegans (a nematode) of the plant kingdom (Gardner et al., 1991). Among cross pollinated crops, heterosis is exploited in the form of hybrids, composites and synthetic seeds. Such an evolutionary conservation suggests that the functions of these two histones involve nearly all of their amino acids so that a change in any position is deleterious to the cell. (E), glucose-6- phosphatase, is present Enzymes involved in the biosynthetic pathway of bile acids are in the membrane and has a vectorial hydroxylases, monooxygenases, dehydrogenases, isomerases deposition by which it receives the and reductases. Tissieres and Watson (1958) isolated 70S E.coli ribosomes and showed that they consist of two subunits, 50S and 30S. This is very rare Bombay phenotype (i.e., one case in 13,000 persons; it is so named because it was first described in a family from the Bombay metropolitan. Correct hydrogen bonding with the mRNA template dictates the selection of a new tRNA, and the activity of the EF-Tu ensures the proper positions of the tRNA in the A site. 11.2). (i) Electrolytes. In 1888, he isolated them from insect muscles (which contain many slab-like mitochondria ; Fig. The S-phase activator that normally of the EF-Tu ensures the proper positions of the tRNA in the A site. 11.2). appears in the cytoplasm only during S-phase and 'switches on' DNA synthesis (Rao and Johanson, 1970). The extraneous coats sometimes act as filters. These germ Embryos being stored at -190°C in liquid nitrogen. (ii) Elaioplasts. Contents 232 CELL BIOLOGY energy move down an electron transport chain (of thylakoid membrane) and during this process ATP molecules are formed (Fig. F1 : cp/+ X cp/+ Creeper \downarrow Creeper (Heterozygous) 3. All the molecules of ATP and NADP generated in the light reaction of photosynthesis are used by soluble enzymes of stroma of chloroplast during the dark reaction. He used his lenses in building numerous microscopes, some with magnifications approaching 300X (Fig. the animal and plant cells are the disaccharides such as sucrose, maltose and lactose. The biochemist, Albrecht Kossel identified the constituent nitrogenous bases of nuclein as well as its 5-carbon sugar and phosphoric acid. Unfertilized eggs are biologically static, but shortly after fertilization many new proteins must be synthesized, for example, the proteins of the mitotic apparatus, the cell membranes, histones for nucleosome formation of the entire PCR reaction. The stored chemical energy is disposed of very quickly at the time of the need in various cellular functions such as respiratory cycle, protein and nucleic acid synthesis, nervous transmission, cell division, transportation and bioluminescence, etc. the genetic instructions that ensure continuity of their species from generation. space C Skeletal muscles and Fig. Porter; G.M. Edelman received Nobel Prize (physiology and medicine) for the discovery of chemical structure of antibodies. Dermatitis; 4. Define the terms basal bodies and centrioles. Envelope The entire chloroplast is bounded by an envelope which is made of a double unit membranes. In the binary fission the animal body splits or divides in such a plane that two equal and identical halves are produced. The polyploid plants are more vigorous than diploids. It occurs in some algae, fungi, and diatoms. six molecules of PGA or 3- phosphoglyc- Calvin with a student. Muller's breakage first theory. What are the ribosomes ? A positively charged carrier binds negatively charged carrier binds negatively charged first theory. Bb BB, Bb 4. For them electron microscope is used. The 2 : 2 : 2 : 2 : 2 inear pattern is indicative of a second division segregation ascus produced by E.R. Sears in variety called "chinese spring" and being used for genetic studies all over the world. F.W.Stahl. The term transposons (i.e., jumping genes) is used in 1974 by R.W. Hedges and A.E. Jacob of Hammersmith Hospital in London, for a DNA segment or genetic element which could move from one molecule to another and carried resistance for antibiotic ampicillin in the bacterial cells. active regulator gene m-RNA gene 1 m-RNA gene 2 m-RNA gene 3 Breakdown of the sugar lactose in bacteria controlled by a segment of DNA called the lactose operon. Translocation The shifting or A D transfer of a part of a chromosome or a set of genes to a non-homologous one, End of MII is called translocation. mRNA synthesis in bacteria. For example, in the tissue-culture experiments, the mutant cells which are deficient in the enzyme thymidine
lipid bilayer kinase can be shown by autoradiography to be capable of cell 2 DNA synthesis only when grown in a culture vessel to- intercellular space gether with the wild type cells (Hooper and Subakcytoplasm hydrophilic channel Sharpe, 1981). It may contain mRNA, tRNA or rRNA and may be processed before translation can occur. When F1 females of the Morgan's classical cross in Drosophila between gray, vestigial (b+vg/b+vg) and black, normal or long (bvg+/bvg+) were testcrossed to double-recessive (bvg/bvg) males, all four types of progeny were obtained in following ratio, showing occurrence of crossing-over : Parents : Gametes : F1 : Test cross : Gametes : F1 : Test cross ratio : Gray, Vestigial b+vg/b+vg (b+vg) × Black, Long bvg+/bvg+ (bvg+)

Gray, Long b+vg/bvg+ × F1 Female Gray, Long b+vg/bvg+ \downarrow (b+vg) (bvg+) = Non-crossovers (b+vg+) (bvg) = Recombinants 1. Contents 192 CELL BIOLOGY He showed that these granules concristae tained enzymes catalyzing oxidative slab-like cellular reactions. Genetical effects of duplication. Mycoplasmas are filterable through the bacterial filters (this fact was first demonstrated by Iwanowsky in 1892). Constitutive heterochromatin. Alkaline phosphatase 10. Due to ordered tetrads in mitosis meiotic tion division + (a) and mutant (a) strain, will give rise to a linear arrangement of four ascus (4 spore normal spores (a+) at one end fol2n transient 4 haploid product pairs = 4 products diploid of meiosis lowed by four mutant spores (a) at of meiosis) the other end (i.e., 4 : 4 ratio). Some disease-causing bacteria exert their pathogenic effect, because they excrete inhibitors of mammalian protein synthesis. In 1977, Riggs and his colleagues have been able to synthesize a DNA piece (i.e., a gene) which codes for the polypeptide (containing 14 amino acids) of somatostatin. t seems to be an axiom of nature that where there is also similarity. The cilia may line the internal cavities or passages of the metazoan bodies as air passage of the respiratory system and reproductive tracts. Pathways leading to production of antigens on the red blood cells or erythrocytes showing how the Bombay phenotype is caused (after (Fig. Sulphur containing amino acids. Ribosomes are tiny spheroidal dense particles (of 150 to 200 A0 diameter) that contain approximately equal amounts of RNA and proteins. It replicates, transcribes, transcribes, transcell lysis release a large number of free integrated viral DNA bacterium (Fig. In other EF- G site words, the ribosomal genes are in a single operon which is transcribed as a mRNA site unit to synthesize a large molecule of RNA containing the 16S, 23S and 5S A 70S ribosome rRNA sequences. It pinches the cell membrane in. What is molecules from self molecules from self molecules from self molecules is another fundamental feature of the immune system. FUNCTIONS The mitochondria perform most important functions such as oxidation, dehydrogenation, oxidative phosphorylation and respiratory chain of the cell. Cartilage tissue contains the related supports the otherwise soft bodies of arthropods and fungi. 20 1 Synthesis of complete gene. The export of new ribosomal subunits is particularly problematic since these particles are about 15 nm in diameter and are much too large to pass through the 9 nm channels of nuclear pores, it is believed that they are Contents 252 CELL BIOLOGY specifically exported through the nuclear pores by an active transport system. (6) Excess labelled RNA was washed. The male possesses two Z chromosomes (hence, referred to as ZZ) and is homogametic, producing single type of sperms, each of which carries a single Z chromosome. Structure An eukaryotic cell consists of the following components : A. In Zea mays (maize) a case of incomplete linkage between the alleles for colour and shape of the seed has been observed by Hutchison. The unshaded circles or squares designate people who are normal for the character being studied, while solid black squares or circles depict "affected" individual. The chromatids occur in the form of dyads. But if the genes are situated in the same chromosome and are fairly close to each other, they tend to be inherited together. 2.8. Electrophoresis. grains or granules (they are located inside the spherical plastids). Sulpho and glycotransferases : Glycolipid biosynthesis 3. There Mitotic spindle is constructed primarily of microtubules. The fibres of the chromatin are twisted, finely anastomosed and uniformly distributed in the nucleoplasm. SEX-INFLUENCED GENES Sex influenced by the sex of the bearer. Francis Crick and James Watson. As synthesis of ATP occurs in light and the process is not cyclic (i.e., it needs a constant supply of water molecules to be oxidized and NADP to be reduced), the process is called non-cyclic photophosphorylation. Such a sameness can also be observed at the molecular level—all cell parts are made of highly organized groups of few types of molecules, i.e., proteins, lipids, carbohydrates, nucleic acids, etc. Contents MULTIPLE ALLELES 117 (iv) Albino. (2) The copy choice model proposed the involvement of only two chromatids in the process of crossing over, while cytological investigations have made it clear that crossing over occurs at four strand stage. Thus, the rate of protein synthesis in eggs is generally low. Next, nitrogen is removed from amino acids by any one following two processes: oxidative deamination. cDNA bank or cDNA mRNA 5' library. Likewise, the dominant alleles of gene E in homozygous (EE) or heterozygous (EE) or hete colour production from chromogen, while homozygous recessive (ee) condition does not produce any such enzyme. They are secreted by the fibroblasts constituting most abundant (up to 25 per cent of total body's proteins) proteins of mammals. The amoeboid movement occurs in the protozoans, leucocytes, epithelia, mesenchymal and other cells. For instance, the extraneous coats surrounding the blood capillaries of most vertebrates, especially the kidney glomerulus act as filter and regulate the passage of molecules through it. The nucleolus reappears and, thus, two daughter chromosomes are formed. Substitution mutations create a change from wild type to abnormal phenotype, then that type of mutations are known as forward mutations. Extra segments in a chro1 2 3 4 5 6 7 8 A pair of mosome 1 2 3 4 5 6 7 8 1. Moorhead et al., (1960) described a simple method of culturing of lymphocytes from human blood. These bodies were initially described as "perinuclear dense bodies". Rare male plant Pp Selfed PP (25%) Pp (50%) pp (25%) } } Male (75%) Female (25%) Fig. For example, when various twins which carry genes for diabetes mellitus are studied, it is found that the disease appears only in those cases which ate more carbohydrate foods (starch and sugars). Yeast Ty elements are sometimes called retrotransposons because of their overall similarity to the retroviruses. This is loop and the U as the first unpaired base on the 5' strand. Von Wettstein (1956) reported that the plastids of normal barley plant have a well organized system of grana and stroma. of glycoproteins and glycolipids 8. The number of introns per gene varies greatly (Table 5-5) and for a given protein is not the same in all organisms. This is called incomplete dominance. coli The Watson-Crick's model of DNA structure and replication suggested that once DNA replication is initiated, the two original polynucleotide strands of the duplex or helix will unwind, at least locally, so that each can serve as a template for a new strand. These enzymes transfer the electrons and hydrogenases or Fig. The F+ factor was found to be a fragment of DNA molecule which occurred in the cytoplasm of bacterial cell. Mitochondria are distributed between the daughter cells during mitosis and their number increase during interphase. They include the following four types of polypeptides: vimentin, desmin, synemin and glial fibrillary acidic protein (or glial filaments). 26. Transferrin 1 4 Hens-egg food reserve Hormone 5 6 5. The location of a gene on a sex chromosome. DNA polymerase I. WATSON AND CRICK'S MODEL FOR DNA REPLICATION TEM of human DNA from a HeLa cell, illustrating the replication bubble that characterizes DNA replication bubble that characterizes DNA replication within a single replication bubble that characterizes DNA 500 550 650 wavelength (nm) 600 700 tol, glycerol, ethanolamine. Gentle homogenization is preferred to preserve the stacks of cisternae. Contents PLASMA MEMBRANE AND CELL WALL 125 cialized ordered regions, representing 2 to 20 per cent of the membrane of a system, e.g., gap junctions, synapsis of neurons and plaques of halobacteria. TF II S is known to act by first causing hydrolytic cleavage at 3['] end of RNA chain, thereby, helping in the forward movement of RNA polymerase through any block to elongation. The GERL Region Golgi apparatus is a differentiated portion of the endomembrane system found in both animal and plant cells. Within this precursor molecule the rRNAs are separated by stretches of spacer RNA and the order of transcription is : 5' end - 18S-5.8S-28S-3' end. The deutan or green colour blindness is first to be described in literature and is most commonly encountered sex-linked trait in human beings. armoured chamber sedimenting material AUTORADIOGRAPHY Autoradiography is a technique which is used to locate radioactive isotopes in cells, tissues, organs and whole organisms. Normal and aborted pollen in a semisterile corn plant. 9.8), since they fail to form a phosphodiester bond with next incoming deoxynucleotide triphosphate (dNTP). This inhibition is overcome by addition of purified 23S rRNA, which binds to protein L4. The editor who received the paper was doubtful about some aspects of the Miescher's report and delayed publication for two years while he tried repeating some of the more questionable aspects of Miescher's work. In these insects, since, fertilized eggs develop into diploid females and unfertilized ones into haploid males; so arrhenotoky is both a form of reproduction and a means of sex determination. 18.6. Inheritance pattern of PTC taster trait. and the matrix (after Alberts et al., 1989). Thus, meiosis is required to run the reproductive cycle of eukaryotes such as zoospores microorganisms Chlamydomohaploid (n) daughter nas, Neurospora; bryophytes; cells (n) plants and animals. Write short notes on the following : (i) Plasmagenes; (ii) Maternal inheritance; (iii) Male sterility; (iv) Kappa particle; (v) 'Petite' in yeast. Cell wall and plasma membrane; B. coli (Goldstein, 1955). 17.6 E). Such a condition is called a sol. Evidence for Semi conservative Replication of Chromosomes (or DNA) in
Eukaryotes 31 A replicating forks X C Y B parental duplex J.H. Taylor and P. They exhibit many of the permeability properties of natural membranes, i.e., water soluble small molecules or ions can be enclosed by the liposomes and they can also traverse the lipid bilayer of latter. The iojap phenomenon has been explained by two hypotheses. The sex of some reptiles may depend upon the temperature at which the individual develops. Even the CH2OH C— O O H3C H3C O Photograph of DNA made by tunneling microscopy. (2) The RNA primer of the leding strand is synthesized by RNA polymerase enzyme. (a) What genetic attributes does RNA share with DNA? Sections to be examined with the electron microscope are generally not stained (since no colours are seen with the electron microscope). When an abnormal egg with XX chromosomes is fertilized by a sperm carrying Y chromosomes (XXY chromosomes) is formed. The insects do not possess Sertoli cells. The submetacentric chromosomes are J- or L-shaped. Prions were named by S.B.Prusiner (1984) snakes through the environment. Contents 54 CELL BIOLOGY containing large amount of arginine amino acid (Fogg, 1951) or copolymers of alanine and aspartic acid (Simon, 1971); (2) myxophycean starch which is the main food storage compound; (3) polyglucon granules, polyhedral bodies, lipid droplets, polyphosphate bodies etc., are some other cytoplasmic inclusions of cyanobacteria. A particular antibiotic has clinical value only when it acts on bacteria and not on animal cells; the clinically useful antibiotics usually either fail to pass through the cell membrane of animal cells; the clinically useful antibiotic has clinical value only when it acts on bacteria and not on animal cells or do not bind to eukaryotic ribosomes, because of some unknown feature of their structure. Such blue stained cells are treated with a mordant (i.e., agent that fixes stains to tissues) such as iodine (i.e., potassium iodide or KI solution) and ultimately washed with some organisms, number of non-histones can vary from 12 to 20. In the basal bodies of some organisms, the triplets get closer toward the proximal end, so the diameter of the cylinder gets smaller. These short sequences when attached to bigger molecules (even to metal particles such as gold) allow these bigger molecules to enter the nucleus via th between : (a) Primary and secondary sex characters; (b) Sex determination and sex differeniation; (c) Hermaphrodites and monoecious individuals; (d) Heterogametic sex; (e) Autosome and sex chromosome; (f) Freemartin and pseudohermaphrodite. The substances in the vacuole differ qualitatively and quantita(water loss) tively from those in the cytoplasm. However, when the supply of inducer was depleted through the activity of lac enzymes, dissociation of the inducer-repressor could once more bind to the operator to shut down transcription. The nature and location of this genetic element have still to be investigated (Ramanis and Luck, 1986). U A The number of these genes may vary from 50 to 30,000 in a A U G C cell and this number may be unequally distributed on NOs, if G GA more than such loci are present. This is a time of resumption of normal cell metabolism which has slowed down during the previous cell division. If such a partially digested structure is exposed to as little as 10 µM ATP, the axoneme elongates until it is up to nine times its original length, the component microtubules in the axoneme telescoping out of the loosened structure. (b) following : (i) Auxetic growth ; (ii) Cell cycle ; (iii) G0 phase ; (iv) Mitotic spindle ; (v) MPF ; (vi) Synaptonemal complex. processing of eukaryotic tRNAs resembles with that of prokaryotes. In undigested chromatin the DNA extends as a continuous thread from nucleosome to nucleosome to nucleosome. individuals are sinistral but B the main interest attaches to a species in B a' b' which sinistral individuals occur as a mutab' a' A c' C tion among a population of normal dextral d' A C animals. 10.9. Agglutination tests for A, B, AB and O of transfusions can be summarized in following human blood groups (after Gardner, 1968). It has been observed that the genes occurring only in the X chromosomes are represented twice in female (because female contains 2X chromosomes) and once in male (because female contains 2X chromosomes). F1 polypeptide of F1 and probably particle can be detached from the membrane by the y are involved in binding F1 to the membrane-embedded F0-parmechanical agitation and is water soluble. It is electrophoresed through an agarose gel which separates the various fragments according to size. It also continued in the M.W. Nirenberg. Contents CELL BIOLOGY 184 C H A P T E R 9 Microbodies: Peroxisomes and Glyoxysomes T he cells of Protozoa, fungi, plants, liver and kidney of vertebrates contain membrane-bound, spherical bodies of 0.2 to 1.5 µm diameter in close association of endoplasmic reticulum, and mitochondria or chloroplast, or both. The flagella are less (1 or 2) in number. The closer two genes are linked lesser the chances for a chiasma occurring between them. The plants in general have large-sized chromosomes in comparison to the animals. Thus, only one class of male (with ClB X chromosome) male H.J. Muller. Benzer combination frequencies between these also applied the term muton to the smallest unit of four sites have also been indicated. Portions of chromosomes without a centromere (called accentric fragments) lag in anaphase movement and are lost from reorganizing nuclei or digested by nucleases. They generally occur singly, but may occasionally be found in pairs (diplobacilli) or chains (streptobacilli). Collagens are exceptionally rich in proline (and hydroxyproline; both accounting for more than 20 per cent of collagen's amino acids) and glycine. Contents 98 MOLECULAR BIOLOGY bolic enzymes, neither glucose nor cAMP-CAP has a role in the operon activity. Implicit in this requirement is that some mechanism be available for decoding, or translating, the information contained in the genetic material into its "productive" form. 17.6. Schematic representation of the mechanochemical cycle, the next step would be cycle involved in sliding of filament in ciliary movement (after reextension of the dynein arm (Fig. This glucose is used by the plant to form a large variety of organic compounds required for its structure and function (e.g., starch, cellulose, lipids, amino acids and proteins, etc.). He found that out of A and B antiCH 2OH CH 2 OH gens, a person may contain either O H one (i.e., A or B antigen) or neither HO HO O H of them. He crossed the tall and dwarf varieties of tobacco, Nicotiana. Change in a single base of the DNA molecule. One type of topoisomerase (i.e., topoisomerase I) cause a single-strand duplex DNA break or nick which allows the two sections of DNA helix on either side of nick to rotate freely relative to each other, using the phosphodiester bond in the strand opposite the nick as a swivel point. Since such a synthetic gene could replicate and make its own copies, so, was used for subsequent work. The small, shriveled pollen grains contain an euploid meiotic products of reciprocal translocation heterozygote (after Suzuki et al., 1986). There are also secondary and tertiary Tertiary trisomics. This experiment known as the blender was used as a major piece of apparatus, was performed by Alfred Hershey and Martha Chase in 1952. The gametes of both parents unite in the process of fertilization and produce a hybrid with long wings in F1 generation. Tertiary trisomics 1 1 c 2 2 2 2 1 or 1 1 2 1 2 2 2 2 2 c d 4 3 4 4 2 1 1 2 2 2 2 2 c d 4 3 4 4 3 (a pentavalent) Fig. Other functions. X- RAY DIFFRACTION ANALYSIS This technique is used to analyze three-dimensional (tertiary) structure of DNA molecule and a variety of proteins such as myoglobin, collagen, myelin sheath of nerve cells, myofibrils of striated muscles, etc. The main organic compounds of the matrix are the carbohydrates, lipids, proteins, vitamins, hormones and nucleotides. } } NUMBER OF RIBOSOMES An E. During this stage, each homologous chromosome of bivalents splits Origin of basal bodies. This is called post-translational control of gene action. Individuals with Patau syndrome appear to be markedly mentally retarded; have sloping forehead, harelip and cleft palate. Adding the 10% safety factor, 293+29.3 = 322.3 or approximately 322 progeny. The alleles of B locus express themselves only when epistatic locus has dominant alleles (e.g., AA or Aa). The nucleotides of mRNA are arranged as a linear sequence of codons, each codon consisting of three successive nitrogenous bases, i.e., the code is a triplet codon. Thus, growth regulation seems to hinge upon the nucleolus and its control over ribosome synthesis. According Contents 88 GENETICS, HUMAN GENETICS AND EUGENICS to him the degree or strength of linkage depends upon the distance between the linked genes in the chromosome. tion of coiling of shell depends upon the distance between the linkage de sequence of nucleotide bases in a segment of DNA - in this case, the human gene cluster HL-A, which plays an important role in immunology. The outer mitochondrial membrane'. The karyotypes of different species are sometimes compared and similarities in karyotypes are presumed to represent evolutionary relationship. In proteins that are composed of two or more polypeptide chains, the quaternary structure refers to the specific orientation. If the parents B and C are full sibs, i.e., B and C parents are 50 per cent related, the inbreeding coefficient of individual (A) can be calculated by the equation FA= ½ RBC, where RBC is the coefficient of relationship between the full sib parents (B and C) of A. 18.14. Increased magnification without improved resolution results only in a large blurred image. After entering the cell, the gene may become a part of nuclear DNA or remain free in cytoplasm like extra-chromosomal DNA. These have a
semi-crystalline array of internal membranes that contain protochlorophyll (a yellow chlorophyll precursor) instead of chlorophyll. Thus, not so long ago, biology was divided into many camps that rarely communicated with each other; today, however, every biologist must be a bit of a geneticist, because the findings and techniques of genetics are being applied and used in all fields. There are four types of lipoproteins : 1. Other dominant amino acids of collagens are lysine and alanine. 18.13). Contents 58 GENETICS, HUMAN GENETICS AND EUGENICS 2. A large piece of nitrocellulos paper is laid over the agarose gel, followed by several layers of absorbent material such as filter paper. Hydrolases. Cytoplasmic matrix); chemical organization of cytosol; inorganic compounds - water; organic carbohydrates, lipids (fats), proteins, enzymes, prosthetic groups and coenzymes, isoenzymes, vitamins, hormones, nucleic acids; properties of cytoplasmic matrix; revision questions. This discrepancy in A/P site EF-G site percentages can be explained as fol5' end 23S exit lows—First, rRNA is greatly stabimRNA rRNA lized and protected by ribosomal proC 50S subunit B 30S subunit teins, and thus any rRNA molecule Fig. Four types of gametes result : AB, Ab, aB and ab, A case of incomplete linkage (after De Robertis et al., 1970). For peroxisomes this is not a problem. Heptoglobin 15 18 20 Blood coagulation protein of blood plasma Copper transport protein of blood plasma Enzyme Enzyme Hormone 10. After shaking, only radioactive32P was found associated with bacterial cells and 35S was found only in surrounding; 3. (iii) The mRNA at its 5' end binds with 43 ternary initiation complex. An order arrives for two dozen young mice each of waltzer, jittery and waltzer plus jittery. If glycolysis is carried out under aerobic conditions the final products are pyruvic acid and coenzyme NADH. Initially, there were four breeding : sunflowers, rye, timoself-fertilized for 30 generations. In this stage the chromosomes are extremely thin, long, uncoiled, longitudinally single and slender thread-like structures. QUANTITATIVE GENETICS (INHERITANCE OF MULTIPLE) 67 E.M. East (1913) extended the polygenic hypothesis to several cases in plants. These intersexes were sterile individuals and had phenotype in between male and female sexes. One function of some of these plasmids (called colcinogenic factors) is the production of antibiotically active proteins or colicins which inhibit the growth of other strains of bacteria in their vicinity. A chemical mutation can cause mutation only when it enters in the nucleus of the cell. Fingers Absent Thickened Short Webbed Extra digits Normal hearing Free ear lobe Opaque lens Glaucoma Absent Ability to role Taste bitter to PTC 4. Size of bacteria. SEX DETERMINATION IN PLANTS Most flowering plants are monoecious and, therefore, do no not have sex chromosomes. For this reason, if pH differences are established across the membrane, they act as energy-rich gradients. Rarely monoploid plants may originate from the pollen tube, synergids and antipodals of the embryo sac and are called androgenic monoCertain insect species, such as ants and bees ploids (or androgenic haploids). Molecular biology. Iodine I- Cu2+ (Heaviest Constituent of plastocyanin and cofactor of respiratory enzymes. Trimonoecious Perfect (O), female (O) and male (O) flowers on the same plant. In the presence of added isoleucine, the cells preferentially use this exogenous end product (i.e., isoleucine) and their own isoleucine synthesis becomes ceased. Contents PLASMA MEMBRANE AND CELL WALL 127 the cytosol. If black cocks, heterozygous for silky, are crossed to barred, silky hens, what genotypes and phenotypes and phenotypes will be produced and in what proportions? However, in many type of cells, there is a separate "fuzzy layer", beyond the cell coat, which is composed mainly of carbohydrates and is secreted by the cell. A helicase unwinds a helix. 18.6). 4.2). Although the products of some of these genes, the ribosomes, are used continuously transcribed at maximum rate The siphonal algae Vaucheria contains hundreds of nuclei and certain fungi are the best example of the coenocytic plant cells. On reaching the adult stage, half of the offsprings (those of the genotype aa) become light eyed. laevis oocytes reveals tandemly arranged sequences coding for the 45S precursor of ribosomal RNA, each gene adorned with a Christmas-tree arrangement of RNA in the process of synthesis (i.e., transcription). Ecology ; growth of pollution biology ; g chain. Also these viruses TMV protein RNA reconstructed give different symptoms. As a result, the ribosome binding site is transcribed first, followed in order by the AUG codon, the region encoding the amino acid sequence, and finally the stop codon. (globular proteins). Or, a proteolytic Golgi enzyme may cut a secretory or membrane protein into two or more specific segments (e.g., molecular processing involved in the formation of pancreatic hormone insulin -> proinsulin -> insulin). This peculiar mode of sexual reproduction in which egg development occurs without the fertilization is known as the parthenogenesis (Gr., parthenos=virgin; genesis=origin). At least nine sex alleles are known at this locus in Bracon and may be represented by sa, sb, sc, sd....si. In the final stage of cell respiration, the electron transport system, these electrons will at last release their energy to the cell. However, other enzymes are synthesis stops. male. The tonoplast has little mechanical strength, however, the hydrostatic pressure must remain roughly equal in cytoplasm and vacuole, and two (a) Turgid cell (b) Cytoplasm shrinks compartments must act together is away from cell wall osmotic balance to maintain turgor. In fact, this is a small deletion and acts as a recessive lethal in this regard. Evidently this force is generated due to muscle-like sliding of actin and myosin filaments in the contractile ring. Bacteriophages may have the following two types of life cycles; (1) Lytic cycles, in which viral infection is followed by lysis (bursting and death) of the host cell and release of new infective phages, e.g., virulent phages such as T4 and all other T-even coliphages. Standard environmental conditions; e. However, unlike mitochondria there occurs third system of membranes within the boundary of inner membranes within the boundary of inner membranes within the boundary of inner membrane. It is the most common chromosomal abnormality in live births (1/650 births). cells grown in 15N would be denser than 14N containing DNA, it would band further down the tube. In rodents the mutuations are responsible for black, white and brown coats. Further, deletion involving CDE in the presence of a deletion, a recessive allele of the normal homologous chromosome will behave like a dominant allele, i.e., it will be Fig. Let us consider the specific function of the Krebs cycle. Two hypotheses or models have been proposed to explain various patterns of protein synthesis which are meant for cell growth: 1. Due to duplication, there occur unequal crossing over which results in deletion and reduplication from a minute deletion, i.e., one too small to be cytologically detectable? Moreover, they form the structural units of the centrioles, basal granules, cilia and flagella. In the cytoplasmic matrix certain non-living and living structures remain suspended. The most widely studied phages are T-even bacteriophages such as T2, T4, T6, etc., which infect the colon bacillus, Escherichia coli and are also known as coliphages (T for "type". Mg2 + ATPase (Endoenzyme of erythrocyte) 6. Discovery of sex chromosomes. If the common ancestors are not inbred, the inbreeding coefficient is calculated by the equation : $F = \sum (\frac{1}{2}) n1 + n2 + 1$ where n1, is the number of generations (arrows) from one parent back to the common ancestor and n2 is the number of generations from the other parent back to the same ancestor. However, it contains more unsaturated fatty acids and less cholesterol. The defect of brachydactyly is caused by a dominant gene existing on an Contents 238 GENETICS, HUMAN GENETICS autosome. Sexual separation of the same ancestor. defective. Gave the first correct human chromosome count (46 chromosome count in men and recessive in women. Regulation; (ii) Haemophilia; (ii) Non-disjunction; (iv) Heterogametic sex; (v) Sex chromosomes and autosomes. Gemmule formation; 4. (iv) Pentasaccharides contain five monomers, e.g., verbascose. The knife does not cut cleanly under those conditions, but tends to fracture (crack) the specimen along the lines of natural weakness, such as the middle of a membrane that runs parallel to the cut (Fig. coli cell extract containing an enzyme Fig. Define the following terms : resolution, magnification, birefringent, vital stain, electron stain, cell fractionation, chromatography and electrophoresis. Generally, as a acids × rule, the same codon shall never code for C A T G A T two different amino acids. Their presence in both free and membrane attached form was confirmed by Palade and Siekevitz by the electron microscopy. Rubisco is a large protein molecule (500,000 dalton MW) comprising 16 per cent of chloroplast protein. Though the plasma Contents 126 CELL BIOLOGY membrane is a limiting barrier around the cell but it performs various important physiological functions which are as follows : 1. One-eight for halfbrother-half-sister matings. (ii) Evidence for constitutive expression of some genes. Animal cells have a single highly complex and prominent Golgi apparatus. 13.13. 4.19) and causes unwinding of the DNA in the presence of ATP, SSB protein and DNA gyrase (a topoisomerase). 2.1) uses the much shorter wavelengths of electrons to achieve resolution as low as 3 A0, with a usual working range between 5 to 12 A0. This expansion can be obtained by the use Stansfield, 1969). Hodkin and A. He stated in Latin that
the cells arise only from the pre-existing cells (viz., his actual aphorism was "omnis cellula" - every cell from a cell). (b) What is the corresponding anticodon ? Green Wrinkled - 1 5.3. A model of the structure of prokaryotic RNA polymerase initiation sites (promoter). 15.1). Secondary Non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a result of primary non-disjunction to normal red-eyed males (AAXvXvY) that arose as a res linked dominant condition usually are heterozygous and pass the condition to one-half of their progeny (after Suzuki et al., 1986). (Gr., telo=for; B meros=part). 15.4. Various steps in in vitro polymerization or assembly of the microtubules (After Thorpe, 1984). Further, once antibodies bacteria B cell specific antibodies plasma cell have been produced against a particular miviruses crobe, defence against the disease is set up (at fungi virus least for the time being) and immunity is phagocyte cellular immunity acquired. Since most protein synthesis, ensuring maximum access to the target asparagine residues, which are present in the sequences-Asn-X-Ser or Asn-X-Thr (where X is amino acid except proline). The use of the new high-yield varieties produced diversed social and economical problems for the poor/developing countries where they are most needed. It is also called Hill reaction, photosynthetic electron transfer reaction or the poor/developing countries where they are most needed. It is also called Hill reaction, photosynthetic electron transfer reaction or the poor/developing countries where they are most needed. photochemical reactions. (b) What is mRNA splicing? The turning of the cyclic-phosphorylation gear causes the gear of ATP synthesis to turn, and the turning of noncyclic-photophosphorylation gear causes both the ATP synthesis and NADPH- synthesis gears to turn. AMNIOCENTESIS Prenatal (=occurring before birth) screening of babies for gross chromosomal aberrations (such as polyploidy, aneuploidy, deletions, translocations, etc.), as well as, sex prediction, is now possible by the technique of amniocentesis. Sex-linked inheritance in moth showing different result in the reciprocal crosses. Basal bodies and centrioles. Fur 2 2 4 4 ther, when the extra chromosome is identical to its homology. such a trisomic is called primary tri1 1 1 3 3 somic. A glycogen molecule contains three types of chains— A, B and C. cell wall cytoplase F Telophase B Late prophase B Late p Interphase Fig. This pattern indicates that microfilaments possess a polarity, a property that is probably crucial to their role in mediating cell movements. Those contributing or non-effective alleles. - phosphate of a nucleoside of a nu triphosphate molecule forms a 3', 5' phosphodiester bond with a free 3'-OH in the growing polynucleotide chain, and a molecule or phyrophosphate (P~P) is simultaneoulsy release. The DNA of this extract was eradicated by the help of deoxyribonuclease enzyme, thus, the template which might synthesize new mRNA was destroyed. The approximate percentage composition of the human body (Source : Roberts, 1986). Contents 138 GENETICS, HUMAN GENETICS AND EUGENICS Likewise in other experiment in which a white-eyed female is crossed with red-eyed P1 male, similar X-linked inheritance of recessive gene for white eye colour is revealed. Reproduction 342-346 Asexual reproduction sexual reproduction ; revision questions. Some strains of E. Mitochondria. She named the factor that produced these breaks, Ds, for "Dissociation". What colour did the male and female parents possess as adults? Translocation is driven by both ATP hydrolysis and the electrochemical gradient across the inner membrane, and the transported protein is unfolded as it crosses the mitochondrial membranes. Table 13.1. Group Animals : Protozoa Chidaria Nematoda Arthropoda Chordata Chromosome number of some organisms. PHYSIOLOGY OF CILIARY MOVEMENT The cilia and flagella serve many purposes and their movements propel the organism. Tests have disclosed that CO2 sensitivity is dependent upon an infectious DNA virus called sigma, found in the cytoplasm of CO2 sensitives Drosophila. But, when a rose combed chicken crossed with that of pea combed, the F1 progeny was found with a different type of comb known as 'walnut' (Malay breed). Mode of condensation between two nucleotides with protected 5' OH and 3' OH groups in the sugars and protected amino groups in the nitrogen bases (AC=acetyl, An=anisoyl and B3= benzoyl protective groups). The proteins made on these ribosomes are transported into space between the The cell nucleus. The extra-celtermed deplasmolysis (D) (after De Witt, 1977). The genetical and evolutionary consequences of somatic mutations are insignificant, since only single cells and their daughter cells are involved. Copy choice hypothesis or Switch model. The furrowing invariably occurs in the plane of the metaphase plate, at right angles to the long axis of the mitotic spindle. Furthermore, if the mechanism regulating haemoglobin synthesis in the fortune due to the long axis of the mitotic spindle. discerned, they might be able to cure lethal conditions, such as thalassemia major and sickle cell anemia, by suppressing synthesis of the abnormal beta chains and allowing foetal or gamma chains to be produced instead. The chromosomes of most organisms contain only one centromere and are known as monocentric chromosomes. There is no lipid content in ribosomes. enzyme of T4 bacteriophages, and (c) comparison of a DNA or mRNA polynucleotide cryptogram with its corresponding polypeptide clear text (e.g., comparison of a mino acid sequence of the R17 bacteriophage coat protein with the nucleotide sequence of the R17 mRNA in the region of the molecule that dictates coat-protein synthesis by S. Type O Type AB Recombination. The cells of green plants contain less number of mitochondria in comparison to animal cells because in plant cells the function of mitochondria is taken over by the chloroplasts. 1984). Sterol metabolism. An amino- benzyloxymethyl paper which is prepared from Whatman filter paper No. 540 after a series of simple reactions, is diazotized (Gr., di= two; Fr., azote = nitrogen; to introduce the diazo group into a chemical compound, usually An autoradiogram is used to decode the base sequence after through the treatment of an Amine electrophoresis. Each arm of the Y contains a complete L chain and a part of an H chain and the leg of the Y contains the remaining parts of antigen-binding the H chains. The eggs in which the yolk is not evenly distributed in the ooplasm are known as the heterolecithal eggs. This is because an affected female can result only when both mother and father bear the X-linked recessive allele (e.g., XA Xa × Xa Y), whereas X aY XAXA I an affected male can result when only the mother 1 2 carries the gene. Thus, gene is neither a unit of mutation nor of recombination. Trans face of Golgi is located near the plasma membrane. He studied the metabolism of this amino acid) and showed that the metabolism of phenylalanine (an essential amino acid) and showed that the metabolism of this amino acid) and showed that the metabolism of this amino acid proceeds in chains of enzyme-mediated reactions and a change or absence of an enzyme result an abnormality. In microgamy the fusion of microgametes takes place. The proteins are present not to give it strength, but to serve as enzymes catalysing chemical reactions within the membrane and as pumps moving things across it. Therefore, the trait of male sterility of plants is controlled by the following three methods : (a) Genetic male sterility. Thus, the mutant allele HbS causes the production of abnormal haemoglobin. In certain other mutant rice the duration of one of these would probably not interfere with protein synthesis. 14.5. Different RNA and protein components of eukaryotic ribosomes 20.3. Diagram of a simple transposon. Mendel's original paper was republished in Flora, 89, 364 (1901). (ii) Tryptophan operon. Quite interestingly, it is now possible to calculate the size of many genes, as well as distances separating them, and to photograph genes in the electron microscope (see Burns and
Bottino, 1989). Watson and F. 12.5. A cross started to recognize the importance of "juicy" or "slimy" contents of the cells. coli (after Alberts et al., 1989). In termiTwo pairs of chromosome is ab1 2 3 4 5 6 7 8 9 10 11 12 7 8 3 4 5 6 1 2 9 10 11 12 7 8 3 4 5 6 7 8 9 10 11 12 7 8 flowers on separate plants. Both lipid and protein molecules have irregular distribution in both monolayers of the lipid bilayer, this is called membrane asymmetry. Pure line population is the one which breeds true when selfed without producing any genetic variability in the progeny. Determine the average number of nucleotides in each recon Cistron. Agriculture Law Some geneticists even fear that increased exposure to chemical food additives and to vast array of chemicals in other commercial products may be Genetics changing the human genetic makeup in a very undesirable and haphazard manner. Indices 1-30 (xxiii) Contents CHAPTERS 1. The endosomal compartment also acts as the main sorting station in the endocytic Contents 138 CELL BIOLOGY pathway. In 1952, Siekevitz and Zamecnik showed clearly that radioactive amino acids first were incorporated into proteins on ribosomes and then were released to the soluble portions of the cell. following : 1. 5.1. Langmuir trough (after Sheeler and Bianchi, 1987). Actin filaments are shown in blue, microtubules in red. A disease characterised by swelling of gums, multiple haemorrhages, anaemia and weakness. The ability to form plaques on strain K-12λ was used as a selective procedure in the recovery of recombinant wild-type phage particles. Each 3 triplet or blade is tilted inward to the central III II axis at an angle of about 450 to the circumferFig. where biogenesis of ribosomal subunits Contents NUCLEUS 255 (i.e., 40S and 60S) fibrillar takes place. transported to the embryo, where they function as Gibberellic acid, a plant growth hornutrients (after Thorpe, 1984). The ubiquitin is covalently bound via the side chain amino group of lysine 19 of the histone. Infoldings of plasma membrane. In the cross of two walnut chickens, two genes interact variously and produces four types of offsprings in F2. These infective particles are transmitted normally via the egg's larger amount of cytoplasm but occasionally through the sperms as well. Such autodigestion (called autophagy) of cellular organelles is a normal event during metamorphosis or regeneration) and tissue under stress. There are differentiating tissues (e.g., cells undergoing programmed death during metamorphosis) or regeneration) and tissue under stress. as IS1, IS2, IS3, IS4 and so on in E.coli (Table 20-1). X linkage. Since centrioles have no outer membrane, the triplets are considered to form the wall of the centriole. HISTORICAL centromere sister chromatids Human chromosomes during mitosis. On confirmation for its presence through biochemical procedures, the replica of the same cell (i.e., clones) can be produced. Many species of bacteria may also carry extrachromosomal genetic elements in the form of small, circular and closed DNA molecules, called plasmids. Besides the haploidy mechanism of sex determination, two hymenopteran insects - Bracon hebetor (a tiny parasitic wasp which is also called Habrobracon sa sb Diploid Gametes : (sa) (sb) Eggs F1 : 1. 3.3. A cross between black and white guinea pigs. Most genes are relatively stable and mutation is a rare event. Both are prosthetic groups whose isoalloxazine ring can accept two hydrogen atoms. codons are also found within coding sequences (that is, methionine occurs within a polypeptide chain), some signal must be present in the base sequence of the mRNA molecule to identify a particular AUG codon as an initiation or start signal. Molecular weight and amino acid content of some proteins (Source : Sheeler and Bianchi, 1987). CoA can because the mRNA molecule to identify a particular AUG codon as an initiation or start signal. easily transformed into an ester at the thiol end(-SH) by acetyl group making acetylCoA. He also observed the striated muscles. 1987 UNIT OF MEASUREMENT OF CELL The viruses and cells of most bacteria, blue green algae, animals and plants are minute in size and are measured by the fractions of standard units. The production of monoploids in tobacco plant by anther and pollen culture was demonstrated for the first time in the laboratory of Prof. According to Matile (1969) the plant lysosomes can be defined as membrane-bound cell compartments containing hydrolytic digestive enzymes. Some parasitic species of bacteria are pathogenic (disease producing) to plants, animals and man. The most important hormones are growth hormones, estrogen, and regen, insulin, thyroxine, cortisone, and adrenocortical hormones, etc. However, they can be recogA : BUK A:T nized only by analysis of Mutant base pair amino acid substitutions in proteins. The biological science which deals with the mechanism of heredity and causes of variations in living beings (viruses, bacteria, plants and animals) is known as genetics. All of these aneuploids are probably produced by nondisjunction during mitosis or meiosis (Fig. What are the possible fates of an absorbed photon ? However, careful observations show that other traits as well are affected—(i) the tiny wing- like balancer behind the wings; (ii) certain bristles; (iii) the structure of the reproductive organs; (iv) egg production is lowered, and, (v) longevity is reduced. These triploids are obtained from seeds raised by a cross of tetraploid and diploid plants. 12.5. Table 12-1. 4.18). aqueous channel through which water-soluble molecules shuttle between the nucleus and the cytoplasm. Cell Wall and Plasma Membrane 1. How can a gene be synthesized from an mRNA molecule ? Grifth discovered the phenomenon of transformation in bacteria. However, Okajima (1966) reported Fig. Philadelphia chromosome. Dominant and recessive characters in man. Mycoplasmas are unicellular, prokaryotic, containing a plasma membrane, DNA, RNA and a metabolic machinery to grow and multiply in the absence of other cells (i.e., they are capable of autonomous growth). 15.3. Meiotic pairing possibilities in tetraploids (each chromosome is really two chromatids). Freeze-fracture electron microscopy of the plasma membrane by Branton (1968) revealed the presence of bumps and depressions (7 to 8 nm in diameter) which are randomly distributed. Currently, the term Golgi apparatus is more prevalent one, than many other names such as Golgi complex, Golgiosome, Golgi bodies, Golgi bodies, Golgi membrane, etc. intron When the total mRNA population of an orexon-l and exon-2 are fused, ganism is considered, it is found to be heterointron is spliced out geneous in size, showing a wide range of S GU AG values of 6 to 30. In the eukaryotic cells, the stability to the mRNA is provided by certain proteins. Temperature as mutagen. chain prime (iv) DNA polymerase δ (=delta). LH complex is mainly associated with PS II, but may also be associated with PS II (Anderson, 1975). Haemophilia is well known in the royal families of Europe, where it is traceable to Contents SEX LINKED INHERITANCE 141 Queen Victoria of England, who must have been heterozygous (carrier). The hallmark of a transposon is the presence of identical, inverted terminal repeat (IR) sequences of 8 to 38 base pairs (b.p.) (Fig. A—The non-histone proteins form two scaffolds, one per chromatid, while the naked DNA fibres form a halo around it; B— Laemmli's radial loops (after De Robertis and De Robertis, Jr., 1987). The sex of the offspring depends on the kind of egg, the Z bearing eggs produces males but the W bearing eggs produce females as shown in Fig. Integrate contractile units in muscle 2. Euploids above the diploid level may be referred to collectively as polyploids. For example, Stein and his coworkers established the amino acid sequence (i.e., primary structure) of the enzyme ribonuclease. Table 5-5. Moore and W.H. Stein got Nobel Prize (chemistry) for the discovery of chemical structure and activity of the enzyme ribonuclease. The extracted profragments teins are subjected to polyacrylamide with gel electrophoresis (PGE) and are staggered cut ends
then transferred onto nitrocellulose to which they bind. When prepard in this way, chromatin appears as a viscous, gelatinous substance. A d ATP molecule is shown being added to a parental DNA duplex or helix at its 3'-OH end. Each of the four samples is electrophoresed in four different lanes of the gel. Epistatic allele 1. In the metaphase and the anaphase, the chromosomes become thick and filamentous. Double bonds in unsaturated hydrocarbon chains tend to increase the fluidity of a phospholipid bilayer by making it more difficult to pack the chains together. Their shape and density vary greatly. Permeability. of the most famous hybridizers of his time such as Carl von Naegeli and Anton Kerner von Marilaum, but not to the younger generation of scientists who were perhaps less prejudiced against new ideas. significant variations in its pH balance. Alternatively, they could be formed by binding of DNA at the base of loop to a chromosome axis. gross mutations). For example, there may be single thylakoids (e.g., red alga), paired thylakoids (e.g., Chrysophyta), triple thylakoids and multiple thylakoids (e.g., green algae and higher plants) (Fig. Cytochrome-c 5. These closed vesicles are not coated by clathrin protein and they move across the cytoplasm of endothelial cells (which line the blood capillaries) to fuse with opposite plasma membrane discharging their contents. 6.3. A - N o n - o v e r l a p p i n g which means that no codon is reserved for punctuations. Describe the structural peculiarities of prokaryotic organization. Increasing concentrations of ethanol followed by benzene. Asexual reproduction ; 2. A strain of individuals homozygous for all genes being considered. The other important phospholipids of the matrix are the phospholipids of plasmalogens and isositides. But prior to Morgan, W. Lastly, in Britten-Davidson's model, a set of structural genes controlled by one sensor site is called inclusion bodies or storage granules. Thylakoids The thylakoids The thylakoids The thylakoids The thylakoids are stored in the cytoplasm either as finely dispersed or distinct granules. (thylakoid = sac-like) consists of flattened and closed vesicles arranged as a membranous network. Chemically the chlorophyll is a porphyrin like the animal pigment haemoglobin and cytochromes except besides the iron (Fe), it contains Mg atom in between the rings of the pyrols which remain connected with each other by the methyl groups. Length Metre (m) Millimetre (mm) 1 1,000 (1 × 10 3) 0.001 1 0.000001 0.001 1 × 10 - 9 1 × 10 - 1 × (ng) Picogram (pg)) 1,000,000 1,000 1 0.001 1 × 10-6 1 × 109 1 × 10-6 1 × 103 1 0.001 B. The time at which meiosis takes place varies among different organisms, and on this basis the process can be classified into : terminal, intermediate or initial. When the two genes w+ and apr+ (+ +) occur next to each other on the same chromosome (cis position) they produce the normal red eye colour. They help to position the phage's tail perpendicularly to the cell wall. For example, E. Determination of Sex and Sex Differentiation 151-169 Genetically controlled sex determination of sex : heterogametic males, heterogametic females, genic balance mechanism, sex determining mechanism; sex determining mechanism; sex determination in plants, sex differentiation : dosage compensation of genes, hormonal or genital sex, sociopsychological sex; revision mutation C (which prevents the chromosome to do crossing over with the normal X chromosome therefore, called crossover suppressor), a recessive lethal mutational gene, 1 and a dominant gene B for bar-eye. Contents PLASMA MEMBRANE AND CELL WALL 153 brane lining cytoplasm of each daughter cell. In 1894, he coined the term bioblasts for mitochondria. If these are defective, the undifferentiated gonadal cells fail to respond to H-Y antigen and testes do not form, leading the individual to mature as a female. These include amount and distribution of hair (e.g., facial, body, axillary, pubic), pelvis dimensions, general body proportions, subcutaneous fats over hips and thighs and breast development in females, as well as, increased larynx size and deepening of the voice in the male special cytological techniques have been used to determine the physical locations of a gene in a chromosome. According to Shull, the developed. Isolated nuclei and nucleoprotein from pus cells, spermatozoa and from haemolyzed erythrocytes of birds. Like the membrane of the rough ER, the outer surface of outer nuclear membrane is generally studded with ribosomes engaged in protein synthesis. It is also true that in the nucleated erythrocytes of lower vertebrates such as Xenopus, all genes may be turned off (Maclean et al., 1972), including those for ribosomal RNA and tRNA. The first step of this central dogma is known as transcription and does not involve a change of code since DNA and mRNA are complementary. Many DNA ligases have already been discovered. Cell fractionation method inSwinging bucket volves, essentially the homogenisation or rotors destruction of cell boundaries by different mechanical or chemical procedures, followed by the separation of the subcellular fractions according to mass, surface and specific gravity by centrifuges. Constraints on the Motility of Membrane Molecules. Chromoplasts impart colour to roots (Carrot), fruit (Tomato) and petals (Rose). The process of fixation involves the following events — (1) The proteins and other macromolecules are precipitated. Line breeding. Suggest a mechanism by which individuals possessing Turner's syndrome and Klinefelter's syndrome may originate. proankyrin tein meshwork (cytoskeleton) that actin underlies the erythrocyte's plasma band 4.1 membrane (Fig. When a base occurs in its rare or tatuomeric state, it cannot be linked to its normal partner. Vital stains selectively stain the intracellular structures of living cells without serious alteration of cellular metabolism and function. The exchange of chromo8 some parts between nonhomologous 14 chromosomes creates new linkage or genetic map is the outcome of crossing over studies, is also called cross over map. Contribute toward maintaining cell shape NH2 Microfilaments Solid made up of polymerized actin (F-actin) 7-9 G-actin None 1. Such a F1 progeny or hybrid may have improved general fitness, resistance to diseases and it may show remarkable growth and vigour. 42. Ploidy levels higher than tetraploid are not commonly encountered in natural populations, but our most important crops and ornamental flowers are polyploids, e.g., wheat (Hexaploid 6x), strawberries (octaploid, 8x), many commercial fruits and ornamental plants. Recent studies have revealed that most cytoplasmic microtubules do not arise directly from the centriole, but from a densely staining pericentriolar material that surrounds the centrioles, but from the centrioles, but from a densely staining pericentriolar material that surrounds the centriole (see King, 1986). of Pascal's triangle (see Table 5-2). One expressed in only one of the sexes; e.g., cock feathering in fowl is limited to normal males. There is no dominance, rather, there exist pairs of contributing and non-contributing and n plant, Zea mays, devised an elegant demonstration of chromosome breakage and rejoining during crossing over. Arachnids, e.g., ticks, mites and certain spiders (Pediculoids ventricusm). Discuss two lines of research that indicate that codons are three base long. In many species, entire chromosomes become heterochromatic and are called B chromosome, satellite chromosomes or accessory chromosomes and contain very minor biological roles. In eukaryotes there are more initiation factors have been identified in red blood cells (= reticulocytes). In HeLa cell, the processing of rRNA involves the following steps (Weinberg et al,. Such type of chromatin exists both in the region of centromere (called constitutive heterochromatin) and is lateNucleus. If the erythrocyte is placed in a 0.9% solution of sodium chloride (NaCl), then it
neither shrinks nor swells. Inversion involves a rotation of a part of a chromosome or a set of genes by 1800 on its own axis. If more than one locus is considered at a time, the rate of homozygosity achievement will be slower than for one locus. The coat of coated pits and coated vesicles is made up of proteins. 1500 bp) and do not code for proteins. the total amount and not the rate of fibroin synthesis that must be great; the silk worm achieves this by synthesizing a fibroin mRNA molecule that is very long lived. 4.25). The increase in the volume of the matrix causes into the growth of the cell which ultimately divides into daughter cells by the cell division. 1959 R.L. Sinsheimer isolated singlestranded DNA from a small virus φ -X174 which attacks Escherichia coli. Thus, a true Flowers of a negro has four tobacco plant. In modern genetical literature one more method of symbolization called "wild type symbolism" is widely used. Tight junctions: A— The adjacent plasma membranes are held firmly most neurons do not at the sealing strand which is composed of two rows of particles, as show electrical couin zipper; B— Three-dimensional representations (after De Robertis pling. The cytoplasm of the egg cell is known as the ooplasm. Photorespiration. Various ribosomal proteins have been found to mainly enhance the catalytic function of the rRNA in the ribosomes (see Alberts et al., 1989). Whenever trait fails to demonstrate the classical segregation patterns and deviates from standard ratios, the conclusion is again a cytoplasm based type of inheritance (e.g., mitochondrial inheritance in yeast). This is called C-value paradox (Gall, 1981). 5.5), the plasma membrane contains a bimolecular lipid layer, both surfaces of which are interrupted by protein molecules. This theory holds that before the occurrence of chiasma and crossing over two chromatids or chromosomal segments takes place. For example, in certain euglenoid cells, the mitochondria fuse into a reticulate structure during the day and dissociate during darkness. cells. They isolated the chromatin from Contents REGULATION OF GENE ACTION 103 different tissues separately and then dissociated into DNA, histones and non-histones. Motility of eukaryotes Hollow with walls made up of 4 to 5 protofilaments 10 Five types of protein defining five major classes None 1. Facilitated diffusion. Baltzer (1935). The RNA nucleocapsid (RNA + capsid) of segments with protein influenza virus is ultimately sur(nucleocapsid) rounded by a phospholipid bilayer polymerase membrane in which are embedded complex the following two types of viral glyFig. Hydrogen ions reduce the molecules of NAD and FAD, both of which pass on hydrogen ions to respiratory or electron transport chain where oxidative phosphorylation takes place to generate energy- rich ATP molecules. Such polytenic cells, etc. Explain your answer fully. resolve the various parts of the structure being examined. Golgi Functions in Animals In animals, Golgi apparatus is involved in the packaging and exocytosis of the following materials : 1. Micropinocytosis. This was termed as plus-minus method. In fact, centriole precursors are stored in the cytoplasm of unfertilized eggs and can be activated to form a new centriole under special situation. A— Model of Dupraw and Rae showing band and interband structure in giant chromosome. Dynein is a Mg2+ and Ca2+-activated ATPase enzyme which protein "arms" central unfused pair of microtubules 0.1 micrometer cilium plasma membrane centrile 0.1 micrometer cilium plasma membrane central unfused pair of microtubules fused pair of microtubules fused pair of microtubules 0.1 micrometer cilium plasma membrane central unfused pair of microtubules fused pair of microtubules fused pair of microtubules 0.1 micrometer cilium plasma membrane central unfused pair of microtubules fused pair of microtubules fuse Removal of phosphate 9. Maturation Phase The maturation or meiotic division. How does mitosis differ in animal and plant cells ? For mitochondrial instance, the primary oocyte of the mature egg piece reaches about 1000mm to 2000mm. Cyclopentano-perhydro-phenanthrene classes (PGA, PGB, PGC, PGI), Carrot is 1 6 another cultivated species in 1 7 20 which inbreeding leads to loss in 1 9 vigour and production, 4.26. CHARACTERISTICS OF GENETIC CODE The genetic code has the following general properties : 1, 1978 Hinnen et al., first of all described the transformation of yeast Walter Gilbert (1932-). Mitochondria may also produce heat (brown fat), and accumulate iron-containing pigments (Heme ferritin), ions of Ca2+ and HPO42-- (or phosphate; e.g., osteoblasts of bones or yolk proteins). Two or more different pairs of alleles, with a presumed cumulative effect that governs such quantitative traits as size, pigmentation, intelligence, among others. Cyanobacteria form another group of prokaryotes which include about 1500 species (85 genera and 750 species (85 genera and 750 species are found in India; see Sharma, 1992). The chosen organisms should be sexually reproducing (i.e., by fusion of male and female sex cells) because only then the offsprings will be able to receive different characters from both the male and female parents. (iii) Selective permeable plasma membranes. INBREEDING The process of mating of individuals which are more closely related than the average of the population to which they belong, is called inbreeding. The human eyes have limited distinguishing or resolving power. These points are where crossing over took place. These peculiar results were interpreted by Bateson and Punnett as follows : The rose comb is caused by the combination of homozygous recessive genes "pp" and homozygous or heterozygous dominant genes 'RR' or 'Rr'. Outdet et al., (1975). Diagram explaining chemiosmotic coupling according to Mitchell. Since a single allele per locus is present in a haploid, products of recombination can be studied without any difficulty due to dominance. In the early prophase, there are two pairs of centrioles, each one surrounded by the socalled aster which is composed of microtubules radiating in all directions. a a 4. During anaphase B these two sets of antiparallel polar microtubules appear to slide away from each other in the region of overlap. Each little bit, one at a time, is stitched into a special, viruslike piece of DNA gifted with the ability for self-replication; B-Alternate disjunction; C-Adjacent I and II disjunctions (after Stansfield, 1986). Despite its high surface tension, water has low viscosity, a property that favours the movement of blood through minute capillaries and of cytoplasm inside cellular boundaries. The genetic material must contain biologically useful information that is maintained in a stable form. What are the viruses ? Such copy error mutations have been shown by Figure 16.4. The abnormal pairing due to transitional substitution may also occur due to ionization. McCarthy recognized the DNA nature of transforming principle of pneumococcus bacteria. In fact, during meiotic chromosome condensation, the nuclear lamina completely disappears by the pachytene stage of prophase and reappears later during diplotene in oocytes, but does not reappear at all in spermatocytes. Types of proteins. Being local chemical mediators, prostaglandins are continuously synthesized in membranes from precursors cleaved from membrane phospholipids by phospholipids. different kinds of radiations and chemical mutagens utilized for induction of mutations. What is pedigree analysis? A DNA molecule is composed of three kinds of moieties: (i) phosphoric acid, (ii) deoxyribose sugar, and (iii) nitrogen bases. Garrod (1902) deciphered the inheritance pattern and metabolic nature of the human disease alkaptonuria (in which urine of patient turns dark to black upon exposure to air). Likewise, A-form of DNA is found at 75 percent humidity in the presence of high ionic strength of NA+, Ka+ or Cs+ ions. wild type to be expressed. It is hoped that this textbook will serve the purpose of students of B.Sc., B.Sc. (Hons.), M.Sc. (Zoology, Botany and Biosciences) of various Indian Universities. The exceptional flies (i.e., ultrabar) do not arise due to mutation because the mutation frequency of this locus is much lower Alfred Henry Sturtevant than in 1600. At the time of differentiation an important epigenetic factor is the production of androgens (testosterone) by somatic cells in the embryonic male gonad. This abnormality is much less common than the deutan type, occurring in only about 2 per cent of males and in only 4 women out of 10,000. When any two recessive alleles were brought together, intermediate types, called compound, is obtained. What is Pribnow box? In a sense, Red Pink codominance at all, the R RR Rr heterozygote showing the phenotypes of both homozygotes. The nuclear envelope breaks down. Cell shape changes 3. The chromosomal differences between the sexes of several dioecious species were found earlier in the course of cytological investigations. The reaction is catalyzed by an enzyme associated with 50S subunit and called peptidyl transferase. 9.7. test tubes 2 3 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 destroys base C 4 longer Polymerase chain reaction (PCR) has also been used for sequencing the amplified DNA product (Fig. Bauer rediscovered them in Drosophila and recognized them as the chromosomes. Spherosomes are membrane-bounded, spherical particles of 0.5 to 2.5 µm diameter, occurring in most plant cells. ANSWERS TO PROBLEMS 7. In globular protein, too, it is not uncommon for half of all the residues of each polypeptide to be organized into one or more specific secondary structures. When interchromomeric regions are synthesized to join these new genes or chromomeres, they may switch The photograph illustrates several chiasmata found in a tetrad isolated during first meiotic prophase stage. White ww Contents MENDEL AND HIS WORK Table 3.2. The dominant and
recessive characters in plants. Under the Fig. CO2 is released by α- ketoglutarate dehydrogenase in the presence of CoA to produce succinyl - CoA which changes by succinyl In this computer graphics image of ATP, kinase enzyme (also called succinyl CoA synthetase) into a 4- adenosine is blue, pentose is white and carbon compound, the succinic acid (at this stage one GTP is the phosphate groups are red. OH) and hydrazine (HZ = NH2 NH2). First described in 1960 by John H. (ii) The plasma membrane of certain bacterial cells gives out finger-like projections in the cytoplasm known as mesosomes. Such experiments have clearly established that the nucleus is the storehouse for and the control tower of, all hereditary information. 75 cient for A in the following arrow diagram can be calculated by following method. B and C are the parents of A. Each H1 molecule binds through its globular portion to a unique site on a nucleosome and has arms that are thought to extend to contact with other sites on the histone cores of adjacent nucleosomes, so that the nucleosomes are pulled together into a regular repeating array (Fig. By another density gradient centrifugation can separate peroxisomes from lysosomes and lysosomes of endoplasmic reticulum and plasma membrane) B supernatant: ribosomes not bound to membranes and soluble molecules Fig. The enzymes are the specialized proteins and they have the capacity to act as catalysts in chemical reaction. EUGENICS AND HUMAN BETTERMENT Both hereditary and environmental factors play a significant role in the development of the total cellular water is used by the matrix as the solvent for various inorganic substances and organic compounds and is known as free water. In going from DNA to RNA the language (nucleotide sequences) remained the same. However, a Rh-negative person can develop these antibodies on receiving Rh antigens through transfusion of Rh-positive blood. It is an integral membrane ε δ complex, composed of very hydrophobic proteins— 3 or 4 distinct polypeptides and one proteolipid— which together span the mitochondrial membrane. All the animals, non-green parts of the plants (viz., stem, root, etc.), non-green plants (e.g., fungi), bacteria and viruses depend on green parts of the textbook of Cell Biology gy,, Genetics, Molecular Biology, Evolution and Ecology will enhance the curiosity of our target readers to know more and more about the subject. The SR spirochaete is infectious, for when isolated from the haemolymph of female carriers and male sterile introduced into normal females the latter become carriers. complex Fig. The egg fertilizin usuSperms surround the oocyte, attacking its ally occurs in the jelly surrounding the egg. In the erythrophores found in fish scales the pigment granules may move at a speed of 25 to 30 µm per second between the microtubules. Cell Number of cells present in an organism varies from a single cell in a

unicellular organism (Protists such as protozoa and protophyta) to many cells in multicellular organisms (Most plants, fungi and animals). NON-EPISTATIC INTERACTIONS In certain cases, two pairs of genes determine a same phenotype but assorted independently, produce new phenotypes by mutual non-epistatic interactions and the F2 phenotypic ratio 9:3:3:1 Contents GENETIC INTERACTION AND LETHAL GENES 47 remains unaltered. Trace amounts Naturally produced by 4. Several biological processes such as pinocytosis, phagocytosis and transport of molecules across plasma membrane can be studied by the use of appropriate tracers (e.g.,gold mercuric sulphide, iron oxide, etc.). Metabolic patterns 14. migration is started by adding a solvent. Contents CHROMOSOMAL MUTATION-I 183 2. These are rod-like bacteria. Contents 24 GENETICS, HUMAN GENETICS and many peroxisomal proteins are found to have a signal sequence (comprising of three amino acids) which is located near their carboxyl ends and directs them to peroxisome (Gould, Keller and Subramani, 1988). Such enzymes influence the rate of transcription by modulating acetylation. The electron microscopic and radioautographic observations of the culture cells have shown clearly that the new mitochondria are originated by the growth and division of pre-existing mitochondria. Such post-translational control mechanisms do play a significant role in determining the activities of differential cells. In 1610, an Italian Galileo Galilei (1564 - 1642) invented a simple microscope having only one magnifying lens. Human beings are found to contain eight different types of Rh antigens. larities between the bacteria and mitochondria, the symbiont hypothesis postulated that the host cell (eukaryotic cell) represented an Contents MITOCHONDIRA 219 anaerobic organism which derives the required energy from the oxidations of food by the process of glycolysis. During cell growth many other components of the cell (RNA, proteins and membranes) become double in quantity and during cytokinesis cell as a whole divides into two. It also contains phospholipids, orthophosphates and Ca2+ ions. 4.7. Contents 56 GENETICS, HUMAN GENETICS AND EUGENICS Table 4-12. Red eyed female White eyed male The males produce two types of sperms, half carry the '+' and half carry no such gene on Red eyed female F1 Red eyed male Y chromosomes. In 1951, E.W. Lewis reported results of one of his experiments where from a cross of apricot (wapr and white (w) eye he obtained F1 having intermediate eye colour. There is no interference across centromere. The process of interchange of chromatin material between one non-sister chromatid of each homologous chromosome is known as the crossing over which is accompanied by the chiasmata formation. The new which RNA was derived. small size; 2. Acids as butyric acid, lactic acid, oleic acid and other fatty acids. Contents GENETICAL TERMINOLOGY 15 (closed, circular DNA molecule) in bacterial chromosome and replicate with the chromosome, e.g., F factor of E. 14.14. micronutrients; revision 11. What is the difference between a linkage (genetic) map and a chromosome (cytological map)? The transport processes involved have been most extensively studied in mitochondria, especially in yeasts (Attardi and Schatz, 1988). leafy vegetables. The chromatids still remain connected by the terminal chiasmata and these exist up to the metaphase. The process of eukaryotic DNA replication involves the following steps: 1. In the autoradiography technique (after Sheeler and Bianchi, 1987). The genes for red and white spotting is dominant in females. The organisms in which both male and female gametes are produced by different individuals are called dioecious. They produce identical phenotypes in homozygous or heterozygous combinations. It is composed of mainly the nucleoproteins but it also contains other inorganic and organic substances, viz., nucleic acids, proteins, enzymes and minerals. (ii) In man, the tendancy to develop diabetes mellitus (a condition in which there is an excess of sugar in the blood) is controlled by certain genes. The pairing of the homologous chromosomes is known as synapsis Pachytene (Gr., synapsis=union). Watson and Crick who were already engaged in constructing some are union). Watson and Crick who were already engaged in constructing some are union). chemosynthetic, some are photosynthetic, but most of them are heterotrophic. Dr. M.S. Swaminathan, one of the most distinguished and legendary figure in the field of cytogenetics and plant breeding in Indian subcontinent, have utilized amber mutation of Mexican wheat variety to develop a new variety of wheat, called Sharbati Sonora while working at Indian Agriculture Research Institute (IARI), New Delhi. They are also found in meristematic cells and in those regions of the plant which are not receiving light. Breeding and cross breedB dextral A sinistral cleavage ing of dextral and sinistral showed that cleavage ing of the plant which are not receiving light. allelomorphic genes, the gene for sinistrality being recessive (S), and the gene for the normal dextral coiling being dominant (S+). envelope protein coated pit translation coated vesicle mRNA endosome capsid disassembly progeny nucleocapsid assembles envelope proteins budding replication RNA synthesis and glycosylation of envelope proteins is completed golgi apparatus Fig. Attached to the F0 complex is F1 particle, a complex of five distinct polypeptides: Fig. Globular proteins are water-soluble, roughly spheroidal or ovoidal in shape. Metaphase. Describe complementation and recombination tests for allelism. The H chains possess antigenic H2N NH2 determinants in the "tail" segments by S- antigened S SS S- antigened test for allelism. COOH carbohydrate tail region HOOC hinge region of antibody molecule Fig. Phase contrast microscope. Homologous chromosomes, with identical inversions in each member, pair and undergo normal distribution in meiosis. By postmorteming the dead mice, it was found that their heart blood had both R-II and S-III pneumococci. eIF1 4. These hydrogen Contents MITOCHONDIRA 205 atoms (or equivalent pairs of electrons) enter the respiratory chain, being accepted by either NAD+ or FAD. Generally, they have a polyhedron or spherical shape and genetic material in the form of DNA or RNA. adjacent cells are in close The structure of a gap junction. A cavity about 2.5 nm long and varying in width from about 5 to 10 A^o passes through the molecule along the axis. The colloidal cytoplasmic matrix of E. Hundreds of other restriction enzymes with different sequence specificities have been isolated from several bacteria and are commercially available. They occur as constituents of certain structural components of cells such as membranous organelles; plant pigments such as carotene found in carrots and lycopene that occurs in tomatoes; vitamins like A, E and K; menthol and eucalyptus oil; and (2) they may be stored within cells as reserve energy sources. R.W. Holley and his colleagues gave detailed structure of alanyl tRNA (tRNA ala) from yeast. The enzyme RNA polymerase joins the ribonucleotides, thus, catalyzing the formation of 3'-5'-phosphodiester bonds that form the RNA backbone. Chemically speaking, the plant cell wall is composed of a variety of polysaccharides (carbohydrates), lipids, proteins and mineral deposits, all exhibiting distinct staining reactions (Table 5-5). Each loop has an axis which is made of single DNA molecule Fig. (ii) Complimentary chiasma. Similarly, in larger subunit (50S) 34 different proteins designated as L1 to L34, have been isolated. Kasha and Kao (1970) have used this technique for producing monoploids in large number in barley. Water as a solvent. This is the process of etiolation, in which the leaves lose their green pigment and the chloroplast membranes become disorganized. Hybrids from such crosses may acquire disease Contents INBREEDING, OUTBREEDING, OUTBREEDING back crossing to the crop variety can eventually fix the gene or genes for disease resistance. In primitive organism, sexual differences arose at a single gene locus, i.e., one sex was homozygous and the other heterozygous for that locus, and the disassortative or Contents 76 GENETICS AND EUGENICS matings were the matings between an homozygous and an heterozygous individual for sex locus. What is sex differentiation ? Klinefelter's syndrome. Contents CELL BIOLOGY 180 such as Amoeba and other potozoa, these residual bodies are eliminated by defecation. Blood clotting : Normal (Dominant) and Haemophilia (Recessive). shaped helical capsid of viruses such as tobacco mosaic virus (TMV), bacteriophage M13 and influenza virus, consists of numerous identical capsomeres arranged into a helix because they are thicker at one end than the other. plasma membrane Endosome or receptosome. However, bacteriophages with addition or deletion of three base pairs in DNA molecule, had performed normal functions. When many sperms enter in the egg, the fertilization is known as the polyspermic fertilization. Examples of ligands may include viruses, phagocytosis receptor 1-2 µm Fig. In all eukaryotic cells, secretory vesicles are continually carrying new plasma membrane or to cell exterior by the process of exocytosis. Nucleoids. The two subunits of 70S ribosomes of cyanobacteria are freely distributed in the cytoplasm and form polyribosomes during protein synthesis. 299 ecules, granules and vesicles within the cell. Assuming an average molecular weight for one nucleotide to be 330 daltons, one can calculate the total number of each type of rRNA. In general, chromoplasts have a reduced chlorophyll content and are, thus, less active photosynthetically. When only one homologous chromosome is involved, it is called structural heterozygote. R (rough) on the left and S(smooth) on the right. The normal function of a pair of centrioles in most animal cells is to act as a focal point for the centrosome.
Such inequality in fact cannot be tolerated and so female mammals and male Drosophila seem to have developed their own types of dosage compensation mechanisms. COMPARISON BETWEEN MITOSIS AND MEIOSIS Meiosis 1. Here, the specimen is Examples of negatively stained embedded in a droplet of electron dense material, such as, phosphoand metal shadowed specimens. The cytosol of cells also contains fibres that help to maintain cell shape and mobility and that probably provide anchoring points for the other cellular structures. Polysaccharides. When the amount of the egg to form the vegetative pole of the egg, then this condition is known as the telolecithal. Telomere. Thus, most elongation is carried out by the core enzyme (Fig. This type of sex is known as heterogametic sex. Freeze drying is a method that avoids denaturation of enzymes and is particularly useful for histochemical staining. The DHU-loop or D-loop is also variable in size containing 8 to 12 unpaired bases. breeding and found independently, that the yielding ability in these lines finally reduced to about one third of the open pollinated variety from which these samples were derived. An abnormal human phenotype including mental retardation, due to a trisomy of chromosome 21; more common in babies born to older mothers. Release of Ca2+ ions from the sarcoplasmic reticulum into the cytosol of muscle cells. In his youth, here a trisomy of chromosome 21; more common in babies born to older mothers. led a disastrous, poor, difficult and sad life. Sialidase 20. Z-DNA has opposite orientation resulting in dinucleotide units. Contents CELL BIOLOGY 32 C H A P T E R 3 Cell T he cell is the basic unit of organization or structure of all living matter. Genetic control of mutation rate. Carbohydrate metabolism. Got Nobel Prize for his studies on molecular immunology. No RNA is copied from strand B (antisense strand) in that region of which attachment of sigma (o) subthe DNA molecule. Considering human blood group A to include three subtypes, and groups B and O to include one each how many phenotypes are included in the A-B-O series. It is carried out by rapidly cooling or freezing the sample (cryofixation) and then fracturing (cracking) it in a vacuum while it is still at -100°C. This is explained partly by removal of intron RNA and also by many RNA molecules which break up within the nucleus. The outer membrane is quite smooth and has many copies of a transport protein called porin which forms large aquenuclei ous channels through the C Mammal (kidney cell) D Turtle (liver cell) lipid bilayer. Due to the terminalisation the homologous chromosomes are separated completely. Centromere and kinetochore. Our common hexaploid bread wheat too is found to be a segmental hexaploid. A lignified membrane cell wall is composed of microfibrils of cellulose embedded in the matrix containing large amount of lignin. Tijo and Levan provided greatly improved techniques for chromosome preparations. Fruit capsules of the 12 primary trisomics of Datura stramonium, each with its particular phenotype (after Sybenga, 1972). The three polymerases have different properties (see Table 5-3) and can be distinguished by the ions required for their activity, the optimal Contents 52 MOLECULAR BIOLOGY ion strength and their sensitivity to inhibition by various antibiotics (e.g., α -amanitin). A mutation that has effects on several different characters. 3.5. The life cycle of bacteriophage lambda. 13.11 A). The central fibrils, each has a wall of 6 nm thick and are located 35 nm away from each other. between them. Further, some of the proteins present in the ciliary membrane are specific to it and have a role as the barrier against the loss of ATP and certain essential ion that are required at appropriate concentrations to provide the energy for the ciliary movement However, chloroplasts can also synthesize starch and store it in stroma region. Regulation of Gene Action at the Level of Genome In eukaryotic cells, it seems that certain classes of genes are transcribed more or less continuously, and only in extreme situations their activities are repressed. disposed in a helical configuration. Nuclei are then lysed with detergent and the chromatin pelleted at 20,000 rpm (about 50,000 g) in a preparative centrifuge. Hemolytic anemia due to oxidation of unsaturated fats resulting in abnormal structure and function of mitochondria, lysosomes and plasma membrane of cells. A. Hypothetical diagrams showing the origin of mitochondria from plasma membrane. Here, actively emulsion growing cells are exposed to a radioactive precursor for a short period. At the end of process a recipient cell would contain (1) original donor segment, (2) the originally recipient whole chromosome, and (3) a "hybrid" daughter chromosome. 15.1. Schematic diagrams of a microtubule, showing how the tubulin molecules pack together to form the cylindrical wall. Immunological difficulties are encountered, since the enzymes being supplied are antigenic and the body produces antibodies against them. products of a number of asci are analyzed and most of them are found to exhibit a 4:4 pattern, then the locus of c must be close to centromere (this information is used in chromosome mapping). The loss of the base produces gaps in the DNA chain which may be filled with a wrong base, thus, producing mutation. This theory supports the view that the matrix contains many granules of smaller and larger size arranged differently. Deletions result in Anti-Lepore and Kenya variants of haemoglobin (HbA), both causing anaemia (i.e., one type of thalassemia), while duplication result in Anti-Lepore and AntiKenya variants of haemoglobin A (see Suzuki et al., 1986). 2.6) is a smiple method for moving the separation of smaller molecules from one anspots other. Microvilli increase the effective surface of absorption. Cat Skin colour Hoof Body colour Eye colour Wings Body colour Shape of shell Tabby Short hairs Grey Stumpy White Polled or Hornless Black Trotting White Black or blue Long hairs (Angora) Black Normal tail Coloured Horned Red Pacing Black Black Uncleft Dark Red Flat and yellow Grey Unbanded shell 2. Fulton (1971) has doubted the presence of nucleic acids in these organelles. The tendency of hydrogen to dissociate: H2 2H+ + 2e---thereby releasing electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against which the tendencies of other substances to release or accept electrons, is used as a standard against whic mannose, galactose, glucose and uronic acid. Table 7.3. Structure and function of nine initiation factors (eIFs) isolated from the reticulocytes (an eukaryotic cell). ribosomes. In guinea pigs the intensity of coat colour varies from black (variety A) to dark sepia (Variety B), to medium sepia (variety D). Among the best known cell lines are HeLa cells (obtained from a human carcinoma), the L and 3T3 cells (from mouse embryo), the BHK cells (from baby hamster kidney) and the CHO cells (from baby hamster kidney) are the cells (from baby hamster kidney) and the CHO cells nucleic acids, ions or any other molecule into the specific types of animal cells. In 1866 his paper "Experiments on plant hybridization" published in volume 4 of the proceedings of the Natural Science Society. A nucleolar fraction may be obtained by treating the nuclei with highly ionic solutions and digesting the chromatin with DNAse (Penman et al. 1966). 10.4. The hinge region of an antibody molecule improves the efficiency of antigen binding (A) and cross-linking (B) (After Alberts et al., 1989). Which of these samples of natural selection; Population genetics and evolution; Adaptive radiation; Barriers. Thus, while in the folded-fibre model, it was proposed that the histones were bound on the Contents CHROMOSOMES 269 outside of the DNA coils (i.e., histone particle with DNA coils (i.e., histone shell around DNA), the nucleosome model has proposed the converse (i.e., histone particle with DNA coils (i.e., histone shell around DNA), the nucleosome model has proposed the converse (i.e., histone shell around DNA), the nucleosome model has proposed the converse (i.e.,
histone shell around DNA), the nucleosome model has proposed the converse (i.e., histone shell around DNA). of DNA. A NTP an open complex. Cilia and Flagella ; obstribution of the cilia (Kartagenre's syndrome); origin of cilia; derivatives of cilia; revision questions. Subsequently mt DNA was studied in several organisms including plants and animals. Table 8-1. chromatids of a tetrad first touch and cross each other and then at the point of cross the breakage of chromatids occur. In Aurelia, for instance, Fig. 15.3). Morgan's concept about the linkage developed the theory of linear arrangement of genes in the chromosomes which helped the cytogeneticists in the construction of gene activity in E.coli lac operon. Therefore, every person should get better food, living conditions, education and medical guidance, etc., so his or her hereditary traits can do their best development. Mendel adopted self-fertilization technique for it. Through immigration there are enough chances that undesirable or defective genes of different races and nationalities may intermingle with the normal germplasm of the population After washing, the tissue is dehydrated by placing it in higher and higher concentrations of acetone or alcohol. In fact, the attachment of the amino acid to its tRNA is the only step in protein synthesis in which the identity of the amino acid (i.e., R group) plays a part. Got Nobel Prize for the development of chromatographic procedures for the separation of biological substances. Synthesis of fatty acids. 18.11). Inbreeding results in an increase in homozygosity where as outbreeding results in an increase in heterozygosity. The deliberate mating of two parental types of organisms in genetic analysis. 1969 A.D. Hershey, M. The reproduction is a process by which the living beings propagate or duplicate their own kinds. (iii) The centrioles. virus has replicated. The pea plant has various contrasting characters among its different varieties such as stem may be tall or dwarf, cotyledons may be green or yellow; the ripe pods may be inflated or constricted between the seeds, flowers may have axial or terminal positions and the colours of flowers may be red or white. The sequence of steps in the light stage was investigated by a team led by eric acid (i.e. a C-3 or three carbon compound, independent Melvin. There are following three different kinds of polyploids : (i) autopolyploids, (ii) allopolyploids and (iii) autoallopolyploids. (4) Antimorphs. (i) Origin and production of monoploids. The very fact that a cell, especially an animal cell which has no cell wall, can exist as a physically defined entity suggests that it must have some sort of boundary around it. All of these organisms have bodies containing undivided mass of protoplasm which lacks cell-like organization and has more than one nucleus. Cellulose is synthesized by a wide variety of cells that include bacteria (e.g., acetobacter, agrobacter and rhizobium), algae, fungi, cryptogams and seed plants. The elaioplasts store the lipids (oils) and occur in seeds of monocotyledons and dicotyledons. Contents CELL condensed state throughout the cell cycle. They also cause acidification of the mammalian stomach. Allium cepa (onion seed) Source 24.9 29.8 24.7 20.6 2. A heterozygous bald, colour blind man marries a non-bald woman with normal vision. The cytoplasmic inheritance, therefore, will be understood to be based on cytoplasmically located, independent, self-replicating nucleic acids, which differ from chromosomal genes by their location within the cell, and have their own nucleotide sequences. 11.4. Lozenge eye in Drosophila. The enzyme UDPG-glycogen transferase, which is directly involved in the synthesis of glycogen by addition of uridine diphosphate glucose (UDPG) to primer glycogen is bound to the glycogen particles or glycosomes. They contain catalases and oxidases (e.g., D-amino oxidase and urate oxidase). In macrolecithal and highly telolecithal eggs the amount of the yolk is very large and it occupies the largest portion of the egg except a small disc-shaped portion of the cytoplasm. Only one of the two strands of a DNA duplex is transcribed; this strand is called the sense strand. The anticodon permits temporary complementary pairing with three bases (triplet codon) on mRNA. It is a genetic material of many viruses, bacteria, plants and animals. 7. They involve a single break in a chromosome. According to this model, a chromosome is itself programmed for sequential gene expression of genes at different stages in the cell cycle. This enzyme is nucleoside also called nuclear polymerase or small polymerase of stages and is found only in vertebrates. Base analogues. The proliferation of membrane. Non-alleles so closely linked that they are often inherited as one gene, but shown to be separable by crossover studies. Centrioles and basal bodies have a role in the reception of optical, acoustic and olfactory signals. Apparently they are not as important as the histories in maintaining chromosome integrity. 14.2. Functional 80S ribosomes : A—Diagram of a ribosome showing the two subunits and the probable position of mRNA and tRNA. This is called heat of fusion.Water's melting point being 0° C. Starch granules contain a mixture of two different polysaccharides, amylose and amylopectin, and the relative amounts of these two polysaccharides vary according to the source of the starch. Showing incomplete dominance of chinchilla on Himalayan. In many cases it was shown that increased karyotype asymmetry was associated with specialized zygomorphic flowers. Pku homozygotes, for example, would normally not reproduce and transmit the harmful mutations to future generations. The polynucleate cells of the animals are termed as syncytial cells, while the polynucleate cells of the plants are known as coenoThe nucleus surrounded by nuclear membrane. What have the two kinds of genes in common. letters are wasted as the punctuation marks (Fig. singlet, doublet and triplet codes, which are customarily represented in terms of "mRNA is a complementary molecule which copies the genetic informations, AUG codon is the start or initiation codon, i.e., the polypeptide chain starts either with methionine (eukaryotes) or N-formylmethionine (prokaryotes). The RNA primers are removed and the appropriate ionic conditions are maintained, in vitro polymerization reaction summarized in Fig. The bimolecular layer of lipid molecules is of undefined face tension of cells (Harvey thickness and is covered on each side by a continuous layer of and Cole, 1931, Danielle and globular proteins (after De Witt, 1977). Three-dimensional shape is achieved through hydrogen bonding. 16.8. Radiation-induced chromosomal bridges and fragments in cells of matter, they dissipate X-raved anthers of enerally accepted that the plane of the ciliary beat is perpendicular to this plane of symmetry. As shown in Fig. The molecular (i.e., secondscribed spacers (ITS), one each between 18S and 5.8S ary) structure of rRNA showing a helical genes and another between 5.8S and 28S genes. Thus, the improvement went hand-in-hand with the development of cell biology. Describe in brief various essential techniques of genetic engineering. 18.13. Even looking through a microscope can be an elating experience. Isoleucine has three codons. Dupraw (1965) suggested 'folded fibre model' of the chromosome to suggest that it was made of a highly folded single molecule of DNA which is wrapped in chromosome theory of inheritance into the concept of genes being located in a linear array on each chromosome. Since in the induced polyploids, the fertility level and seed set are low, so seedless fruits can be produced by using triploids as in case of seedless watermelons which were produced by a Japanese scientist, Dr. Hitoshi Kihara. The successive meiotic substages can be represented as follows : Contents CELL GROWTH AND CELL DIVISION Meiosis { Interphase Division II or Homotypic division & { { Prophase I Anaphase I Anap that of an intermitotic interphase. For example, if the sequence on one strand is GAATTC read in 5'-3' direction, the sequence on the opposite strand is CTTAAG read in the 5'-3' direction, but when both strands are read in the 5'-3' direction, but when both strands are read in the 5'-3' direction. section. Contents IDENTIFICATION OF THE GENETIC MATERIALS 15 obtained. 5.21). Demonstrated the presence of mitochondria in plant cells. EXTRA-NUCLEAR INHERITANCE IN EUKARYOTES Many geneticists have studied various cases of extra-nuclear inheritance in different eukaryotes. 5.5. Fluid mosaic model of the plasma membrane. In general, if a homozygous deletion is made, it is lethal. This results in severe anaemia and death of the patient due to damaged heart, kidney, spleen and brain as a result of their clogged blood vesseles. a- Glucosidase 12. Clinical importance of chromosome banding. site 5' (iii) DNA polymerase y (= gamma). Chiasma formation or crossing over takes place. Each of thse IF proteins tends to assemble spontaneously in vitro to form homopolymers and will also co-assemble with the other Types II IF proteins to form co-polymers. Each oxygen atom has two electrons which it may share with two hydrogen atoms. (a) What are the major difficulties encountered in the study of the genetics of man ? A colloidal system can be defined as a system which contains a liquid medium in which the particles ranging from about 1/1,000,000 to 1/10,000 millimetre in diameter, remain dispersed. The pH of the site cytosol is about 7.0 (Fig. 14.20). C N N (tautomerisation occurs) A:T Common form H A:T A:C 205 normal replication A:T mutant G ... It is a bipartite structure. The nuclease enzymes act to hydrolyze or break down a polynucleotide chain into its component nucleotides. 14.4. Formation of a deletion heterozygote (after Stansfield, called pseudodominance (Fig. Thus, R gene determines the shape of rose comb and P gene determines the shape
of pea combed chickens, they interact to produce a walnut comb in F1. Contents 140 CELL BIOLOGY their operation. Coenzyme A (CoA) is part of a group (Table 10-3) that is derived from a nucleoside (adenineD-ribose) and contains pantothenic acid (a vitamin of B complex) linked to the ribose by pyrophosphoric acid. Endoplasmic reticulum within the zone of exclusion has a smooth surface (lacking ribosomes), Contents CELL BIOLOGY 170 succules secretory vesicle inner face flow of secretory material and coated vesicles of the Golgi apparatus are restricted to this region. Sexual reproduction. Although multiple strandedness has been demonstrated in several cases of plants such as dipteran salivary gland chromosomes, there are evidences against such as Vicia faba and animals such as dipteran salivary gland chromosomes, there are evidences against such as Vicia faba and animals such as dipteran salivary gland chromosomes, there are evidences against such as vicia faba and animals such as dipteran salivary gland chromosomes, there are evidences against such as vicia faba and animals such as dipteran salivary gland chromosomes, there are evidences against such as vicia faba and animals such as dipteran salivary gland chromosomes, there theory was to be extended and refined further. Autosome. Figure 13.11 B shows how the chromatin is arranged in loops which during metaphase, become arranged so that the base of the loops forms a scaffold in the centre of the chromatin. In chlorophyll molecule, the porphyrin surrounds a magnesium ion, while in haeme of haemoglobin, it surrounds an iron ion (Fig. Mitosis. The process of transmission of characters from one generation to next, either by gametes-sperms and ova-in sexual reproduction, is called inheritance or heredity. Basically, the spherosomes are involved in lipid synthesis and storage. This type of coiling The photograph illustrates mixture of right vs. Chargaff's equivalence rule has been found to apply almost universally in different organisms (viruses, bacteria, plants and animals). Write short notes on the following : 1. In a microscope, the smallest detectable detail is equal to about one-half the wavelength of light with which it is observed. In plant cells, ATP is also produced by the chloroplasts. Another peculiar characteristic of the polytene chromosomes is that the maternal and paternal homologous chromosomes is the called E or exit site has been recognized in the ribosomes by some workers but this three site model (i.e., A, P and E) still is not popular). Constituent of thyroxin, triiodothyronine and other thyroid hormones. Particulate Theories French biologist Maupertuis (1689-1759) has proposed that the body of each parent gives rise minute particles. The cells of macrophagic system can ingest bacteria, Protozoa, cell debris or even colloidal particles by the process of phagophagosome cytosis. Got Nobel Prize for primary discoveries in the field of antibodies (immunobiology). Nonsense or chain termination mutations. In 1952, G.E. Palade described the ribosome. Crossing over in a heterozygous pericentric inversion result in deletions and duplications and also produces rod-shaped (acrocentric) chromosomes. There is no reason to believe that salamanders should have any more. Among the important soluble enzymes present in the matrix are those involved in glycolysis and in the activation of amino acids for the protein synthesis. G1 Phase. Structural changes in chromosomes : 1. Vectors, Transformation and Molecular Cloning treat with ligase recombinant DNA molecule Fig. Consequently, negative staining of ribosomes has led to better understanding Contents 286 CELL BIOLOGY - Mg2+ + Mg2+ eukaryotic 80S ribosome 40S subunit 45~ proteins ~ 33 proteins 28S rRNA (~ 2000 bases) 18S rRNA (~ 2000 bases) 5.8S rRNA (160 bases) 5S rRNA (120 bases) Fig. But, when the mice were injected with the mixture of living avirulent R-II and heat killed S-III virulent, the unexpected symptoms of pneumonia appeared and high mortality resulted in them. Contents GENETICS, HUMAN GENET chromatids start to repel each other because the force of synapsis attraction between them decreases. Fluorescent dyes (e.g., rhodamine 123), which are more sensitive, have been used in isolated mitochondria and intact cultured cells. acrosome nucleus 1. The C-shaped B microtubule develop next and finally the C mirotubules are added. A number of self-incompatibility alleles is known in clover such that the growth of a pollen tube down the style of a diploid plant is inhibited when the latter contains the same self-incompatibility alleles as that in the pollen tube. Raphanobrassica is a classical example of allopolyploidy or amphipolyploidy. Few lysosomes occur in muscle cells or in acinar cells of the pancreas. The central portion of the acrosome elongates and forms a 1 to 75µm long, thin tube known as the acrosomal filament. The colinearity of protein molecules and DNA polynucleotide chains, somehow, determines the sequence of amino acids in protein molecules. A paracentric inversion and a pericentric inversion. Here, the use of the testcross is very important. Contents FERTILIZATION The peripheral portion of the acrosome of sperm collapses and its enzymes the lysins are extruded and dissolve in the water. monosaccharides are joined by β-1→4 hydrogen bonds cross-linking cellulose molecules CH2OH H OH H H O OH H H H H bundle of O O individual cellulose structure and function. Capsule. Moreover, since the Trp operon encodes a set of biosynthetic (or anabolic) rather than cata- region of lactose metabolism promoter site operator site DNA nucleoside cyclic AMP CRP RNA ribosomes lac triphosphates repressor polymerase A. This coupled activity does not occur in eukaryotes, because the mRNA is synthesized and processed in the nucleus and later on transported through the nucleoside cyclic AMP CRP RNA ribosomes lac triphosphates repressor polymerase A. where the ribosomes are located. Designed and built the first interference microscope. Mode of action of mutually supplementary genes. 4.25. Trisomics were obtained for the first interference microscope. Mode of action of mutually supplementary genes. visible along interphase chromosomes. This is known as the cis-trans effect (Fig. IF3 20,700 Kinetic effector of 30S initiation complex formation; shifts equilibrium 70S 30S+ 50S to the right side, thereby ensuring provision of free 30S ribosomal subunit for initiation. mitochondria with one very important exception. An endocytic pathway : ligands which are endocytosed via coated pits, are delivered to the to receptors in the coated-pits and are peripheral endosomes and then move sequenrapidly internalized. Therefore, a plant with genotype sk/sk will be effectively a male plant and a plant with genotype ts/ts will be effectively a female plant. In Drosophila carnation (c) is a recessive eye colour mutant and short wings (s) is a recessive wing mutant. Diamino-monocarboxylic or basic amino acids. Cell wall : its structure and function ; 2. Cytokinesis Both DNA synthesis are coupled to cytoplasmic divison, or cytokinesis—the constriction of cytoplasm into two separate cells. In dark reaction, the reducing capacity of NADPH and the energy of ATP are utilized in the conversion of carbon dioxide to carbohydrate. Low density lipoproteins (LDL) or β- lipoprotiens ; 3. Of these, only the first is the primary lysosome, the other three have been grouped together as secondary lysosomes. The matrix is enclosed in a sheath or pellicle. The ER (especially SER) is the organelle containing the main phospholipid synthesizing and translocating enzymes (i.e., there occurs an intense flip-flop of lipid components). Thus, sex determination is not a single, once-and-for all decision. Explain the inheritance of coat colour intensity. Contents GENETIC ENGINEERING 111 enhance the quality of human life. Lampbrush chromosomes are also found in spermatocytes of several species, giant nucleus of Acetabularia and even in plants (Grun, 1958). They increase rapidly during the cycle, and disappear, presumably as a result of degradation and turnover. 8.3. A-Genetic map of the lac operon, not drawn to scale: the p and o sites cell metabolism, and reguare actually much smaller than the genes; B-Lac operon in induced state. The four polypeptide chains are arranged in such a way that unlike chains have numerous stabilizing interactions, whereas, like chains have few. Three kinds of trisomics. Thus, like spherosomes, aleurone grains store reserve mateembryo rials, mobilize them during germination and in addition form a comA B partment for the digestion of other cell components (Hall et al., 1974). The normal condition with five digits on each limb is produced by the recessive genotype (pp). Most of the protein of chromatin issue and in addition form a comA B partment for the digestion of other cell components (Hall et al., 1974). histone, but "nonhistone" proteins are also present. Those euploid types whose number of sets is greater than two are called polyploid. This phenomenon was termed primary disjunction by Bridges and this event tends to produce three types of eggs. the majority of eggs with normal single X chromosome and a small number of eggs with their two X chromosomes or no X at all. CHAND & COMPANY LTD. In fact, all living systems are subject to the same physical and chemical laws as are non-living systems. Genetic The selection of marriage partners should be made with intelligence. transposase having 1015 amino acids and required for transposition ; 2. The persons with recessive aa genes do phenylketonuria h/h CO2+H2O not produce the tyrosinase enzyme which is needed by melCO2+H2O anocytes for converting DOPA Fig. For the betterment of future generation, it is necessary to increase the population of outstanding people and to decrease the population of outstanding people and to decrease the population of abnormal and defective people by applying the
principle of eugenics. Some of the significant branches of genetics are the following : 1. cell carrying 2. the pre-existing lysosomes (to form phagolysosome). al., 1989). Nomura et al., (1968) fractionated at least six different groups of proteins in the ribosome (Fig. The genetic material must be able to express itself so that other biological molecules, and ultimately cells and organisms, will be produced and maintained. The mammalian eggs contain similar membrane and in them this is known as the zona pellucida. Most mature plant cells have a large central sap vacuole. Formation of the acrosome of lobed nucleus the spermatozoa. The cytoplasmic inclusions include oil drops, triacylglycerols (e.g., fat cells of adipose tissue), yolk granules (or deutoplasm, e.g., egg cells), secretory granules, glycogen granules (e.g., muscle cells and hepatocytes of liver) and starch grains (in plant cells). Half the clones contain the enzyme, whereas the other half (in which the X carrying the normal gene is condensed) lack the enzyme. Describe and illustrate how : (1) deletions, (2) inversions, and (3) reciprocal translocations arise in nature? Following five types of compounds are associated with electron transport system of inner mitochondrial membrane : (i) Pyridine-linked dehydrogenases require as their coenzyme either NAD+ or NAD+ to nature? two microtubules or subfibres (18 to 25 nm in diameter), one is smaller (A) and complete, having 13 protofilaments of tubulin and lying closer to the axis; the other Contents CELL BIOLOGY 312 plasma membrane inner dynein arm outer dyne microtubule Axoneme of a protist. The movement of chiasma is known as terminalisation. They have enzymes for fatty acid metabolism and Contents MICROBODIES: PEROXISOMES 189 gluconeogenesis, i.e., conversion of stored lipid molecules of spherosomes of germinating seeds into the molecules of carbohydrates. Since the positive protein charges are not sufficient to balance the many negative charges in the phosphates of the RNA, so ribosomes are strongly negative and bind cations and basic stains. Mitoplast is found outer membrane to carry out oxidative phosphorylation. Karyotyping human chromosomes. The second protein is a 63,000 dalton protein (that has covalently bound acetyl neuraminic acid) located on the cytoplasmic side of the electron-dense material that occludes the nuclear pores (Davis and Blobel, 1986). RER also synthesize membrane proteins which are cotranslationally inserted into the rough ER membranes. 3.20. 297 Turning on and off of these organizing centres for microtubule assembly at different times in the cell's life are probably regulated by one or all the following factors : changes in nucleation centres, changes in Ca2+ concentration and involvement of MAPs. Assembly and Disassembly of Microtubules Cytoplasmic microtubules are highly dynamic structures, constantly forming and disappearing depending on cell activities. Disease Possible cause I. Group of amino acid s split off from the rest of the molecule, forming ammonia (NH3). On the basis of their functions, proteins of plasma membrane can also be classified into three main types : structural Contents PLASMA MEMBRANE AND CELL WALL 115 proteins, enzymes and transport proteins (permeases or carriers). Though the particulate theory faced many problems in its beginning but its basic concept has formed the central core of the modern understanding of the genetics. Differentiate between spermatogenesis and oogenesis. Transcription of the eukaryotic genome is believed to be regulated by a variety of specific gene regulatory molecules which are produced by specific regulatory genes or by cytoplasm/cell surface. N. Chromatin Structure and Transcription Decondensation of large chromosomal domains (coiled and supercoiled) is a prerequisite for transcripition. First the two members of a pair of centriole, the two organelles being separated from each other by a Contents CENTRIOLES AND BASAL BODIES 307 distance of 50 to 100 nm. (ochre means yellow; opal means milky white and umber means brown). They have a single limiting unit membrane of lipid and protein molecules, which encloses their granular matrix. Because the chemical composition, rate of photosynthetic activity and other properties of intact chloroplasts differ significantly from those of damaged organelles, it is often desirable to separate the two populations. Gas vacuoles serve the function of flotation or buoyancy. Suppose that we testcross trihybrid individuals of genotype ABC/abc and find in the progeny the following : 36% ABC/abc 4% ABc/abc 1% AbC/abc 36% abc/abc 9% aBC/abc 4% abC/abc 1% aBc/abc 72% Parental type : 18% Single crossovers : between A and B. Lamphrush chromosomes are best visualized in salamander ocytes because they have a high DNA content. The tRNA (reddish Nobel Prize in 1968 for his work along with Khorana brown) is shown attached to a bacterial enzyme and Nirenberg). translocation in which the broken segment becomes attached to a nonhomologous chromosome resulting in new linkage relations. In yeast and Neurospora, ribosomes are smaller and have a total sedimentation coefficient of 55S, with subunits of 35S and 25S (Attardi et al., 1971). The light stained and diffused region of the chromatin is known as the euchromatin. Contents 94 CELL BIOLOGY 2. In some experiments, McClintock used a marker (gene) that controlled the deposition of pigmentation in the aleurone which is the outer most layer of endosperm of maize kernels. It should be noted that the promoter itself is not transcribed. In other words, the earlier theory that basic chromatin fibre had DNA core surrounded by histones was incorrect (Berns, 1983). The core of F1 forms the knob or 'tadpole' that protrudes on the particle is an α3 β3 complex. A microtubule consists of a long, unbranched, hollow tubules 24-25 nm in diameter, several micrometers long and with 6 nm thick wall having 13 subunits or protofilaments. Starch granules of amyloplasts are typically composed of concentric layers of starch. Parents : AA XvXvY Gametes : Vermilion females Eggs : (AXv) + (AXvY) + (non-disjunction (AX+) + (AY) Sperms Sperms : F2 : AX+(50%) A4X+XvXv (4%) AAX+XvXv (4%) AXX+XVXV (4%) AXv (42%) AAX+Xv Red female (21%) AAXvY Vermilion male (21%) AAXvY Vermilion male (21%) AAXvY Vermilion male (21%) AAXvYY Vermilion male (21%) terms. Most commonly in the case of multiple births, the number of births is two and the individuals which are born in such a way are called twins. palisade cells DISTRIBUTION The chloroplasts remain distributed homogeneously in the cytoplasm of plant cells. nuclear RNA 3' OH in eukaryotes. 8.4). As a result, lamin A and C benucleolus come entirely soluble during mitosis, and at telophase they become continually more dense with cooling. Transversion. A single major protein (a macromolecular unit, called connexon) of 27000 daltons has been isolated from rat liver preparations consisting of almost Contents PLASMA MEMBRANE AND CELL WALL pure gap junction material (Hertzberg et al., 1981), A connexon appears as an annulus of six subunits surrounding the channel. The differentiation involves separation of the protoplasm into subordinate semi-independent compartments, the so-called cells. Because electrons are scattered so easily, the specimen used in electron microscopy must be extremely thin (ultrathin, i.e., 10 nm to 100 nm (c) thick). It is investigated that a DNA molecule does not leave the nucleus to participate directly in the process of protein synthesis but employs different types of non-genetic ribobucleic acid molecules for carrying its genetic informations from the nucleus to the site of protein synthesis, i.e., ribosomes. The euchromatin, since it has a role in the phenotype expression of the genes. It is believed that the sliding of the subunits caused the channel to open and close. The autopolyploidy have been induced in many plant and animal cells by artificial means such as chemical (e.g., chloral hydrate, colchicine, sulphanil amide, mercury chloride, hexachlorcyclohexane, etc.), radioactive subTetraploid (36) stances, e.g., radium and X-ray) and temperature shocks. They found its wide application in various plants and animals. Recently, it was found that plant viruses exploit the route of plasmodesmata to pass from cell to cell. There is no direct answer to this question at present, but one hypothesis is that the production of red pigment is a two-step chemical formula of cytosine. segregation Thus, translocation A B C D E A B C D E heterozygotes are marked by considerable degree of E acentric meiotic irregularity. (d) Are the mutational consequences of tautomeric shifts base-pair transitions or base pair Alanine (Ala) 71 Amino acids and their messenger RNA codons. It was also shown that the nucleus was essential for the growth and regeneration of the morphologically complicated ciliate Stentor. A black mouse mates with a brown mouse, and all the offspring are black. From the inner end of each channel small vacuoles or pinosomes are pinched off, and these move towards the centre of the cell, where they fuse with primary lysosomes, to form food vacuoles. The long search for the chemical basis of this differentiating staining reaction ended in 1950's when it was detected that cell wall of Gram negative bacteria has high lipid content which tends to be dissolved away by alcohol. In case of ambiguous nucleic code, the same codon could have differ- acids non-overlapping comma free ent meanings or in other words, the same codon could code two or more than two amino 1 2 different amino acids. The name "endoplasmic reticulum" was coined in 1953 by Porter, who in 1945 had observed cisternae of it in electron micro- endoplasmic graphs of liver cells. In the second step, the RI particles are heated at 40°C in the presence of the other proteins that have remained in the supernatant (i.e., S proteins) thereby forming an excited intermediate, RI*, within
20 minutes fully active 30S ribosomal subunits are formed. Further, the polar microtubules from each half-spindle overlap in a central region near the spindle equator (e.g., diatoms). E group : 16 to 18 pairs — Submetacentric (16 is metacentric) 6. (b) Which are the nonsense triplets and why are they so termed? The cell cultures are of three main types: primary, secondary and those using established cell lines. The process, whether sexual or asexual, comprises a basic pattern : (1) the conversion of raw materials from the environment into the offspring, or sex cells that develop into offspring of a similar constitution, and (2) the transmission of a hereditary pattern or code (DNA of the genes) from the parent. one molecule of glucose, a total of six molecules of NADH and two of FADH2 are formed. 11.3). Gel permeation chromatography or Gel filtration (Used for separation of proteins, nucleic acids, polysaccharides and lipids). The recombination in its turn is accomplished through a process known as crossing over in which the non-sister chromatids of homologous chromosomes exchange the chromosomal parts or segments. This is called spinning out and retraction hypothesis (Gall and Callan, 1962). Nondisjunction. The DNA strand having helicase becomes the lagging strand. Explain why are the mitochondria considered as semiautonomous organelles. From what substrates is DNA polymerized? Nexin links are highly elastic : their normal length is 30 nm, but they can be stretched to 250 nm without breaking (see Darnell, 1986). About 5 per cent of total transcribed RNA never leaves the nucleus. Lamins may play a crucial role in the assembly of interphase nuclei after each mitosis. coli contain nonsense codons in all reading frames. The resulting prophage often mutates the genes into which they become inserted (Fig. Proline (Pro, P) CH2 H2C CH - COOH N H Contents CYTOPLASMIC MATRIX Group of amino acids, symbols and chemical formulae D. 10.13. Regulation of this operon occurs in such a way that when tryptophan is present in the growth medium, Trp operon is not active. All bacteria are structurally relatively homogeneous, but their biochemical activities and the ecological niches for which their metabolic specialisms equip them, are extremely diverse. It is most probable that both effects of the AY allele are the result of same basic cause which promotes the yellowness of coat in a ne (see Darnell et al., 1986). Nucleosomes seem to be universal device for con /cerol) is restricted to the inner mitod cting the long DNA molecules of eukaryotic cells. This e dose and death in double dose. Cardiolipin (diphos operty results in many curious structures observed in cells conta Structural changes in chromosome Original chromosome G H D E F G H A B CD E F G H P R Translocation Fig. Facultative heterochromatin is that chromatin that makes up the genetically inactive whole chromosome in human females). Multiple alleles; symbolism for multiple alleles; symbolism for multiple alleles; examples : the C gene in rabbit, A, B, AB and O blood groups in humans, the H antigen and Bombay phenotype, Rh factor, eye colour in Drosophila, self-sterility alleles; revision questions and problems: The probability for a daughter is 1/2. (i) Multiplication phase. In humans, most common type of haemoglobin is haemoglobin A (HbA), which consists of 574 amino acid residues and has a molecular weight of 64,500. The male gametes are motile and small in size and known as the microgametes. By another method we can improve the future generations by improving the germplasm of existing individuals. Secondary constriction. Thus, each chain of the double helix can serve as template for the synthesis of the other. The cells of dormant seeds of higher plants generally lack Golgi apparatuses but they do display zone of exclusion having aggregation of small transition vesicles. Examples of pseudodominance (deletion). A killer Paramecium may contain hun- T.M. Sonneborn (1905-1981). The monosaccharides usually exist as isomers. In fact, hemicellulose molecules (e.g., xyloglucans) are linked by hydrogen bonds to the surface of the cellulose molecules (e.g., and phosphate in the form of phytin. Other Crops Number of released variety up to Year 1991 113 25 278 229 15 136 223 Varieties released in India NP836; Sharbati Sonora, Pusa Lerma; N/I-5643. What types and proportions of eggs will be produced by a Drosophila female trisomic for chromosome 4 and of genotype +/+ +/ey? Bar locus in Drosophila female trisomic for chromosome 4 and of genotype and proportions of eggs will be produced by a Drosophila female trisomic for chromosome 4 and of genotype +/+ +/ey? Bar locus in Drosophila female trisomic for chromosome 4 and of genotype and proportions of eggs will be produced by a Drosophila female trisomic for chromosome 4 and of genotype +/+ +/ey? Bar locus in Drosophila female trisomic for chromosome 4 and of genotype and provides experimental provides intralocus crossing over and (2) position effect. The final image is viewed directly on the fluorescent screen or is recorded on photographic film to produce electron micrograph. However, if life is defined as being able to specify each new generation according to its own genetic instructions, then viruses are living systems. 8.1. The distinction between negative and positive regulation. Polarization microscope. This is the reason that brothers and sisters who do resemble each other are still unique individuals. Polyploids may arise as a result of interference with cytokinesis, once chromosome replication has occurred; (ii) it may occur either in somatic tissues which give rise to tetraploid branches or during meiosis which produces unreduced gametes. The most important work on the genetics of mitochondria done in yeast which was initiated by the discovery of petite mutants by B. DNA Each nucleosome is a disc-shaped particle molecule with a diameter of about 11 nm and 5.7 nm in height containing 2 copies of each 4 nucleosome histones-H2A, H2B, H3 and H4. 2.12% G, 12% C, 38% A. 3.13). Sheath projections (14 nm) Function Principal component of microtubules. Contents MENDEL AND HIS WORK 41 hybrids of F1 generation after mating with each other produced in F2 generation 9 long-winged greybodied, 3 long-winged black-bodied, 3 vestigial-winged black-bodied and 1 vestigial-winged blackbodied Drosophila (Total=16). Summary of various epistatic ratios. ISOLATION AND CHEMICAL COMPOSITION OF CILIA AND FLAGELLA The first detailed chemical analysis of the protein components of the cilia of Tetrahymena pyriformis was conducted by I. Metalloproteins are proteins conjugated to metal ions which are not part of the prosthetic group, e.g., carbonic anhydrase enzyme containing copper; and siderophilin contains iron. The remainder of the amino acid then enters the main metabolic stream as a keto acid. Describe the Golgi apparatus. Proteins, Cytoplasmic cycle. Some of the end products of bacterial anaerobic respiration are useful to man, so, they are used in the manufacture of various foods such as butter, cheese and vinegar. Higher organisms are found to contain 60 tRNA molecules and 60 tRNA genes. Because the inactive chromosome is faithfully inherited, every female is a mosaic composed of clonal groups of cells in which only the maternally inherited X chromosome (Xm) is active (Fig. This allows production of two distinct proteins both immunoglobulins (Ig), but one with a long strand of hydrophobic amino acids at its carboxyl terminus, and the other with only a short length of relatively hydrophilic amino acids. The pressure of water day, when light energy can be used to supports leaves (b)(top) when water is scarce, the central convert it to sugar while the stomata vacuole shrinks and cell becomes soft and shrunken (bottom) are kept shut. In human, the gene for disease phenylketonuria has pleiotropic effect and produces various abnormal phenotypic traits, collectively called syn- A young cystic fibrosis patient. Gene symbol Wiener Fisher r cde Ro cDe R' Cde R' cdE R1 CDe R2 cDE Ry CdE Antigen produced none Ro R' R' Ro more properly by considering the behaviour of X and Y chromosome, such as follows : In the cross between red-eved female and white-eved female and white-eved female and white-eved female contains the gene ++ for red colour of eve. In vivo, direct delivery of the DNA is carried by the vector into the living cells of the body. The ligand-loaded receptors diffuse into these coated-pits. Table 1-3. If a lipid containing hydrophilic groups of fatty acids or the phosphate groups of fatty acids or the pho monomolecular film. Ph :381740 285/J, Bipin Bihari Ganguli Street, Kolkata-700 012. They were studying inheritance of wing colour in the magpie moth (Abraxas), using two different pure lines—one with light wings, the other with dark wings. The body of an alga Acetabularia is about six centimeters long and is differentiated into a foot, a stalk and a cap. 14.4). The vacuoles of the plant cells are bounded by a single, semipermeable membrane known as Contents 62 CELL BIOLOGY tonoplast. In the presence of centromere the duplicated part of a chromosome act as independent chromosome. In affected children, the metabolic imbalance caused by the mutation will turn the urine green. Different vacuoles with distinct functions (e.g., lysosomal and storage) are often present in the same cell, we have already described the role of lysosomal vacuole. In contrast, in monoploid male honey bees during spermatogenesis the meiosis is bypassed by mitosis. Three strand double cross over Functions of Cell Coat In addition to the protection of the plasma membrane, the cell coat performs the following important functions : (i) Filtration. It has been said that the chromosomes in mitosis are like the corpse at a funeral : they provide the reason for the proceedings but play no active part in them (see Alberts et al., 1989). He used the silver staining method in
studies. Metaphase subtraction 1 2 3 4 5 6 7 8 9 10 1 1 2 3 4 5 6 7 8 9 10 1 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 shortens by depolymerization at both ends Fig. Meanwhile the molecules within the membrane undergo continuous replacement. Carbohydrates Per cent dry weight Variable 4. The Krebs cycle itself releases no energy, but as the glucose breaks up, it also frees the hydrogen atoms attached to the carbons. Hence, the wavelength of light is the area which has great chances of improvement. Metacentric. The organism with the lowest number of the chromosomes is the nematode, Ascaris megalocephalus univalens which has only two chromosomes in the somatic cells (i.e., 2n = 2). Contents INTRODUCTION 13 Year Name of contributor Cell biological contribution 1955 G.E. Palade Observed ribosomes in animal cells and in 1956 he detected RNA in the isolated ribosomes. Yeast, A comparison of normal vs. This indicates that codon and anticodon pairing is antiparallel. But rather it is a gradual awakening that spreads from the ovary to testis to the reproductive tract, to the general body tissues and even to the brain itself; finally almost the whole body is overtaken by the process of sexual differentiation. Homologues continue to stay in synapsis for days during pachytene stage and chromosomal material between non-sister chromatids of each tetrad. 7.6). An Englishman by the name of Edward Lambert was born in 1717. eIF2 10. Write short notes on the following: (i) Binary fission; (ii) Anisogamy. Microtubule Organizing Centres (MTOCs) The microtubules are not found helter-skelter about the cell, but are organized in specific patterns designed to carry out specific function. Each PS I unit consists of about 200 molecules of chlorophyll a and 50 carotene molecules. It was Yule (1906) who suggested that quantitative variation may be controlled by large number of individual genes, each having a small effect. and specific (i.e., alignment of chromosomes is exactly gene-for-gene). Linkage studies provided the first proof that a gene occupies a fixed locus on a specific chromosome. The prophase is the longest meiotic phase, therefore, for the sake of convenience it is divided into six substages, viz., proleptonema (pachytene), leptonema (pachytene), and diakinesis. When the polyploidy results due the doubling of chromosome number in a F1 hybrid which is derived from two distinctly different species, then, it is called allopolyploidy and the resultant species is called an allopolyploid. The two members of a gene pair segregate from each other during meiosis; each gamete has an equal probability of obtaining either member of the gene. Socio-psychological sex. The gonads and the sex cells depend on the mitosis for the increase in their number. However, the narrowing effect is greater if the duplicated segments are on the same chromosome (called position effect) (Table 14-1). Due to its low density, Golgi apparatuses tend to form a distinct band in gradient centrifugation. actual physical distances between linked genes bears no direct relationship to the map distance calculated on the basis of crossover percentages. agic vacuole, cytolysosomes or autolysosomes. Depending on their staining properties, the following two types of chromatin may be distinguished in the interphase nucleus : B Ginkgo biloba Fig. 4.10 A). If an F2 is produced, its progeny P Red 1 White exhibits the following results : RR rr ¹/₄ red petals - 1C1C1 ½ pink petals - 2C1C2 r R ¼ white petals - 1C2C2 3. Plasma membrane. The chromosome number in each daughter cell remains the same like the parent cell. The same explanation is applied to the triple monosomics. The X-ray diffraction pattern of DNA. (II) Polymerase or replicase enzymes. Suppose that 150 primary oocytes could be scored for chiasmata within this region of the chromosome. Maxam - Gilbert technique (used for separation of polynuclotide fragments of RNA and DNA). Further, in extreme cases, such as in the state of dormancy adopted by many animal eggs and plant seeds, mRNA is maintained in a stable form for months or even years. a. The 80S ribosome also consists of two subunits, viz., 60S and 40S. Therefore, presently, both of these theories have been replaced by another new theory called organismal theory. The loci of genes A and B are on different chromosomes. Catalase can be visualized with the electron microscope when cells are treated with the stain DAB (i.e., 3, 3'-diaminobenzidine). Peroxisomes contain receptors exposed on their cytosolic surface to recognize the signal on the imported proteins. Since each nucleotide sccur per complete turn. Sankaranaravana, 1979) (after Suzuki et al., 1986). Gene z contains 3063 base pairs and codes for an enzyme, β - galactosidase, which converts lactose into glucose and galactose; while gene y Fancois Jacob and Jacques Monod. The LDL receptors move lysosome laterally within lipid bilayer, until they become associated to the newly hydrolytic formed coated-pits. The water also forms the good disFig. 4.2 in which old DNA is shown in black and new DNA in Fig. Some of the most desirable apples are triploids. The purity of isolated membranes is controlled by electron microscopy, enzyme analysis and the study of surface antigens. 3.4) involves the following steps: 1. The chlorophyll a and chlorophyll a and chlorophyll b and DNA and RNA. Ergosterol is also a precursor of vitamin D. Morten and R. Ghosal (1979) reported that DNA sequence of IS1 and IS2 of E. may be of two types : (i) peripheral endosomes just beneath the plasma membrane and (ii) perinuclear or internal endosomes. Binucleate cells. Contents CYTOPLASMIC MATRIX 77 drates from the water and CO2 in the presence of sunlight and chlorophyll by the process of photosynthesis. Suppose that a female undergoes sex reversal to become a functional male and is then mated to a normal female. Various names have been attached to the intertight mediate filaments that have a basis in junction the cell type in which they are observed. Like cell wall Contents PLASMA MEMBRANE AND CELL WALL 129 the simple diffusion, facilitated (a) simple diffusion does not require the metabolic energy and it equilibrium occurs only in the direction of a con(b) carrier-facilitated diffusion centration gradired blood ent. For instance, when homozygous black guinea pig is crossed with a homozygous white guinea pig is crossed with a homozygous black guinea pig is constitute a polarized phemomenon. Since the work of hepatic cells is mainly biosynthetic and degraditive, and work locations are spread throughout the cell, in these cells, it may be more efficient to have a large number of "low key" sources of ATP production distributed throughout the cell. S. Each mitochondrion is bound by two nucleolus highly specialized memA Rat (primary branes that play a crucial part B Turtle (liver cell) spermatocyte) in its activities. intermediate density. It is named after the Macaca rhesus monkey in which Rh factor was first discovered by Landsteiner and Wiener in 1940. HbAHbS : No anaemia. They contain only 1 to 2 per cent of the total protein of the chloroplast. 3.10. For example, there is a possible competition for type II polymerase (which is meant for hnRNA and mRNA) by the various promoter sequences that lie upstream of protein coding sequence. Controlled mating. Sir Francis Galton. (ii) Transverse binary fission. 3.16. After performing some 10,000 experiments with more than 500 different chemicals, in 1899. SPERMATOGENESIS The process of spermatogenesis occurs in the male gonads or testes. Each δ sequence is oriented in the same direction, forming what lac+ gene Contents GENETICS, HUMAN GENETICS AND EUGENICS 260 are known as direct long terminal repeats or LTRs. Ty elements are flanked by five base-pair direct repeats created by the duplication of DNA at the site of the Ty insertion. In a similar fashion, guanine in its common form. Sutton in 1902 proposed the chromosome theory of heredity," in which he postulated that the newly rediscovered Mendel's hereditary factors were
physically located on chromosomes. Which is the proximal and which is the distal face ? 10.23. NH2 A N C N C HC C CH HO P H2C 3' 3' O P OH T 2' 3' O P OH T 2' 3' O P OH T 2' 3' O C N N O G 1' H 5' H H 4' P P 5' 5' P OH 5' H OH H Fig. Harvey (1578-1657) speculated that all animals arise from eggs and that semen only plays vitalizing role. Contents 220 CELL BIOLOGY C H A P T E R 11 Plastids (Chloroplasts, Photosynthesis and Vacuoles) plastid starch globules P lant cells are readily distinguished from animal cells by the presence of two types of membrane-bounded com partments- vacuoles and plastids. However, certain plant viruses such as TMV can enparticles large plasmodesmata in order to use this

route to pass embedded from cell to cell. All of their proteins (both structural and enzymatic) are encoded by nuclear genes and are synthesized in the cytosol(cytoplasmic matrix) (i.e., on the free ribosomes). The term nucleolus was coined by Bowman in 1840. Sendai virus facilitates fusion of the plasma membranes and cytoplasms of both cells to produce a hybrid cell or heterokaryon with two types of nuclei. Here a human sperm is being seen fertilizing an egg. Each may produce phenotypic changes, modifications of phenotypic ratio, or alteration of linkage groups. The genetic mapping includes following processes : 1. Such mutations are heritable and of immense genetical significance. Because the cellulose is synthesized at the plasma membrane, each new wall lamella forms internally to the last formed lamella. (3) Hypermorphs. Mated F1 heterozygous ClB females are distributed individually into culture tubes in which each lays fertile eggs and so produces a single F2 culture. The thickest are the microtubules (20 nm in diameter) which consists primarily of the tubulin protein. Moving-boundary electrophoresis (used for proteins). The solutions which have cytoplasm higher concentrations of solutes than the intracellular fluc A B D ids are known as hypertonic Fig. There upon EF2 (also called translocase or G factor) causes the translocation of newly formed P-tRNA and its codon from A to P site; again one GTP is hydrolyzed to GDP to provide the necessary energy. In 3' direction, in group of three bases. Secondary non-disjunction, on the other hand, occurs in XXY females, where it gives rise to XX, XY, X and Y eggs (Fig. All 64 possible triplets have been synthesized and tested in this way. These granules have been observed moving between channels created by the microtubules in the cytoplasmic matrix. Genotypes HH Hh hh Males Hen-feathering Hen-feathering Ken-feathering Hen-feathering Hen-featherin opposite poles is called non-disjunction. Thus, in each microtubule, there are 13 protofilaments, each composed of αβ dimers that run parallel to the long axis of the tubule. However, some of the members of this multiple allelic series have been found to be pseudoalleles by Lewis (1951) (see Chapter 11: Fine structure of Gene). phate site and 5 ' → 3 cleavage site (or 5' - 3' exonuclease site) (Fig. Transfer RNAs are also processed from larger precursors. 11.5. Diagram showing the distribution of the main complexes within the thylakoid membranes both in the granal or stacked and stromal or unstacked regions (after De Robertis, Jr., 1987). He thought that in certain cases the particles of the male parent might dominate on those of the female parent and produce the male individual. At low ionic strength, rRNA behaves as a random coil, but with increasing ionic strength the molecule shows helical regions produced by base pairing between adenine and uracil and guanine and cytosine. E. anticodon A B loop Extended anticodon hypothesis. The light microscopy has shown that in Amoeba tiny pinocytic channels are continually being formed at the cell surface by invagination of the plasma membrane. Beriberi. After digestion for a short period DNA with microscopy has shown that in Amoeba tiny pinocytic channels are continually being formed at the cell surface by invagination of the plasma membrane. X chromosomes to autosomes. In McClintock's analysis, the events of breakage were detected by following the loss of certain genetic markers. Changes in number of genes (a) Loss : deletion (b) Addition : Duplication 2. Dimerization. The red colour of ripe tomatoes is the result of chromoplasts that contain the red pigment lycopene which is a member of carotenoid family. 20.4) : 1. The lysosomes of leucocytes enable the latter to devour the foreign proteins, bacteria and viruses. Passive transport. When crossing over is known as multiple crossing over takes place at more than two places in the same chromosome pair then such crossing over is known as multiple crossing over takes place at more than two places in the same chromosome pair then such crossing over is known as multiple crossing over is known as multiple crossing over takes place at more than two places in the same chromosome pair then such crossing over is known as multiple crossing over takes place at more than two places in the same chromosome pair then such crossing over is known as multiple crossing over takes place at more than two places in the same chromosome pair then such crossing over is known as multiple crossing over takes place at more than two places in the same chromosome pair then such crossing over is known as multiple crossing over takes place at more than two places in the same chromosome pair then such crossing over is known as multiple crossing over takes place at more take by a ciliary or basal plate which has two functions : termination of the C Tubule of each triplet of basal body ; and beginning of two central microtubules (iv) Lysosomes (vi) Ribosomes (vii) Microtubules (ix) Flagellae 12. The addition of Ca2+ inhibits polymerization of tubulin ; this effect is also enhanced by the addition of calmodulin. However, certain eukaryotic cells such as the mature sieve tubes of higher plants and mammaliam erythrocytes contain no nucleus. Chromoplasts impart a variety of colours to plant cells, such as red colour in tomatoes, red chillies and carrots, various colours to petals of flowers and green colour to many plant cells. Lysosomes. separation of sister chromatids, in the first generation of duplication both chromatids, in the first generation of duplication both chromatids were labelled. Each set of chromatids were labelled (this is interpreted as one DNA double helix in each chromatid and only one of the two strands labelled). a "Renner complex." In Oenothera lamarckiana, however, a ring of only 12 instead of 14 chromosomes is observed (Fig. The cell coat of intestinal microvilli are found to contain a variety of enzymes which are involved in the terminal digestion of carbohydrates and proteins. As shown in Figure (17.5c), a mixture of green, striped and white progeny again results, even though some of the striped and white plants now have an Ij/Ij genotype. DNA polymerase holoenzyme (or DNA pol III HE); ori DNA 4. Because, each chiasma produces 50% crossover products, 50 percent crossing over is equivalent to 50 map units or centimorgans. Tricarboxylate carrier 3. Such species are called heterothallic (literally "different bodied"). The degree to which electrons are scattered is determined by the thickness and atomic number) scatter electrons more than regions of (a) cilia nucleus contractile vacuole lesser density and consequently appear darker in the final image. It may be of two types : (i) Pathological polyspermy. Heterogeneity and types of mRNA. To perform this function, the Golgi vesicles contain different sets of enzymes in transiently in the Golgi membranes as they are en route to their final destinations (Fig.7.4). Differentiate between transformation and transduction. The first successful use of this technique was made by Nirenberg and Matthaei who synthesized a chain of uracil molecules (poly U) as their synthetic mRNA (homopolymer). The symbionts seem to be capable to get the energy by oxidative phosphorylation from the partially oxidised food (pyruvic acid) of the host cell. Element Ionic form present Functions ? D B C A Inversion product 14.12) : 1. Roles of RNA Primers in DNA Replication No known DNA polymerase can initiate synthesis of DNA without the availability of a primer RNA strand. Are Viruses Living Entities ? Numerous cisternae are associated with each other and appear in a stack-like (lamellar) aggregation. Chromosome mutations have proved to be of great significance in applied biology— agriculture), animal husbandry and medicine. Project from microtubule doublets and interact with adjacent doublets to produce bending. duced thymine dimers takes place by specific enzymes in the presence of visible light waves. This prediction is diagrammed in Fig. Environment 20–48 Atmosphere (air) : various zones of atmosph animals, air as medium for living organisms; hydrosphere (water) : physical properties of water, chemical properties of water, effect of factor of aquatic organisms, water and ecological adaptations, snow as habitat ; lithosphere (soil) ; soil, soil formation or pedogenesis— process of soil formation, weathering of soil forming rocks, mineralization and humification, formation of organo-mineral complexes, soil profile, climate and soil types, morphology of soil, physical properties of soil, soil as habitats for animals, soil fauna and soil flora, revision questions. 14.16. They digest the material taken bacterium is digested. male fertility (see Suzuki, et al., 1986). Contents GENETICS, HUMAN GENETICS AND EUGENICS 72 C H A P T E R 6 Inbreeding, Outbreeding and Hybrid Vigour T he word reproduction almost always yields a rea sonable carbon copy of parent unit. The palindrome appears accordingly — 5' GAATTC 3' 3' CTTAAG 5' In addition, there is a point of symmetry within the palindrome. 13.3). CH—CH—COOH | NH2 Leucine (Leu, L) CH3 5. Uric acid oxidase (uricase) is important in the catabolic pathway that degrades purines. If it is inherited in a Mendelian fashion, then probability of producing affected offspring can be calculated. Homozygote (Homozygous). 13.2) 1. 8.9 A. The mitochondria may be filamentous or granular in shape and may change from one form to another depending upon the physiological conditions of the cells. (a). 10.19). Moreover, the procentrioles which are formed at right angles to the centriole, are located near the proximal end. Proteins of these two viruses differ in having different frequencies and sequences of amino acids. Comparison of banded karyotype of humans and apes reveals numerous paracentric as well as pericentric inversions in humans as compared to apes. Chromoplasts of blue-green algae or cyanobacteria
contain various pigments such as phycocyanin, chlorophyll a and carotenoids. These proteins may also control the synthesis at the level of the translation and, thus, may regulate or modulate the protein synthetic process. Since all three enzymes are synthesized through the translation of a single polycistronic mRNA, it follows that the entire operon is responding as a unit to the presence of inducer. The prefix iso is derived from the greek isos, meaning equal and indicates that the agglutinations caused by a serum from the same species, man). Each of the contributing alleles R1 or R2 adds some red to the phenotype of kernel colour, so that the genotypes of whites contain neither of these alleles and a red genotype contains only R1 and R2 alleles. Regions of Z-DNA may be involved in gene regulation in the cells of "higher" organisms. For the isolation muscle cell; B—Lobed in a human neutrophil cell; C—Branched of nuclear envelope, nuin a silk spinning cell of an insect larva; D1 to D4—Variable shape clei are first of all sepain leucocytes. The primers are about 10 nucleotides lagging strand of DNA long in eukaryotes and they are made at intervals on the lagging strand where they re elongated by the DNA polymerase enzyme to begin each okazaki fragment. This discovery was followed by a thorough search of occurrence of DNA as the genetic material in other microorganisms, plants and atomic nature of a different reactions of living cells. The attached cysteine residue was then chemically reduced to alanine and the altered molecule (i.e., alanyl tRNAcys) added to a cell-free protein synthesizing system. The greater the difference in redox potentials, the greater the di Aa or Kk genes, only half of Contents CYTOPLASMIC OR EXTRA-NUCLEAR INHERITANCE 221 the larvae show dark pigment in the eye. Prokaryotes are generally free-living unicellular organisms that grow and divide continually as long as environmental conditions are suitable and the supply of nutrients is adequate. In order to make full use of available resolving power of the compound light microscopes, special techniques have been designed to improve contrast. The single nucleus is situated in the rhizoid portion. Levitzky (1931) suggested that in flowering plants there is a prominent trend towards A Pinus asymmetric karyotypes. Cytoplasmic vacuoles. The centromere has a similar interference effect; frequency of crossing over is also reduced near the ends of the chromosome arms. The Rh+ blood type, later on, is found to be composed of several antigens such as C, c, D, d, E and e, all of which indicate towards the possibility of multiple allelism of gene R. Thus, this pair of receiprocal crosses does not give similar results, and in the second cross the wing phenotypes are associated with the sex of the moths. The rate of synthesis may increase during cell cycle; in mammalian cells rate of rRNA synthesis becomes double after S phase. Maternal inheritance in variegated four o' clock plant. The lethals become effective in the zygotic stage so that only a bivalent the gaudens-velans (G-V) zygotes are viable. The X-linked genes are viable. The X-linked genes are viable. The X-linked genes are viable. known as cristae, in the matrix space. 10.23A). A.V. Leeuwenhoek in 1677 observed sperms of several animals (man, dog, rabbit and other mammals, frog, fish and insects) and also suggested their association with eggs. Chemical formula of vitamin A. The term plastid was used by Schimper in 1885; he also classified the plastids of plants. These transposons, however, were originally discovered in maize plant by Barbara McClintock by the name controlling elements in 1956. Binding of RNA Polymerase to Promoter, Initiation, Elongation and Termination Unlike replication, transcription does not progress along the entire length of a chromosome. Contents LINKAGE 91 Example. The crossing of two chromatids is known as chiasma (Gr., chiasma=cross) formation. The phosphate is further linked to a hydrophilic compound such as etanolamine, choline, inositol or serine. Long before biology existed as a scientific discipline, people selected grains with higher yields and greater vigour and animals with better fur, meat or milk. The three genotypes have different phenotypes, as follows : HbA HbA : Normal. Reproduction. Thus, IA allele specifies A antigen, IB allele determines B antigen and allele specifies no antigen. Surface active agents such as liposoluble vitamins (A,K,D and E) and steroid sex hormones have a destabilizing influence, causing release of lysosomal membranes. The cytoskeleton is also can be referred to as cytomusculature, because, it is directly involved in movements such as crawling of cells on a substratum. muscle contraction and the many changes in the shape of a developing vertebrate embryo; it also provides the machinery for the cyclosis in cytoplasm. 5.1). Some carbohydrate molecules may also be attached to the external surface of the plasma membrane, they Contents CELL BIOLOGY 58 remain attached either to protein molecules to form glycoproteins or to lipids to form glycolipids. The membrane of endoplasmic reticulum is fluid-mosaic like the unit membrane, nucleus, Golgi apparatus, etc. According to trichromatic theory of colour vision, there are three different types of cones, each with its characteristic pigment that react most strongly to red, green and violet light. 14.22). The most common example of the syncytial The pits are nuclear pores. the fusion of transport vesicles from the Golgi apparatus, (Note. Tissue is now placed in dilute solution of plastic embedding medium. Investigated the chemistry of the nucleus and got Nobel Prize for this contribution. To study the genetics of various human traits several techniques such as pedigree analysis, amniocentesis (and cell culture), twin's study, etc., have been utilized. Contents GENETICS AND EUGENICS 114 8. Certain proteins of the membrane are involved in oxidative metabolism, i.e., they act as enzymes and carriers for electron flow in respiration and photosynthesis (and cell culture), twin's study, etc., have been utilized. leading to phosphorylation (i.e., conversion of ADP to ATP). Intragenic mutation within the same codon, either restoring the original amino acid; intragenic mutation within the same cistron, such as one that restores the normal reading frame; intergenic direct suppression, such as alteration in some component directly involved in protein synthesis, for example, tRNA; intergenic indirect suppression by an alteration in the cellular milieu. Various events of protein synthesis can be studied under the following headings : A. What is the function of the glyoxylate cycle ? 17. In pentose (fivecarbon) sugars such as ribose, a five-membered furanose ring is formed. The Lesch-Nyhan syndrome, in which a deficiency of one enzyme of the purine metabolism (i.e., hypoxanthineguanine phosphoribosyl transferase) produces mental retardation and increased uric acid levels results, from a recessive mutation in the X chromosome. A— Intact chromatin, note that the nucleo polyanion dextran sulphate. The rDNA is amplified in oocytes of amphibians, some beetles and spiders, as well as in the macromolecules of ciliate protozoons such as Tetrahymena and Stylonichia. In many types of cells, the cytosol is differentiated into following two parts : (i) Ectoplasm or cell cortex is the peripheral layer of cytosol which is relatively non-granular, viscous, clear and rigid. 22.2). Certain cells, viz., liver cells of rat contain only 500 to 1600 mitochondria. All the 21 possible tetrasomics are available in wheat. Heteromorphic chromosomes that do not occur in identical pairs in both sexes in diploid organisms; in humans and fruit flies these are designated as X and Y chromosomes, respectively; in fowl, as the Z and W chromosomes. Hypostatic alleles Phenotypic expression of allele F2 Phenotypic ratio 1. The gangliosides have complex molecules of glucose, lactose, galactosamine and neuraminic acid. Specific immune responses involve many different types of cells. Assume that a crossover and resulting chiasma occured between two gene loci 100 per cent of the time. 15.6). Sanger's Dideoxynucleotide Synthetic Method Fred Sanger had initially developed a method for DNA sequencing, which utilized DNA polymerase to extend DNA chain length. Regulation of Gene Action 9. In contrast, intermediate filaments and microtubules are found in subcortical and deeper regions of the cell. A.Klug, the Nobel laureate of 1982, has contributed much to the TDS of tRNAs. S.H.Kim (1973) proposed a most acceptable TDS model of T\u03c8 C loop 5' end tRNA (i.e., phenyl-alanine tRNA of yeast cells). Characteristics of Crossing Over 1. umblical cord monozygotic twins umblical cord dizygotic twins HUMAN TRAITS Heredity affects a variety of human traits. The trinucleotide codons are written in the 5' - Table 6-2. Due to the secretory or anabolis = a throwing up) of the cell, new protoplasm continuoulsy increases in its volume. Thus, in vitro and in vivo studies, so far described, gave the way to formulate a code table for twenty amino acids (see Table 6-2 and Table 6-3). Electron microscopic studies of Neurospora crassa (Luck, 1963) and HeLa cells (Attardi et al., 1975) have suggested that organelle division begins by an inward furrowing of the inner membrane, as occurs in cell division in many bacteria (Fig. Non-histones In contrast to the modest population of histones in chromatin, non-histone proteins display more diversity. Thus, Crick's wobble hypothesis states that the base at 5' end of the anticodon is not spatially confined as the other two bases allowing it to form hydrogen bonds with any of several bases located at the 3' end of a codon (Fig. The Y-linked recessive allele responsible for this disorder is a lethal and will change the sex ratio in a given group of offspring over time. It is however, involved in controlling the cell size. (ii) The
phosphate backbone of Z-DNA follows a zigzag course, while in B-DNA this backbone is regular. Such an examination has been greatly facilitated by colouration with vital stain Janus green which stains living mitochondria greenish blue due to its action with cytochrome oxidase system present in the mitochondria. Important properties of some of these proteins. Both of these rRNAs persist in the nucleolus for another 30 minutes before entering the cytoplasm as part of the large ribosomal subunit. This was confirmed by the technique of pulsed gel electrophoresis that in yeast Saccharomyces cerevisiae, each chromosome is formed from a single linear DNA molecule (Kavenoff et al., 1974). Dissimilar? Male and meiospores sperm (n) female haploid cells egg cell (n) (n) called spores, are pro(2 n) duced by meiosis in the meiosis diploid (sporophyte) organism. The first clue to codon assignment was provided by Marshall Nirenberg and Heinrich Matthaei (1961) when they used in vitro system for the synthesis of a polypeptide using an artificially synthesized mRNA molecule containing only one type of nucleotide (i.e., homopolymer). Its incidence is about 0.2 per 1000 births. Many mutations described by de Vries in O. In the leptotene stage the chromosomes become more uncoiled and assume a long thread-like shape. The cholesterol is synthesized from the acetate and its entire biosynthetic pathway involves about 20 steps, each step catalyzed by an enzyme. Since a polyhedron of 20-sided icosahedron basitipula influenza virus cally has triangular faces, it iridescent virus herpes virus φ 29 bacteriois also known as phage of deltahedron (Alberts et al., Bacillus subtilis 1989). 18.9. Two alternative models to explain the generation of poleward force by the kinetochore for its chromosome during anaphase. 8. When, interference decreases, coincidence increases. The new association of genes in a recombinant individual; this association arises from A punnett square for inheritance of ABO independent assortment of unlinked genes, from crossblood group in humans. For example, in wheat Triticum aestivum 2n = 42; n = 21 and x = 7, showing that common wheat is a hexaploid (2n = 6x). The proximal Golgi saccules are formed by fusion of ERderived vesicles, while distal saccules "give their all" to vesicle formation and disappear. Describe its evolutionary and biochemical significance. adipose tissues) is consumed to run the body machine, and then the energy is obtained at the expense of proteins of the protoplasm. Both types of this heterochromatin appear to be connected and together, they are referred to as nucleolar biology Leeuwenhoek was the first to observe living free-living cells; he described in 1675, microscopic organisms in rainwater collected from tubes inserted into the soil during rainfall. The antifertilizin is a protein which is composed of acidic amino acids. Human genetics. In the cytoplasm of animal and plant cells, microscopic organisms in rainwater collected from tubes inserted into the soil during reactive described in 1675. transcriptional activity of the cell. Secondary structure of the protein is any regular repeating organization of the polypeptide chain. They are bound to DNA in spermatozoa of some fishes, e.g., salmine, of salmon and sturine in sturgeons. ANEUPLOIDY Changes that involve parts of a chromosome set results in individuals, called aneuploids (Gr. aneu = uneven; ploid = unit). Photo of individual atoms on the surface of a silicon crystal developed by tunneling microscopy. When Mendel crossed many varieties of hawk-weeds, the progeny did not show evidence of segregation of genes from her daughter, implanted into her womb and successfully carried them to term to give birth to triplets. Within the cell, microtubules are in equilibrium with free tubulin. Among the fully sequenced proteins are ribonuclease and nearly 100 types of haemoglobin. These molecules constitute the 30S preinitiation complex (Fig. Similarly, Klinefelter's syndromes (XX Y) are males, despite the presence of two X chromosomes. In many algal and fungal species, there are two mating types that are determined by alleles at one locus. β' rpo C 165,000 Core enzyme 4. This is called inbreeding de50 pression. Strychnine 3. Therefore, it was safe to conclude for molecular biologists that genetic informations were existed in DNA molecule in the form of certain special language of code words which might utilize the four nitrogen bases of DNA for its symbols. For example, if the linear order of three genes ABC is to be determined, then these three genes may be in any one of three different orders depending upon that which gene is in the middle. Similarly, the male population of F2 includes 50 per cent, red eyed and 50 per cent, red eyed flies. Both of these organelles have very similar structure; they differ mainly in size and number, while cilia are short and number, while cilia are short and number (i.e., flagella are longer and fewer in number, while cilia are short and number (i.e., flagella are longer and fewer in number, while cilia are short and numerous). these molecules to move across it. Karyotype and Idiogram All the members of a species of a plant or the animal are characteristics. The group of nucleotides that specifies one amino acid is a code word or codon. Write short notes on the following:(i) ABO blood group; (iii) Universal donor, and universal recipient; (iv) Inheritance of Rh phenotype. 4.31. During these intervening thirty four years many developments occurred in biology which prepared the way for the rediscovery of Mendel's work. There were several reasons for the sad neglect of Mendel's work. Because the sperm or spermatozoon is a very active and mobile cell so to provide great amount of mobility to the sperm, the superfluous material of the developing sperms is discarded. The differences and similarities of Z-DNA and B-DNA have been summarized in Table 3-3; some other features are the following : A. Phaseolus vulgaris (bean seed) 24.9 31.4 24.1 19.6 3. Hybridoma. (b) Diagram a cross between dichaete and wild type and summarize the expected results. RNA transcripts of some genes do not seem to give rise any cytoplasmic mRNA, but get degraded within the nucleus. Further, hybrid ribosomes containing one bacterial subunit from the chloroplast ribosomes are found fully active in protein synthesis, but if hybrid ribosomes contain one subunit from any eukaryote, they are found to be inactive or non-functional in protein synthesis. The B chains are shown in the light shaded tical ultracentrifuge contains an optical system, allowing one to observe changes in the sample. In prokaryotes, tRNA processing includes removal of nucleotides from the precursor or primary transcript and modification of some occurs when helix contains minimum six helical turns or 36 glycosyl units). Golgi apparatus can be studied as follows (Fig.7.1): 1. The chambers or cells are now recognized to be empty spaces left behind after the living portions of the cell had disintegrated. Within 10 generations, full-sib matings can produce an inbreeding coefficient of 90 per cent 21.2). Endonuclease enzyme also attacks one of the two sides of phosphodiester linkages, but they react only with those bonds that occur within the interior of a polynucleotide chain. mutations can be artificially induced by certain chemical substances called mutagens such as acridine dye and proflavin. What conclusion could you draw regarding the form of breeding natural to the two species ? coli cell. (a) What is the basic test by which cytoplasmic inheritance is distinguished from nuclear inheritance is distinguished from nuclear inheritance is distinguished from nuclear inheritance in a very limited space of the cell. Contents TECHNIQUES IN CELL BIOLOGY Steps Mounting Staining Viewing Electron Microscopy On a perforated metal disc (grid) usually covered with formvar or paralodian. Some organic compounds such as carbohydrates occur in the matrix as the monomers. The mother was heterozygous for colourblindness; nondisjunction of the X chromatids, each bearing gene c, occurred at the second meiotic division to produce an egg of sex genotype XcXc. Fertilization by a Y-bearing sperm resulted in a son. Gynodioecious Perfect (O) and female (O) flowers on separate plants. The corresponding lower case letter designates the allele which is recessive to all others in the series. AA, Aa 2. An isochromosome is a chromosome in which both arms are identical. Therefore, plants must subsist on molecules of low molecular weight, and any intercellular signaling molecules that have to pass through the cell wall must also be small and water soluble. According to McKusick (1987), in man there are Table 18-2. He conceived of a cytoskeleton that determines both the shape of the cell and the changes in its form. (b) Heparin. (The other cleavage product, galactose, is also ultimately converted to glucose by the enzymes of galactose, is also ultimately converted to glucose by the enzymes of galactose, is also ultimately converted to glucose by the enzymes of galactose, is also ultimately converted to glucose by the enzymes of galactose, is also ultimately converted to glucose by the enzymes of galactose, is also ultimately converted to glucose by the enzymes of galactose, is also ultimately converted to glucose by the enzymes of galactose, is also ultimately converted to glucose by the enzymes of galactose, is also ultimately converted to glucose by the enzymes of galactose (b) and is activated by helicase (b) and is activated by helica polymerase primase nucleotides long) on the lagto start first RNA chain ging strand. Each recessive genotype contributes one unit to the phenotype and each dominant genotype contributes two units to the phenotype. This enzyme is PCNA independent and occurs in mammalian HeLa cells and budding yeast. But in certain cells, the chloroplasts become concentrated around the
nucleus or just beneath the plasma membrane. The important cerebrosides are the kerasin, cerebron, nervon and oxynervons. Fisher's hypothesis. Benzer has found that about 300 sites are separable by recombination within the rII region. Foreign DNA/Passenger DNA. Finally, to endow the helix with thermodynamics stability, the structure would have ample opportunities for the formation of hydrogen bonds between amino or hydroxyl-hydrogens and keto-oxygens or immino-nitrogens of the purines and pyrimidine bases. counselling can do great benefit to human society. Leaves are homogenized in an ice-cold buffered isotonic saline solution (e.g 0.35 M NaCl) at pH 8.0. The disruption is generally carried out with bursts of Waring blender. Contents PLASTIDS 225 Comparison of Chloroplasts and Mitochondria do and they are organized on the same principles. Recently, IS21 has been reported in bacteria by Willetts et al., (1981). It provides a unifying thread for the previously diverse fields of biology. Once the gradient is formed, the homogenate is layered on the top and centrifuged until the particles reach equilibrium with the gradient. Black, Long; bvg+/bvg = 3. The closely linked genes have less chances of departure or frequency of crossing over than the widely located genes. Snail haemocyanin Number of amino acids Molecular weight 39 4,500 51 124 140 150 180 574 4,500 8, 200 5,700 12,000 15,600 16,000 20,000 64,500 473, 000 910,000 2. Chemical formula of sphingosine. The ova or eggs containing moderate amount of yolk are called mesolecithal ova or eggs, e.g., Peteromyzon, Dipnoi and Amphibia. CH CH3 CH HC N CH2 CH CH3 N Fe N CH3 CH2 CH COOH teristics. According to the plane of fission following types of binary fission. A—Protein import by mitochondrial matrix through single signal; B— Import of proteins from the cytosol (cytoplasmic matrix) to the mitochondrial intermembrane space or inner membrane through two (or multiple) signals (after Albert et al; 1989). The agent causing diphtheria is an example; it binds to a factor necessary for movement of mammalian ribosomes along the mRNA. The A24 is an unusual hybrid protein, being a complex of histone H2A and the non-basic protein ubiquitin. Molecules have four nucleotides as adenosine monophosphate, guanosine monophosphate, cytidine monophosphate, cytidine monophosphate, guanosine monophosphate and uridine monophosphate. (= an enzyme isolated from Thermus aquaticus growing in hot springs; this enzyme acts best at 720C and the denaturation temperature of 900C does not destroy its enzymatic activity, see Kary Mullis, 1990). Fab fragments heavy chain light chain hinge region Fc fragment Antibody structure: (a) Ribbon model of an IgG molecule (b) Schematic model showing the domain structure of an IgG molecule. From the cross ds mp/++ × ds+/+mp, what percentage of the progeny would be expected to be both ds and mp in phenotype ? Oxaloacetic acid loses its oxygen and picks up the NH2 group and becomes the amino acid, aspartic acid. This defective enzyme leads to metabolic disturbances in the biosynthesis of starch, lipid and protein. Moreover, if the recessive type of genes occur in X chromosomes of males, they express themselves phenotypically. Pore densities and nuclear pores per nucleus in various cell types (source : Thorpe, 1984). At metaphase, subunits (tubulin dimers) are added to the plus end of a microtubule at the kinetochorees per nucleus in various cell types (source : Thorpe, 1984). and are removed from the minus end at the spindle pole. (viii) Macrogamy. For example, Mycoplasma laidlawii (0.1 µm in diameter) is saprophytic and is found in sewage, compost, soil, etc. Also, according to Whaley (1944) 'hybrid vigour denotes the manifest effects of heterosis'. For example, desmin remains concentrated in the Z-lines and T-tubule system of striated or skeletal system, together with vimentin, synemin and α - actinin. What is the general formula of amino acids ? Two dominant mutants in the first linkage group of guinea pigs govern the traits pollex (Px), which is the ativistic return of thumb and little toe, and rough fur (R). Methods of Sample Preparation for Transmission Electron Microscopy The standard procedure for the preparation of specimen for TEM entails fixation, dehydration, staining and sectioning similar to light microscopy (Table 2-1.). Coined the term karyokinesis. Cell Volume The volume of a cell is fairly constant for a particular cell type and is independent of the size of the organism. So, it is possible that some information necessary for centriole formation is usually carried in the centriole itself (just as the replication of mitochondria and chloroplasts depends on extrachromosomal genes carried in the organelles). The narrow spaces between the microvilli form a kind of sieve through which substances may pass during the process of absorption. F1 heterozygote : Auria X Auria Cc Cc F2 : 1 Cc : 2 Cc or 1 : 2. 16.1. Cross-sectional structure of a centriole. In this model (Fig.10.18A), the membrane is impermeable to both H+ and OH⁻ ions. Ratios of the bases present in different samples of nucleic acid yielded the following results: (1) (A+C) / (T+G) = 1, (2) (A+C) / (U+G) = 0.8, (3) (A+G) / (T+C) = 1.5. Which were RNA and w bar locus of Drosophila contains more than one functional and recombinational units. Duration in hours Parts of cell cycle Interphase Mitosis Phases Bost-DNA synthesis phase Mitotic phase Vicia faba Mouse L cells Human HeLa cells 12 6 12 1 12 6-8 3-4 1 12 10 3 1 2. (i) Origin and production of autopolyploids. LYSOSOMES AND DISEASE Malfunctioning of lysosomes often results in various pathological disorders affecting the life of the cell or an individual. Residual bodies are formed if the digestion inside the food vacuole is incomplete. GENETIC ENGINEERING AND GENE THERAPY During the late 1970s, the science of genetics entered a new era dominated by the use of recombinant DNA technology or genetic engineering (or biotechnology) to produce novel life forms not found in nature. Wiener's hypothesis. agic cells of mammals. 4.2. Checkerboard derived from a cross between two heterozygous white coated dogs showing 12 : 3 : 1 ratio due to dominant epistatic inhibitor genes. The cells in which meiosis takes place are known as meiocytes. Thus, all the cells in an organism contain the A computer - generated model of the structrue of DNA replication — experimental evidence for semiconservative DNA replication in E. coli, Meselson and Stahl's experiment, visualization of replication in E. What are the lethal genes ? In case of Ascaris, annelids and molluscs this type of fusion of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base. - phosphatement, visualization of two pronuclei does not occur. When DNA is treated with hydroxylamine (HA), its cytosine base is the strongest reacting base is the strongest reactin group (e.g., dATP, dCTP, dGTP and d TIP). Contents 42 MOLECULAR BIOLOGY DNA replication in Eukaryotic DNA replication requires two different DNA polymerase δ. Contents CELL 47 C. However, such methylation has not been detected in the DNA of lower eukaryotes such as yeast and Dictyostelium, nor in Drosophila. Thus, primary non-disjunction may occur in either XX females or XY males. Contents 134 GENETICS, HUMAN GENETICS, HU regardless of which individual is female or which individual is male or we can say that sex makes no difference in Mendel's crosses. Segregation. For example, in man the recessive trait of albino is represented by letter 'A'. A number of alleles of lozenge occupyfiguration of the cis-trans test. units). Similar results were obtained by Bridges (1916) from the cross of red eyed male and white eyed female Drosophila. The C translocation heterozyB D gotes produce both transA E BD located and normal chromosomes and exhibit characteristic cytological A E and genetical effects. Some steroids (e.g., cholic acid) are fat emulsifier found in the bile. This implies that in these particular tissues degradation and replacement of collagens is relatively fast. Experiments in which male and female amphibians larvae (e.g., toad, frog, salamander) have been surgically united to one another so that their circulation fused, gave rise to the concept of "cortico-medullary antagonism". 20.5. Four main types of eggs : A—Microlecithal and isolecithal egg of man; B—Mesolecithal and moderately telolecithal egg of frog; C—Macrolecithal egg of an insect, the fly. Organismal theory too fails to ascertain the position of viruses. The electrons of the beam are scattered by a specimen placed in the path of the beam. Roberts, 1969).
Role of coenzymes in mitochondria. Contents CHROMOSOMAL MUTATION-I Example. Describe their types, structure and cellular functions. (4) The smallest clearly defined unit of life is the cell. There are, probably, at least 30 to 40 different tRNA genes and tRNA molecules in E.coli. In concentrated solutions of β -mercaptoethanol and urea, the disulphide bridges of the enzyme are broken and the resultant unfolding of the polypeptide chain is accompanied by a loss of enzyme activity. after solubilization can recombine at the same position on the A microtubule. These are absent in bacterial cells. RNA polymerase moves to the moter slides into place, and forms site and is covalently linked to next DNA base. Table 7.1. Some important enzymes of the Golgi apparatus of animal cells (Source: Thorpe, 1984; Rastogi, 1988). The acentric chromosomes cannot attach to the mitotic spindle and remain in the cytoplasm. Thus, heterozygotes for paracentric inversions are highly sterile and produce only parent-like progeny. The rhodoplasts occur in the red algae. Such a signal peptide probably establishes the initial association of the ribosome with the membrane, but some protein factors are involved. Erythrocytes of person having- -hh genotype give no reaction with anti-A or anti-B sera (even though they possess IA or IB genes); in fact, they contain no antigen of this multiple allelic series. Escherichia coli. 7.6. Different steps of initiation of protein mRNA is base paired by the appropriate AA-tRNA synthesis in eukaryotes. They are insoluble in all neutral solvents and in dilute alkalis and acids, e.g., keratin and collagen. 11nm nucleosome H1 binds to specific region of nucleosome 1. 24 H2O) selectively stain the maturing or trans face of Golgi stack. A barrier can be pushed across the trough to compress the film. This system of sex determination occurs in certain insects (gypsy moth) and vertebrates such as fishes, reptiles and birds and plants such as Fragaris elatior. Paper chromatography (used for separation of amino acids, nucleotides, and other low molecular weight solutes). The cross of two doubly heterozygous "curl beakless" (Cu Bk/cu bk) plants yields four phenotypic classes in the offspring, of which 23.04 per cent are "normal beaked". Two methods by which DNA loops may form a metaphase chromosome. Assume an average-sized gene consisting of a linear sequence of 1000 bases and there were 1000 genes in a bacterial chromosome. Discuss the use and biological significance of each type of cell division. Black some and the other 50% have the paternal heterochromatic X chromohair is produced by the domisome. These virus-like, recombined DNA molecules now invade rapidly-dividing host cells, again one at a time. Contents 174 GENETICS, HUMAN GENETICS AND EUGENICS 1 6 2 7 3 8 9 4 10 5 11 12 13 14 15 16 17 18 19 20 21 22 X Y Karyotype of a child exhibiting cri-du-chat syndrome. Some portion of ER membranes remains continuous with the plasma membrane and the nuclear envelope. The nuclear envelope is broken at the point of A B C D contact and the nuclear contents of both pronuclei are intermingled. There is some in vitro evidence to indicate the BU immediately adjacent to an adenine in one of DNA strands causes the latter to pair with guanine. Leaf peroxisomes were first isolated from spinach leaf homogenate (i.e., from mesophyll cells) by Tolbert's group in Michigen in 1968. Further the hybrids which happen to receive a gene '+' from mother and Y chromosome from father produce red-eyed males. The resulting colonies were again S-III type. Initial steps leading to formation of replication forks at the each new RNA primer is recE.coli (after Alberts et at., 1989). Recently the study of mitochondrial and chloroplast biogenesis became of great interest because it was demonstrated that these organelles contains a number of phospholipid transport proteins that function to transfer phospholipid molecules from one cellular membrane to another (e.g., from ER membranes to plasma membranes) (see Sheeler and Bianchi, 1987). The most common carbohydrates of the chloroplasts are the starch and sugar phosphates. In the growth phase, the size of centriole the primary oocyte increases enormously. 15.1. Mode of formation of different kinds of polyploid. The way histone H1 is thought to help to pack adjacent nucleosomes together (after Alberts et al., 1989). However, sometimes irregularities occur in nuclear division or "accidents" (as from radiations) may befall interphase chromosomes so that cells or entire organisms with aberrant genomes may be formed. The cytochrome oxidase reaction is estimated to account for 90 per cent of the total oxygen uptake in most cells. Chemical formula of vitamin E (alphatocopherol). This is followed by a decarboxylation (loss of CO2) by isocitric dehydrogenase, producing 5 carbon α- ketoglutaric acid. At the cellular level, the growth of all multicellular organisms is governed by two main activities. and composed of two identical heavy (H) polypeptide chains and two smaller identical light (L) chains. Wild type. (ii) Why, nevertheless, the mutation process is considered to be the basis of evolutionary progress? (ii) The amino acid stem or helix consists of seven paired bases. Since the Primary extra chromosome may belong to any one of trisomic 2 2 2 4 4 different chromosomes of a haploid complement, the number of possible trisomics will be equal to the haploid chromosome number. Certain other examples of phenomenon of dominance in animals. At this stage each bivalent contains four chromatids, so it is known as tetrad. homozygous condition (HbSHbS) acts as a lethal gene, i.e., it causes the death of its bearer; the homozygotes dies of fatal anaemia before they attain sexual maturity. In case of Xenopus, each nucleolar organizer contains 450 rRNA genes. The aporepressor and the tryptophan molecule join together to form the active Trp repressor which binds to the operator. This leads to a decrease in auxin supply and a decrease in respiration. Some of the unique properties of water are the following : Contents CYTOPLASMIC MATRIX 75 1. But when some yeasts are grown on fatty acids, they develop large peroxisomes that break down fatty acids to acetyl-CoA (Veenbuis, et al., 1983). A-Male phase; B, C-Transitional phases; female phase continues D-Female phase. Among plants, chromosome number varies from 2n = 4 in Haplopappus gracilic (Compositae) to 2n = >1200 in some pteridophytes. What is dosage compensation? Genetics of Rh+ blood type. IFs in epithelia form a transcellular network that seems designed to resist external forces. When both white varieties of fowl are crossed, in F1 white coloured hybrids appear. Single chiasma. Females F of many Drosophila species can harbour a population of spirochaete male fertile bacteria known generally as SR. The term eugenics (Gr. eugenes = well born) was coined by an English scientist Francis Galton in 1885. Contents GROWTH 367 Woody perennial plants on the other hand show unlimited growth. A typical cell of a blue green alga is composed of outer cellular coverings and cytoplasm. poliomyelitis polyoma tobacco mosaic virus virus 2. More recent computerized image-processing techniques of Unwin and Mulligan (1982) have shown that the pore complex consists of two "rings" (R or annuli) at its periphery with an inside diameter of 80 nm, a large particle that forms a central plug (C) and radial 'spokes' (S) that extends from peri-nuclear space the plug to the rings (Fig. The X/A ratio bears no relation to "sex" but, through studies of plants with multiple sets of chromosomes, the X/Y ratio is found to be critical. For example, in the frog Xenopus laevis oocytes (which are very active in transcription) have 60 pores/µm 2 (and up to 30 million pore complexes per nucleus) (Scheer, 1973) Type A serum Table 10-2 Blood groups (phenotype) Type B serum Human blood groups. Thus, more than half the weight of glycoprotein is carbohydrate. Manifestation of Heterosis is manifestation of Heterosis is manifestation of Heterosis. Thus, more than half the weight of glycoprotein is carbohydrate. novo" origin. Table 5-2. In such back crosses, when F1 is back crossed to the parent with dominant characters (phenotype), no recessive individuals are obtained in the progeny. Chromatin Fibres The nucleoplasm contains many thread-like, coiled and much elongated structures which take readily the basic fuchsin. (I) Nuclease to the parent with dominant characters (phenotype), no recessive individuals are obtained in the progeny. enzymes. What was the genotype of the parental female ? Meiosis. In fact, the array of the rough endoplasmic reticulum provides extensive surface area for the association of metabolically active enzymes, amino acids and ribosomes. Rr rr F2 µ particle. Pulse-chase experiment. With the help of recombination studies at intragenic level (e.g., rII locus of T4 bacteriophage, lozenge and white eye loci in Drosophila) Micromaps have been prepared for different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical
maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as genetical maps of different genes in the same fashion as organization of the membrane). A cross between a culture with a wild type (c+) spreading form mycelial growth and one with a restricted form of growth, called colonial (c) has been shown in Fig. The events at each stage are described in the tex. The cross AA X aa is the reciprocal of the IAi IAi IBIB cross aa X AA. Which is usually the longest stage? Further, sialic acid confers a high negative charge to the cell surface of erythrocyte. In peroxisomes, the dehydrogenase reacts directly with O2 and in so doing generates H2O2. Genetic or molecular "fingerprinting" provides almost infallible proof of identity and is used as evidence in cases of missing persons, rape, murder and paternity suits. Band 3 protein (= anion exchange permease) catalyzes the exchange of the anions : Cl--and HCO3--- across the erythrocyte membrane (after Darnell et al., 1986). A 5 C A A 5 C 12 B In this case, because the distances between A-B are equitable, therefore, gene C must be in the middle. (ii) Dense fibrillar component. According to their nature these can be divided into normal, abnormal, and sex-linked characters. Chemically the secondary cell wall is composed of compactly arranged macrofibrils of the cellulose, in between which sometimes occurs lignin as a interfibrillar material. Bald, Normal vision Bald, Colour blind Daughters 1/8 3/8 3/8 Sons 3/8 3/8 1/8 1/8 Contents C H A P T E R 13 Determination of Sex and Sex Differentiation M The average human ejaculate contains 175 million X - bearing spermatozoa and 175 million X - bearing spermatozoa which determines the sex of the child. mediterranea has about 81 rays with rounded tips. Got Nobel Prize for the discovery of human blood groups and for studies of cellular agglutinins or antigens. When walking through the woods, across a field, along a stream, through the woods across a field along a stream across a field. simple dominant recessive relationship. In the previous section, we have discussed a lot about the inorganic substances except the water which will be discussed in the following paragraph. Glucose-oxidase 7. It is particularly abundant in liver cells and muscle cells of man and other vertebrates. For example, an eukaryotic gene of 10,000 nucleotide pairs will be associated with 50 nucleosomes and each human cell with 6 x 109 DNA nucleosomes. In a biosynthetic (anabolic) pathway, the final product usually regulates negatively its own synthesis; in the simplest type of negative regulation, absence of the product usually regulates negatively its own synthesis. decreases its synthesis. These in turn get converted into six molecules of glyceraldehyde-3phosphoglyceric acid (triose) by utilizing six NADPH molecules. Describe the 'Fluid mosaic model' of the plasma membrane. They contain a variety of hydrolytic enzymes that remain active under acidi conditions. If an individual is homozygous for any of these alleles such as sa sa, sc sc, etc., it develops into a diploid male (which is usually sterile). F.R. Lillie (1917) has suggested that the formation of a freemartin was due to a fusion of the formation of a freemartin was due to a fusion of the twin calves, while they were in uterus of the mother. The activity of these factors causes the termination of translation, the release of the polypeptide from the tRNA (this is specifically done by the peptidy) transferase enzyme which new serves as a hydrolase, see King, 1986), and dissociation of the 70S ribosome into its 30S and 50S subunits which leave the mRNA (This step is performed by IF3). factor). Although most of these lymphocytes die in the thymus (this gland too regresses in adult), others migrate to secondary lymphoid organs to become thymus-derived lymphocytes or T cells. Chemical Composition decorated actin + HMM Actin is the main structural protein of microfilaments. But he failed to provide convincing evidences in support of his concepts. The replication of chloroplast DNA has been followed with 3H-thymidine. It is the outermost layer of the cell and in the immature meristematic and parenchymatous cells it forms the only cell wall. The linear portion of time. Since these cells are involved directly in defense against infection, they are also called effector cells. But control over the use of ge1. Strasburger (1875) discovered thread-like structures which appeared during the mitochondrial clouds. The law of independent assortment is also applicable to these crosses. In fact, the peripheral area of dictyosome is fenestrated (lace-like) in structure. Nuclei of cells of silk worm have finger-like extensions that greatly increase their surface area (Fig. Digestion of intracellular substances. Break and exchange theory. 12.4. A model of the nuclear surface complex as 'hole' in the centre of the pore complex is an proposed by Schatten and Thoman (1978) (after Thorpe, 1984). They have the capacity to recognize specific base sequences on DNA and then to cut each strand at a given place. In the apical membrane of a parietal cell or oxyntic cell (which sercete HCl or H+ Cl---) are located ATP-dependent proton pumps. Ionization involves the loss of the hydrogen from the number one nitrogen of a base. herbaceum (2n = 26) and G. The application of genetic analysis to development of plant lines better suited for human purposes. During adsorption, long tail fibres of the phage are first to contact and attach to the cell. By crossing different stocks, Ac could be combined with Ds, creating the condition that led to chromosome breakage. At this high temperature the two DNA strands separate. Male is of the size of large Protozoa and has rudimentary organs. Displaced duplication. DNA in which the nitrogen atoms are heavy (15N) can be disting the condition that led to chromosome breakage. DNA containing light nitrogen (14N), because during isopycnic centrifugation, the two different DNAs band at different density positions in the centrifuge tube. Synthesis of mRNA by the lac operon of Escherichia coli increases with addition of the inducer. THEORIES ABOUT THE MECHANISM OF CROSSING OVER Following theories have been propounded to explain the mechanism of crossing over : 1. For E. Such mutations which formed during DNA replication are called copy error mutations. In cross-section, intermediate filaments have a tubular appearance. Copper Cu+, 4. strand starts here B (b) Unidirectional replication. 53 Mode of action of complementary alleles in the production of coloured flowers in sweet pea. Allele (Allelomorph). Vitamin B6 (Pyridoxin) 1.5-2 mg Liver, meat, fish 1. This chromatin body is called sex chromatin body is called sex chromatin or Barr body after the name of its discoverer. The signal hypothesis. The majority of Contents CELL BIOLOGY 250 proliferating cells have pore densities between 7 and 12 pores/µm2. Electrons have a very low penetrating power, that is, they are easily scattered by objects in their paths. Test of Allelism (Allelism and Pseudoalleles) If one wishes to find out whether two mutant alleles in question are allelic to each other or not, then from their crosses it is expected that F1 individuals (which have mutant phenotypes) should not give rise to the wild type in the F2 generation. Detoxification. The protein coat or capsid of the phage remains outside the cell. In barley, such a trisomic series is produced and extensively studied by T. (v) The base on the 3' side of anticodon is a purine. Decarboxylases, 8. Autocatalytic functions - The functions of DNA which directs the synthesis of DNA itself, are called autocatalytic functions. As colchicine interferes with spindle formation, its effects are limited to dividing and meristematic cells. 18.6. The mitotic spindle at metaphae. The F1 red-eyed female with F1 red-eyed male P1 having the gene '+'. If a leaf is grown in darkness, its proplastids enlarge and develop into etioplasts. Once the double stranded DNA is made single stranded by heating up to 90 - 98°C, the mixture with two primers (= deoxyoligonucleotides) recognizing the term glyoxisome for the glyoxylate cycle containing microbody of plant cells. Warburg linked the phenomenon of ATP formation to the oxidation of glyceraldehyde phosphate. Histidine also contains a N group. (iv) Cytochromes are proteins containing iron-porphyrin (haem) groups. Simultaneously, the transfer of protons from the outside to the inside of the thylakoid membrane occurs. SEX DETERMINATION In human beings, the presence of Y chromosome determines maleness and its absence determines femaleness. 11.2. Comparison of a mitochondrion and a chloroplast (after In a general way, one Alberts et al., 1989). marriage A family pedigree affected individuals chart conventionally has circles for female individuals chart conventional has circles for female has conventional has circles for female has conventional has conv providing enough contrast to form an image. The quantitative traits are also called metric traits. At the end of telophase, a barrel-shaped or disc-like region, called phragmoplast (Gr., phragma = hedge, enclosure; plasso = to form) forms in the plane of former spindle equator. spectrin α and biconcave shape of this memβ brane (Branton et al., 1981). 4.1. Physical appearance of protoplasm. Suggest a method of detection
of chromosome abnormalities at the foetal stage. The number of the cell, but it usually remains constant for a particular plant cell. a far longer lifetime than other RNA, mRNA). Of the 20 commonly occurring amino acids, 19 may be represented by the following general formula (Fig. The common example of their derivation from chloroplasts can be observed in the petals which are green initially but become coloured subsequently. In Neurospora meiotic products are linearly arranged in the form of ordered tetrad, because of which a distinction can be made between 'first division segregation' and 'second division' and 'sec FOURTEENTH E D I T I O N he revised edition of Cell Biology, Genetics Genetics, Molecular Biology, Evolution and Ecology comprises 84 chapters. The male sex has two homomorphic Z chromosomes and is homogametic producing single type of sperms, each carries a Z chromosome. Calculate ? OAA is converted into another intermediate of Krebs cycles, the malic acid (4C) or aspartic acid in some cases. In fact, Ca2+-containing membrane vesicles accumulate at spindle poles and release calcium ions to initiate anaphase (Hapler and coworkers, 1980, 1987). The lysase enzymes add or remove group to or from the chemical compounds containing the double bonds. Soon after a dense D E F granule known as the Fig. Monoaminodicarboxylic or acidic amino acids. 13.15. In the concluding step three duplex fragments A, B and C were joined (linked by ligase enzyme) to give complete gene in each of the following two ways : 1. In time, the purines and pyrimidines of DNA in new cells contained 15N (where 14N normally occurs) and, thus, the DNA molecules were denser. Improvement of environmental conditions. In the thymus, the precursor cells divide and differentiate into T lymphocytes. The mutation could be in genes for adenyl cyclase or in the gene for catabolic activator protein (CAP). Contents CYTOPLASMIC MATRIX Table 4-1. OCCURRENCE The Golgi apparatus occurs in all cells except the prokaryotic cells (viz., mycoplasmas, bacteria and blue green algae) and eukaryotic cells of bryophytes and pteridiophytes, cells of certain fungi, sperm cells of bryophytes and pteridiophytes, cells of mature sieve tubes of plants and mature sperm and red blood cells of certain fungi, sperm cells of bryophytes and pteridiophytes, cells of mature sieve tubes of plants and mature sperm and red blood cells of certain fungi, sperm cells of mature sieve tubes of plants and mature sperm cells of mature sperm and red blood cells of certain fungi, sperm cells of certain fungi, sperm cells of mature sperm and red blood cells of mature sperm and red blood cells of mature sperm cells of mature sperm cells of mature sperm cells of mature sperm and mature sperm cells of mature spectra s ingrain, peas, beans, volved in enpulses, nuts (groundergy-releasing nuts) potato, tomato, reactions; green vegetables, germinated seeds and milk 2. Bacterial conjugation is simplest form of sexual reproduction known. Free calcium ions (Ca++) may occur in cells or circulating blood. Inbreeding, Outbreeding and Hybrid Vigour 72-83 Inbreeding: method of inbreeding, genetic effect of inbreeding, inbreeding and mule production, manifestation of heterosis, evolutionary significance of inbreeding and hybrid vigour: cross breeding and hybrid vigour: cross outbreeding; revision questions and problems; answers to problems. In man if inbreeding continued over a number of generations it results in increasing homozygosity, but some what slowly. Here, growth rate is independent of cell mass but is related to a constant number of generations it results in increasing homozygosity, but some what slowly. throughout the growth cycle. Similar observations have been made with other proteins, that is, they are capable of spontaneously reestablishing their biologically active tertiary (or even quaternary, e.g., haemoglobin) structure after having undergone extensive molecular disorganization. Mitosis occurs continuously in the body or somatic cells. Examples 1. Table 7.2. Factor 1. The number of pores in the nuclear envelope or pore density seems to correlate with the transcriptional activity of the cell (Table 12-1). 24. EFGH; (c) ABCDCD. Contents GENETICS, HUMAN GENETICS AND EUGENICS 36 Morgan crossed a homozygous long-winged (wild type) Drosophila with a homozygous vestigial-winged (mutant) Drosophila. Plastids are of the following types: 1. Specific immune response function by recognizing particular chemical structures, known as antigens—on the surface Contents CYTOPLASMIC MATRIX antigen binding site NH2 ends VH CH1 CL CH2 VL disulphide bonds CH3 of invading cells. Spg As it matures the male Oc Oc phase is changed by tranA B C D sitional phase to a functional female phase. In the seed-producing plants, development is arrested at an early multicellular stage as a seed, which may remain stable for long time before germination, Microevolution, Macroevolution, Megaevolution, Punctuated Equilibria and Related Phenomena) 93-112 Adaptive radiation; microevolution, macroevolution, macroev evolution of horses, general principles of macroevolution, megaevolution, megaevolution and megaevolution, doctrine of punctuated equilibria, whether human evolution for many light activated genes involved in chloroplast development, not only in the chloroplast itself but also in the nucleus. Due to this, the OH groups of sugar molecules stick outwards from the chain in all directions which can form hydrogen bonds with OH groups of neighbouring cellulose chains, thereby establishing a kind of three-dimensional lattice. Eyes 7. How was Neurospora found suitable for the study of crossing over and recombination. Histones are involved in the tight packing of DNA molecules during the condensation of chromatin into chromosomes for the mitosis. The amount and types of proteins in the membranes are highly variable : in the membranes which serve mainly to insulate nerve cell axons, less than 25 per cent of the membrane mass is protein, whereas, in the membranes involved in energy transduction (such as internal membranes of mitochondria and chloroplasts), approximately 75 per cent is protein. The DNA is then denatured into single strands by exposing the gel to NaOH. IS2 appears to have a chain termination codon. Because the highly endowed persons lead a well-planned life and to avoid unnecessary difficulties in nursing the children. Albinism in humans. Plasma membrane is a ultrathin, elastic, living, dynamic and selective transport-barrier. B1 B2 The haemoglobin is a conjugated globular protein, that is, it contains some non-protein part. Transposons (Tn) or Complex Transposons (Tn) or Complex Transposons The wrinkled trait in garden pea is caused by the insertion of transposable element into the structure. Heterogametic Males In this type of sex chromoHaploid male-Diploid female type somal determination of sex, the Honeybee female sex has two X chromosomes, while the male sex has only one X chromosomes, while the male sex has only one X chromosomes, while the male sex has only one X chromosome. In this way, ATP acts as a carrier molecule like the acetyl CoA and as coenzyme like the acetyl CoA and as coenzyme like the CoA or NAD. A similar phenomenon occurs during normal amphibian development. Wolff believed that these tissues and organs developed de novo due to mysterious vital forces. The to and fro movement of the solute on its either sides. Mating between relatives more frequently than would be expected by chance. Both have been compared in Table 4-8. Table 1-4. In the double crossing over following two types of chiasma may be formed : (i) Reciprocal chiasma. Aromatic amino acids. But in other plant cells β-oxidation occurs in glyoxysomes and mitochondria. The energy for the production of ATP or other energy rich molecules is produced during the breakdown of food molecules including carbohydrates, fats and proteins (catabolic and exergonic activities). The receptor proteins with bound ribosome and probably translation which requires that mRNA and ribosome move with respect to each other. The synthetic messengers contained the bases at random (called random copolymers). Many membranes contain cholesterol. RNA polymerase I molecules are found to remain bound to the nucleolar organisers during mitotic metaphase (Scheer and Rose, 1984). The phenotypes and genotypes of multiple allelic series for coat colour in rabbit. The gene, thus, can be considered as the unit of inheritance that is transmitted in a gamete and determines or controls the development of a character by interaction with the other genes, the cytoplasm and the environment. These infoldings contain many mitochondria. Contents TECHNIQUES IN CELL BIOLOGY 17 aided human eye under optimal conditions in green light (to which it is most sensitive) cannot distinguish between points less than about 0.1 mm or 100 µm apart. For instance, a monoploid in maize (2n = 20) will have 10 chromosomes and the number of chromosomes in a gamete can range from 0-10. There is little specificity to the process. They store the food materials as carbohydrates, lipids and proteins and accordingly are of following types : (i) Amyloplasts. Different combination of X chromosomes and autosomes and autosomes and accordingly are of following individuals : (a) AAX ; (b) AAXX; (d) AXX; (d) AXX (e) AAXXX; (f) AAAXXX; (g) AAY. More recently, D.A. Comings and T.A. Okada (1971), have shown electron microscopically that synapsis occurs at two levels one at chromosomal level and the other at the molecular level. They are primarily found in all cells and serve as a scaffold for the ordered interaction of the numerous molecules involved in protein synthesis. Such studies demonstrated that DNA was a helical structure with a diameter of 20 A^o and a pitch (one round) of about 34 A^o. G banding has become important tool in the analysis of mammalian, avian, reptilian and amphibian chromosomes; distinct G bands
have not been found in plant chromosomes. Lipoproteins include some of the blood plasma proteins, various DNA Histone proteins, lipovitellin of egg Nucleosome yolk and proteins of brain and nerve tissue. 3.4. Chemical energy. LAW OF INDEPENDENT ASSORTMENT To formulate the law of dominance and law of segregation Mendel considered monohybrid crosses in which single pairs of contrasting characters were considered at a time. It can be achieved with 16S RNA from yeast or the 23S RNA from E. I A 8 II c 10 III A b 10 c b 22 30 d e 2 d We can superimpose each of these segments by aligning the genes shared in common. Bacteria vary in their shapes. When cleavage ends, the contractile ring is finally dispensed with altogether and the plasma membrane of the cleavage furrow narrows to form the midbody, which remains as a tether (Tether means a rope for confining a beast within Cytokinesis in an animal egg. plasmid passes through the sex pilus of donor cell to the recipient. The regular crystal lattice of two prolamellar bodies surrounded by young thylakoid membranes is observed by Osumi et al., (1984). This trait show strictly maternal inheritance. The regular crystal lattice of two prolamellar bodies surrounded by young thylakoid membranes is observed by Osumi et al., (1984). will be proportional to the concentration gradient across the membrane. Development of DNA-specific staining techniques by Feulgen and Rossenbeck in 1924 enabled Feulgen to demonstrate in 1937 that most of the DNA content of cal polypeptide chains. The pentose sugar, ribose is the important constituent molecule of the ribonucleic acid (RNA) and certain coenzymes as nicotinamide adenine dinucleotide (NAD), NAD phosphate (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), adenosine triphosphate (ATP) and coenzymes as nicotinamide adenine dinucleotide (NAD), additional additionadditionadditionadditionadditionadditionad additionadditio loop in a wide arc and course back into the cytoplasm. Centromeres are found to contain specific DNA sequences with special proteins bound to them, forming a disc-shaped structure, called kinetochore (a term that is much preferred by the cytoplasm). This membrane contains proteins with three types of functions: 1. Enzymes of glyoxysomes are used to transform the fat stores of the seed into carbohydrates by way of glyoxylate cycle. observed between the cells of the root cap and the : 1. The cell cycle involves the following three cycles (see Albert et al., 1989). (Saccharomyces cervisae) by the help of plasmid of E.coli. α2 rpo A 41,000 each Core enzyme 2. True leucoplasts occur in fully differentiated cells such as epidermal and internal plant tissues. A dividing fibroblast. The concentration of anti-Rh antibodies is gradually built up

in the mother and Contents 122 GENETICS, HUMAN GENETICS she, thus, becomes sensitized only at or just before birth of her first Rh-positive child. For a time, Spain had a monopoly on the valuable merino sheep. Gene therapy can be performed at two different levels : (i) Patient therapy. These vacuoles contain water, phenol flavonols, anthocyanins (blue and red pigment), alkaloids and storage products, such as sugars and proteins. A sequence observed to occur with very little variation in many different organisms. Presence of an extra Y chromosome in males (XYY) results in their unusual height, mental retardation, severe facial acne during adolescence and criminal bent of mind. (a) Determine the genotypes of the parents. For the required cross-pollination, the anthers have to be removed from the flower in bud stage (i.e., before their maturity). Previously it was believed that a diaphragm made of amorphous to fibrillar material extends across each pore limiting free transfer of material. Name of the plant 1. Witschi). 11.8. Model for chemiosmotic coupling. The axoneme is connected with the basal body which is an intracellular granule lying in the cell cortex and which originates from the centriles. The fertilization ensures the usual specific diploidy of the organisms by the fusion of the male and female pronuclei. The mitochondria were first observed by Kolliker in 1850 as granular structures in the striated muscles. A variety of other cytoplasmic inclusions, such as vacuoles and granular structures in the striated muscles. nucleoplasm) is a colloidal solution, because the main molecular components of protoplasm— proteins—show all characteristics of the colloidal state. The gangliosides occur in the grey matter of the brain, membrane of erythrocytes and cells of the spleen. Britten and Davidson proposed the gene-battery model for Contents 6 MOLECULAR BIOLOGY regulation of protein synthesis in eukaryotes. The plant cells besides containing starch and the cellulose contain other polysaccharides such as xylan, alginic acids, inulin, agar-agar and hemicellulose. This enzyme resembles DNA polymerase-I in its activity, but is a DNA repair enzyme. In certain organisms, the mitosis is involved in asexual reproduction. Xp Xm condensation of a randomly selected X chromosome condensation only Xm active in this clone only Xp active in this clone Fig. They are called spinae and are known to help the bacterial cells to tolerate some environmental conditions such as salinity, pH, temperature, etc. Carbohydrates (L., carbo=carbon or coal, Gr., hydro=water) are the compounds of the carbohydrates (L., carbo=carbon or coal, Gr., hydro=water) are the compounds of the carbohydrates (L., carbo=carbon or coal, Gr., hydro=water) are the compounds of the carbohydrates (L., carbo=carbon or coal, Gr., hydro=water) are the compounds of the carbohydrates (L., carbo=carbon or coal, Gr., hydro=water) are the compounds of the carbohydrates (L., carbo=carbon or coal, Gr., hydro=water) are the carbohydrates (L., carbo=carbon or coal, Gr., hydro=water) are the compounds of the carbohydrates (L., carbo=carbohydrates) are the carbohydrates (L., carbo=carbohydrates) are the compounds of the carbohydrates (L., carbo=carbohydrates) are the compounds of the carbohydrates (L., carbo=carbohydrates) are the carbohydrates (L., carbo=carbohydrates) are the compounds of the carbohydrates (L., carbo=carbohydrates) are the c both glycoproteins and gangliosides. In simple terms, Benzer demonstrated that the linear array of genes on chromosomes as shown by Morgan, was exFrancis Crick and James Watson. Carbohydrate content of glycoproteins (Source : Sheeler and Bianchi, 1987). Authors will feel highly obliged if suggestions for the improvement of the book are brought to their notice, so that future edition of the book may become more useful. C Himalayan Genotype = chch,chc. (b) By restitution. Invaginations or infoldings of the plasma membrane. Certain important enzymestation and contain many invaginations or infoldings of the plasma membrane. of this membrane are monoamine oxidase, rotenone-insensitive NADH-cytochrome-C-reductase, kynurenine hydroxyalase, and fatty acid CoA ligase. Centrioles are cylinders that measure 0.2 µm × 0.5 µm. Like the yeast, in other eukaryotes such as Zea mays, Drosophila, mice and snapdragons (Antirrhinum majus) transposable elements of one or other type are found. (6) The affinity of the tissue for dyes (stains) is increased. For the synthesis of lagging strand, the DNA poll III He has to work on the same strand to which DNA B helicase is bound, but it travels in opposite direction. Deposits of calcium compounds are found in the cell wall of cruciferous and cucurbitaceous plants. Rapid rotation of the particles form a gelatinous pellet at the bottom of the rotor generates immense centrifugal forces, which cause particles in tube leaving smaller particles in tube leaving smaller particles in tube leaving smaller particles in the supernatant solusample to sediment. He Gregor Mendel (1822-1884). The eggs with very little amount of yolk are known as the microlecithal eggs, e.g., Amphioxus, eutherian mammals Cellulose Hemicellulose 3. T.H. Painter was the first geneticist who used polytene chromosomes of Drosophila in the cytological verification of genetic data. Now it is possible to distinguish pku homozygotes from normal individuals by testing the urine of all newborn babies with ferric chloride. There are several extraordinary properties of water that make it especially fit for its essential role in the protoplasmic systems (i.e., cytosol or matrix). What types of vesicles arise from Golgi membranes ? de Duve, in 1955, renamed these organelles was lysed (See Reid and Leech, 1980). For example, a salt crystal can "seed" a salt solution so that new salt crystals are formed, but this is the extent of its influence over its surroundings. P1 :: 1 Chinchilla Fig. For example, 5-bromouracil (5BU) or its nucleoside 5-bromouracil (5BU) or its nucleoside 5-bromodeoxyuridine (5-BUdR) in its usual (keto) form is a structural analogue of thymine (5-methyl uracil) and it will dihybrid cross has incompletely dominant alleles at both gene loci, then in F2 large number of phenotypic classes are produced. Natural Parthenogenesis in Vertebrates. A cross is made between a homozygous gold-coloured male and a silver-coloured female. 8.9 B), it results in a c+ chromatid and a c chromatid being attached to the same centromere. (f) Complementary sex factors. Development of Plastids, which are relatively small organelles present in meristematic cells. The chromatid being attached to the same centromere. type of the centromere. R factors are also plasmids which carry genes for the resistance to one or more drugs such as chloramphenicol, neomycin, sulphonamides and tetracyclines. 15.9. Artificial synthesis of a octoploid triticale. More recently, polymerase chain reaction (PCR) which involves a thermostable DNA polymerase enzyme (e.g., Taq polymerase) has also been used to obtain millions of copies of DNA segments (or genes) of choice. Suppose that there are four different haploid sets of chromosomes A, B1, B2 and C, in which B1 and B2 genomes are related. Red and green colour blindness, a recessive trait known to be X-linked. Describe the general properties of the genetic code. The complimentary chiasma occurs when three or four chromatids of the tetrad Fig. (b) RNA is of three types in eukaryotes and bacteria. This was followed by E.B. Lewis' (1952) demonstration that the white eye locus of Drosophila can be divided into many functional subunits. Each step being mediated by a specific enzyme. Contents 214 GENETICS, HUMAN GENETICS AND EUGENICS Besids the ClB method there are many more methods such as Muller-5 method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached X- method (for the detection of sex-linked visible mutations); attached visible mutatio method and Singleton's method (for the detection of specific loci in plants). The oligomers and polymers contain large-sized molecules form a fern DNA RNA Proteins like structure around a backbone of DNA inverse transcription molecule which is undergoing transcripIn fact, the step of translation of this central dogma is the tion. In these animals the E F G H centriles form
the accelerated (20 minutes) by supplementing the medium with various amino acids, purine, and pyrimidine bases. dictyosome As a growing secretory polypeptide emerges from ribosome, it passes pinosome through the RER membrane and gets accumuplastid granular lated in the lumen of endoplasmic RER. 4.2. Sol and gel state of the cytosol. G AATTC C TTAA G G C TTAA AATTC G Contents 114 MOLECULAR BIOLOGY In this example, we have used the palindrome sequence recognized by one of the most popular restriction enzymes, called Eco RI from E.coli (bacterium). It consists of six subunits (i.e., polypeptide chains)—two α) subunits and one identical alpha (α β), beta dash chain of each of beta (β P P - P β'), omega (ω ω) and sigma (σ) sub(β 5' DNA RNA strand units (Fig. The superiority of the hybrid over the best parent is called heterosis, a term coined by Shull (1914) for describing hybrid vigour. In the lower organized planaria cut posterior part isms, sometimes the entire mature organized planaria cut posterior part is called heterosis, a term coined by Shull (1914) for describing hybrid vigour. fusion of posterior region such mature invividuals is known as the regenerated hologamy. Such sickle-shaped red blood cells show a lower life span, since they clump together and often causes vascular obstruction and are rapidly destroyed. Chromoplasts contain pigment molecules and are coloured organelles. It is believed that nucleolar material and matrix disA appears, the nucleolar material and matrix disA appears, the nucleolar material and matrix are intertelomere changeable, i.e., when chromosomal matrix disA appears, the nucleolar material and matrix disA appears. control and the enzymes used (i.e., polymerases) are (after Thorpe, imported from the cytosol. mixture of compounds cathode ELECTROPHORESIS anode Molecules or macromolecules may be sepasupporting film of paper, rated in an electric-field if salt salt agar or starch solution they are charged to differsolution ent extents. Viral control of mutation rate. These are tiny circular membrane-bound organelles containing a crystal-core of enzymes (such as urate oxidase, peroxidase, peroxidase, peroxidase, peroxidase, peroxidase, no citation oxidase and catalase, e.g., liver cells and kidney cells). For example, in E.coli, the precursor for the amino acid tyrosine (pre tRNAtyr) consists of 128 bases; in processing to tRNA tyr 41 nucleotides are removed from the 5' end and two are removed from the 3' end (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch allele for Himalayan coat is recessive to c+ (agouti) and cch (chinchilla) but dominates over albino (Fig. R banding. Likewise, ch mRNA produces a preprotein of larger molecular weight than the final protein. All females must be heterozygotes such as sa sb, sa sc, sd sf, etc. (a) 1 million , (b) 3.4 mm. Pachytene or Pachynema. Ecological Succession; trends of succession; trends of succession; trends of succession for the final protein and the final protein nudation, invasion, competition and coaction, reaction, stabilization (climax); some examples of succession in xeric habitat; concept of climax theory, certain recent models of succession, resource-ratio hypothesis, information theory, certain recent models of succession; community evolution; revision questions. Skin becomes dry and scaly and so does cornea of eyes causing xerophthalmia or 'dry eye'; 2. 4% secondary exceptional progeny phenotypes Contents 148 GENETICS, HUMAN GENETICS, HUMAN GENETICS and O sperms. Elongation. Genetic engineering. freemartin which occurs in cows, sheep, pigs and goats, a female foetus that is twin to a male and shares a conjoined placental circulation undergoes a partial sex reversal of her ovaries, which interferes with the subsequent sexual differentiation of the reproductive tract. Linkers at intervals along their entire length. This gene was synthesized in 1970. coli, evidences for semiconservative replication, enzymes of DNA metabolism, roles of RNA primers in DNA replication, replication, proteins involved in opening of DNA helix, replisomes and primosomes; mechanism of DNA replication in prokaryotes; DNA replication in eukaryotes, model's of DNA replication in eukaryotes, model's as long as 30 µm in some plants such as Trillium. In Drosophila, a transformer gene (tra) has been recognized which when present in homozygous condition (tra/tra) transforms a female fly into a sterile male, but, it does not act upon normal male individuals. Filial generations. When homozylost gous waltzing mice (vv) are A B C B C mated with normal mice carrying the dominant allele (VV), all the affecting (Vv) a b c a b c are normal. There exists a controversy that whether centrioles and basal bodies have DNA and RNA. PROKARYOTIC CELLS The prokaryotic (Gr., pro = primitive or before; karyon = nucleus) are small, simple and most primitive. Cathepsin A,B,C,D and E 2. Homopolysaccharides. Which of the following human phenotypes would appear to be based on polygene inheritance : intelligence, absence of incisors, height, phenylketonuria, ability to taste phenylthiocarbamide, skin colour, cryptophthalmos (i.e., failure of eyelids to separate in embryonic development), eye colour ? Comparison of DNA and RNA. Examples of Pleiotropism 1. At both ends the C tubule often terminates before the A and B tubules. Bacteria inhabiting mouth - These bacteria they can cause tooth decay unless animals and with few exceptions, most bacteria they are removed by their chief antagonist, a toothare pathogenic. The hydrogen bonds between purines and pyrimidines are such that adenine can bond only to cytosine by three hydrogen bonds, and guanine ° 20 A can bond only to cytosine by three hydrogen bonds are such that adenine can bond only to cytosine by three hydrogen bonds are such that adenine can bond only to cytosine by three hydrogen bonds are such that adenine can bond only to cytosine by three hydrogen bonds are such that adenine can bond only to cytosine by three hydrogen bonds are such that adenine can bond only to cytosine by the cytosine expressed in almost all mammalian cells, but one Fig. The hybrid from the reciprocal cross (i.e., a female donkey or jenny and a male horse or stallion) is called henny. Such a type Fig. Lastly, nuclear pores are not the only avenues for nucleocytoplasmic exchanges (Fig. A nuclear envelope reassembles around each group of chromosomes to form two daughter nuclei. TMV is a rod-shaped, helically symmetrical RNA virus (Fig. coining the term cell (L., Cella = hollow space) in 1665. 17.4A), i.e., successive waves move toward the tip of the flagellum, propelling the cell (e.g., sperm) in the opposite direction. Whenever, there occurs an intragenic crossing over at the bar locus, it is accompanied by a separating of the flanking markers. The conjugation is the temporary union of the two individuals of the same species. Certain XYlinked genes of man are of total colour blindness, two skin P1 diseases (Xeroderma pigmentosum and Epipermolysis bullosa), Retinitis pigmentosum and Epipermolysis bullosa). progressive development of Golgi bodies in these zones of exclusion; and the development of Golgi apparatuses coincides with the disappearance of the aggregation of vesicles (see Sheeler and Bianchi, 1987). If a normal-tailed female is mated to a bent-tailed femal for synthesis of 1.2 mg (girls) (e.g., unpolished rice); acetylcholine; pulses; oil-seeds, soyabean; nuts (espe- 2. (a) What types of mutation would this be ? Thus, the cells of an elephant are not necessarily larger than those of other tiny animals or plants. Each bead was thought of to control one character by controlling some biochemical step. (ii) Flavin-linked dehydrogenases (often called flavoproteins or FPs) require either FAD or FMN. The chromosome segments then unite to form new combinations. Chemical composition of nucleolus. The DNA sequencing using PCR involves two main steps : 1. 4.3. Results of the Meselson-Stahl experiments (right) and their interpretation (left) (after Sheeler and Bianchi, 1987). In this type of growth, the volume of the body increases due to the growth of body cells without any
increase in the number of cells. (a) Autopolyploids. In 5S RNA genes box A and box C are found at +59 to +69 and +80 to +90 sequences, respectively. It performs following important functions: A. ATP in initiation site binds to T on coding strand. Strasburger in 1875 discovered the chromosomes and he along with Kolliker and Weismann formulated the nuclear theory of heredity. Nucleus contains in its nucleoplasm a conspicuous, darkly stained, circular suborganelle, called nucleolus. Contents PROTEIN SYNTHESIS 79 Mussels, busily demonstrating the importance of proteins for survival. Spiegelman in 1966 reconstruncted purified RNA from two different mutant virus strains of the RNA Phage QB which had quite distinct base compositions. This artificially synthesized hexaploid wheat was P1 Triticum dicoccoides (Tetraploid emmer wheat) AA BB (2n = 28; 14 bivalents) F1 : X \downarrow ABD Triploid hybrid Aegilops squarrosa (Diploid goat grass) DD (2n = 14; 7 bivalents). outer chamber In general, the cristae of plant mitochonmatrix dria are tubular, while those of animal mitochondria are lamellar or plate-like (Hall, FlowDNA molecule ers and Roberts, 1974), but, in many Protozoa F1 particle and in steroid synthesizing tissues including the adrenal cortex and corpus luteum, they cristae occur as regularly packed tubules (Tyler, 1973). (ii) Another enzyme, possibly and corpus luteum exonuclease widens the gap produced by the action of the endonuclease. But he tried to find out how different characters, this type of individual in known Genotype as gynandromorph. melogaster, has only 4 polytene chromosomes. What is a fermentation, and why is it needed by some cells ? It is a type of diffusion in which an ion or molecule crossing a membrane moves down its electrochemical or concentration gradient. In snapdragons (Antirrhinum majus) three types of plants occur : 1. Give an example. coded system (e.g., T1, T2, P1 phages). Further the endoplasmic reticulum provides increased surface for various enzymatic reactions. The rDNA in the amphibian oocyte undergoes this process to accumulate in the egg the huge number of ribosomes (1012) that are used in the first stages of development. 15.13). thus, resembles a sieve that is permeable to all molecules of 10,000 daltons or less, including small proteins. The Transformation. Due to this d d b observation, inversions are called crossc c b a bd e over-suppressors. For example, D.W.OW et al., (1986) produced a transgenic tobacco plant harbouring the luciferase genomic DNA plasmid gene of the firefly (see Gardner et al., 1991). At each stage, the released energy is used to form ATP. Contents MOLECULAR BIOLOGY 64 7. subunits (oxysomes) Attached to M face of inner mitochondrial membrane are repeated units mitoribosomes of stalked particles, called elementary cytosol or C particles, inner membrane subunits or face of cristae oxysomes (Fig.10.5). When a drop of type O blood is added A to each drop there is no agglutination or clumping of red blood cells in either drop takes place. These are water soluble proteins which are rich in basic amino acids such as arginine and lysine. Light Microscopy Bouin's solution; formalin; Zenker's fluid. coil. The monosaccharides are the simple sugars with the empirical formula Cn (H2O)n. The pattern for mRNA is not known since different species of mRNA are synthesized at different species of mRNA is not known since different species of mRNA are synthesized at different species of mRNA are s DNA. Crossing over or recombination occurs at two levels (i) at gross chromosomal level, called chromosomal crossing over and (ii) at DNA level, called chromosomal level, called genetic recombination. Little is known about the function of the core, except that it is the site of the enzyme urate oxidase in rat liver peroxisomes and much of the catalase in some plants (see Hall et al., 1974). Babies with this defect are unable to properly metabolize an amino acid, phenylalanine, the resulting chemical imbalance causes severe mental retardation. Protoplasm Theory Up to middle of the 19th century, greater emphasis was given to the cell wall and less to the cellular content. Each genera of non-genetic RNA has DNA-dependent replication of itself, that is, it is not self-replicating like DNA and is transcribed by DNA. Autophagosomes 179 digestive vacuole primary lysosome 'specific' granules alkaline phosphatases proteases peroxidase bacteria lysosome ('azurophilic') granules alkaline phosphatases proteases peroxidase bacteria lysosome ('azurophilic') granules alkaline phosphatases peroxidase bacteria lysosome ('azurophilic') granules alkaline phosphatases peroxidase bacteria lysosome ('azurophilic') granules alkaline phosphatases peroxidases peroxidases peroxidase bacteria lysosome ('azurophilic') granules alkaline phosphatases peroxidases peroxidases peroxidase bacteria lysosome ('azurophilic') granules alkaline phosphatases peroxidases the hollow of the small subunit and vaulted seat of the large subunit. This phenomenon of cells or nuclear constancy is called eutely. Acquired characters are usually not heritable. When the animal reproduces into new individual, these gemmules pass on to it and it has blending of both parents. Consequently, it may appear that cell is Contents INTRODUCTION 7 no longer a basic unit of life, because life may exist without cells also. These plasmids contain DNA sequences coding for drug resistance, sex factor (F factor) etc., and probably has arisen from chromosomal DNA. Microvilli and terminal web (after Darnell, et.al., 1986). Haploid greatest, polyploid least. The cytosol consists of water proteins (including multifunctional enzymes), lipids, carbohydrates, different types of RNA molecules, and various smaller molecules. (b) Describe the genetic effects of outbreeding and their relation to the viability of offspring. The plasmid can reproduce itself inside the bacterium independently of the main bacterial DNA. Regulation at the level of DNA; 2. REVISION QUESTIONS AND ANSWERS 1. Euplotes (a freshwater ciliate) is 120 µm fat cell in length. mRNA tRNA of several kinds Enzymes (a) Amino-acid activating system (e.g., aminoacyl-tRNA-synthetase). coli has both oxygen-requiring (anaerobic) respiratory machinery for the breakdown of sugar and contains a special group of proteins called the electron transport chain for the generation of stored energy in the form of ATP molecules. Thus, Chargaff reported that the DNA extracted from calfthymus nuclei contains the four bases in the following molar proportions: 28% adenine, 24% guanine, 20% cytosine and 28% thymine. (2) With the mediation of RNA polymerase and on the standard base-pairing principles, the viral RNA serves as a template in the synthesis of a complementary RNA chain, and thus a double stranded structure is produced. What differences exist in structure is produced structure is produced. closely associated and tend to transmit together. Polymorphism of DNA Helix (Or Alternative Forms of DNA double helix in 1953, DNA was thought to have the same monotonous structure, with exactly 36° of helical twist between its adjacent base pairs (10 nucleotide pairs per helical turn) and a uniform helix geometry. Contents REPRODUCTION 343 protozoans and various metazoans. Extension of a cellulose microfibril is presumably achieved by lateral movement of the enzyme complex in the fluid phase of plasma membrane, with the microfibril is presumably achieved by lateral movement of the membrane behind the moving enzyme complex (Fig. The pore appears to function like a close fitting diaphragm that opens to just the right extent when activated by a signal on an appropriate large protein (having a diameter up to 20 nm). Seed form : Round × Wrinkled or Rugosus R, r ; W, w R, r 7 Round 5474 Round 1850 Wrinkled or Rugosus 2.96 : 1 2. But since tRNA molecules are fairly small in size (about 80 nucleotides), a gene responsible for giving rise to a tRNA molecule was found to be within the reach of synthesis. Polydactyly (both hands and feet) is almost always present; the hands and feet are deformed. Define the following : electron transport; respiratory chain; oxidative phosphorylation; cytochrome oxidase. The following statement of Vincent Allfrey (1968) completely qualifies the central position of the nucleus, central and commanding, is essential for the biosynthetic events that characterize cell type and cell fraction; it is a vault of genetic information encoding the past history and future prospects of the cell, an organelle submerged and deceptively serene in its sea of turbulent cytoplasm, a firm and purposeful guide, a barometer exquisitely sensitive to the changing demands of the organism and its environment. (a) and (e) are true. crossing over is found to be performed by a large protein assembly of 90 nm diameter, called recombination nodule, which is placed on the synaptonemal complex (Carpenter, 1977, 1987). In addition, by the production of specific antibodies against these proteins, it has been possible to examine under the light and the electron microscopes the disposition of the microtubules and microfilaments. Leucocytes, especially granulocytes are a particularly rich source of lysosomes. This area (nucleoid) is not bound by the nuclear membrane and it does not contain a nucleolus. A heterozygous individual. (b) Reciprocal of cross (a) (c). An unlimited supply of amplified DNA is obtained by repeating the reaction, which is made possible by regular denaturation of freshly synthesized double stranded DNA molecules by heating it to 90° - 98°C. This may be achieved by isopycnic density gradient centrifugation of the chloroplast preparation. The number or set of the chloroplast preparation of the chloroplast preparation. kinds of sperms : half with X chromosome and half with Y chromosome. Genetic engineering is the 'hot cake' of todays' high-tech world; it has been applied for the production of valuable
polypeptides, insulin, interferon, growth hormones and of course in the transfer of Nif (=nitrogen fixing) genes and control of genetic diseases (e.g., cancer). plicated DNA molecules along with certain chromosomal proteins. Meselson and F.W. Stahl (1958) verified the semiconservative nature of DNA replication in a series of elegant experiments using isotopically labelled DNA and a form of isopycnic density gradient centrifugation. Thus, a virus may be defined as an infectious, subcellular and ultramicroscopic particle representing an obligate cellular parasite and a potential pathogen whose reproduction (replication) in the host cells. Trisomy-22 has been reported in chimpanzees (McClure et al., 1969); this shows Down syndrome-like phenotypic features. For each of these genes different technique was used. 14.15). In fact, more than 2000 types of enzymes have been identified in the living organisms. Thus, a ring of nine complete microtubules (i.e., A tubules) is formed. Contents 264 CELL BIOLOGY 1. Currently, it is believed that transport proteins form the channels through the membrane that permit certain ions or molecules to pass across the latter (see Darnell et al., 1986). A cross of two creeper birds yields viable offsprings in the ratio of 2 creepers : 1 normal. A good example of translational control is the extension of the lifetime of silk fibroin mRNA in the silkworm Bombyx mori. Beerman and Bahr (1954) have studied the fine structure of these puffs. Abortive pollen is reduced in size (Fig. f B fu – f+ Fig. The free ions of phosphate (primary, H2PO4—and secondary, HPO4—) occur in the matrix and blood. DNA polymerase-II. Microbial genetics. Bloch and F.Lynem Kato and Takeuchi De Duve 1964 1965 Harris and Watkins 1967 1971 1972 R.W.Breidenbach and H.Beevers E.A. Sutherland 1978 1981 S.J. Singer and G.L. Nicolson A.Claude, C.de Duve and G. The code is non-overlapping. 19.5. A schematic representation of sexual reproduction. In animals the term transfection is used in place of transformation. (v) Colinearity of nucleic acid and the primary protein synthesized. If larvae of these insects are treated with ecdysone at stages of development prior to or between moultings, patterns of chromosome puffing occur that are identical to those occurring during natural moultings. The most convenient measurement of DNA is picogram (10-12 gm). In human beings, a dominant X- linked gene is necessary for the formation of the colour sensitive cells, the cones, in the retina of eye EFH; (B) ADCB. 155 Coccinia indica, the female possesses two homomorphic X chromosomes in their body cells (hence, referred to as XX) and they being homogametic, produce one kind of eggs, each with one X chromosome. The males of these organisms possess one X chromosome and one Y chromosome (hence, referred to as XX). Describe the functions of specific structures of plant cells only. use of Gomori/staining technique (Gomori, 1952). 3.16). After the glucose is transported into the erythrocyte, it is rapidly phosphorylated (by hexokinase enzyme and ATP) to form glucose-6-phosphate. Ph : 8460026 z S.C.O. 6, 7 & 8, Sector 9D, Chandigarh-160017, Ph-749376, 749377 z 1st Floor, Bhartia Tower, Badambadi, Cuttack-753 009, Ph-2332580; 2332581 z 1st Floor, 52-A, Rajpur Road, Dehradun-248 011. If it is weakened or injured, the cell loses its ability to maintain gradients, to carry out the selective transport of nutrients, and to contain the pool of enzymes and organelles essential for the homeostasis. (iv) Hexoses contain six carbon atoms in their molecules, e.g., glucose, mannose, fructose and galactose. Molecules of some polysaccharides are unbranched (i.e., linear) chains whose structure may be ribbon-like or helical (usually a left-handed spiral). the nick is then resealed. In cells they regulate various metabolic activities. Substance Chemical unit 1. However, a purine such as adenine can in its rare state forms a bond with cytosine (besides thymine), provided the cytosine is in its normal state. Forms the coenzyme FAD which is involved in metabolism of carbohydrates and proteins. Karl Landsteiner (1868-1943). The dinucleotide remains RNA polymerase DNA A T GA C A A C T GA C A A T CT GACA RNA polymerase binds to pro- II. Apparently, in intact structure this sliding movement is converted to Fig. Because, all the genes of a chromosome have their identical genes (alleomorphs) on the homologous chromosome, therefore linkage groups of a homologous pair of chromosome is considered as one. Euploidy. In this paper, Mendel proposed some basic genetic principles. 22.1). Mode of action of recessive epistasis in alleles for coat colour in mice. It possesses a histone to DNA ratio of 0.1 : 1. Permanent hybridity is maintained in some species of Oenothera due to operation of balanced lethal system which may function due to gametic and zygotic lethality. For example, three hexose sugars—glucose, fructose, and galactose, contain the same number of carbon, hydrogen atoms (i.e., C6H12O6), but they are different sugars because of different sugars because of different sugars because of different sugars. organs such as the cortex of adrenal gland, the ovaries, the testes and the placenta. Such Robertis, Jr., 1987). XX embryos normally develop ovaries, female external genitalia and Mullerian ducts. 20.4. Egg membranes of frog egg. In Salby the cell monella ty-phimurium Repressor when the amino acid, hisGenes Enzymes tidine occurs in high cong10 e10 centration in the medium, that starts to act as core10 e9 g9 pressor. For instance, in the embryo the genetic expression is manifested late during organogenesis. Aminoacyl-tRNA) Amino acids alone do not come to the ribosome to be incorporated into protein. Thus, the probability for a colourblind daughter is 1/2 × 1/2 = 1/4. Contents 106 MOLECULAR BIOLOGY For example, different lymphocyte cells to produce different proteins from the same hn RNA molecule. ω σ rpo D 12,000 95,000 Core enzyme Sigma factor Promoter binding DNA template binding — Initiation The first step in transcription is binding of RNA polymerase to a DNA molecule. Formation of coated-pits and coated-vesicles. Generally, the plus ends of microtubules terminate near cell margins (Fig. The plasma membrane serves as a molecular barrier with the surrounding medium. Mice also contain two other genes Tdy and Tda-1 which interact to cause sex reversal in XY male Sachs proved that starch was synthesized by plants in a light-dependent reaction (photosynthesis). By reporting the existence of such an organelle inside cell, he inadvertently raised a storm of controversy in the scientific world, which is commonly known as the Golgi controversy. In consequence, in all types of cells there exists a difference in ionic concentration with the extracellular medium (Table 5-3). The increase in the number of cells is brought about by the mitotic divisions. Contents 336 CELL BIOLOGY Stern and Hotta (1969) have reported that during the pachytene and zygotene stage, synthesis of small amount of DNA takes place. Define the term gametogenesis. The rate of replication, thus, would be approximately 30 µm - 40 µm per minute (1 mm = 1000 µm). Meselson. LETHAL GENES Lethal genes are mutant genes and result in the death of the individual which carries them. Higher plant chloroplasts are generally biconvex or plano-convex. (ii) Morphology of monoploids. coli contains a protein called the catabolic activator protein (CAP), which is encoded in a gene called crp. Nucleoplasmins are actively transported through the nuclear pores, probably while still in their folded form. gions (S1, S2 and S3) of the secondary cell Plasmodesmata. Table 4-8. Gametogenesis 347-354 Spermatogenesis—formation of spermatids, spermiogenesis; oogenesis multiplication phase, growth phase, maturation phase, structure of mature egg; revision questions. Hence, it is often called the F1-ATPase. 4.15). This photo shows the nucleus (N) of a cell being held in place by a network of cytoskeleton. At the point of stimulation there is a sudden and Facilitated diffusion. Section wax or affect the silver grains of the emulsion. It usually occurs in cells in the form of Glycogen granules in a liver cell. Water has a high specific heat : it requires 1 calorie (4.185 joules) to elevate the temperature of 1 gram of water by 1°C (such as from 15 to 16° C). Rh Factor The surface of erythrocytes (RBC) of some individuals contain one more type of antigen called Rh factor besides the A and B antigens. It is also the region at which the double helix opens to form the open promoter complex. In 1909 Johannsen formulated the genotype-phenotype concept to distinguish hereditary variations from environmental variations. No, because of the dominance relationship of the four multiple allele: c+ >cch >ch >c. It also contains five coenzymes (e.g., NAD, coenzyme A, etc.) and Fig. Aminopeptidase 11. The monoterpenes are responsible for the Choline polar (hydrophobic) tail fatt, bead group) Phosphate 200 nm or more glycerol B 1 2 micelle water C triglycerides form large spherical fat droplet in cell cytoplasm lipid bilayer water id ac ty fat non-polar (hydrophobic) tail fatt, acid lipid bilayer 5 nm D 25 nm A E Fig. Contents ENDOPLASMIC RETICULUM (ER) Table 6.1. 1. C Dase comprises 16 subunits of high molecular weight (14,000 daltons). If any one of them is dominant, a Rh antigen is produced, but if all of them are recessive, no Rh antigen is formed. A—Reticular, B—Alveolar, C—Granular, and D—Fibrillar. On particle subunit virus leaves of a particular variety of tobacco, while TMV produces infection infec replication of DNA is probably a universal mechanism. Similar changes have been reported in yeast species, apparently in response to culture conditions (see Reid and Leech 1980). DEF......GH. When dihybrid pollex, rough pigs (with identical linkage relationships, were crossed to normal (wild type) pigs, their progeny fall into four phenotypes : 79 rough, 103
normal, 95 rough pollex and 75 pollex. However, in bisexual plants numerous structural and functional adaptations have been recorded (such as self sterility, see Chapter 10) which help plants with bisexual or hermaphrodite flowers avoid self-fertilization. Because, all the alleles of multiple series occupy same locus in chromosome, therefore, no crossing-over occurs within the alleles of a same multiple allele series. H. In certain self-pollibeyond 20 generations of inbreeding. For the most part, biochemical errors of many genetic diseases. Thus, they are found in the microvilli of the brush border of intestinal epitheliun and in cell types. ultimately killing the host cell. The parthenogenesis causes the polyploidy in the organisms. 18.7). Thymine. Chemical constituents 1. Kinetics of Cell enlargement of the cells between divisions, since the criteria for measuring growth (for example, dry mass, volume and linear dimensions) do not behave consistently even within the same cell. The fission is the most widely occurring type of asexual reproduce. Polyploidy is rare in animals but occur in flatworms, leeches and the nutrient polysaccharides. This tendency of dominant or recessive alleles to inherit together was explained as "gametic coupling" by Bateson and Punnett. Heredity is the cause of similarities between individuals. This change of state is PF called a phase trancytoplasm sition and the temperature at which it P half occurs becomes Fig. The asymmestructure try of glycolipids such as galactocerebroside, ganglioside, etc., in nonpolar more myelin sheath of nerves (i.e., they are hydrocarbon fluid tail found only in the outer half of lipid rigid bilayer) is found to be originated in region lumen of Golgi apparatus. Describe the differences, if any, between the chemical reactions catalyzed by DNA polymerase and RNA polymerase. On the contrary, the cortisone, hydrocortisone and other drugs tend to stabilize the lysosomal membrane and have a colourless centre. Pyridoxyl phosphate (PALP), 9. Teeth 8. In plant cells, plasma membrane occurs just inner to cell wall, bounding the cytoplasm. mutant Fig. Just as Watson and Crick suggested in their original model of DNA replication, the polymerase enzymes observe the rule of complementary base pairing. Triticum aestivum. Within a fraction of a second after light is absorbed by a photosynthetic pigment, the molecule is altered; some electrons associated with the pigment are raised to new energetic heights, changing their spin or modifying their s sideways movement of the lipid and protein integral molecules within it. the cell's plasma membrane, which are due to abnormal prolifDue to the ages had some vague knowledge about genetics and more often have tried to explain the causes of heredity. (A) Compounds that occur in ETS. Type IVIF proteins. Determination of Linkage Groups Before starting the genetic mapping of the chromosomes of that species and then, he has to determine the total number of genes of that species by undergoing hybridization experiments in between wild and mutant strains. In such case, because the intra-cellular and extra-cellular and extra-cellular and extra-cellular and no osmosis takes place. Four nitrogen bases, nucleosides and nucleotides of DNA molecule. Answer each of the following as briefly and completely as possible : (a) Which do you think would be easier to identify, the effects of plasmagenes or the effects of chromosomal genes? Maul (1977) has reported that in less than an hour (prophase to prometaphase) almost the entire 4000 pores disappear from the nuclear membranes of cultured mammalian cells. Asis Dutta of JNU, New Delhi, was selected for the Birla Award for Science and Technology for cloning and characterization of two novel genes-gene for oxalate decarboxylase from Lathyrus sativus (in 1991) and gene for a seed specific nutritionally balanced protein from Amaranthus (in 1992). The genomic DNA of higher eukaryotes is modified following replication so that a large proportion of the cytosine (C) residues are present as 5-methylcytosine DNA strand : 3' ATT CGA CCT TAT TAC TGC AC 5' (a) What would be the first 5 bases in the 3' end of the complementary strand? Dominant 1. Inbreeding, Outbreeding and Hybrid Vigour 7. coprotein is to contain a Contents ENDOPLASMIC RETICULUM (ER) 165 terminal glucose, fucose or sialic acid, then those sugars are added in the Golgi apparatus where the appropriate sugar transferase enzymes are localized. Contents CHEMICAL NATURE OF GENETIC MATERIALS (i.e., DNA AND RNA) Table 3-4. Thus, the proximity of one crossover to another decreases the probability of another very close by. This is just like a watch which is a timepiece only when all of its gears, springs, Contents 70 CELL BIOLOGY and bearings are organized in a particular way and interact with one another. Describe the concept of complex loci. Consequently, the more completely we can understand the phenomenon of life McClintock fertilized CC ears with pollen from CICI tassels, producing kernels in which the endosperm was CICC. For example, chymotrypsin. 29 Dominant Nettle Sunflower Cotton Maize Snapdragon Barley Wheat Tomato Recessive Serrated leaves Branched habit Coloured lint Round starchy kernel Red flower Beardness Susceptibility to rust Two celled fruit B. D group : 13 to 15 pairs — Acrocentric 5. In some individuals, the coat lacking the yellow pigment and due to the optical effect of black and gray hairs, have the appearance of silvery-gray. dinucleotide is released. The RNA polymerase moves along the genome transcribing genes in sequence. Describe the Nomura's experiment of ribosomal self-assembly. Rickets in children; Trace amounts Vegetable oils (espeVitamin E (Tocopherol) (15 IU) cially polysaturated fatty acids); wheat germ oil; egg-yolk; green leafy vegetables; tomato; milk and butter. coelenterates consist of certain other additional egg membranes. Developed the technique of tissue culture; cultivated amphibian spinal cord in a lymph clot. 12.11). Surrounding the DNA is dark dense region of matrix Cyanobacteria living inside the hairs of these polar bears are containing 20,000 to 30,000 70S type riresponsible for the unusual greenish colour of their coat. Most organic molecules are built with these six elements. Asexual reproduction by Fig. Plastids are present in all living plant cells and in Euglena (a protozoan). Glycolate cycle. 14.9. Map of proteins in the ribosome showing their position in ample, some ribosomal prosmall subunit (B). The cells in which active protein synthesis takes place, the ribosomes remain attached with the membranes of the endoplasmic reticulum. The substances or agents which induce artificial mutations are called mutagenes or mutagenic agents. Since there loop 3' are 61 codons specifying amino acids, the cell should anticodon 5' wobble contain 61 tRNA molecules, each with a different anticposition odon. Hydrogen peroxide metabolism. Contents 126 MOLECULAR BIOLOGY C H A P T E R 10 Immunology, the study of the immune system, grew out of the common experience that people who recover from certain infections become there-after "immune" to the disease again. This pro- concentrated RBC trations equal inside concentrated RBC outside RBC outside RBC outside RBC outside RBC outside RBC outside RBC trations equal inside concentrated and outside RBC outside RBC outside RBC outside RBC trations equal inside concentrated and outside RBC outside RBC outside RBC outside RBC outside RBC outside RBC outside eventually depend on genetic engineering, which has made it possible to extract and store the DNA of whole organisms indefinitely. The bacterial plasma membrane also provides a specific site at which the single circular chromosome (DNA) remains attached. Explain the following : Germplasm theory; pangenesis theory; preformation theory; particulate theory; and variation. Initial binding proteins have also been found essential in the control of synthesis of ribosomal proteins. Diatoms have a length of 200 µm or more. Linkage 8. 16A, 16A/16A Heterozygous ultrabar (=double bar) 45 5. 4.4. A cross between two strains of pig having sandy coats producing 9 : 6 : 1 ratio due to mutually supplementary genes. They are attached to the outer lamellar membrane surface (Berns, 1983). Of their two children one belongs to blood group O and the other to group A. What are the lysosomes ? So, males are XX in human beings. The green coloured chromoplasts are called chloroplasts. (2) Alex Novikoff and his research group (1962, 1964) worked in United States and their approach was morphological and cytochemical. The dominance hypothesis of heterosis holds that increased vigour and size in a hybrid is due to combination of favourable growth genes by crossing two Contents 82 GENETICS, HUMAN GENETICS and cytochemical. The dominance hypothesis of heterosis holds that increased vigour and size in a hybrid is due to combination of favourable growth genes by crossing two Contents 82 GENETICS and cytochemical. RNA is transcribed from several particular sites on template DNA and comprised of about 15 per cent of the RNA present at any one time in an E. Size 2. The present name mitochondria was assigned by Benda (1897-98) to them. Contents 202 GENETICS, HUMAN GENETICS, HUMAN GENETICS and EUGENICS "mutation" to describe the heritable phenotypic changes of the evening primrose, Oenothera lamarckiana. Since these chromosomes were discovered in the salivary gland cells, they were called salivary gland chromosomes (Fig. Cholesterol also tends to decrease the permeability of lipid bilayers to small water-soluble molecules and is thought to enhance both the flexibility and the mechanical stability of the bilayer. von SzentGyorgyi Contents 12 CELL BIOLOGY Year Name of contributor Cell biological contributor C in the gut of termite; Fig. Luteinizing hormone 9. The pinocytosis which occurs at submicroscopic level is known as micropinocytosis. They may then initiate
new cycles of infection in other host cells. Synaptonemal complex has also been observed in a wide variety of species of plants and animals. From this it follows that the choice of solvent determines the speed of migration of the individual molecules and is crucial for a successful separation. Coined the term peroxisome is a vestige of an ancient organelle that carried out all of the oxygen metabolism in the primitive ancestors of eukaryotic cells. The polyploid plants have been found to contain large-sized pollen grains, cells, leaves, stomata, xylem, etc. 5'-3' direction by the length of one codon (three nucleotides). Plastids (Chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastids ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastids (Chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastids ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastids ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Vacuoles) Historical ; types of plastide ; chloroplasts, Photosynthesis and Photosynthesis and Photosynthesis and Photosynthesis and Photos ultrastructure ; functions of the chloroplast : photosynthesis ; (vi) 220-242 chloroplasts are colourless Contents CELL 63 plastids of embryonic and germ cells lacking thylakoids and ribosomes. Robert King (1970) suggested that the synaptonemal complex may orient the non-sister chromatids of homologs in a manner to facilitate enzymatically induced exchanges between their DNA molecules. Later studies revealed the fact that both loci or genes (i.e., epistatic and hypostatic) could be epistatic to one another. 12.8). The D-hexose permease of the erythrocyte is an integral and transmembrane protein. This amino acid was phenylalanine and it could be concluded that some sequence of UUU coded for phenylalanine. In fact, Fig. A combination of two amino acids by the peptide bond is known as dipeptide. Intracellular glycoproteins which are present in cell membranes and have an important role in membrane interaction and recognition. If a woman (XX) is colour blind and she happens to marry a normal visioned male (XY), then all F1 sons will be colourblind and daughters will be normal visioned. The presence of a gene on the X chromosome but not on the Y. Contents 28 CELL BIOLOGY pestle ribosomes homogenization usually in sucrose nucleus endoplasmic reticulum mitochondrion lysosome plasma membrane disrupt cells-usually with "homogenizer" A supernatant contains nonsediment material centrifuge at low speed, imposing force of less than 1,000 × gravity (g) for 10 minutes "pellet" homogenization, and large plasma membrane fragments transfer supernatant to new tube and centrifuge at higher speed (10,000 × g) for 20 minutes "pellet" chiefly of mitochondria, lysosomes and peroxisome suspended pellet in "density gradient" (such as sucrose solution whose concentration increases from top to bottom of tube) and centrifuge mitochondria supernatant centrifuge mitochondria supernat solution density matches their own density. Some virus, some virus, influenza virus, mumps virus and Semliki forest virus are surrounded by a 100 - 150 A0 thick spiked membrane. R-C zygote Fig. A translocation homozygote and a translocation homozygote is 5.31). gene mutation is abrupt inheritable qualitative or quantitative change in the genetic material of an organ ism. Water is formed by the combination of hydrogen and oxygen through the formation of covalent bonds, in which atoms by sharing pairs of electrons, become linked together (Fig. Continuous synthesis on leading strand. Antibodies are also occasionally used as probes to recognize specific protein sequences (see Dubey, 1995). a a bb BB, Bb bb P: P gamete : F1 : Capsella, flattened, triangular seedpods. The different types of inbreedings and their corresponding increase in homozygosity have been graphically illustrated in Fig. defensive barriers. According to the available evidence, where do the membranes come from, and what happens to them. The gametes of both united to form a hybrid or heterozygote having the alleles Rr both for redness and whiteness. However, they can be observed easily in cells cultured in vitro, particularly under darkfield illumination and phase contrast microscope. Each of these enzymes is a large protein (~ 500,00 daltons), with two large and several (8 to 10) smaller subunits. He got the Nobel Prize in 1962, along with J. microtubule CENP-E corona fiber contain and align the chromosomes at the metaphase plate. According to their biological functions, proteins are of two main types : 1. Subfibre A has two dynein arms which are oriented in a clockwise direction. Deoxynucleoside triphosphates. Contents FINE STRUCTURE OF GENE 133 In maize, complex loci have been reported at the A locus, which controls pigment production; the R locus, which control pigment production; the R locus, which control pigment production; the R locus plant, however, sometimes the female flowers bear rudimentary anthers and the mal flowers bear rudimentary pistils. For example, due to substitution mutation, in the gene for tryptophan synthetase enzyme in E.coli, the GGA codon for glycine becomes a missence codon AGA which codes for arginine. elongating cells such as during the formation of the lens or during spermatogenesis of certain insects. Cairns placed E. Nexin links head, a base and a platform. In fact, individuals have been discovered whose β chain locus for some unknown reason never becomes active. Write short notes on the following : (ii) Reverse transcription; (iv) Kozak's scanning hypothesis; (v) Shine-Dalgarno sequence; (vi) rho factor; (vii) Aminoacyl RNA synthetase; (viii) Elongation factors; (ix) Chaperones ; (x) Peptidyl transferase. Both heredity and environment have interrelated role in the development of eugenically better persons. Western blotting technique. HISTORICAL Lysosomes. consists not of one gene, but of a Contents CHROMOSOMES 279 number of duplicate copies, linearly arranged, of one gene. Heterosis in other plants. Due to accumulation of ribosomal RNA (rRNA) and ribosomal proteins in the nucleolus, the size of the latter is greatly increased. Chemical nature and staining reaction of various components of plant cell wall. Usually 10-100 nm thick sections cut with a glass or diamond knife on an ultramicrotome. Among living organisms that have the smallest mass, are small bacteria called mycoplasmas which produce infectious diseases in animals including humans. Such an integrated and dormant viral genome is often termed as provirus or prophage. Cross. When two egg pronuclei unite with single male pronucleus, the phenomenon is known as polygamy, e.g., sea urchins, polychaete worms, urodels and rabbits. F0-complex can be extracted only with strong detergents. This type of plasma membrane having extraneous coats around it, acts as a dialyzer. So the growth of body of a higher organism takes place by the addition of new substances, both protoplasmic and apoplasmatic, when the anabolic process dominates the metabolic activity. The technique of cell fractionation has been improved through the use of density gradient centrifugation. In such a microscope, called ultraviolet light. The organism having two similar genes for a particular character in a GENES 59 4. The mu particles exist only in those cells whose micronucleus contains at least one dominant gene of either of two pairs of unlinked chromosomal genes (M1 and M2). Since, the cell wall varies in composition and morphology at Cell wall growth studied in a moss leaf cell; progressive growth of different locations around the cell, cell wall microfibrils after 4 hours (left) and after 10 hours (right). Reciprocal translocations. N-acetyl-D-galactosamine Recent, chemical investigations (type A) have shown that A and B antigens Fig. Absorption spectra for chlorophylls. This acid is The central vacuole and turgor pressure in plant cells. The labelled subunits are found Interphase nuclear envelope lamina made of three proteins nuclear pores dephosphorylation of lamina proteins reassembly of lamina proteins reasse lamina proteins chromosome segregation on spindle Telophase Prometaphase Fig. The phragmoplast comprises a double-ring of short microtubules. Introduced the term chloroplast. Except the sex chromosomes (X) and (Y) other chromosomes are the autosomes. Deletion (or Deficiency) The simplest result of breakage is the loss of a part of a chromosome. BIOGENESIS OF CHLOROPLAST 237 CO2 outer mesophyll cell air space PEP carboxylase oxaloacetic acid (4C) malic acid (4C) CO2 bundle sheath cell Calvin
cycle sugar sieve tube member The chloroplasts never originated de novo. Example of Monohybrid Back Cross and Test Cross following results (DD) and homozygous tall (DD) and homozyg are obtained : P1 : Homozygous Tall DD F1 : A. Maize is a monoecious plant with male inflorescence (tassel) and the female inflorescence (silk) located on the same plant. For instance, when the egg is transferred from the 300 C to 0-100 C the parthenogenesis is induced. All traits showing practically continuous variation are likely to be due to polygenes. One copy remains at the parent site while the other appears at the target site (on the host chromosome). This indicate that such tissues arise as a result of mitotic crossing over, rather than due to mutation. Table 10-4 Comparison of Wiener's and Fisher's hypotheses about the genetics of Rh+ blood phenotype. Source Intact ribosomes Ribosome subunits rRNA in subunit Number of proteins in subunit Prokaryotes 70S 30S 50S 16S 23S, 5S 21 32-34 Eukaryotes 80S 40S 60S -30 ~50 Animals 40S 60S 18S 25-26S, 5S 5.8S Protozoa (some other protists) 40S 60S 18 evidently play a central role in the catalytic activities of ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucleolus contains many more incomplete 60S ribosomal subunits; therefore, nucl C C U C G G A A A AUU U U G G A G C C U U U high G + C 3'-terminus UUUU Base sequence of (A) the DNA of the E. Because male receives one X-linked recessive gene for colour-blindness from colour-blind mother. In adult tissues it is usually found in epithelia, cardiac A intercellular tight junction cells and liver cells. Two types of chromatin material have been recognised, e.g., heterochromatin and euchromatin. Different lethals in each of two haploid sets of 7 chromosomes administer structural heterozygosity. The X-Y linked genes are partially or incompletely sex -linked, because, sometime, the crossing over may occur in the homologous sections of X and Y chromosomes. Usually the karyokinesis is followed by the cytokinesis but sometimes the cytokinesis and results into the multinucleate cell, e.g., cleavage of eqg in Drosophila. DNA helicase opens helix synthesis on lagging strand. The germinal cells form the gonads (testes and ovaries) in the animal body. For example, those who may inherit genes for heart trouble would then refrain from smoking and avoid high fat diets. Involvement of actin microfilaments. Sialyl transferases Transfers sialic acid from CMP-sialic acid 2. This system of sex determination is found in certain moths and butterflies. Thus, not until electron microscopic studies were performed in the 1950's was the Golgi recognized and accepted as a legitimate cell organelle. Microtubules and According to the amount of the yolk following types of egg cells have been recognised (Fig. Contents MOLECULAR BIOLOGY 110 C H A P T E R 9 Genetic Engineering (Isolation, Sequencing, Synthesis of Gene and DNA Fingerprinting) A llaby (1995) has defined the genetic engineering as the modification of the genetic information of living organisms by direct manipulation of their DNA (rather than by the more indirect method of breeding). These crystals are normally found in the form of sheet-like structures containing large quantities of carotenoids. the frontal face of the 30S subunit with its hollow faces the vaulted seat of the 50S subunit. The multiple fission occurs in most algae, fungi and some protozoans, e.g., Amoeba, Plasmodium and Monocystis, etc. Mode of action of recessive epistasis. The cytoplasm contains the zygote nucleus and birds. Vibrios cause human disease such as cholera (Vibrio cholerae). To explain recombination in micro-organisms, J. Write an essay on "chloroplast and photosynthesis." Write short notes on the following : (i) Quantosome concept; (ii) Pyrenoid; (iv) Photosynthetic pigments of certain extraneous coats around them. Thus, lampbrush chromosomes are much larger (longer) than the polytene chromosomes of insects. 4.24. From citric acid, H2O is released twice by aconitase enzyme to product isocitric acid. Instead globules of sulphur were formed as a waste product. to cell. What is the significance of parthenogenesis? Chloroform 2. book with Shubha Cyclic parthenogenesis shows several variations in the alternation of sexual (S) and parthenogenetic (P) generations : (1) In gall flies (e.g., Neuroterus) there is an alternation of one sexual and one parthenogenetic generation per year (P, S,....P, S,.... With the progress of biochemistry, it was shown that there were fundamental similarities in the chemical composition and metabolic activities of all cells. Identical twins. They enable the bacteria, to a surface or to some eukaryote such as mold, plant and animal cells including red blood cells and epithelial cells of alimentary, respiratory and urinary tracts. At the end of the period, the membrane again becomes essentially impermeable to Na+, but the K+ permeability increases and this ion leaks out of the cell, repolarising the nerve fibre. 19.1. Transverse binary fission in Paramecium. cellulose fibre Contents 82 CELL BIOLOGY glycosidic bonds. The structure of cell wall is stabicell wall lized by the deposition of lignin in the cell wall matrix. In the dense cytoplasm occur thousands of particles, about 25 nm in diameter, called ribosomes. A map unit is equal to 1 per cent of crossovers (recombinants); that is, it represents the linear distance along the chromosome for which a recombination frequency of 1 per cent is observed. Linkage of dominants of two or more pairs of alleles on one chromosome and the recessive on the homologous chromosome. All plastids in a particular plant species contain multiple copies of same relatively small genome (DNA) and 70S-type ribosomes. In other words, the hybrid vigour is a result of action and interaction of dominant or fitness factors or cumulative (polygenic) effect of dominant genes. If the mutant gene is recessive the symbol would be a lower case letter corresponding to the initial letter in the name of the trait. In a medium containing glycerol or any carbon source that cannot enter the biochemical pathway used to metabolize glucose (the glycolytic pathway), the cAMP concentration becomes high. Although Barbara McClintock many of these kernels were colourless, as expected,
some showed patches of brownish-purple pigment. The maternal inheritance has been studied in some of the following cases : (a) Shell coiling in Limnaea. (b) Glycogen. Much of the cell biology is devoted to the study of structures and functions of specialized cells. The nucleoplasm has a complex chemical composition. Contents 48 CELL BIOLOGY It is driven by energy stored in the transmembrane proton H+ gradient (not by ATP breakdown; see Jones, 1986) and rotates rapidly (~ 100 revolutions/second) in the lipid bilayer against another protein disc, called the 'stator'. 8.1. A lysosome showing its various used as a marker for the lysosomes by the the characteristics (after Albert et al., 1989). The point mutations may occur due to following types of subnucleotide change in the DNA and RNA. Certain important oligosaccharides are as follows : Contents CYTOPLASMIC MATRIX 79 (i) Disaccharides contain two monomers, e.g., sucrose, maltose, lactose, etc. The genes on these sex chromosomes determine femaleness, The polysacchaHO O OH rides can be hydrolysed into simple sugars. In last four decades, it has became a most favorite research material for the plant geneticists and molecular biologists. What is polybolidy? added continuously to synthesis starts here A given replication the exposed (3') end (unidirectional) unit may or may not leading strand undergo bidirec3' 5' ional synthesis in 3' 5' 5' 3' 5' synchrony with con3' 5' 5' 3' 5' synchrony with con3' 5' 5' 3' 5' synchrony with con3' 5' 5' 3' 5' tiguous units. Doublets are linked together by nexin links. By bringing about death, sex-linked lethals will alter the sex ratio in a progeny. CHLOROPLAST AS SEMIAUTONOMOUS ORGANELLE Like the mitochondria, the chloroplasts have their own DNA, RNAs and protein synthetic machinery and are semiautonomous in nature. The need of eugenics is apparent from the stand point of education, sociology and civilization. In males, group G includes a variable Y chromosome which lacks the satellites. Potassium K+ Cofactor for pyruvate kinase and K+- stimulated ATPase. For the study of chromosomes with the help of electron microscope, whole chromosomes were studied. The progeny of this cross included 96 per cent female with red eves and only 4 percent females had vermilion eves indicating that there was 4 per cent secondary non-disjunction (Fig. Prostate 13. Control of immigration. Normally vermillion-eyed females mated to red-eyed daughters and vermilion eyed sons (Fig. Degeneracy also provides a mechanism of minimizing mutational lethality. The character which expresses itself (i.e., tall) in F1 generation is called by Mendel as dominant character, while the character which remained unexpressed or latent had been called recessive. In 1919, T.H. Morgan mated gray bodies and normal wings (bvg+/bvg+). single quantitative trait, are called polygenes or cumulative genes. The sn RNPs form a Contents 58 MOLECULAR BIOLOGY macromolecular complex (called spliceosome; 40 to 60 nm in size) in association with other essential protein factors and pre-mRNA. The substructure of A, B and C tubules, is similar to the structure of other microtubules (Stephens, 1970). Hybrid DNA models. In applying this method to Drosophila melanogaster, he prepared a series of cytological or chromosome maps to correspond with the linkage maps already available. (1) Cellulose is a linear, unbranched polymer, consisting of straight polysaccharide chains made of glucose units linked by 1-4 β- bonds (called glycosidic bonds; see Chapter 4) (Note : Complete hydrolysis of cellulose yields D-glucose and its partial hydrolysis yields disaccharide units, cellobiose.) These are the glucan chains which by intra-and intermolecular hydrogen bonding produce the structural units known as microfibrils, observable under electron microscopy and having toughness like the rubber. Lactate dehydrogenase Immunoglobulin G 135,000 4 150,000 4 Tryptophan synthetase (E.coli) Aspartate transcarbamylase L-arabinose isomerase (E.coli) Apoferritin (iron storage protein) Thyroglobulin 150,000 4 306,000 12 360,000 3. White eyed Drosophila was one of the first mutants known in the fruit flies. Protein Synthesis 77-90 Central dogma and central dogma reverse ; minimum necessary materials ; mechanism of protein synthesis — aminoacylation of tRNA (formation of aminoacyl -tRNA), stages of polypeptide synthesis in eukaryotes, modification of released protein ; antibiotics and protein synthesis; revision questions and problems ; answers to problems. The cross of an individual (generally of dominant phenotype) with one having the recessive phenotype. Meyer in 1883, F. Coupled transcriptiontranslation, too, speeds up protein synthesis in the sense that translation does not have to await release of mRNA from the DNA. (b) If a chiasma occured 50 per cent of the time, what would this percentage be ? But, when the mice were injected with virulent Dead mouse Live mouse S-III pneumococci, the mice suffered Fig. Contents 78 CELL BIOLOGY Further, for the sake of simplicity, sugars can be represented in a linear straight chain form (Fig. If duplication is present only on one of two homologous chromosomes, at meiosis the

chromosome bearing the duplicated segment forms a loop to maximize the juxtaposition (during pairing) of homologous regions (Fig. Contents 150 CELL BIOLOGY Plasmodesmata are formed around the elements of smooth endoplasmic reticulum that become trapped during cytokinesis (of mitotic cell division) within the new cell wall that will bisect the parental cell. This space is continuous into the core of the crests or cristae. Also discuss various properties of the matrix. An immunoglobulin (Ig) molecule is a Y-shaped heteropolymer and is composed of two identical H (heavy) polypeptide chains 101 COOH ends Fig. Certain common viral infections of human beings are : common cold, influenza mumps, measles, rubella (German measles), chickenpox, small pox, polio, viral hepatitis, herpes simplex, viral encephalitis, fever blisters, warts and some types of cancer. What is heterosis? The centromere (a term ere (after De Robertis et al., 1975). During the gametogenesis, the homologous chromosomes with TT or tt genes are separated and each chromosome with T or t gene is passed to the gamete. The double helix model of DNA molecule of Watson and Crick beautifully embodied a built-in template system for self-replication or autocatalytic function. rowth is an increase in size of an organism, reflecting an increase in size of an organism. infundibuliform ciliary movement occurs due to the rotary movement of the cilium and flagellum. Later on, such a transforming substance, the DNA, was found in a variety of bacteria (e.g., Hemo-philus influenzae, Bacillus subtilus, Shigella para-dysenteriae, etc.) and several other organisms. ATP- dependant proton (H+) pump. compound lipids and 3. Give examples. The position of the nucleolus in the nucleolus is eccentric. The quantitative traits, however, are economically important measurable phenotypic traits of degree such as height, weight, shape, skin pigmentation, metabolic activity, reproductive rate, behaviour, eye-facet or bristle number in Drosophila, susceptibility to pathological diseases or intelligence in man; amount of flowers, fruits, seeds, milk, meat or egg produced by plants or animals, etc. The regenerate their lost or worn out parts. A clue to the cause of this controlled response on the part of the lac operon was provided by a mutation in whose presence all three enzymes were produced constitutively regardless of the presence or absence of lactose. Mendel's considerations about the material were as follows : 1. What genotypes and their proportions would be produced by the following crosses? The next step, base plate core tube however, is unique to tail fibre protein tail sheath lysogeny. Yet at the ultrastructural level there is sameness about cells that is almost tedious. Gram negative and Gram positive bacteria. Got Nobel Prize for the discoveries concerning the role of chromosomes in the transmission of heredity. Now homozygous tall plant will contain the genotype "TT" and likewise a homozygous dwarf plant will have the genotype "tt". A relatively simple approach is to first prepare purified nuclei from thymus, liver, or any other desired source. They are probably the first to come into existence perhaps 3.5 billion years ago. A study of the egg during oogenesis in Mirabilis reveals that the ooplasm contains plastide like cytoplasm of other plant cells. The process in which the water molecules enter into the cell is known as endosmosis, while the reverse process which involves the exit of the water molecules from the cell is known as exosmosis. A normal female (AAXX) has a male and female ratio of 2:3 and, therefore, the balance is in the favour of femaleness (See Fig. The mitochondira are supposed to be derived from the bacterial cells (purple bacteria) while chloroplasts are supposed to be originated from the blue green algae (see Margulis, 1981). Explain with illustrations the genotypes of the progeny expected in matings between a normal parent and one in which non-disjunction occurs at the time of gamete formation. 1,000,000 Conceptions 8,50,000 Live births 8,33,000 Children 1 5,165 Chromosomal abnormalities 1,849 Sex Chromosome aneuploids 17,000 Perinatal deaths* (1247 males; 422 females) 42 Trisomy-13 1,183 Autosomal 100 Trisomy-13 1,183 Autosomal 10 + 75,000 Chromosomal abnormalities 39,000 Trisomics (e.g., 3,510 Trisomy-21) 13,500 Turner syndrome (XO) 12,750 Triploids 4,500 Tetraploids 5,250 Others * perinatal = pertaining to the period between the seventh month of pregnancy and the first week of life. In order to explain these results, Sturtevant (1891-1970) and Morgan (1923) postulated that new types of flies arose as a result of intragenic rather than intergenic crossing over at the bar locus. This preloaded b subunit may then capture the core of DNA poly III HE when it becomes available after finishing its synthetic job on the preceding okazaki fragment. and the ribosomes, there is no obvious reason why the 70S initiation Contents PROTEIN SYNTHESIS initiation site of DNA 5' mRNA 1 1 mRNA 2 2 mRNA 3 3 mRNA 4 4 85 complex should not form before the mRNA is released from the DNA. The transitional substitution mutations occur due to tautomerization. An estimated 5 per cent of our population survives with severe physical or mental genetic defects. As already described elsewhere, the In recombinant protein research, a scientist takes DNA sequences recognized by restriction enzymes are a sample in which genetically engineered mamcalled palindromes. The sex which possesses two identical sex chromosomes (XX or ZZ) and produces single type of gametes each with X or Z chromosome is known as homogametic sex . 1.1) which were built by him. From these results, Griffith concluded that the presence of the heat-killed S-III bacteria must have caused a transformation of the living R-II bacteria, so as to restore to them the capacity for capsule formation they had earlier lost by gene mutation. The ability to resist infection by pathogens (viruses, bacteria and other unicellular endoparasites) and by multicellular endoparasites, is called immunity. The double trisomic causes great genetic imbalance and has the genomic formula 2n+1+1. Sutton-Boveri Chromosome Theory of Heredity The formal statement of the chromosome of theory of heredity is usually credited to both walter Sutton (an American graduate student who studied meiosis in grasshopper and confirmed Montegomery's conclusion (1901) that associations were Mendel's Events Chromosome pairing somes) and Theodor Boveri (a a paternal chromosome great German biologist, who in 1902 demonstrated in sea urchin zygotene A that different chromosome. Hence, the R-II colonies retained the R-II colonies bred true as S-III (iii) Tetrasaccharides contain four monomers, e.g., stachyose and scordose. In contrast to other higher plants, (2) White (pale) leaves and branches having all white chloroplast, (3) Variegated branches having leukoplast in white (pale) areas and chloroplast in green patches (Fig. Its autotriploid status was established from its meiotic behaviour by Prof. nal for nuclease cleavage. As in 30S subunits of prokaryote ribosomes, the 40S ribosomal subunit of eukaryotes is divided into head and base segments by a transverse groove (Fig. Its autotriploid status was established from its meiotic behaviour by Prof. nal for nuclease cleavage. As in 30S subunits of prokaryote ribosomes, the 40S ribosomal subunit of eukaryotes is divided into head and base segments by a transverse groove (Fig. Its autotriploid status was established from its meiotic behaviour by Prof. nal for nuclease cleavage. As in 30S subunits of prokaryotes is divided into head and base segments by a transverse groove (Fig. Its autotriploid status was established from its meiotic behaviour by Prof. nal for nuclease cleavage. As in 30S subunits of prokaryotes is divided into head and base segments by a transverse groove (Fig. Research and base nucleoprotein index, Vn is the volume of the nucleus and Vc is the volume of the cell. It is a cup-shaped organelle which is located near the nucleus in many types of cells. The regions of chromosome flanking the centromere contain highly repetitive DNA and may stain more intensely with the basic dyes. In the year 1906, Camillo Golgi and S. Nuclear pores and nucleocytoplasmic traffic. (d) Anaphase: The spindle fibers (e) Telophase: The chromosomes are moving one set of chromosomes are moving one set of chromosomes involve the production of specialized cells that react with foreign antigens Pollens provokes an allergic response in on the surface of other host cells. The lysosomal Na+ K+ and ouabain membrane contains the 3 binding site ATP-dependent proton pump that transports protons from the cytosol into potassium sodium eletrochemical the lumen of the organelle, eletrochemical gradient binding pump 4.5 to 5.0). Discuss its importance for the humans. Dominant and Recessive
Interactions (13:3) Sometimes, the dominant alleles (bb) of another gene locus (A) in homozygous (AA) and heterozygous (AA) and hete 13: 3 instead of 9: 3: 3: 1. albinism. Fusion of endocytic vesicle and endosome. In bread wheat, many useful mutations have been obtained and utilized in plant breeding, e.g., branched ears, lodging resistance, high protein and lysine content, amber seed colour and awned spikelets. A cell grows at the expense of food materials that it draws from its environment and converts it into its cellular constituents. The spectrin heterodimers self-associate head-to-head to form 200 nm long tetramers. ANSWER TO PROBLEMS 2. Oudet et al., (1975). A type of uniparental inheritance in which phenotypic differences in progeny occur due to factors such as chloroplasts and mitochondria transmitted by the female gamete. Contents CYTOPLASMIC OR EXTRA-NUCLEAR INHERITANCE 229 In 1954, Ms. Ruth Sager isolated a streptomycin - sensitive (sm-s) mutant of Chlamydomonas with a peculiar inheritance pattern. Krebs received the Nobel Prize in 1953 along with Lipmann for his discovery of the citric acid cycle. Ultrastructurally cell wall is found to consist of a microfibrillar network lying in a gel-like matrix. Let us assume that gene B is in the middle (e.g., A-B-C) : A 12 B 5 B B 7 C C In this case, because the distance between A-C are not equitable, therefore, gene B cannot be in the middle. ized in the satellite of chromosomes 13, 14, 15, 21 and 22. nuclei Sometimes their length may reach up to 7 µm. These patients have problems with breathing & digestion. (ii) Translocation of a small segment of the Y chromosome to an X chromosome results in the XY females, (For more details of sex determination, sex reversal and sex differentiation see Chapter 13). Introduction 3-13 Definition of ecology ; historical background of ecology; relationship of ecology; relationship of ecology with other disciplines ; ecological tools and techniques; significance of ecology for man ; revision questions. 4.1 B). T.S of adipose cells of a mammal where fat is stored. The DNA fragments which are generated by random incorporation of ddNTP leading to termination of reaction are then separated by electrophoresis on a high resolution polyacrylamide gel. Ph : 22690881, 22610885 z 3, Gandhi Sagar East, Nagpur-440 002. It is called a test cross, because it is used to test whether an individual is homozygous (pure) or heterozygous (hybrid). They sometimes fuse with one another and then separate again. 14.12. Belling (1924). (An ISO 9001 : 2000 Company) Head Office : 7361, RAM NAGAR, NEW DELHI - 110 055 Phones : 23672080-81-82; Fax : 91-11-23677446 Shop at: schandgroup.com E-mail: Branches : z 1st Floor, Heritage, Near Gujarat Vidhyapeeth, Ashram Road, Ahmedabad-380 014. The inheritance of polygenes or quantitative traits is called quantitative inheritance, multiple factor inheritance, multiple gene inheritance, multinheritance, multiple gene inheritance, capture light energy and to transduce it into chemical energy, which is stored in covalent bonds between atoms in the different nutrients or fuel molecules. It is this latter possibility that can happen when a molecule of chlorophyll absorbs a photon. Apparently, RNA polymerase induces this conformational change. B Barred bb SEX-LINKED LETHALS Nonbarred Certain X-linked genes are lethals, i.e., they cause death of an individual from egg up to sexually mature adult stage. Within seconds of synthesis being completed, the protein folds into a specific three-dimensional form, which is the same for all molecules of the same type of protein and which now is capable of doing catalysis. This is done by the general technique of Southern blotting (developed by E.M. Southern, 1975). Cyclic AMP is synthesized enzymatically by adenyl cyclase and its concentration is regulated indirectly by Contents REGULATION OF GENE ACTION 97 glucose metabolism. Got Nobel Prize for the studies of bioenergetics. The cAMP-CAP complex must be bound to a base sequence in the DNA in the promoter region in order for transcription to occur (Fig. The de novo origin of centrioles and basal bodies. Howmicrovillus ever, in three-dimensional structure, revealed by freeze-fracture technique (Pinto da Silva and Kachar, 1982), the tight junctions appear as a network of ridges on the cytoplasmic tight half of the membrane, with complementary tonofilajunctions grooves in the outer half. Heterocatalytic functions of DNA are called heterocatalytic functions 2. Amino acid amides. Each prophase chromosome is composed of two coiled filaments, the chromatids, which are the result of the replication of DNA during the S phase. Some examples of DNA swquences involved in gene regulation have been such media are blood, lymph, or other identified. Reactive groups (called adsorption protein or pilot protein; Kornberg, 1974) at the end of the tail of the phage can join with a complementary set of chemical groups (a receptor site) in the cell wall of the bacterium. They resemble with peroxisomes in morphological details, except that, their crystalloid core consists of dense rods of 6.0 µm diameter. It includes the study of structure and function of gene and regulation of its activity. Electron microscopy Fig. Variation in chromosome number by whole sets or exact multiples of the monoploid (haploid) number, e.g. diploid, triploid. In this type of fission the cell or body Binary fission in sea anemone. Once a recessive allele is in a homozygous state, natural seA lection can operate upon the rare recessives. Thus, phage DNA is both replicated and transcribed; first the enzymes needed for synthesis of phage DNA are translated, then the capsid proteins are proteins. According to a calculation, the leaf of Ricinus communis contains about 400,000 chloroplasts per square millimeter of surface area. Later on DNA molecule has been reported from the chloroplasts of other algae and higher plants. 12.8) : (i) Fibrillar centre. The nuclear envelope in all eukaryotic forms, from yeasts to humans, is perforated by nuclear pores which have the following structure and Nucleus of a cultured human cell that has been stained with function : fluorescently labeled antibodies to reveal the nuclear lamina 1. Normally, the synthesis of these three enzymes is not constitutive and in the absence of lactose only a few molecules of each enzymes, it follows that several tRNA will often have an affinity for the same amino acid. (iii) DNA polymerase resynthesizes the missing Adenine Contents 212 GENETICS, HUMAN GENETICS, HUM tension and adsorption, the matrix possesses other mechanical properties, e.g., elasticity, contractility, rigidity and viscosity which provide to the matrix many physiological utilities. The oligosaccharides (monomers) in their molecules. 12.7). Al- Contents 116 GENETICS, HUMAN GENETICS though only two actual alleles of a gene can exist in a diploid cell), the total number of possible different allelic forms that might exist in a population of individuals is often quite large. Rhoades (1946) to nuclear chromosomes 7. bacterial cell wall). Malfunctioning of nervous DNA synthesis, system. From all these studies has emerged the realization that the basic chemical organization and the metabolic processes of all living things are remarkably similar despite their morphological diversity and that the physical and chemical principles governing living systems. What is tetrad analysis ? The end product of this reaction is a 2- carbon compound, the acetyl group which is attached to coenzyme A to produce the carrier molecule, called acetyl CoA. (a) Precocity theory. A "checkerboard" grid designed to determine all possible genotypes produced by a given cross. Single Gene Control of Sex In certain organisms, for example Chlamydomonas, Neurospora, yeast, Asparagus, maize, Drosophila, etc., individual single genes are found to be responsible for the determination or expression of sex; (a) Sex-determination in Asparagus. Gene. Fraenkel Conrat and B. Due to the classic works of Henneguy and Lenhossek (1897), it has been proposed that basal bodies of cilia and flagella are homologous with the centrioles found in mitotic spindle. The distal centriole and the basal part of the axial filament occur in the middle piece of the spermatozoa. Nexin link (86 nm) 4. (d) If polymerase I is added to the four nucleoside triphosphates without a DNA template, DNA is synthesized but with a random base sequence. The diploid number of a species bears no direct relationship to the species position in the phylogenetic scheme of classification. In general, chloroplasts have a double helical DNA circle with an average length of 45 µm (about 135,000 base pairs). In them starch granules may become so large that they rupture the encasing membrane. The trait of barred eye in Drosophila is another sex-linked trait which is dominant over the normal eye shape but display inheritance pattern like eye-colour. This potential of the H2- 2H+ couple is - 0.421V; standard redox potentials at pH7.0 are noted by the symbol E'o. Depending upon whether Triticum is a tetraploid (2n = 4x = 28) or hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid
triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42), one would get hexaploid triticale (2n = 6x = 42). substance capable of forming the organized body after fertilization. The microtubules of the spindle are arranged like Contents 322 CELL BIOLOGY two cones base to base, broad at the centre or equator of the cell and narrowing to a point at either end or pole. This suggested that hexaploid wheat must have originated in the past due to natural hybridization between tetraploid wheat and goat grass followed by subsequent chromosome doubling. These proteins in combination with some non-protein components, called prosthetic groups. Within a H chain or L chain, Ckappa (k) or lambda (\lambda termini segments exhibit very little variation in primary structure from one individual to another and are called constant regions (C). They are also mentally retarded (IQ below 20), have malformation in the larynx, moon faces, saddle noses, small mandibles (micrognathia), malformed low-set ears and microcephally (small head). Three mol- CO2 2C3 P C6 2C3 2C3 P - C6 P - C 15C) are regener2ADP Ribulose 2ATP may be ated by a complex serespired ADP ATP ries of reactions which utilize three ATP molSource of energy (respired) ecules and five molSynthesis of fats, proteins, etc. Such a homozygosity is also caused when two alleles in a diploid organism are not descended from the common gene but the alleles of identical origin are brought together through mating between first cousins. (a) What would be the percentage of the other bases in each sample? (x) 12. In fact, both Schleiden and Schwann are incorrectly credited for the formulation of the cell theory; they merely made the generalizations which were based on the works of their predecesors such as Oken (1805), Mirbel (1807), Lamarck (1809), Dutrochet (1824), Turpin (1826), etc., (see Sheeler and Bianchi, 1987). The excited molecule becomes reactive and other cells is an ion exchange permease protein which catalyzes an one-for-one exchange of anions such as chloride (Cl-----) and bicarbonate (HCO3-----) across the membrane (called chloride shift; erythrocyte has 100,000 times more permeability of Cl----- than other cells). Both tRNAf Met and tRNAMet recognize the codon AUG, but only tRNAf Met is used for initiation. 10.1/2 White (w/Y st/+ and w/Y st/st) : 1/4 wild type (+/Y st/+) : 1/4 oogonium tetrad 1st polar body 2nd meiotic metaphase suppression of 2nd polar body 1st cleavage Fig. In Drosophila virilis, constitutive heterochromatin occupies 40 per cent of the chromosomes. of electron microscopy and X-ray diffraction techniques, and (2) the convergence of cytology with other fields of biological research, especially genetics), physiology (cell physiology) and biochemistry). Certain well known examples of X-linked recessive genes in humans are those for red- green colour blindness or daltonism, haemophilia and Duchenne's muscular dystrophy. Certain inorganic substances such as manganese chloride is mutagenic for many organisms, as, they are the compounds which bind calcium and, thus, interfere with the integrity of the chromosome structure. (Fig. Extracellular digestion. Like plasma membrane has permeases and carriers. Contents CELL GROWTH AND CELL DIVISION 323 Lastly, during prophase, the nucleolus gradually disintegrates. If a particular larva settles on the proboscis of an adult female, it becomes a male individual. This discovery fore shadowed the idea that "genes" could be subdivided, i.e., certain genes are compound or complex genes. Movements of intracellular materials 4. On the other hand, changing the wavelenght of light does change the velocity of ejected electrons, implying that the energy of a photon must be related to its wavelength. The vapour of heavy metal is deposited on one side of the particles; on the other side a shadow forms, the length of the particles. There are about 200 dehydrogenases for which NAD+- linked compounds such as pyruvic acid dehydrogenase, are involved in ETS. Contents MOLECULAR BIOLOGY DNA radioactive label (double stranded DNA labelled at 3' end) B (single stranded DNA la C 1 D 3 2 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 E F Fig. Contents 226 CELL BIOLOGY relative light absorption The isolated chloroplasts of higher plants are found to contain the chemical composition shown in Table 11-1. Manago and Ochoa found that outside of the cell (in vitro), with high concentrations of ribonucleotides, the reaction could be driven in reverse and an RNA molecule could be made (see Burns and Bottino, 1989). Thus, if the pollen derives from a normal green Ij/Ij plant as in Figure 17.5 b, the resulting progeny green varlegated white will be Ij/ij heterozygotes, but many will exhibit abnormal plastid pigmentation : Fig. When more than two or more genes become involved in the specification of enzymes for different steps of a common biosynthetic pathway, the phenomenon of genetic interaction occurs. Since the mutant allele produces a phenotypic effect that is qualitatively different from that of its wild type counter part, it is called neomorph. Robertsonian translocation results in the formation of metacentric chromosome by fusion of two acrocentric chromosomes (after Stansfield, 1986). One-half for self-fertilization. Blood-group glycoprotein 23 33 50-60 85 Haemoglobin-binding protein of blood plasma Hormone Mucus secretion Unknown Lipids (Gr., lipos=fats) are the organic compounds which are insoluble in the water but soluble in the non-polar organic solvents such as acetone, benzene, chloroform and ether. Contents 98 CELL BIOLOGY So far, about 20 distinct collagen-chains have three-stranded helix been identified, each encoded by a separate gene. The nucleus loses water from the nucleus A strain is found which requires streptomycin in the culture medium for its survival (sd). commonly cultivated in U.P. and Bihar. dreds (e.g., 400) of kappa particles. In sheep, the genes for the development of horns is dominant in males and recessive in female (Table 12.1). Give an account of Watson and Crick's double-stranded model of DNA molecule. Glyoxysomes occur only in plant cells and are particularly abundant in Contents 186 CELL BIOLOGY germinating seeds which store fats as a reserve food material. Proper ties of three different eukaryotic nuclear RNA polymerases. (3) In nucleated eukaryotic cells, the mobility of the peripheral endoproteins and integral proteins is restrained by their attachment to the ectoplasmic cytoskeleton. The chromosome number of some animals and plants is tabulated in Table 13-1. For example, in cylindrical cells the mitochondria usually remain orientated in the parallel to the main axis. ? Bulk transport by the plasma membrane. Therefore, there must be something which represents the characters and is responsible for their production. Recombination in phage was first demonstrated in 1948 by Max Delbruck and Mary Delbruck. dimensional structure of tRNA. Write short notes on the following : (1) Spermiogenesis; (2) Growth phase of oogenesis (3) Egg membranes, e.g., cerebrosides and gangliosides. The generic promoter cannot bring about regulated expression (i.e., tissue or stimulus specific expression of genes, called luxary genes). CELLS OF CELLULAR ORGANISMS The body of all living organisms (bacteria, blue green algae, plants and may contain one or many cells. The cerebrosides are the important lipids of the white matter of the cells of brain and the myeling organisms (bacteria, blue green algae, plants and animals) except viruses has cellular organization and may contain one or many cells. sheath of the nerve. The mode of origin of aneuploid gametes by non- disjunction at either the first or second meiotic division (after Suzuki et al. The number of homologous pairs of chromosomes or bivalents of the species. The sperm nucleus in man and bull becomes ovoid and laterally flattened. The ionsection at either the first or second meiotic division (after Suzuki et al. The number of homologous pairs of chromosomes or bivalents of the species. are important in maintaining osmotic pressure and acid-base balance in the cells. Phospholipase A 17. In mammals too, up to 60 per cent of hamster eggs becomes spontaneously activated and develops up to two-cell stage (Austin, 1956). Loci for the human Duffy blood group, that is, production of either, both, or neither of the antigens Fya and Fyb, and the rare Charcot-Marie Tooth disease (a severe sensory and motor neuropathy) are both located on autosome 1. The spindle orientation is, thus, controlled by the organization of HGPRT or hypoxanthine guanine phosphoribosyl transferase locus and int-2 loci in mouse embryonal stem cells). Further, this neglect of his work and other economical and physical hazards made him greatly disappointed and bitter. The various types of infective symbionts are as follows: (i) Sigma virus in Drosophila. 17.1. Correlation of sinistral (A) and dextral (B) The eggs of a homozygous sinistral cleavage with sinistral (A') and dextral individual (SS) are fertilized by the sperm of (B') coiling of the shell in gastropods. It was also believed that bands were the sites of genes (DNA) and interbands were relatively inert linker regions. Quite often such recessive alleles are revealed by consanguineous matings-for example, cousin marriages. Weismann supported the idea of Roux by propounding his germplasm theory. Like the glycophorin, band 3 protein (93,000 daltons M.W.) is a transmembrane protein, i.e., its highly folded polypeptide chain (about 930 amino acid long) extends across the lipid bilayer at least 10 times. Therefore,
it is normally assumed that the ER has originated by evagination of the nuclear membranes. Evidence in support of mosaic arrangement of proteins. The chain may have great flexibility, permitting the amino acids to snake their way single file through the proposed pore. Though, the genes of nuclear chromosomes have a significant and key role in the inheritance of almost all traits from generations, but they altogether cannot be considered as the sole vehicles of inheritance, because certain extranuclear genes or DNA molecules in the cytoplasm of many prokaryotic cells. MECHANISM OF PROKARYOTIC TRANSCRIPTION Transcription involves the following three aspects : 1. Which were single and double-stranded? Thus, their initiation, production and maturation seem to progress from centre to periphery. Ribosomal RNA makes 80 per cent of cellular RNA and occurs in four sizes namely 28S, 18S, 5.8S and 5S. RNA splicing. What information does this fact provide? Nucleo-cytoplasmic traffic. The axoneme is about 0.2 to 10 µm in diameter and may range from a few microns to 1 to 2 mm in length. This is a body cells' ability to repair UV damage. For example, in modern wheat x and n are different. Example For explaining interference and coincidence, we can consider the results of one of the experiment of Hutchison (1922). prevention rather than cure. Human Sex Anomalies 1. As, we are already faChromosome miliar that matter composed of atoms, in their turn, are made up of a positively Fragments charged atomic nucleus (with neutrons, proChromosome miliar that matter composed of atoms and atoms, in their turn, are made up of a positively Fragments charged atomic nucleus (with neutrons, proChromosome miliar that matter composed of atoms and atoms, in their turn, are made up of a positively Fragments charged atomic nucleus (with neutrons, proChromosome miliar that matter composed of atoms and atoms, in their turn, are made up of a positively Fragments charged atomic nucleus (with neutrons, proChromosome miliar that matter composed of atoms and atoms, in their turn, are made up of a positively Fragments charged atomic nucleus (with neutrons, proChromosome miliar that matter composed of atoms and atoms, in their turn, are made up of a positively Fragments charged atomic nucleus (with neutrons, proChromosome miliar that matter composed of atoms and atoms, in their turn, are made up of a positively Fragments charged atomic nucleus (with neutrons, proChromosome miliar that matter composed of atoms atoms, in their turn, are made up of a positively Fragments charged atomic nucleus (with neutrons, proChromosome miliar that matter composed of atoms atoms) atoms atom negatively charged electrons. Qualitative genetics Quantitative genetics 1. This shows that O blood group has neither A nor B antigen. Most strains of Chlamydomonas are sensitive to streptomycin(s). Water's Relatively properties as a solvent for negative - inorganic substances as min- - (-) (-) eral ions, solids, etc., and 8P organic compounds such as oxygen - - 8N carbohydrates and proteins, - - H - depend on water's dipole 104.5 H + - + (+) Relatively (+) nature. The somatic cells of a grasshopper are analyzed and found to contain 23 chromosomes. (ii) In nucleolus, 45S RNA is rapidly methylated, even before transcription is completed. This requires the presence of EF1 Contents PROTEIN SYNTHESIS 87 (elongation factor1) and energy (i.e., one GTP is hydrolyzed to GDP). Death of the foetus may occur before birth or soon after birth. In fact, most lysosomal proteins are unusually highly glycosylated, which may help protect them from the lysosomal proteins are unusually highly glycosylated. the discovery of molecular model of DNA by Waston and Crick. Pringsheim (1855) first saw nuclear fusion in green algae (Vaucheria). (c) Do codons have the same meaning in vitro as in vivo? Such a mechanism is found in many operons responsible for amino acid biosynthesis. Due to this fact the diameter of Z-DNA molecule is 18 A^o than the 20 A^o diameter of B-DNA. Dosage compensation, availability of homogeneous rRNA; 2. Chromosomes are not always rod-shaped. It is a short period of chromosome condensation, segregation and cytoplasmic division. In sexual reproduction, the particles of both individuals unite together to form a new individual. Complex Gene Loci The Russian geneticist N.P. Dubinin in 1939 recognized step allelism (that is, the graded effect of different alleles) in Drosophila. It is necessary for the natural selection because due to this the chances of variation increase. similar), a tertiary trisomic would mean that the extra chromosome should be the product of translocation (Fig. dominant diploid and multicellular generation (called sporophyte) and a short, multivegetative plant cellular haploid generation, called gametophyte vegetative plant generation, called gametophyte vegetative plant generation. (a) (b) Are quantitative characters restricted to sexually reproducing organism? However, the perat right angles to the other produces a L-shaped structure. A These segments would be single computer controls which base is added. This has to add to our genetic load and to weaken the human species from the evolutionary point of view. Cotyledon colour : Yellow × Green Y, y; G, g I, i 1 Yellow 6022 Yellow 2001 Green 3.01 : 1 3. An overview of the types of biological molecules that make up Centrioles, basal bodies various cellular structures. Role of cytoskeleton in mitosis. Types of sex chromosomes. With the huge population of humans on earth, our dependence on high yield varieties of crop plants and domestic animals has become increasingly clear. Each of the central microtubules (25 nm in diameter) is composed of 13 protofilaments. Locus. 4 n. Because inbreeding cause homozygosity of deleterious recessive genes which may result in defective phenotype, therefore, in human society, the religious ethics unknowingly and modern social norms consciously have condemned and banned the marriages of brothers and sisters. With prokaryotes (E. scribed as tetrad. a a Hypostatic alleles Phenotypic expression of allele BB, Bb, bb a 2. In past, there has been a lot of controversy about the physical nature of the matrix. 1934 M. Glucose units are represented by circles and the branch points (i.e., 1 – 6 linkages) by heavier connections. (c) Assuming the presence of complementary strands, what is the per cent composition of the polymer with respect to AT base pairs and with respect to GC base pairs. Macrocytic anaemia (production of abnormally large red blood cells). n preceding chapters, we have discussed different roles of genes of the nuclear chromosomes in inheritance, cellular metabolism, development and mutation of the organisms in which they occur. The sections are then coated with a photographic emulsion and stored in the dark for periods ranging up to several months. 1:2:1 (viz., 1 green (CC): 2 auria (Cc): 1 white (cc). Cell components, viruses Arrangement of atoms 10 µm to 0.2 µm (200 nm) 200 nm to 1 nm Smaller than 1 nm (10A0) } ray diffraction Contents INTRODUCTION 5 Further growth and development of cell biology are intimately associated with the development of these lenses in the construction of these lenses and to the combination of these lenses and to the combination of these lenses and interbands and a puff or Balbiani ring. Mathew Meselson and Franklin W. These microfilaments are sensitive to cytochalasin-B, an alkaloid that also impairs many cell activities such as beat of heart cell, cell migration, cytokinesis, endocytosis and exocytosis. Write short notes on the following : (a) Philadelphia chromosome; (b) Ring chromosomes; (c) Dicentric bridge; (d) Robertosonian translocation; (e) Pseudodominance; (f) Deficiency; (g) Renner complex to give the 70S initiation complex to give the 70S initiation complex (i.e., a complete 70S ribosome). The 21 new chapters, which have been added in this edition, are distributed in the five parts/ sections of this textbook which are as follows : 1. Such complete dominance of agouti also occurs on Himalayan (Fig. 10.18. The Y chromosome PAR contains small amount of Human Y Chromosome PAR contains small amount of euchromatin and large amount of Human Y Chromosome PAR contains small each bivalent is clearly seen to contain four separate chromatids with each pair of sister chromatids linked at their centromeres, while non-sister chromatids that have crossed over are linked by chiasmata. This kind of virusimmunity is called acnormal cell foreign associated surface protein proteins tive immunity, beprotein cause the body makes matures into its own antibodies in active killer T cell response to the arrival of an antigen. Turner's syndrome, coli cell with lambda adsorption to host cell renders that cell immune and injection of DNA to further attack by phage of the same type. They tend to interfere with chromatin condensation during interphase of cell cycle. pH exposes hydrophobic sites on fusogenic proteins Viroids. Amyloplasts produce a standard arrangement, the karyotype. In the free state viruses are quite inert. In this case all of the gametes will contain some extra segments (duplications) and some pieces will be missing (deletion). However, our new ability to recognize genetic disease poses an important moral dilemma. A—The components as they might be seen by electron microscopy of thin sections; B—A three-dimensional reconstruction of Golgi apparatus (after Thorpe, 1984). Likewise, the enzyme trypsinogen of the stomach is activated in the intestine by the enzyme enterokinase and the enzyme enterokinase and the enzyme trypsinogen of the stomach is activated by the hydrochloric acid which is secreted by parietal cells. The pattern of change is itself controlled by other genes. Law of segregation; 2. The main proteins that are present in the cytoskeleton are tubulin (in the microtubules), actin, myosin, tropomyosin and others (in intermediate filaments). The
result of this mode of replication is a circle with a linear branch; it resembles the Greek letter sigma and is called or replication. Nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any limiting membrane and is formed during interphase by the ribosomal DNA (rDNA) of nucleolus lacks any linitial during membrane and ribosomal DNA (pairs of pseudoalleles or separate gene such as Cc, Dd and Ee. Recent genetical investigations have confirmed the Fisher's concept of pseudoallelism. In the n-1 monoploid organisms, addition of single chromosome produces n-1 disomy (n + 1). One in which dominance of an allele depends on sex of the bearer, e.g., pattern baldness in humans in dominant in males, recessive in females. For example, the oxidized form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) can oxidize the reduced form of cytochrome b (E'o value = + 0.254 V) ca frequently also caused by transoposons which are segments of DNA that have a tendency to jump around the genome. 6C×3C = 18C). 14.1A). It is reported that the rate of mutation is increased due to increase in temperature. have the same effect as the standard gene but their phenotypic expression is less effective (2) Amorphs. N - K - ATPase is a transmembrane protein of 50,000 daltons M.W., C HCO3 CO2 H2O having a unknown function ; and another N C H larger unit having 1,20,000 daltons M. During their experiment, when they added or deleted single, or double base pairs in a particular region of DNA of T4 bacteriophages ceased to perform their normal functions. What is the role of histories in this structure ? In fact, the DNA sequencing method using PCR eliminates the need of cloning the DNA in single stranded DNA phage vector, i.e., M13. succinate deh. It was observed by Lyon in 1961 that each of the paternal (P) and maternal (M) X chromosomes has a chance to become inactive (i.e., Barr body). membrane membrane acid synthesis takes place in the chloroplast. (a) 1.15% C, 15% G, 35% T, 35% A. Autosomal mutations. 8.8. The development of a chromosomal puff in a larval salivary gland cell nucleus of Chironomus tentans. More extensive duplex unwinding occurs due to association of RF-A and a topoisomerase with the help of DNA helicase component of T-ago Topoisomerases help in unwinding of DNA by altering topology of DNA at the replication fork. of mRNA that has just been synthesized ? Education. In 1965, Jacob, Monod and Lwoff were awarded Nobel Prize for their contribution to microbial genetics. These investigators discovered that the area covered by the lipid monolipid molecular layer film was twice molecule than what was needed to cover the surface of the cells from which the lipid was extracted. close line breeding. NAD-ase (Ectoenzyme of erythrocyte) 15. (ii) The growth phase. The amphimixis. (a) By definition, codon occurs only in mRNA. As DNA polymerase catalyzes the tide monophosformation of the phosphodiester bond, pyrophosphate (P~)) is hydrolyzed into phates (i.e., d two phosphate molecules. Trans arrangement. Contents 362 CELL BIOLOGY Thus, the queen bee is fertilized only once by one or many males (drones). Certain cells contain exceptionally large number Contents 194 CELL BIOLOGY of the mitochondria, e.g., the Amoeba, Chaos chaos contain 50,000; eggs of sea urchin contain 140,000 to 150,000 and oocytes of amphibians contain 300,000 mitochondria. 5.26. When a cell has reached its maximum limiting size, it divided into two daughter cells. Thus, here two pairs of genes interact to produce comb size and shape in fowl. Michaelis (1900) used the supravital stain Janus green to demonstrate that mitochondria were oxidation-reduction sites in the cell. Somatic mutations have been often related with malignant (cancerous) growth. Differences between photosynthesis and oxidative phosphorylation (Source: De Robertis, Jr., 1987). The pattern of processing of 45S rRNA precursor molecule RNA polymerase I (about 100 into three separate ribosomal RNAs (after Alberts et al., 1989). 4.15. The sex chromatin appears in the interphase nucleus as a small chromocentre, heavily stained with basic dyes. During meiosis as well as during mitosis the nucleolus disappears during prophase. that readily enter cells through the plasma membrane. According to him the mother furnishes inert matter and the father gives the motion to the operator unless tryptophan is present. Preformation theories; 3. The microfibrils are mostly made up of cellulose. proteinaceous scaffold Some bacteria thrive in extreme conditions like this hot spring. (2) Copy error. They originate from the endoplasmic reticulum (ER). Glycogen along with enzymes involved in the synthesis of glycogen (Rybicka, 1981). Some of them have been described as follows : 1. 15.4. Meiotic pairing possibilities in triploids (each chromosome is really two chromatids). Amniotic fluid contains sloughed foetal cells. Extra-chromosomal duplication. EUKARYOTIC CELLS The eukaryotic cells. The cells of the germinal epithelium Contents 348 CELL BIOLOGY testis epididymis vas deferents form sperms by the process of spermatogenesis. If each haploid set of autosomes carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors
with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male-determining value equal to one (1), then each X chromosome carries factors with a male equal to one (1), then each X chromosome carries factors with a male equal to one (1), then each X chromosome carries factors with a male equal to one (1), then each X chromosome carries factors with a m indicated that the structural unit is an $\alpha\beta$ dimer of 8 nm length. The higher temperature could well increase the mutation rate nearly two fold, leading the investigators to suggest that the wearing of pants has possibly been much more unhygienic than fall out from testing of nuclear devices threatens to be. The fish Carassius auratus gibelio is reported to consist of females only (Lieder, 1955). Although for sometime these contractile proteins were thought to be contaminants, it is now believed that they are vital ingredients of the chromosome, functioning during chromosome condensation and in the movement of chromosome condensation and in the movement of chromosome contractile proteins were thought to be contaminants, it is now believed that they are vital ingredients of the chromosome condensation and in the movement of chromosome condensation and in the movement of chromosome condensation and in the movement of chromosome contactile proteins were thought to be contaminants, it is now believed that they are vital ingredients of the chromosome condensation and in the movement of chromosome condensation and (singular, bacillus). Complementary interaction between alleles indicates complex loci even when recombination between them has not been observed. Prophase.

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