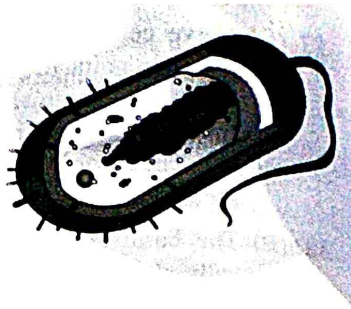
CHAPTER



8 Cell: The Unit of Life

8.1. What is a Cell?

1. Given below are two statements:

Statement I: Mycoplasma can pass through less than 1 micron filter size.

Statement II: Mycoplasma are bacteria with cell wall.

In the light of the above statements, choose the most appropriate answer from the options given below:

(A) Both Statement I and Statement II are incorrect.

(B) Statement I is correct but Statement II is incorrect.

(C) Statement I is incorrect but Statement II is correct.

(D) Both Statement I and Statement II are correct.

[NEET 2022]

2. A protoplast is a cell:

(A) without plasma membrane

(B) without nucleus

(C) undergoing division

(D) without cell wall. **[AIPMT Latest July 2015]**

3. Identify the correct order of organisation of genetic material from largest to smallest:

(A) Genome, chromosome, nucleotide, gene

(B) Genome, chromosome, gene, nucleotide

(C) Chromosome, genome, nucleotide, gene

(D) Chromosome, gene, genome, nucleotide

[AIPMT 2015]

4. A major breakthrough in the studies of cells came with the development of electron microscope. This is because:

(A) the electron microscope is more powerful than the light microscope as it uses a beam of electrons which has wavelength much longer than that of photons.

(B) the resolution power of the electron microscope is much higher than that of the light microscope.

(C) the resolving power of the electron microscope 200-350 nm as compared to 0.1 - 0.2 nm for the light microscope.

(D) electron beam can pass through thick materials, whereas light microscopy requires thin sections.

[AIPMT 2006]

5. A student wishes to study the cell structure under a light microscope having 10X eyepiece and 45X objective. He should illuminate the object by which one of the following colours of light so as to get the best possible resolution?

(A) Blue (B) Green

(C) Yellow (D) Red **[AIPMT 2005]**

6. Chromosomes in a bacterial cell can be 1 – 3 in number and:

(A) can be circular as well as linear within the same cell

(B) are always circular

(C) are always linear

(D) can be either circular or linear, but never both within the same cell **[AIPMT 2003]**

7. Which is correct about cell theory in view of current status of our knowledge about cell structure?

(A) It needs modification due to discovery of subcellular structures like chloroplasts and mitochondria.

(B) Modified cell theory means that all living beings are composed of cells capable of reproducing.

(C) Cell theory does not hold good because all living beings (*e.g.*, viruses) do not have cellular organisation.

(D) Cell theory means that all living objects consist of cells whether or not capable of reproducing.

[AIPMT 1993]

8. Angstrom (Å) is equal to:

(A) 0.01 μm (B) 0.001 μm

(C) 0.0001 μm (D) 0.00001 μm

[AIPMT 1992]

9. Magnification of compound microscope is not connected with:

(A) numerical aperture

(B) focal length of objective

(C) focal length of eye piece

(D) tube length. **[AIPMT 1990]**

10. Organelles can be separated from cell homogenate through:
(A) chromatography
(B) X-ray diffraction
(C) differential centrifugation
(D) auto-radiography. **[AIPMT 1989]**

8.4. Prokaryotic Cells

11. Mesosome in a cell is a:
(A) membrane bound vesicular structure.
(B) chain of many ribosomes attached to a single mRNA.
(C) special structure formed by extension of plasma membrane.
(D) medium sized chromosome. **[Re-NEET 2024]**

12. Which of the following components provides sticky character to the bacterial cell?
(A) Cell wall (B) Nuclear membrane
(C) Plasma membrane (D) Glycocalyx **[NEET 2017]**

13. Cell wall is absent in:
(A) *Aspergillus* (B) *Funaria*
(C) *Mycoplasma* (D) *Nostoc*
[AIPMT Latest July 2015]

14. The term 'glycocalyx' is used for:
(A) a layer surrounding the cell wall of bacteria.
(B) a layer present between cell wall and membrane of bacteria.
(C) cell wall of bacteria.
(D) bacterial cell glyco-engineered to possess N-glycosylated proteins. **[NEET Karnataka 2013]**

15. Which one of the following does not differ in *E.coli* and *Chlamydomonas*?
(A) Ribosomes
(B) Chromosomal organisation
(C) Cell wall
(D) Cell membrane **[AIPMT Screening 2012]**

16. Which of the following statement regarding cilia is not correct?
(A) Cilia contain an outer ring of nine doublet microtubules surrounding two single microtubules.
(B) The organised beating of cilia is controlled by fluxes of Ca^{2+} across the membrane.
(C) Cilia are hair-like cellular appendages.
(D) Microtubules of cilia are composed of tubulin.
[AIPMT 2006]

17. Flagella of prokaryotic and eukaryotic cells differ in:
(A) type of movement and placement in cell
(B) location in cell and mode of functioning
(C) microtubular organisation and type of movement
(D) microtubular organisation and function.
[AIPMT 2004]

18. In bacteria, plasmid is:
(A) extra chromosomal material
(B) main DNA
(C) non-functional DNA
(D) repetitive gene. **[AIPMT 2002]**

19. Difference in Gram positive and Gram negative bacteria is due to:
(A) cell wall (B) cell membrane
(C) ribosome (D) cytoplasm. **[AIPMT 2001]**

20. What are the sex organs provided in some bacteria?
(A) Sex pili (B) Plasmid
(C) Circular DNA (D) Gametes **[AIPMT 1996]**

21. The prokaryotic flagella possess:
(A) unit membrane enclosed fibre
(B) protein membrane enclosed fibre
(C) '9 + 2' membrane enclosed structure
(D) helically arranged protein molecule. **[AIPMT 1995]**

22. Golgi apparatus is absent in:
(A) higher plants
(B) yeast
(C) bacteria and blue-green algae
(D) none **[AIPMT 1993]**

8.5. Eukaryotic Cells

23. Match List-I with List-II:

List-I	List-II
(a) Fleming	(i) Disc shaped sacs or cisternae near cell nucleus
(b) Robert Brown	(ii) Chromatin
(c) George Palade	(iii)Ribosomes
(d) Camillo Golgi	(iv)Nucleus

Choose the correct answer from the options given below:

	(a)	(b)	(c)	(d)
(A)	(ii)	(iv)	(iii)	(i)
(B)	(ii)	(iii)	(i)	(iv)
(C)	(i)	(ii)	(iii)	(iv)
(D)	(iv)	(ii)	(iii)	(i)

[Re-NEET 2024]

24. Match List-I with List-II:

List-I	List-II
(a) Metacentric chromosome	(i) Chromosome has a terminal centromere
(b) Submetacentric chromosome	(ii) Middle centromere forming two equal arms of chromosome

(c) Acrocentric chromosome	(iii) Centromere is slightly away from the middle of chromosome resulting into two unequal arms
(d) Telocentric chromosome	(iv) Centromere is situated close to its end forming one extremely short and one very long arm

Choose the correct answer from the options given below:

	(a)	(b)	(c)	(d)
(A)	(ii)	(i)	(iv)	(iii)
(B)	(iv)	(i)	(ii)	(iii)
(C)	(i)	(ii)	(iii)	(iv)
(D)	(ii)	(iii)	(iv)	(i)

[Re-NEET 2024]

25. Match List-I with List-II:

List-I	List-II
(a) F_1 Particles	(i) Chromosomes
(b) Histones	(ii) Cilia
(c) Axoneme	(iii)Golgi apparatus
(d) Cisternae	(iv)Mitochondria

Choose the correct answer from the options given below:

	(a)	(b)	(c)	(d)
(A)	(ii)	(i)	(iv)	(iii)
(B)	(iv)	(i)	(ii)	(iii)
(C)	(iv)	(i)	(iii)	(ii)
(D)	(iv)	(iii)	(i)	(ii)

[Re-NEET 2024]

26. Given below are two statements:

Statement I: Concentrically arranged cisternae of Golgi complex are arranged near the nucleus with distinct convex *cis* or maturing and concave *trans* or forming face.

Statement II: A number of proteins are modified in the cisternae of Golgi complex before they are released from *cis* face.

In the light of the above statements, choose the correct answer from the options given below:

(A) Statement I is true but Statement II is false.

(B) Statement I is false but Statement II is true.

(C) Both Statement I and Statement II are true.

(D) Both Statement I and Statement II are false.

[Re-NEET 2024]

27. Match List I with List II:

List I	List II
(a) Nucleolus	(i) Site of formation of glycolipid
(b) Centriole	(ii) Organization like the cart-wheel
(c) Leucoplasts	(iii) Site for active ribosomal RNA synthesis
(d) Golgi apparatus	(iv) For storing nutrients

Choose the correct answer from the options given below:

	(a)	(b)	(c)	(d)
(A)	(ii)	(iii)	(i)	(iv)
(B)	(iii)	(iv)	(ii)	(i)
(C)	(i)	(ii)	(iii)	(iv)
(D)	(iii)	(ii)	(iv)	(i)

[NEET 2024]

28. The DNA present in chloroplast is:

(A) circular, double stranded

(B) linear, single stranded

(C) circular, single stranded

(D) linear, double stranded

[NEET 2024]

29. Given below are two statements:

Statement I: Mitochondria and chloroplasts are both double membrane bound organelles.

Statement II: Inner membrane of mitochondria is relatively less permeable, as compared to chloroplast.

In the light of the above statements, choose the most appropriate answer from the options given below:

(A) Both Statement I and Statement II are incorrect.

(B) Statement I is correct but Statement II is incorrect.

(C) Statement I is incorrect but Statement II is correct.

(D) Both Statement I and Statement II are correct.

[NEET 2024]

30. Match List I with List II:

List I	List II
(a) Axoneme	(i) Centriole
(b) Cartwheel pattern	(ii) Cilia and flagella
(c) Crista	(iii) Chromosome
(d) Satellite	(iv) Mitochondria

Choose the correct answer from the options given below:

	(a)	(b)	(c)	(d)
(A)	(iv)	(ii)	(iii)	(i)
(B)	(ii)	(iv)	(i)	(iii)
(C)	(ii)	(i)	(iv)	(iii)
(D)	(iv)	(iii)	(ii)	(i)

[NEET 2024]

31. Which of the following functions is carried out by cytoskeleton in a cell?

(A) Motility (B) Transportation

(C) Nuclear division (D) Protein synthesis

[NEET 2023]

32. Which of the following are NOT considered as the part of endomembrane system?

(I) Mitochondria (II) Endoplasmic reticulum
(III) Chloroplasts (IV) Golgi complex
(V) Peroxisomes

Choose the most appropriate answer from the options given below:

(A) (I) and (IV) only (B) (I), (IV) and (V) only
(C) (II) and (IV) only (D) (I), (III) and (V) only

[NEET 2023]

33. Which of the following statements with respect to Endoplasmic Reticulum is incorrect?

(A) SER is devoid of ribosomes
(B) In prokaryotes only RER are present
(C) SER are the sites for lipid synthesis
(D) RER has ribosomes attached to ER **[NEET 2022]**

34. Match List-I with List-II:

List-I	List-II
(a) Metacentric	(i) Centromere situated close chromosome to the end forming one extremely short and one very long arms
	(ii) Centromere at the terminal chromosome end
(c) Sub-metacentric	(iii) Centromere in the middle forming two equal arms of chromosomes
(d) Telocentric	(iv) Centromere slightly away chromosome from the middle forming one shorter arm and one longer arm

Choose the correct answer from the options given below:

	(a)	(b)	(c)	(d)
(A)	(i)	(iii)	(ii)	(iv)
(B)	(ii)	(iii)	(iv)	(i)
(C)	(i)	(ii)	(iii)	(iv)
(D)	(iii)	(i)	(iv)	(ii)

[NEET 2022]

35. Which of the following is an incorrect statement?

(A) Mature sieve tube elements possess a conspicuous nucleus and usual cytoplasmic organelles.
(B) Microbodies are present both in plant and animal cells.
(C) The perinuclear space forms a barrier between the materials present inside the nucleus and that of the cytoplasm.
(D) Nuclear pores act as passages for proteins and RNA molecules in both directions between nucleus and cytoplasm. **[NEET 2021]**

36. When the centromere is situated in the middle of two equal arms of chromosmes, the chromosome is reffered as:

(A) Metacentric (B) Telocentric
(C) Sub-metacentric (D) Acrocentric **[NEET 2021]**

37. The organelles that are included in the endomembrane system are:

(A) Endoplasmic reticulum, Mitochondria, Ribosomes and Lysosomes.
(B) Endoplasmic reticulum, Golgi complex, Lysosomes and Vacuoles.
(C) Golgi complex, Mitochondria, Ribosomes and Lysosomes.
(D) Golgi complex, Endoplasmic reticulum, Mitochondria and Lysosomes. **[NEET 2021]**

38. Match List-I with List-II

List-I		List-II	
(a)	Cristae	(i)	Primary constriction in chromosome
(b)	Thylakoids	(ii)	Disc shaped sacs in Golgi apparatus
(c)	Centromere	(iii)	Infoldings in mitochondria
(d)	Cisternae	(iv)	Flattened membranous sacs in stroma of plastids

Choose the correct answer from the options given below:

	(a)	(b)	(c)	(d)
(A)	(iv)	(iii)	(ii)	(i)
(B)	(i)	(iv)	(iii)	(ii)
(C)	(iii)	(iv)	(i)	(ii)
(D)	(ii)	(iii)	(iv)	(i)

[NEET 2021, AIPMT 2015]

39. Match the following columns and select the correct option from the codes given below.

Column I	Column II
(a) Smooth Endoplasmic reticulum	(i) Protein synthesis
(b) Rough endoplasmic reticulum	(ii) Lipid synthesis
(c) Golgi complex	(iii) Glycosylation
(d) Centriole	(iv) Spindle formation

Select the correct option:

	(a)	(b)	(c)	(d)
(A)	(ii)	(i)	(iii)	(iv)
(B)	(iii)	(i)	(ii)	(iv)
(C)	(iv)	(ii)	(i)	(iii)
(D)	(i)	(ii)	(iii)	(iv)

[NEET Oct. 2020]

40. Which of the following statements about inclusion bodies is incorrect?

(A) These are involved in ingestion of food particles.

(B) They lie free in the cytoplasm.

(C) These represent reserve material in cytoplasm.

(D) They are not bound by any membrane.

[NEET Sept. 2020]

41. Which of the following statements regarding mitochondria is incorrect?

(A) Enzymes of electron transport chain are embedded in outer membrane.

(B) Inner membrane is convoluted with infoldings.

(C) Mitochondrial matrix contains single circular DNA molecule and ribosomes.

(D) Outer membrane is permeable to monomers of carbohydrates, fats and proteins.

[NEET National 2019]

42. Which of the following statements is not correct?

(A) The hydrolytic enzymes of lysosomes are active under acidic pH.

(B) Lysosomes are membrane bound structures.

(C) Lysosomes are formed by the process of packaging in the endoplasmic reticulum.

(D) Lysosomes have numerous hydrolytic enzymes.

[NEET National 2019]

43. Which of the following cell organelles is present in the highest number in secretory cells?

(A) Mitochondria

(B) Golgi complex

(C) Endoplasmic reticulum

(D) Lysosomes **[NEET Odisha 2019]**

44. Non-membranous nucleoplasmic structures in nucleus are the site for active synthesis of:

(A) protein (B) *m*RNA

(C) *r*RNA (D) *t*RNA.

[NEET Odisha 2019]

45. Match the Column I with Column II.

Column I	Column II
(a) Golgi apparatus	(i) Synthesis of protein
(b) Lysosomes	(ii) Trap waste and excretory products
(c) Vacuoles	(iii) Formation of glycoproteins and glycolipids
(d) Ribosomes	(iv) Digesting biomolecules

Select the correct option from the following.

	(a)	(b)	(c)	(d)
(A)	(iii)	(iv)	(ii)	(i)
(B)	(iv)	(iii)	(i)	(ii)
(C)	(iii)	(ii)	(iv)	(i)
(D)	(i)	(ii)	(iv)	(iii)

[NEET Odisha 2019]

46. The Golgi complex participates in:

(A) respiration in bacteria

(B) formation of secretory vesicles

(C) fatty acid breakdown

(D) activation of amino acid **[NEET 2018]**

47. Which of the following is true for nucleolus?

(A) It takes part in spindle formation.

(B) It is a membrane-bound structure.

(C) Larger nucleoli are present in dividing cells.

(D) It is a site for active ribosomal RNA synthesis.

[NEET 2018]

48. Which one of the following events does not occur in rough endoplasmic reticulum?

(A) Cleavage of signal peptide

(B) Protein glycosylation

(C) Protein folding

(D) Phospholipid synthesis **[NEET 2018]**

49. Which of the following cell organelles is responsible for extracting energy from carbohydrates to form ATP?

(A) Lysosome (B) Ribosome

(C) Chloroplast (D) Mitochondrion

[NEET 2017]

50. Microtubules are the constituents of:

(A) spindle fibres, centrioles and cilia

(B) centrioles, spindle fibres and chromatin

(C) centrosome, nucleosome and centrioles

(D) cilia, flagella and peroxisomes.

[NEET Phase-I 2016]

51. Mitochondria and chloroplast are:

(I) semi-autonomous organelles.

(II) formed by division of pre-existing organelles and they contain DNA but lack protein synthesising machinery.

Which one of the following option is correct?

(A) II is true but I is false.

(B) I is true but II is false.

(C) Both I and II are false.

(D) Both I and II are correct. **[NEET Phase-I 2016]**

52. Water soluble pigments found in plant cell vacuoles are:

(A) chlorophylls (B) carotenoids

(C) anthocyanins (D) xanthophylls

[NEET Phase-I 2016]

53. A cell organelle containing hydrolytic enzyme is:

(A) lysosome (B) microsome

(C) ribosome (D) mesosome

[NEET Phase-II 2016]

54. The structures that are formed by stacking of organised flattened membranous sacs in the chloroplasts are:

(A) cristae (B) grana

(C) stroma lamellae (D) stroma

[AIPMT Cancelled 2015]

55. Nuclear envelope is a derivative of:

(A) smooth endoplasmic reticulum

(B) membrane of Golgi complex

(C) microtubules

(D) rough endoplasmic reticulum.

[AIPMT Cancelled 2015]

56. Which of the following structure is not found in a prokaryotic cell?

(A) Nuclear envelope (B) Ribosome

(C) Mesosome (D) Plasma membrane

[AIPMT Latest July 2015]

57. Match the columns and identify the correct option.

Column I	Column II
(a) Thylakoids	(i) Disc-shaped sacs in Golgi apparatus
(b) Cristae	(ii) Condensed structure of DNA
(c) Cisternae	(iii) Flat membranous sacs in stroma
(d) Chromatin	(iv) Infoldings in mitochondria

Select the correct option.

	(a)	(b)	(c)	(d)
(A)	(iv)	(iii)	(i)	(ii)
(B)	(iii)	(iv)	(i)	(ii)
(C)	(iii)	(i)	(iv)	(ii)
(D)	(iii)	(iv)	(ii)	(i)

[AIPMT Latest July 2015]

58. Which of the following are not membrane bound?

(A) Vacuoles (B) Ribosomes

(C) Lysosomes (D) Mesosomes

[AIPMT Latest July 2015]

59. Cellular organelles with membranes are:

(A) nuclei, ribosomes and mitochondria

(B) chromosomes, ribosomes and endoplasmic reticulum

(C) endoplasmic reticulum, ribosomes and nuclei

(D) lysosomes, Golgi apparatus and mitochondria

[AIPMT Latest July 2015]

60. Which structure performs the function of mitochondria in bacteria?

(A) Nucleoid (B) Ribosomes

(C) Cell wall (D) Mesosomes

[AIPMT 2014]

61. The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as:

(A) microtubules

(B) microfilaments

(C) intermediate filaments

(D) lamins.

[AIPMT 2014]

62. Match the following and select the correct answer.

Column I	Column II
(a) Centriole	(i) Infoldings in mitochondria
(b) Chlorophyll	(ii) Thylakoids
(c) Cristae	(iii) Nucleic acids
(d) Ribozymes	(iv) Basal body of cilia or flagella

Select the correct option.

	(a)	(b)	(c)	(d)
(A)	(iv)	(ii)	(i)	(iii)
(B)	(i)	(ii)	(iv)	(iii)
(C)	(i)	(iii)	(ii)	(iv)
(D)	(iv)	(iii)	(i)	(ii)

[AIPMT 2014]

63. A major site for synthesis of lipids is:

(A) RER (B) SER

(C) symplast (D) nucleoplasm **[NEET 2013]**

64. Which one of the following organelle in the figure correctly matches with its function?

(A) Rough endoplasmic reticulum, formation of glycoproteins

(B) Golgi apparatus, protein synthesis

(C) Golgi apparatus, formation of glycolipids

(D) Rough endoplasmic reticulum, protein synthesis

[NEET 2013]

65. Select the alternative giving correct identification and function of the organelle 'X' in the diagram.

(A) Mitochondria - Produce cellular energy in the form of ATP

(B) Golgi body - Provides packaging material
(C) Lysosomes - Secrete hydrolytic enzymes
(D) Endoplasmic reticulum - Synthesis of lipids

[NEET Karnataka 2013]

66. Ribosomal RNA is actively synthesised in:

(A) lysosomes (B) nucleolus
(C) nucleoplasm (D) ribosomes.

[AIPMT Screening 2012]

67. What is true about ribosomes?

(A) The prokaryotic ribosomes are 80S, where S stands for sedimentation coefficient.
(B) These are composed of ribonucleic acid and proteins.
(C) These are found only in eukaryotic cells.
(D) These are self-splicing introns of some RNAs.

[AIPMT Screening 2012]

68. Nuclear membrane is absent in:

(A) *Penicillium* (B) *Agaricus*
(C) *Volvox* (D) *Nostoc*

[AIPMT Screening 2012]

69. Select the correct statement from the following regarding cell membrane.

(A) Na^+ and K^+ ions move across cell membrane by passive transport.
(B) Proteins make up 60 to 70% of the cell membrane.
(C) Lipids are arranged in a bilayer with polar heads towards the inner part.
(D) Fluid mosaic model of cell membrane was proposed by Singer and Nicolson. **[AIPMT Screening 2012]**

70. Which one of the following structure is an organelle within an organelle?

(A) Ribosome (B) Peroxisome
(C) ER (D) Mesosome

[AIPMT Mains 2012]

71. Which one of the following organism is not an example of eukaryotic cell?

(A) *Escherichia coli* (B) *Euglena viridis*
(C) *Amoeba proteus* (D) *Paramecium caudatum*

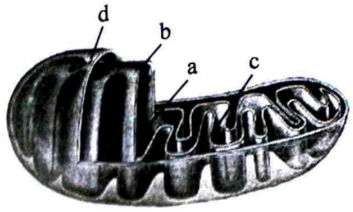
[AIPMT Screening 2011]

72. Important site for formation of glycoproteins and glycolipids is:

(A) Golgi apparatus (B) plastid
(C) lysosome (D) vacuole.

[AIPMT Screening 2011]

73. The given figure shows the structure of a mitochondrion with its four parts labelled (a), (b), (c) and (d). Select the part correctly matched with its function.



(A) d-Outer membrane-gives-rise to inner membrane by splitting
(B) b-Inner membrane-forms infolding called cristae
(C) c-Cristae-possess single circular DNA molecule and ribosomes
(D) a-Matrix-major site for respiratory chain enzymes.

[AIPMT Mains 2011]

74. Which one of the following is not considered as a part of the endomembrane system?

(A) Golgi complex (B) Peroxisome
(C) Vacuole (D) Lysosome

[AIPMT Mains 2011]

75. Peptide synthesis inside a cell takes place in:

(A) chloroplast (B) mitochondria
(C) chromoplast (D) ribosomes

[AIPMT Screening 2011]

76. Which one of the following has its own DNA?

(A) Mitochondria (B) Dictyosome
(C) Lysosome (D) Peroxisome

[AIPMT Screening 2010]

77. The main arena of various types of activities of a cell is:

(A) plasma membrane (B) mitochondrion
(C) cytoplasm (D) nucleus

[AIPMT Screening 2010]

78. The plasma membrane consists mainly of:

(A) phospholipids embedded in a protein bilayer
(B) proteins embedded in a phospholipid bilayer
(C) proteins embedded in a polymer of glucose molecules
(D) proteins embedded in a carbohydrate bilayer.

[AIPMT Screening 2010]

79. Which one of the following statement about the particular entity is true?

(A) Centromere is found in animal cells which produces aster during cell division.
(B) The gene for producing insulin is present in every body cell.
(C) Nucleosome is formed of nucleotides.
(D) DNA consists of a core of eight histones.

[AIPMT Mains 2010]

80. Middle lamella is mainly composed of:
(A) hemicellulose (B) muramic acid
(C) calcium pectate (D) phosphoglycerides.
[AIPMT Screening 2009]

81. Plasmodesmata are:
(A) lignified cemented layers between cells
(B) locomotory structures
(C) membranes connecting the nucleus with plasmalemma
(D) connections between adjacent cells.
[AIPMT Screening 2009]

82. Cytoskeleton is made up of:
(A) calcium carbonate granules
(B) callose deposits
(C) cellulosic microfibrils
(D) proteinaceous filaments. **[AIPMT Screening 2009]**

83. Keeping in view the 'fluid mosaic model' for the structure of cell membrane, which one of the following statement is correct with respect to the movement of lipids and proteins from one lipid monolayer to the other (described as flip-flop movement)?
(A) Both lipids and proteins can flip-flop.
(B) While lipids can rarely flip-flop, proteins cannot.
(C) While proteins can flip-flop, lipids cannot.
(D) Neither lipids, nor proteins can flip-flop.
[AIPMT Screening 2008]

84. Polysome is formed by:
(A) several ribosomes attached to a single *m*RNA
(B) many ribosomes attached to a strand of endoplasmic reticulum
(C) a ribosome with several subunits
(D) ribosomes attached to each other in a linear arrangement. **[AIPMT Screening 2008]**

85. Vacuole in a plant cell:
(A) is membrane-bound and contains storage proteins and lipids.
(B) is membrane-bound and contains water and excretory substances.
(C) lacks membrane and contains air.
(D) lacks membrane and contains water and excretory substances. **[AIPMT Screening 2008]**

86. In germinating seeds fatty acids are degraded exclusively in the:
(A) proplastids (B) glyoxysomes
(C) peroxisomes (D) mitochondria
[AIPMT Screening 2008]

87. Cellulose is the major component of cell walls of:
(A) *Pythium* (B) *Xanthomonas*
(C) *Pseudomonas* (D) *Saccharomyces*
[AIPMT Screening 2008]

88. Select the wrong statement from the following:
(A) Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by the thylakoid membrane.
(B) Both chloroplasts and mitochondria contain DNA.
(C) The chloroplasts are generally much larger than mitochondria.
(D) Both chloroplasts and mitochondria contain an inner and an outer membrane. **[AIPMT 2007]**

89. Which one of the following is not a constituent of cell membrane?
(A) Glycolipids (B) Proline
(C) Phospholipids (D) Cholesterol
[AIPMT 2007]

90. Which of the following statement regarding mitochondrial membrane is not correct?
(A) The outer membrane resembles a sieve.
(B) The outer membrane is permeable to all kinds of molecules.
(C) The enzymes of the electron transfer chain are embedded in the outer membrane.
(D) The inner membrane is highly convoluted forming a series of infoldings. **[AIPMT 2006]**

91. The main organelle involved in modification and routing of newly synthesised proteins to their destinations is:
(A) chloroplast
(B) mitochondria
(C) lysosome
(D) endoplasmic reticulum **[AIPMT 2005]**

92. Centromere is required for:
(A) movement of chromosome towards the poles
(B) cytoplasmic cleavage
(C) crossing over
(D) transcription **[AIPMT 2005]**

93. According to widely accepted "fluid mosaic model" cell membranes are semi-fluid, where lipids and integral proteins can diffuse randomly. In recent years, this model has been modified in several respects. In this regard, which of the following statement is incorrect?
(A) Proteins in cell membranes can travel within the lipid bilayer.
(B) Proteins can also undergo flip-flop movements in the lipid bilayer.
(C) Proteins can remain confined within certain domains of the membrane.
(D) Many proteins remain completely embedded within the lipid bilayer. **[AIPMT 2005]**

94. Protein synthesis in an animal cell occurs:
(A) only on the ribosomes present in cytosol.
(B) only on ribosome attached to the nuclear envelope and endoplasmic reticulum.
(C) on ribosome present in the nucleolus as well as in cytoplasm.
(D) on ribosomes present in cytoplasm as well as in mitochondria. **[AIPMT 2005]**

95. In chloroplasts, chlorophyll is present in the:
(A) outer membrane (B) inner membrane
(C) thylakoids (D) stroma **[AIPMT 2004]**

96. Mitotic spindle is mainly composed of which protein?
(A) Actin (B) Myosin
(C) Tubulin (D) Myoglobin **[AIPMT 2002]**

97. In fluid mosaic model of plasma membrane:
(A) upper layer is non-polar and hydrophilic.
(B) polar layer is hydrophobic.
(C) phospholipids form a bimolecular layer in the middle part.
(D) proteins form a middle layer. **[AIPMT 2002]**

98. Ribosomes are produced in:
(A) nucleolus (B) cytoplasm
(C) mitochondria (D) Golgi body
[AIPMT 2002]

99. Microtubules are absent in:
(A) mitochondria (B) centriole
(C) flagella (D) spindle fibres
[AIPMT 2001]

100. Experiments on *Acetabularia* by Hammerling proved the role of:
(A) cytoplasm in controlling differentiation
(B) nucleus in heredity
(C) chromosomes in heredity
(D) nucleo-cytoplasmic ratio **[AIPMT 1992]**

101. Polyribosomes are aggregates of:
(A) ribosomes and rRNA
(B) only rRNA
(C) peroxisomes
(D) several ribosomes held together by string of mRNA
[AIPMT 1989]

102. Nucleoproteins are synthesised in:
(A) nucleoplasm (B) nuclear envelope
(C) nucleolus (D) cytoplasm **[AIPMT 1989]**

103. A bivalent consists of:
(A) two chromatids and one centromere
(B) two chromatids and two centromeres
(C) four chromatids and two centromeres
(D) four chromatids and four centromeres
[AIPMT 1989]

104. *Acetabularia* used in Hammerling's nucleocytoplasmic experiments is:
(A) unicellular fungus
(B) multicellular fungus
(C) unicellular uninucleate green algae
(D) unicellular multinucleate green algae **[AIPMT 1988]**

SOLUTIONS

1. (B) *Mycoplasma are* the smallest living cells with an approximate size of 0.2 micrometers. So, they can easily pass through a filter of less than 1 micron size. They do not have a cell wall.

Related Theory
➥ *Mycoplasma are resistant to antibiotics as they lack cell wall.*

2. (D) A protoplast is a cell without cell wall. It is a plant, bacterial or fungal cell that has had its cell wall removed, either completely or partially, *via* mechanical, chemical or enzymatic actions.

3. (B) A genome is an entire collection of DNA made up of all of an organism's genes, non-coding DNA, mitochondrial DNA, and chloroplast DNA. The hundreds to thousands of genes on a chromosome are responsible for the characteristics of an organism. The basic building block of heredity is a gene, which is made up of nucleotides.

4. (B) On an average, the resolving power of a light microscope is 0.25–0.3 μm, while that of an electron microscope is 2–10 Å. The magnification range of the light microscope is 2000–4000, while that of an electron microscope is 1,00,000– 3,00,000.

Related Theory
➥ *The resolving power of an objective lens is measured by its ability to differentiate between two lines or points in an object. The greater the resolving power, the smaller the minimum distance between two lines or points that can still be distinguished. The larger the numerica aperture (NA)., the higher the resolving power.*

5. (A) In order to increase the resolution, the specimen must be viewed using either shorter wavelength (λ) light or through an imaging medium with a relatively high refractive index (n) or with optical components which have a high numerical aperture (NA). Thus, resolution of microscope is inversely proportional to the wavelength of the light used.

$$\Delta d = \frac{\lambda}{2n\sin\theta}$$

Where,

λ = wavelength

n = refractive index

θ = half angle subtended

Δd = shortest distance

6. (B) The majority of bacterial cells contain just one circular double-stranded DNA molecule. They can also contain multiple chromosomes, for example, rod-shaped, Gram-negative bacterium *Rhodobacter sphaeroides* containing 2 or multiple circular DNA. In *B.burgdorferi*, which has eukaryotic chromosome organisation and a linear chromosome of about 1.0 Mb. There are two chromosomes in *Agrobacterium tumefaciens*, one circular and one linear.

7. (C) Cell theory does not hold good because all living beings, do not have cellular organisation (*e.g.*, viruses). Cell theory proposed by 'Schwann and Schleiden' states that:

(1) All living organisms are composed of one or more cells.

(2) The cell is the basic unit of structure and organisation in organisms.

(3) Cells arise from pre-existing cells.

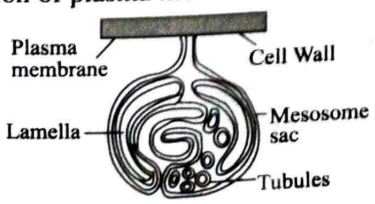
(4) The exception to cell theory are those organisms that lack cellular organisations like the viruses.

8. (C) 1 Angstrom is equals to 0.0001 μm.

9. (A) Magnification is the degree to which a lens, mirror or other device can magnify an object. Magnification of microscope depends on focal length of lenses and length of body tube. It does not depend on numerical aperture of objective lens and the nature of light being used for illumination. The total magnification of a microscope is determined by multiplying the magnifying power of the objective lens by that of an eye piece.

10. (C) Cell organelles can be separated from cell homogenate through the method of differential centrifugation. The basic principle involved in this method is sedimentation of particles in a suspension by centrifugal force. In a centrifuge, the organelles settle down at the bottom of centrifuge tube at different centrifugal speeds. The rate of sedimentation depends upon the size of the organelles, its shape and density.

11. (C) Mesosomes are prominiently found in bacterial cell's membrane, these are special structure formed by extension of plasma membrane.



12. (D) Glycocalyx is the outermost mucilaginous layer of the cell envelope, outer to cell wall. It gives sticky character to the bacterial cell. Bacterial cell lacks nuclear membrane.

13. (C) *Mycoplasma* is a genus of bacteria that lack a cell wall around its cell membrane. *Aspergillus* is a fungus having chitinous cell wall. *Funaria* is a bryophyte having cellulosic cell wall. *Nostoc* is a cyanobacteria surrounded by cellulosic cell wall.

14. (A) Glycocalyx or pericellular matrix is a carbohydrate-enriched coating of glycoprotein and a glycolipid that covers the cell membranes of few bacteria, epithelial cells and other cells. The composition and thickness of the glycocalyx layer differ in different bacteria. It may be present in the form of a slimy layer or as a thick capsule. It is mainly used in the recognition of the cell by the help of Gram staining procedure.

15. (D) Cell membrane of prokaryotes (*E. coli*) is structurally similar to that of eukaryotes (*Chlamydomonas*).

Related Theory

Differences between prokaryotes and eukaryotes:

Prokaryotes	*Eukaryotes*
Most prokaryotes are unicellular.	*Most eukaryotes are multicellular.*
The nucleus is poorly defined due to the absence of a nuclear membrance.	*The nucleus is well defined and is surrounded by a nuclear membrance.*
Nucleolus is absent.	*Nucleolus is present.*
Cell organelles such as plastids, mitochondria, golgi bodies, etc. are absent.	*Cell organelles such as plastids, mitochondria, golgi bodies, etc. are present.*
Bacteria and blue-green algae are prokaryotic cells.	*Fungi, plant and animal cells are eukaryotic cells.*

16. (B) Cilia are minute, hair-like processes on the surface of protozoans or on metazoan cells. Each cilium contains a peripheral circle of nine doublet microtubules arranged around two single microtubules. Each microtubule is composed of tubulin protein. The mechanism of ciliary movement is not completely understood. The fluxes of Ca^{2+} across the membrane are not responsible for controlling the organised beating of cilia.

17. (C) The difference between prokaryotic and eukaryotic flagella are as follows :

Prokaryotic Flagella (Bacterial flagella)	**Eukaryotic flagella**
Made up of protein flagellin.	Made up of protein tubulin (9+2 microtubule arrangement).
Rotatory movement.	Bending movement.
Proton driven.	ATP driven.

18. (A) A plasmid is a small, often circular DNA molecule found in bacteria and other cells. Plasmids are separate from the bacterial chromosome and replicate independently of it.

Related Theory

Each bacterial cell typically produces many copies of a plasmid, in contrast to making only one copy of its own chromosome. The fact that plasmids are smaller and in greater number than the host chromosome make plasmids easier to isolate in pure form, which is why researchers commonly use them for studying DNA in the laboratory. Plasmids are thus a fundamental tool of recombinant DNA technology.

19. (A) The Gram-negative cell wall is characterised by presence of an outer membrane, a thinner peptidoglycan layer and extensive periplasmic space surrounding the peptidoglycan. The uppermost layer of the outer membrane has lipopolysaccharide, while the innermost layer is a typical lipid layer. Presence of membrane channels formed by porin proteins in outer membrane make them less penetrable as compared to Gram positive cells.

Gram positive cells are characterised by presence of single thick layer of cell wall, which is made up of peptidoglycan, teichoic acid and lipoteichoic acid. They lack outer membrane and porin and have narrow periplasmic space.

20. (A) Sex pili are minute and non-flagellar hair-like structures that are projecting from the wall of many Gram negative bacteria and a few Gram positive ones. They are made up of protein called pilin. They are used as sex organs during conjugation, for the formation of conjugation tube during reproduction.

Related Theory

Sex pili are 1-4 narrow protoplasmic outgrowths. Both sex pili and fertility factor are absent in female or recipient cells. If these two types of cells happen to come nearer, a pilus of male cell establishes a protoplasmic bridge or conjugation tube with the female cell. It takes 6-8 minutes.

21. (D) A membrane-free space does not surround a bacterial flagellum. It is made up of just one thread. Flagellin, a group of multiple identical spherical protein subunits, make up the thread. The flagellin subunits are organised in a hollow cylinder with helical spirals.

22. (C) A prokaryotic cell lacks membrane-bound cell organelles and nucleus. Golgi apparatus is a membrane bound organelle and therefore, it is absent in bacteria and blue-green algae.

23. (A) Chromatin is discovered by Fleming, Nucleus was first noticed by Robert brown, ribosomes are discovered by George palade. Disc shaped sacs or cisternae near cells are discovered by Camillo Golgi.

24. (D) Metacentric chromosome is the X shaped chromosome in which the middle centromere forming two equal arms of chromosome.

Submetacentric means that the centromere is slightly away from the middle of the chromosome resulting into two unequal arms.

Centromere is situated close to its end forming one extremely short and one very long arm called acrocentric chromosomes.

Telocentric chromosome has a terminal centromere.

25. (B) F_1 Particles are associated with mitochondria, where they play a role in ATP synthesis. Histones are found in chromosomes, where they help in packaging of DNA.Axoneme is the core structure of cilia, involved in movement. Cisternae are membrane-bound sacs in the Golgi apparatus, involved in modifying and packaging of proteins.

26. (D) Concentrically arranged cisternae of Golgi complex are arranged near the nucleus with distinct convex cis or forming face and concave trans or maturing face. A number of proteins are modified in the Golgi cisternae and released from the trans face, not the cis face.

27. (D) (a) Nucleolus is a site for active ribosomal RNA synthesis.

(b) Centrioles are two cylindrical structures present in a centrosome lie perpendicular to each other in which each has an organisation like the cartwheel.

(c) Leucoplasts are the colourless plastids of varied shapes and sizes with stored nutrients.

(d) Golgi apparatus is an important site of formation of glycoproteins and glycolipids.

28. (A) The DNA of chloroplast contains small, double stranded circular DNA molecules and ribosomes.

29. (B) Both mitochondria and chloroplasts are double membrane bound cell organelles. Transport of ions occurs across the inner membrane of mitochondria. The inner membrane of chloroplast is less permeable to ions and metabolites. Therefore, it is said that inner membrane of mitochondria is relatively more permeable than that of chloroplast.

30. (C) Axoneme is seen in cilia and flagella. Centriole shows cartwheel appearance. Crista is found in mitochondria. Satellite is present in chromosomes.

31. (A) The cytoskeleton is a network of protein fibers that provides shape, support, and movement to the cell. It is involved in various cellular functions, including cell division, organelle transport, and cell motility. The three main types of protein fibers that make up

the cytoskeleton are microfilaments, intermediate filaments, and microtubules. Microfilaments and microtubules are involved in cell motility and transportation, respectively.

32. (D) Mitochondria, peroxisomes, and chloroplasts are not part of the endomembrane system, as their functions are not co-ordinated with the members of the endomembrane system.

33. (B) RER (rough endoplasmic reticulum) have ribosomes attached to endoplasmic reticulum, which is a membrane bound organelle found in eukaryotes not in prokaryotes. So, RER is not present in prokaryotes.

34. (D) **Metacentric:** Centromere in the middle forming two equal arm of chromosome.
Acrocentric: Centromere is situated close to the end forming one extremely short and one very long arm.
Sub-metacentric: Centromere slightly away from the middle of the chromosome resulting into one shorter arm and one longer arm.
Telocentric: Centromere with terminal centromere.

35. (A) Mature sieve tube elements are deep, tubular and do not contain nucleus in the cells with no secondary wall and terminal sieve plate. They lack nucleus at the maturity so that they are associated with companion cells for support. Their features are the same as prokaryotic cells.

Related Theory

Companion cells are the associated cells of sieve tubes. Sieve tubes have pores in the transverse walls, while companion cells do not have pores.

36. (A) A metacentric chromosome is a chromosome whose centromere is centrally located. Sub-metacentric chromosomes have the centromere slightly offset from the centre. Acrocentric chromosomes have a centromere, which is severely offset from the centre. Telocentric chromosomes have the centromere at the very end of the chromosome.

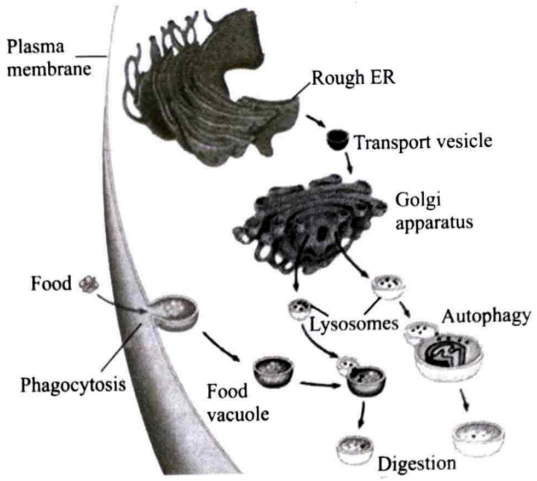
Related Theory

Human chromosomes 1 and 3 are metacentric. Human chromosomes 4 to 12 are sub-metacentric. Human chromosomes 13, 15, 21, and 22 are acrocentric. Humans do not possess telocentric chromosome, but they are found in other species such as mice.

37. (B) In eukaryotes the organelles of the endomembrane system include: the nuclear membrane, the endoplasmic reticulum (ER), the Golgi apparatus, lysosomes, vesicles, vacuoles, endosomes, and plasma (cell) membrane among others.

Related Theory

The endomembrane system is a group of membranes and organelles in eukaryotic cells that works together to modify, package and transport lipids and proteins. Vesicles with the integral protein bud from the ER and fuse with the cis face of the Golgi apparatus.



Endomembrane System

38. (C) The inner membrane of mitochondria is infolded variously to form involutions, which are called cristae. Thylakoids are membrane lined flattened sacs, which run throughout the stroma or matrix of the chloroplast. Centromere are primary constriction of the chromosome. Golgi apparatus consists of a stack of generally 4-8 membrane-bound cisternae. Cisternae are disc-shaped.

Related Theory

Cristae are meant for increasing the physiologically active area of the inner membrane. The density of cristae indicates the intensity of respiration.

Caution

Students need to understand that secondary constrictions are the constricted or the narrow region found at any point of the chromosome other than that of centromere (primary constriction).

39. (A) Smooth endoplasmic reticulum (SER) is the major site for lipid synthesis. Rough endoplasmic reticulum (RER) is actively involved in protein synthesis. Golgi complex is involved with glycosylation, *i.e.*, formation of glucolipids and glycoproteins. Centriole helps in the spindle formation during cell division.

Related Theory

Functions of various cell organelles:

Organelles	*Functions*
Endoplasmic reticulum (ER)	*(1) Passage way for transport of materials within the cell* *(2) Synthesis of lipids*
Ribosomes	*(1) Site of protein synthesis*
Proteasomes	*(1) Site of destruction of old or damaged proteins*
Golgi apparatus	*(1) Modification and sorting of carbohydrates* *(2) Packaging of materials for secretion from the cell*

Mitochondria	*(1) Site of aerobic cell respiration – ATP production*
Lysosomes	*(1) Contain enzymes to digest ingested material or damaged tissue*
Centrioles	*(1) Organise the spindle fibers during cell division*

40. (A) Inclusion bodies are cytoplasmic aggregates of proteins. They are the elementary bodies, formed during infectious diseases or within the virus-infected cells, such as rabies, herpes, measles, *etc*. Inclusion bodies are abnormal structures with distinct size and shape and usually observed in nerve, epithelial or endothelial cells. They have a characteristic staining property and are typically composed of proteins. Inclusion bodies are non-living chemical compounds and by-products of cellular metabolism. They are found both in prokaryotes and eukaryotes. In prokaryotic cells, they are mainly formed to store reserve materials. In animal cells, they store fats and sugars that are ready for cellular respiration and in plant cells, they store granules of materials like glycogen, starch, *etc*. Gas vacuoles, cyanophycean granules, phosphate granules, glycogen granules are a few examples of inclusion particles.

41. (A) The electron transport chain is located in the inner mitochondrial membrane. The inner membrane of mitochondria has many folds that form a layered structure called cristae, and this helps in increasing the surface area inside the organelle. The mitochondrial matrix comprises ribosomes, inorganic ions, circular mitochondrial DNA, nucleotide cofactors, enzymes, protein and organic molecules. The outer membrane covers the surface of the mitochondria and has a large number of special proteins known as porins. It is freely permeable to ions, nutrient molecules, energy molecules like the ADP and ATP molecules.

Related Theory

The electron transport chain is the portion of aerobic respiration that uses free oxygen as the final electron acceptor of the electrons removed from the intermediate compounds in glucose catabolism.

42. (C) Lysosomes are actually formed by budding off from the *trans* face of Golgi bodies. These membrane bound structures contains hydrolytic enzymes, which are active under acidic pH. The precursors are synthesised by RER.

Related Theory

The cell's endoplasmic reticulum (ER) generates biological raw materials, packaging them in membrane-enclosed bubbles called vesicles, for transport to the Golgi. These vesicles enter the Golgi through the side nearest to the cell nucleus.
The process can be summarised as:
RER → Cis face of Golgi apparatus → Trans face of Golgi apparatus → Secretory vesicle

43. (B) In secretory cells, Golgi complexes are found in highest number as they are involved in the modification, packaging and secretion of glycoproteins and proteins outside the cell. Mitochondria is the powerhouse of the cell, providing energy in the form of ATP. Endoplasmic reticulum is involved in the synthesis of proteins and phospholipids. Lysosomes are formed by budding off from the trans face of Golgi bodies.

44. (C) Non-membranous nucleoplasmic structure, called nucleolus are the site for the active synthesis of rRNA. Ribosomes are the site of protein synthesis. tRNA and mRNA are formed by the process of transcription.

Related Theory

The nucleolus is a prominent sub-nuclear structure that is not bound by a membrane and resides within the nuclear matrix. It manufacture the subunits that combine to form ribosomes, the cell's protein-producing factories. In cells that produce large amounts of protein, and thus, call for significant numbers of ribosomes, the size of the nucleolus is considerable, sometimes occupying as much as 25 percent of the total volume of the nucleus.

Caution

Students should remember that rRNA formed in nucleolus, are transported to cytoplasm, where ribosome serves as the site for protein synthesis.

45. (A) Golgi apparatus was discovered by Camillo Golgi and is involved in the formation of glycolipids and glycoproteins. Lysosomes are single membrane bound organelles, consisting of digestive enzymes and are also known as suicidal bags. Vacuoles are a kind of vesicle or closed sacs, made of inorganic or organic molecules inside, such as enzymes. In animal cells, vacuoles are generally small and help to trap waste and excretory products. In plant cells, vacuoles helps in maintaining water balance. Ribosomes are called protein factory, as they are exclusively involved in the synthesis of proteins in the cells.

46. (B) Formation of secretory vesicles and secretion is the primary function of Golgi complex. They help in the collection, storage, condensation, modification and packaging of various materials into secretory vesicles. The secretory material is released out of the cell through exocytosis or reverse pinocytosis. In bacteria, mesosomes aids in respiration. The breakdown of fatty acids occurs in peroxisomes and mitochondria. Activation of amino acid occurs in cytoplasm, where they attach to tRNA to initiate the process of protein synthesis.

Related Theory

Golgi body shows two distinct faces. The convex face of the cisternae, also known as the "cis face" or "forming face", is usually oriented towards the nucleus and the "trans face" or the "maturing face" is oriented towards the plasma membrane.

47. (D) Nucleosomes are known as the ribosome subunit manufacturing units, or ribosomal factory as several fractions of ribosomes synthesised in the cytoplasm migrate to nucleolus before they take on their final form. They help in the synthesis of rRNA and also store them. Centriole takes part in spindle formation. Nucleolus is a membrane less organelle.

Related Theory

Nucleolus is a naked, round or slightly irregular structure which is attached to the chromatin at a specific region called nucleolar organiser region (NOR). It is absent in muscle fibres, RBCs, yeast cells, sperms and prokaryotes. Usually, a diploid cell contains two nucleoli, but there are certain exceptions like oocytes of Xenopus bear approximately 1000 nucleoli. The nucleolus gets darkly stained and bears no limiting membrane.

48. (D) Phospholipid synthesis does not occur in RER. It occurs in SER. A single peptide is a short peptide present at N-terminal of newly synthesised protein. It targets them to RER and then cleaved off. RER is involved in the synthesis of proteins. It bear enzymes for modifying polypeptides, synthesised by attached ribosomes, *e.g.*, glycosylation.

Related Theory

The smooth ER is involved in the synthesis of lipids, such as cholesterol and phospholipids, which form all the membranes of an organism. It also synthesise and secrete steroid hormones from cholesterol and other lipid precursors. The SER performs detoxification in liver.

49. (D) Mitochondrion is known as the powerhouse of the cell, as it oxidise carbohydrates to produce ATP in the presence of an enzyme, during the process of respiration. Lysosomes contain hydrolytic enzymes and are known as suicidal bags. Ribosomes are protein factory of the cell. Chloroplast is known as kitchen of the cell and functions during photosynthesis.

Related Theory

Like mitochondria, chloroplast is a double membrane bound organelle. The matrix of chloroplast is known as stroma. They have many small disc-shaped sacs called thylakoids within their stroma. These thylakoids are stacked on top of one another, and a stack of thylakoids is called a granum. The thylakoids contain chlorophylls and carotenoids, and these pigments absorb light during the process of photosynthesis. In the stroma, enzymes make complex organic molecules that are used to store energy, such as carbohydrates. It also contains its own DNA and ribosomes that are similar to those found in photosynthetic bacteria.

50. (A) Microtubules are found in cilia, flagella, centrosomes and spindle fibres in the cell. Chromatin and nucleosome are the part of nucleus, which lacks microtubules. Peroxisomes are oxidative organelles.

Related Theory

Microtubules and microfilaments are two components in the cytoskeleton. The main difference between microtubules and microfilaments is in their structure and function. Microtubules have a long, hollow cylindrical structure. On the other hand, microfilaments are helical structures, more strong and flexible compared to microtubules.

51. (B) Mitochondria and chloroplasts are semi-autonomous organelles. They contain DNA, 70S ribosomes. Thus, they are capable of self-replication and can synthesise its own proteins.

Related Theory

According to the theory of Endosymbiosis, eukaryotic organelles are thought to have evolved by a symbiosis between two cells, which were originally free-living. During the course of evolution, a prokaryotic cell was engulfed by another cell. The engulfed prokaryote gradually became a part of another cell and acted as a precursor of modern eukaryotes. This theory also suggests that the engulfed prokaryotes provided their hosts with certain advantages that were associated with their special metabolic abilities. Two key eukaryotic organelles that are believed to be the descendants of these endosymbiotic prokaryotes are mitochondria, which are thought to have originated as bacteria that were capable of carrying out oxidative metabolism, and chloroplasts, which apparently arose from photosynthetic bacteria.

52. (C) Anthocyanin are the pigments that give red, purple and blue colour and are present in vacuoles. They are soluble in water and alcohol, insoluble in polar organic solvents, and unstable in neutral or alkaline medium. Rest of the chlorophyll pigments, *i.e.*, chlorophylls, carotenoids and xanthophyll are insoluble in water.

53. (A) Lysosomes contain hydrolytic enzymes, such as acid phosphatases, nucleases, lipases, glycosidases, *etc.* The enzymes usually function in an acidic medium. Due to the presence of these digestive enzymes, lysosomes are called suicidal bags.

Related Theory

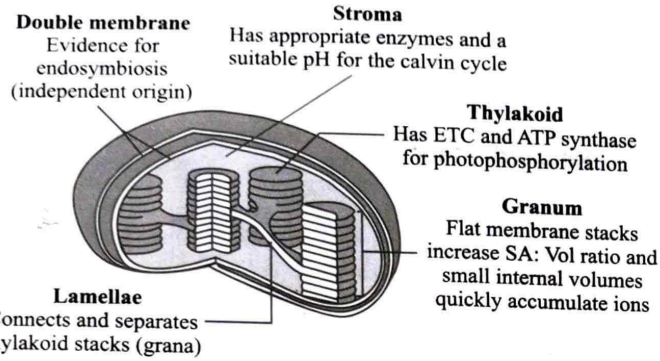
Lysosomes are common in animal cells and protozoans and less common in plant cells. Mature mammalian RBCs and yeasts are a few animal cell types that lack lysosomes. Amongst plants cells, lysosomes are exceptionally present in the meristematic cells, root tip cells of maize, cotton and pea seeds, etc. Usually in plant cells, the lysosomal activities are carried out by vacuoles, spherosomes and aleurone grains, which are together known as plant lysosomes. Lysosomes are absent in prokaryotes.

54. (B) The chloroplast has an inner and outer membrane with an empty intermediate space in between. Inside the chloroplast are stacks of thylakoids, called grana (each granum contain 10-20 thylakoids), as well as stroma, the dense fluid inside of the chloroplast. These thylakoids contain the chlorophyll that is necessary for the plant to go through photosynthesis

and the space is called the thylakoid space. The grana are connected to each other with the help of a layer of thin tissue called the stroma lamellae. Inner folding of the membrane called cristae are found in mitochondria.

Related Theory

Structure of chloroplast



55. (D) Nuclear envelope is formed through rough endoplasmic reticulum (RER) during telophase by fusion of vesicles into which the nuclear envelope develops during prophase. The perinuclear space present between two membranes of nuclear envelope runs continuous with channnels of the ER aiding in shrinkage or expansion of envelope.

Related Theory

The nuclear envelope protects the cell's genetic material from the chemical reactions that take place outside the nucleus. It also contains many proteins that are used in organising DNA and regulating genes. It manages what materials can enter and exit the nucleus. This protects genetic information from mixing with other parts of the cell, and allows different cellular activities to occur inside the nucleus and outside the nucleus in the cytoplasm, where all other cellular structures are located.

Caution

Students should remember that the outer nuclear envelope is in continuation with the rough endoplasmic reticulum.

56. (A) In prokaryotes, nuclear membrane is absent and the genetic material is naked, lying in cytoplasm. They, however possess ribosomes, mesosomes and plasma membrane.

Related Theory

Mesosome is a convoluted membranous structure formed in a prokaryotic cell by the invagination of the plasma membrane. These extensions help in the synthesis of the cell wall and replication of DNA. They also help in the equal distribution of chromosomes into the daughter cells. It also increases the surface area of the plasma membrane to carry out various enzymatic activities. It helps in secretion processes as well as in bacterial respiration.

57. (B) The thylakoid are arranged into stacked and unstacked regions called grana and stroma thylakoids, respectively, that are differentially enriched in photosystem I and II complexes. Cristae are infoldings in mitochondria, which greatly increases the surface area of the inner membrane. Cisternae are disc-shaped sacs in Golgi apparatus. Chromatin is the condensed structure of DNA.

58. (B) Ribosomes are non-membranous organelles. They are simply the aggregation of rRNA and ribosomal proteins. They are the site of protein synthesis and hences, known as protein factory.

Related Theory

Ribosome functions by binding to a messenger ribonucleic acid (mRNA) and decoding the information carried by the nucleotide sequence of the mRNA. The transfer RNAs (tRNAs) comprising amino acids, enter into the ribosome at the acceptor site. Once it gets bind up, it adds amino acid to the growing protein chain on tRNA.

59. (D) Ribosomes is a membrane less organelle. It is usually an aggregate form of rRNA and ribosomal proteins. Chromosomes are the genetic material composed of nucleotides and histone proteins. Lysosomes, Golgi apparatus and endoplasmic reticulum are single membrane bound organelles, while mitochondria, nuclei and chloroplast are double membrane bound organelles.

60. (D) The mesosome helps to increase the surface area of the cell, aiding the cell in cellular respiration as cristae in the mitochondrion in eukaryotic cells. They also help in cell wall formation, DNA replication and distribution to daughter cells.

Related Theory

Mesosomes are the invaginated structures formed by the localised infoldings of the plasma membrane. Mesosomes are found in association with nuclear area or near the site of cell division. They are absent in eukaryotes. They are of two types: Septal mesosomes that extend from the plasma membrane towards the centre in the cell cytoplasm and are associated with nuclear material.

Lateral mesosomes are located at the periphery and need not be associated with nucleus. They contain respiratory enzymes, called chondroid.

Caution

Students should remember that mesosomes are more prominent in gram negative bacteria than in gram positive bacteria.

61. (B) The three main structural components of the cytoskeleton are microtubules, microfilaments and intermediate filaments.

Microfilaments are ultra-microscopic, thin, cylindrical solid rods made up of polymers of actin and myosin protein chains loosely twined together like two strands of pearls. Microfilaments are most prominent in the muscle cells where they are known as myofilaments.

Caution

Students should remember that microfilaments are the only hollow cytoskeletal structure in the cell.

62. (A) The basal body of the cilia or the flagella are derived from the centriole. During their development, the centrioles divide multiple times and orient themselves along the surface of the cell forming the basal bodies of cilia and flagella. Chlorophyll is the photosynthetic pigment, found in the thylakoid membrane in chloroplast. Cristae are inner membrane foldings of mitochondria, providing surface area for various biochemical reactions of the cell. Ribozyme or ribonucleic acid enzyme are involved in catalysing biochemical reactions of nucleic acids.

63. (B) The smooth endoplasmic reticulum (SER) is the major site for the synthesis of lipids. RER is actively involved in protein synthesis and secretion. Nucleoplasm is the fluid filled interior of the neculeus. Symplast is the system of interconnected protoplast through which water movement occurs.

Related Theory

The regions of the ER with relatively few bound ribosomes are referred to as smooth ER (SER). It is mostly made up of vesicles and tubules and appears more like a network of tubules than the flattened sacs of the RER. The membranes of the SER contain many embedded enzymes that catalyse the synthesis of a variety of carbohydrates and lipids. They are found in abundance in cells synthesising lipids and in those producing steroid hormone such as cholesterol, glycerides, testosterone and progesterone or in those that are involved in the metabolism of vitamins, such as pigmented epithelial cells of retina.

64. (D) Rough endoplasmic reticulum – protein synthesis.
Smooth endoplasmic reticulum – lipid synthesis.
Golgi Apparatus – important site of formation of glycoproteins and glycolipids.

Related Theory

Specialised functions of SER are:

(1) It modifies foreign substances making them less toxic. In the liver, SER utilizes cytochrome P-450 to carry out this detoxification process.

(2) In muscle cells, SER is modified into sarcoplasmic reticulum, which stores Ca^{2+} in cells and releases it during muscle contraction.

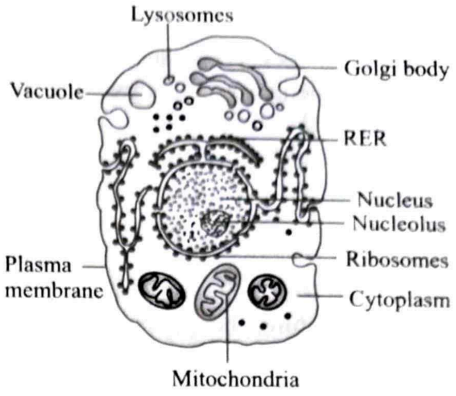
(3) In retinal cells, SER produces visual pigments from vitamin A.

(4) The SER of liver cells contain certain enzyme bodies called glycosomes that help in the glycogen metabolism (glycogenesis and glycogenolysis).

(5) In adipose tissues, the SER help in the synthesis of fats.

(6) In the interstitial cells of the ovary and testis, SER helps in the synthesis of the steroid hormones.

65. (A)



Animal Cell

Related Theory

Mitochondria is sausage-shaped or cylindrical having double membrane, dividing its lumen distinctly into two aqueous compartments, i.e., the outer compartment and the inner compartment. The outer membrane forms the continuous limiting boundary of the organelle. The inner membrane forms a number of infoldings called the cristae towards the matrix, which increase the surface area.

66. (B) Molecules of rRNA are synthesised in a specialised region of the cell nucleus called the nucleolus, which appears as a dense area within the nucleus and contains the genes that encode rRNA.

Related Theory

The eukaryotic ribosome is composed of two subunits: a large subunit (60S) and a small subunit (40S). The 60S subunit is composed of the 28S rRNA, 5.8S rRNA, 5S rRNA, and 50 proteins. The 40S subunit is composed of the 18S rRNA and 33 proteins. The bacterial ribosome is composed of two similar subunits- the 50S subunit (composed of the 23S rRNA, 5S rRNA, and 31 proteins), and the small subunit is called the 30S subunit (composed of the 16S rRNA and 21 proteins).

67. (B) Ribosomes are large, non-membranous RNA-protein complexes, which are necessary for protein synthesis. In eukaryotes, 80S type of ribosomes are found, while in prokaryotes, 70S type is found. Introns occur in ribosomal RNA, tRNA, and in protein encoding genes. Many of these introns are self-splicing *in-vitro* and do not require proteins for activity.

Related Theory

The proteins and nucleic acids that form the ribosome sub-units are made in the nucleolus and exported through nuclear pores into the cytoplasm. The two sub-units are unequal in size and exist in this state until required for use. The larger sub-unit is about twice as large as the smaller one. The larger sub-unit has mainly a catalytic function and performs the function

of an enzyme and is termed a ribozyme; the smaller sub-unit mainly a decoding one links up with mRNA and then locks-on to a larger sub-unit. When production of a specific protein has finished the two sub-units separate and are then usually broken down. Ribosomes have only a temporary existence.

68. (D) *Nostoc* is a prokaryote, and hence, lack membrane bound organelle, well organised nucleus and nuclear membrane. *Penicillium, Agaricus* are fungi, while *Volvox* is an algae.

69. (D) According to the fluid mosaic model of cell membrane structure proposed by Singer and Nicolson (1972), plasma membrane contains about 50-60% proteins. Lipids form a bilayer with hydrophilic heads pointing outwards. Cell membrane allows transport of some molecules by passive transport, *e.g.*, water, neutral solutes, while some are transported actively, *e.g.*, Na^+/K^+ pump.

Related Theory

Components of the Plasma Membrane:

(1) ***Phospholipids:*** *Form a bilayer with phosphate heads facing outwards and fatty acid tails facing inwards.*

(2) ***Cholesterol:*** *Found in animal cell membranes and functions to improve stability and reduce fluidity.*

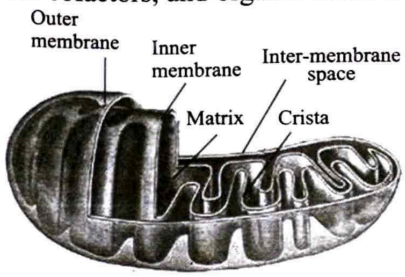
(3) ***Proteins:*** *May be either integral (transmembrane) or peripheral and serve a variety of roles.*

70. (A) The ribosomes are the cell organelle present inside the other cell organelles, like endoplasmic reticulum, mitochondria and chloroplast. They are known as an organelle within an organelle.

71. (A) The bacterium *E. coli* is a prokaryote.

72. (A) The Golgi apparatus principally performs the function of packaging materials. Golgi apparatus is the main site of formation of glycoproteins and glycolipids. Plastids are responsible for photosynthesis, storage of products like starch, and for the synthesis of fatty acids and terpenes. Lysosomes contains hydrolytic enzymes and break down excess or worn-out cell parts. Vacuoles helps to maintain water balance.

73. (B) The outer membrane and the inner membrane are made of proteins and phospholipid layers separated by the intermembrane space. The outer membrane covers the surface of the mitochondrion and has a large number of special proteins known as porins. It is freely permeable to ions, nutrient molecules, energy molecules like the ADP and ATP molecules. The inner membrane of mitochondria is selectively permeable only to oxygen and to ATP molecules and has many folds that form a layered structure called cristae, and this helps in increasing the surface area inside the organelle. The cristae and the proteins of the inner membrane aids in the production of ATP molecules. A number of chemical reactions take place within the inner membrane of mitochondria. The mitochondrial matrix is a viscous fluid that contains a mixture of enzymes and proteins, ribosomes, inorganic ions, mitochondrial DNA, nucleotide cofactors, and organic molecules.



Internal Structure of Mitochondria

74. (B) The different types of membrane-bounded cell organelles collaborate with each other and form an endomembrane system. The components of this system include endoplasmic reticulum, Golgi apparatus, lysosomes, and vacuoles.

Related Theory

The endomembrane system is a group of membranes and organelles in eukaryotic cells that works together to modify, package and transport lipids and proteins. It includes the nuclear envelope, lysosomes, vesicles, and the endoplasmic reticulum and Golgi apparatus. The integral membrane protein in the ER is modified by attachment of a carbohydrate. Vesicles with the integral protein fuse with the cis face of the Golgi apparatus. The protein is further modified by the addition of more carbohydrates in the cisternae of Golgi body. After its synthesis is complete, it exits from the Golgi's trans face and when the vesicle fuses with the cell membrane the protein becomes integral portion of that cell membrane.

75. (D) Ribosomes work with an mRNA template to create proteins. Ribosomes, which are found on RER, convert the genetically coded information for protein synthesis that is carried by the mRNA.

76. (A) Mitochondria and chloroplast are double membraned, semi-autonomous organelle, having their own circular DNA and ribosomes.

Related Theory

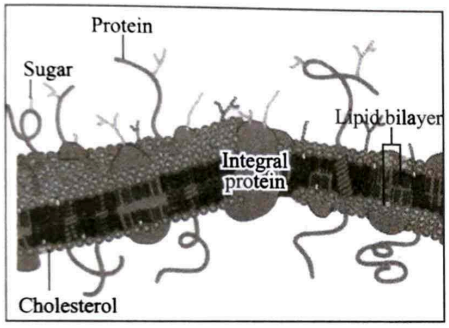
The endosymbiotic theory states that some of the organelles in eukaryotic cells were once prokaryotic microbes as they are descended from specialised bacteria (probably purple non-sulphur bacteria) that somehow survived endocytosis by another species of prokaryote or some other cell type, and became incorporated into the cytoplasm.

77. (C) Cytoplasm forms a seat for both biosynthetic (*e.g.*, protein synthesis) and catabolic (*e.g.*, cellular respiration) pathways. It is the centre of all vital or metabolic activities. Plasma membrane separates the intracellular and extracellular compartments of the cell. Mitochondria is involved in the production of ATP. Nucleus is the central processing unit of the cell, controlling the metabolic activities occurring in the cell.

Related Theory

Cytoplasm is a sticky, semi-fluid material found between the nucleus and the cell membrane. Chemically, it is made up of proteins, lipids, carbohydrates, minerals, salts and water.

78. (B) S. J. Singer and G. L. Nicolson proposed the fluid mosaic model of membranes in 1972. According to this model, the membranes are not a uniform disposition of lipids and proteins; instead, they are a mosaic of the two. The membrane is not solid but is quasi-fluid. The phospholipids of the membrane form a bilayer, which is interrupted by the embedded protein molecules. The lipid bilayer is a two-dimensional fluid, which allows the movement of proteins and lipids.



Internal Structure of Plasma Membrane

Related Theory

The proteins provide the structural and functional specificity to the membranes. Further, since the lipid bilayer is quasi-fluid, the membrane proteins may shift laterally and hence, provide flexibility and dynamics to the membrane.

79. (B) Insulin gene is found in every body cell, but is not expressed in all cells. Centromere is found in chromosomes where two chromatids are attached. Centrosomes produce aster during cell division. Nucleosome is formed of DNA wrapped around the octamer of histone proteins, as core. DNA is the polymer of nucleotides.

Related Theory

The negatively charged DNA is wrapped around positively charged histone octamer to form nucleosome. Each nucleosome has a core histone octamer and a linker DNA. The core particle consists of 4 pairs of histones proteins: H_2A, H_2B, H_3 and H_4. DNA winds around the core (1¾ or 1.65 turns) and two successive nucleosomes are joined together by linker DNA H_1 histone, which holds the entire complex. There are repeating units in chromatin fibre like beads on string.

80. (C) The middle lamella is made up of calcium and magnesium pectates. Muramic acid is found only in the cell walls of bacteria and blue-green algae. Hemicellulose is found in the plant cell wall. Phosphoglycerides are the most abundant phospholipids in cell membranes.

Related Theory

The middle lamella of a mature plant helps in joining the cell walls of the two adjacent cells. This is the first layer that is formed after the division of the cell.

81. (D) Plasmodesmata are membranous channels between adjacent plant cells, linking the cytoplasm, plasma membranes and endoplasmic reticulum (ER) of cells and allowing direct cytoplasmic cell-to-cell communication.

Related Theory

Plasmodesmata are found only in plant and algal cells. It consist of pores or channels, lying between individual plant cells, and connect the symplastic space in the plant.

Caution

Students should remember that in animal cell "equivalent" for plasmodesmata is called the gap junction.

82. (D) The cytoskeleton provides support to the cell. It has a network of protein fibres that support the cell shape and anchor the organelles within the cell.

Related Theory

The three main structural components of the cytoskeleton are microtubules (formed by tubulins), microfilaments (formed by actins) and intermediate filaments.

83. (B) The movement of lipid molecules from one lipid monolayer to another monolayer is called flip-flop movement. Flip-flop movement is rarely found in lipid molecules, whereas it remain absent in protein molecules.

Related Theory

S. J. Singer and G. L. Nicolson proposed fluid mosaic model in 1972. According to this model, plasma membrane is formed of "protein icebergs in the sea of lipids." The membrane is not solid but is quasi-fluid. The phospholipid molecules show two types of movements in this layer.

*(1) **Transition Movement:** Change in the position of molecules within the same layer.*

*(2) **Flip-flop Movement:** The molecules of the two layers of the bilayer can be interchanged.*

84. (A) A polyribosome is a group of ribosomes bound to an mRNA molecule and act to translate mRNA instructions into polypeptides.

Related Theory

Polysomes are found either free in the cytoplasm or attached to the surface of membranes of the endoplasmic reticulum (ER) and the nucleus.

Caution

Students should remember that polyribosome or polysome is a cluster of ribosomes, connected by mRNA, that collectively synthesises protein, while ribosome is a small organelle found in all cells; involved in the production of proteins by translating mRNA.

85. (B) A vacuole is a membrane-bound cell organelle. In animal cells, vacuoles are generally small and help to store water and waste products. In plant cells, vacuoles help maintain water balance. Sometimes a single vacuole can take up most of the interior space of the plant cell.

Related Theory

Vacuoles are storage bubbles found in cells. The tonoplast is the membrane that surrounds the central or large vacuole of the plant. The tonoplast must work to keep the vacuole acidic by bringing in protons. This allows the vacuole's enzymes to break down food matter.

86. (B) Glyoxysomes are peroxisomes that contain the enzymes of the glyoxylate pathway in addition to flavine oxidases and catalase. During germination of oil seeds, the stored lipid molecules of sphaerosomes are hydrolysed by the enzyme lipase to glycerol and fatty acids. The long chain fatty acids are then broken down by successive removal of two carbon fragments in the process of β-oxidation.

Caution

Students should remember that glyoxysomes are present only in plant cells and filamentous fungi, while peroxisomes are present in almost all eukaryotic cells.

87. (A) *Pythium* is a genus in the class Oomycetes, which are also known as water molds. Oomycetes are not true fungi, as their cell walls are made of cellulose.

88. (A) Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by double membrane.

Related Theory

Difference between mitochondria and chloroplast:

Mitochondria	Chloroplast
Known as the powerhouse of the cell, it is responsible for energy metabolism and cellular respiration.	Larger and much more complex than a mitochondrion, it is the site where photosynthesis takes place.
Present in cells of all types of aerobic organisms such as plants and animals.	Present in green plants and green algae.
Matrix and cristae are the two chambers present in a mitochondrion.	Stroma and thylakoid are the two chambers of a chloroplast.
Consumes oxygen.	Releases oxygen.

89. (B) Cell membrane is chemically made of lipoprotein (60%) and carbohydrates (2–10%). The lipids of cell membrane are of three types-phospholipids, glycolipids and sterols. Proline, on the other hand, is an amino acid, which is not a constituent of the cell membrane.

90. (C) In mitochondria, the outer membrane is semi-permeable, and thus, resembles a sieve permeable to all molecules of 10,000 Daltons. The inner membrane is selectively permeable and highly convoluted, forming a series of infoldings known as cristae. The enzymes of the electron transport chain are found in the inner membrane, while the outer membrane contains enzymes involved in mitochondrial lipid synthesis.

Related Theory

The inner membrane surrounds a central fluid-filled space called inner chamber or mitochondrial matrix. The machinery for energy generation can be found on the cristae (infoldings of the inner membrane). The matrix side of the inner membrane and cristae bear numerous tennis racket-like particles called oxysomes or elementary particles or F_0-F_1 particles. The cristae and the proteins of the inner membrane aid in the production of ATP molecules during oxidative phosphorylation. Enzymes of electron transport chain are located in the inner membrane.

91. (D) Endoplasmic reticulum, along with the Golgi apparatus, is involved in the transport of proteins and enzymes to their destination, *i.e.*, within the cell and also outside the cell. Hence, this is the right answer. While the lysosome is also involved in the transport of the hydrolytic enzymes, but it is not the major transporting mechanism in the cell.

92. (A) The main functions of centromere include the attachment of sister chromatids, and it is also the site for attachment of spindle fibre. Centromeres help in the proper alignment and segregation of the chromosomes during the process of cell division in eukaryotic cells.

Related Theory

The main component of the centromere is the kinetochore and DNA associated proteins. Centromeres are densely packed with the heterogeneous domain capped by the trilaminar kinetochore. The DNA of the centromere is normally in a heterochromatin state, which is required for attachment of sister chromatids mediated by cohesin complex and also for the separation during anaphase.

93. (B) The fluid mosaic model of singer and Nicolson (1972), suggests that the flip-flop movement pattern of proteins is energetically unfeasible due to the structure of proteins and their association with the environment around them. Only lipids can undergo flip-flop movements due to their relatively smaller size, as compared to proteins.

94. (D) Ribosomes are known as protein factory and are actively involved in the synthesis of protein. Ribosomes are found in the cytosol and in the semi-autonomous organelles, such as mitochondria and chloroplasts.

Related Theory

Ribosomes either occur singly (monosomes) or in cluster (polysomes). Apart from ribosomal RNA (rRNA), the other two forms of RNA required for protein synthesis are: messenger RNA (mRNA), which carries coding information from DNA, and transfer RNA (tRNA), which carries amino acids. Ribosomes use the information in mRNA to direct the synthesis of a protein. In prokaryotes, during proteins synthesis, many ribosomes line up and join the mRNA to form a string of ribosomes called polyribosome or polysome.

95. (C) The thylakoids of chloroplasts are flattened vesicles arranged as a membranous network within the stroma. Chlorophyll is present in the thylakoids. It provides green colour to the plants and helps in photosynthesis.

96. (C) When cells divide, microtubules in the cytoplasm create structures called spindle fibres. The protein tubulin makes up microtubules. Chromatids or chromosomes are separated diametrically by spindle fibres, which then collect in two clusters at the cell's poles.

97. (C) S.J.Singer and G.L.Nicolson proposed fluid mosaic model of cell membrane. According to this model, the plasma membrane is formed of "protein icebergs in the sea of lipids". The membrane is not solid but is quasi-fluid. The lipids of the membrane form a bilayers, which is interrupted by the embedded protein molecules.

98. (A) Eukaryotic ribosomes are produced in the nucleolus. Ribosomal proteins enter the nucleolus and combine with the four rRNA strands to create the two ribosomal subunits (one small and one large) that will make up the complete ribosome.

99. (A) In general, microtubules are basic structures of spindle apparatus, centrioles, basal bodies, cilia, and flagella.

100. (B) Experiments on *Acetabularia* performed by Hammerling proved the role of the nucleus in heredity. *Acetabularia*, a unicellular algae, is composed of three parts, the rhizoid or base, which contains the nucleus, the stalk, and the cap. The experiment of Hammerling shows that the base is responsible for the type of cap that grows. The nucleus that contains genetic information is in the base, so the nucleus directs cellular development and controls heredity.

101. (D) When several ribosomes are held together on a single mRNA chain and can translate an mRNA simultaneously are called polyribosomes or polysomes.

All the ribosomes can translate the mRNA and thus, many polypeptides chains are formed simultaneously from a single mRNA.

102. (D) Nucleoproteins are the proteins that are associated with nucleic acids, such as nucleosomes (histone proteins). Like any other proteins, the nucleoproteins are also synthesised in the cytosol of the cell.

103. (C) Bivalent is formed during zygotene. Each bivalent is made up of four chromatids, two of each chromosome. Centromere is the part of chromosome that attaches to the spindle during cell division. Each bivalent, thus, contains two centromeres.

104. (C) Unicellular or single-celled and uninucleate green algae of the genus *Acetabularia* are found in subtropical waters and are members of the family Polyphysaceae. They are used in cell biology investigations because of their enormous size and intricate design.