CHAPTER 8

Cell : The Unit of Life

EXAM DRILL

ANSWERS

1. **(d) :** Chloroplast utilises carbon dioxide for photosynthesis and keeps the percentage of it balanced in the atmosphere.

2. **(a) :** Enzymes of Krebs cycle are present in matrix (semi-fluid substance on inner chamber) of mitochondria, except succinate dehydrogenase which is present on inner membrane.

OR

(d) Mitochondrial ribosomes are 55S to 70S in nature.

3. **(c)**

4. **(c) :** Peroxisomes help in photorespiration and peroxide metabolism. Microtubules help in formation of spindle and flagella, microfilaments control cleavage and cyclosis and membrane transformation is done by Golgi apparatus.

5. **(d) :** Centrioles help in formation of astral poles and flagella.

6. Prokaryotic cells are cells without a nucleus. The organelle in a prokaryotic cell is ribosome.

7. A thin cementing layer between two adjacent cells that mainly composed of calcium pectate and hold adjacent cells together.

8. Membrane bound organelles present in eukaryotes are mitochondria, endoplasmic reticulum, Golgi complex, lysosomes and centrioles. These are absent in prokaryotes.

9. Cholesterol molecules maintain the consistency of the plasma membrane and contributes to its fluidity.

10. Three types of cytoskeleton fibres are microtubules, intermediate filaments and microfilaments.

11. **(a)**

12. **(d) :** The endomembrane system includes endoplasmic reticulum, Golgi complex, lysosomes and vacuoles.

13. **(d) :** Pili are tubular structures.

14. **(b)**

15. **(i)** **(a) :** Given figure shows section of cilium or flagellum.
A - Radial spoke; B - Interdoublet bridge
C - Central microtubule

(ii) **(d)**

(iii) **(a) :** The given structure represents internal structure of cilia/flagella. The core of cilium or flagellum composed of microtubules and their associated proteins is called axoneme.

(iv) The given figure shows the axoneme of cilia or flagella, in which axonemal microtubules are arranged in 9 + 2 array.

(v) Interdoublet bridge helps to interconnect the radially arranged peripheral doublets.

16. **(i)** **(a)** A- Granum; B - Stroma lamella; C - Stroma
D - Thylakoid

(ii) **(d)** Chlorophyll is present in the thylakoid.

(iii) 'C' represents a stroma. It contains double stranded circular DNA, ribosomes and enzymes required for the synthesis of carbohydrates and proteins.

(iv) Chloroplasts are found in mesophyll cells of the leaves.

17. The shape of cell is related to its function. Each cell type has evolved a shape that is best related to its function. For example, the neuron has long, thin extensions (axons and dendrites) that reach out to other nerve cells. The extensions help the neuron pass chemical and electrical messages quickly through the body. The biconcave shape of the red blood cells (erythrocytes) enable these cells to easily move through capillaries. The spikes on the pollen grain help it stick to a pollinating insect or animal so that it can be transferred to and pollinate another flower. The long whip-like flagella (tails) of the algae *Chlamydomonas* help it to swim in water.

18. Mitochondria are double membrane bound cell organelles of aerobic eukaryotes which take part in oxidative phosphorylation and Krebs cycle of aerobic respiration.
Three characteristics of mitochondria are:
(i) These are called powerhouse of the cell as they release energy in aerobic respiration.
(ii) Mitochondria are semi-autonomous organelle as they have their own DNA, which can replicate independently and produce its own *m*RNA, *t*RNA and *r*RNA and possess their own ribosomes.
(iii) New mitochondria develop by division/binary fission of pre-existing mitochondria.

The inner membrane has specific proteins such as

(i) ATP synthase - makes ATP,

(ii) cytochrome C - performs oxidation-reduction reactions and

(iii) transport proteins - for selective uptake of materials into the mitochondrial matrix.

19. **(a)** Ribosomes are not bounded by any membrane unlike other cell organelles. 70S ribosomes are found both in prokaryotes and eukaryotes. In prokaryotes, they occur freely inside the cytoplasm. In eukaryotes, they are found in the matrix of plastids and mitochondria.

(b) Functions of ribosomes are:

(i) Ribosomes are protein factories. Free ribosomes synthesise structural and enzymatic proteins for use inside the cell and attached ribosomes synthesise proteins for transport.

(ii) Ribosomes provide enzymes and factors for condensation of amino acids to form polypeptides.

20. Schleiden and Schwann proposed the cell theory.

Fundamental observations of cell theory are:

(i) All living organisms are composed of cells and their products.

(ii) Each cell is made up of protoplasm containing nucleus in its inside and plasma membrane on its outside.

(iii) All cells are basically alike in their chemistry and physiology.

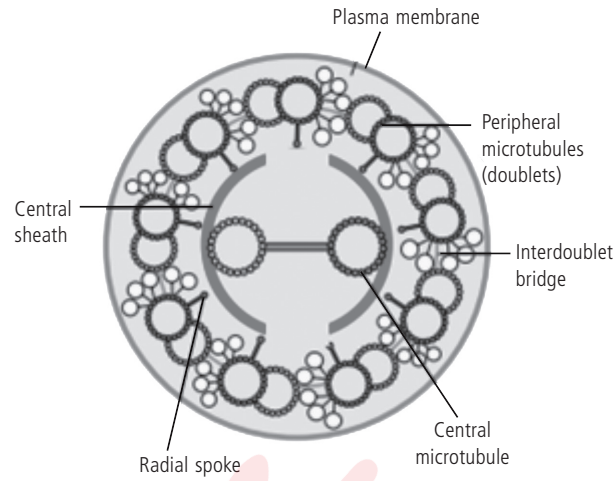
(iv) Activities of an organism are the sum total of activities and interactions of its constituent cells.

Objections to cell theory are:

(i) Viruses are acellular and do not have cellular machinery, still considered to be organisms.

(ii) Bacteria and cyanobacteria do not have nucleus and membrane bound organelles.

21. The electron microscopic study of a cilium or the flagellum show that they are covered with plasma membrane. Their core called the axoneme possesses a number of microtubules running parallel to the long axis. The axoneme usually has nine doublets of radially arranged peripheral microtubules, and a pair of centrally located microtubules. Such an arrangement of axonemal microtubules is referred to as the 9+2 array. The central tubules are connected by bridges and is also enclosed by a central sheath, which is connected to one of the tubules of each peripheral doublets by a radial spoke. Thus, there are nine radial spokes. The peripheral doublets are also interconnected by linkers. Both the cilium and flagellum emerge from centriole-like structure called the basal bodies.



22. Vacuoles are membrane-bound organelles that are believed to be formed by expansion and pinching off from ER. Depending upon content and functions, four types of vacuoles are- sap vacuoles, contractile vacuoles, food vacuoles and air vacuoles.

(i) Sap vacuoles - These are fluid filled vacuoles separated from cytoplasm by selectively permeable membrane called tonoplast. The fluid present in sap vacuole is called vacuolar sap, which contains mineral salts, sugars, amino acids, proteins, water soluble pigments called anthocyanins. Solutes help in maintaining osmotic pressure and anthocyanin provides colouration to the flowers.

(ii) Contractile vacuoles - It has highly extensible and collapsible membrane. These take part in osmoregulation and excretion. They occur in some protistan and algal cells.

(iii) Food vacuoles - It is formed by fusion of phagosome and a lysosome. The food vacuole contains digestive enzymes with the help of which nutrients are digested. The digested material pass out into surrounding cytoplasm.

(iv) Air vacuoles - It consists of number of smaller vesicles. Each vesicle is surrounded by protein membrane and encloses metabolic gases. They provide buoyancy, mechanical strength and protection from harmful radiations.

23. Lysosomes are called suicidal bags because they contain digestive enzymes or acid hydrolases,such as proteases, peptidases, nucleases, lipases,etc. which function in acidic medium at pH of 4-5. The thin covering membrane of lysosomes keep the hydrolytic enzymes out of contact from the cellular contents. It is itself protected by high glycosylation of its proteins and lipids. If the membrane happens to get broken, the various cellular constituents would undergo lysis.

24. Polytene chromosomes are giant chromosomes that were first discovered by Balbiani. They are popularly called salivary chromosomes as they are common in salivary glands of insects. These chromosomes are multistranded and are in permanent prophase stage. The giant chromosomes are formed by somatic pairing between homologous chromosomes and repeated replication of their chromonemata. Polytene chromosomes

bear number of dark bands which are separated by light areas called interbands.

In certain developmental stages, polytene chromosomes bear conspicuous swellings called chromosome puffs. The larger swellings are called Balbiani rings.

OR

Nucleolus is non-membrane bound part present in nucleus. It is the principal site for the development of ribosomal RNAs and is essential for spindle formation during nuclear division.

25. Differences between prokaryotic and eukaryotic cells are:

S. No.	Prokaryotic cell	Eukaryotic cell
(i)	Prokaryotic cell is a cell without an organised nucleus.	Eukaryotic cell is a cell with an organised nucleus.
(ii)	Ribosomes are of 70S type.	Ribosomes are of 80S type.
(iii)	Membrane bound organelles like ER, mitochondria, Golgi body, centrioles, lysosomes are absent.	Membrane bound organelles like ER, mitochondria, Golgi body, centrioles, lysosomes are present.
(iv)	Transcription and translation occur in cytoplasm.	Transcription occurs in nucleus while translation takes place in cytoplasm.

26. (a) X is mitochondria and Y is chloroplast. Similarities between mitochondria and chloroplast are:

(i) Both have double membrane envelope.

(ii) Both are semi-autonomous and possess their own DNA, RNA and 70S ribosomes.

(iii) Both are formed by division of pre-existing organelles.

(iv) Both have naked DNA.

(b) Differences between X (mitochondria) and Y (chloroplast) are:

S.No.	X	Y
(i)	They are colourless cell organelles.	Chloroplast are green coloured organelles.
(ii)	The inner membrane is thrown into folds called cristae.	The inner membrane gives rise to flattened sacs called thylakoids.
(iii)	They liberate energy by breaking down organic food.	They store energy by building up organic food.
(iv)	Pigments do not occur in mitochondria.	The membranes of thylakoids possess chlorophylls and carotenoids.

27. (a) P- Nucleolus, Q- Endoplasmic reticulum, R- Golgi body, S- Centriole, T- Lysosome, U- Microtubule, V- Cell membrane

(b) Q- Porter and Thompson

R- Camillo Golgi

T- Christian de Duve

(c) (i) Q-Endoplasmic reticulum: Synthesis of essential lipids such as phospholipids and cholesterol.

(ii) S- Centriole: Basal bodies from centrioles give rise to cilia and flagella.

(iii) U- Microtubule: Help in the movement of nuclei during division.

28. (a) Label 1 represents nucleoplasm, it is transparent, semi-fluid and colloidal substance which fills the nucleus. It contains nucleosides and a number of enzymes which are required for the synthesis and functioning of DNA, RNA, nucleoproteins, etc.

(b) 2 represents nuclear pore present in nuclear envelope. The nuclear pore is a protein-lined channel in the nuclear envelope that regulates the transportation of molecules between the nucleus and the cytoplasm. In eukaryotic cells, the nucleus is separated from the cytoplasm and surrounded by a nuclear envelope.

29. Similarities between bacterial fimbriae and flagella are:

(i) Both are present in Gram positive and Gram negative bacteria.

(ii) Both are cell surface appendages, present on the cell surface of bacteria.

(iii) Both are made up of proteins.

(iv) Formation of flagella and fimbriae are controlled by nucleoid genes.

Differences between bacterial fimbriae and flagella are:

(i) Fimbriae are bristle like short fibres while flagella are long whip like filamentous structures.

(ii) Fimbriae are evenly distributed on the surface of cell while flagella usually show distinct pattern of distribution.

(iii) Fimbriae help in surface attachment while flagella help in locomotion.

OR

(a) Functions of cytoskeleton as follows :

(i) It helps the cell to maintain its shape and gives support to the cell.

(ii) A variety of cellular organelles are held in place by the cytoskeleton.

(b) Functions of cilia as follows :

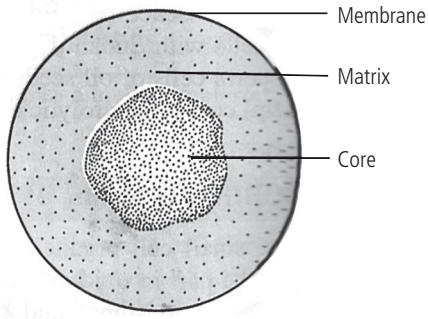
(i) Help in locomotion

(ii) Help in internal transport of several organs, *e.g.*, passage of eggs in oviduct.

30. Glyoxysomes are microbodies which contain enzymes for β-oxidation of fatty acids and glyoxylate pathway. They are considered to be special peroxisomes. The microbodies appear

transiently in germinating oil seeds and the cells of some fungi till the stored fat is consumed. Like other microbodies, glyoxysomes have a single covering membrane and an enzyme rich matrix with a crystalloid core. β-oxidation of fatty acids produces acetyl CoA. The latter is metabolised in glyoxylate cycle to produce carbohydrates. After completion of their function, glyoxysomes are belived to be changed into peroxisomes. They reapper in senescent plant tissues for degradation of lipids and mobilisation of degradation products.

Structure of glyoxysome is as follows :



31. Polymorphism is existence of more than one morphological forms. Lysosomes show different types of forms. Four types of lysosomes are:

(i) Primary lysosomes - They are newly pinched off vesicles from the Golgi apparatus which generally fuse with some endosomes to become fully functional. The primary lysosomes are small in size. They contain hydrolytic enzymes in the form of granules.

(ii) Secondary lysosomes - They are also called heterophagosomes or digestive vacuoles. A secondary lysosome is formed by the fusion of food containing phagosome with lysosome (having hydrolytic or digestive enzymes). Digestion occurs. The digested food passes out into the cytoplasm. Finally, the secondary lysosome is left with undigested food.

(iii) Residual bodies (tertiary lysosomes)- They are those lysosomes in which only indigestible food materials have been left. They pass outwardly and fuse with the plasma membrane to throw out the debris into external environment by exocytosis or ephagy.

(iv) Autolysosomes - They are produced by the fusion of a number of primary lysosomes around worn out or degenerate intracellular organelles. The latter are first wrapped over by one or two membranes from endoplasmic reticulum before being recognised by lysosomes. The cell debris is digested, the phenomenon is also called autophagy or auto digestion. It helps in disposal of cell debris. Autophagic vacuoles provide nourishment during starvation, also used in removing internal obstructions.

OR

Endoplasmic reticulum consists of membrane lined channels or spaces, containing a fluid called endoplasmic matrix. Endoplasmic reticulum exists in three forms- cisternae, vesicles and tubules.

Cisternae - These are long, flat and un-branched interconnected plates or lamellae arranged in parallel rows. These are about 40-50 nm in diameter. They occur in the cells actively involved in synthetic activity.

Vesicles - They are usually round or ovoid sacs of 25-500 nm in diameter. They often occur isolated in the cytoplasm.

Tubules - They are irregularly branched tube-like structures having a diameter of 50-100nm. These are surrounded by unit membrane and their lumen is filled with the secretary products of the cell.

Functions of rough endoplasmic reticulum:

(i) It provides site for protein synthesis.

(ii) Protein translocation, folding and transport of protein.

(iii) Glycosylation (this is the relation of a saccharide group with a hydroxyl or amino functional group to form a glucoside).

Functions of smooth endoplasmic reticulum:

(i) In certain endocrine glands, it plays a key role in the synthesis of steroid hormones from cholesterol.

(ii) In the liver, enzymes in the SER catalyze reactions that render drugs, metabolic wastes, and harmful chemicals water-soluble, thereby contributing to their detoxification, or removal, from the body.

(iii) The SER also plays a role in the conversion of glycogen to glucose, with glucose-6-phosphatase, an enzyme present in SER, catalyzing the final step in glucose production in the liver.

32. (a) Differences between leucoplast and chromoplast are:

S. No.	Leucoplasts	Chromoplasts
(i)	They are colourless plastids.	They are orange-red plastids.
(ii)	They take part in storage of various substances like starch(amyloplast), fat(elaioplast), and protein(aleuroplast).	They provide colour to the flowers and fruits and also the site of synthesis of membrane lipids.
(iii)	They occur in unexposed part of plants.	They are commonly found in exposed parts like flowers and fruits.

(b) Differences between cilia and flagella are:

S. No.	Cilia	Flagella
(i)	These are microscopic, slender, short hair like structures present overall on the surface of the cell, and thus support the locomotion of the cell.	These are unbranched, long, complex, filamentous, thread-like structure extending through cell surface.
(ii)	There number is 300-14000 per cell.	The number is usually 1-4 per cell.
(iii)	They play their primary role in locomotion, aeration (respiration), etc.	They are helpful in locomotion only.

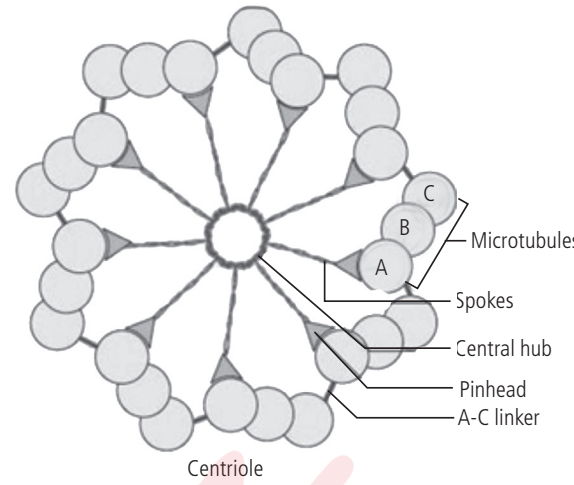
(c) Differences between microfilaments and microtubules are:

S. No.	Microfilaments	Microtubules
(i)	They are solid structures and do not possess longitudinal sub-units.	They are hollow tubules and contain 13 protofilaments.
(ii)	Microfilaments are made up of actin proteins.	Microtubules are formed of α and β-tubulin.
(iii)	They cause cytoplasmic streaming.	They are constituents of spindle fibres, chromosome fibres, centrioles, basal bodies, flagella and cilia.

33. Centrioles are two rod shaped, cylindrical microtubular structures present near the nucleus in eukaryotic animal cells. Centrioles occur as pair that lie perpendicular to each other.

A centriole possesses a whorl of nine peripheral fibrils. Fibrils are absent in the centre. The arrangement is therefore called 9+0. Each fibril is made up of three subfibres, therefore called triplet fibril. From outside to inside, the three sub-fibres of a triplet fibril are named as C, B and A. Subfibre A is complete with 13 protofilaments while B and C subfibres are incomplete due to sharing of some microfilaments.

The adjacent triplet fibrils are connected by C-A proteinaceous linkers. The centre of centriole possesses a rod-shaped proteinaceous mass known as hub. From the hub, 9 proteinaceous strands develop towards the peripheral triplet fibrils,and are known as spokes. Due to presence of radial spokes and peripheral fibrils, the centriole gives a cart wheel appearance in transverse section.



Centriole

OR

(a) Some important characteristics of an animal cells are:
(i) It can change position or move about.
(ii) Cell wall is absent.
(iii) Nucleus is rounded and usually lies in centre.
(iv) Mitochondria are numerous.
(v) Many small vacuoles are present.
(vi) Reserve food is generally glycogen and fat.
(vii) Plastids are usually absent.
(viii) Centrioles are found in animal cells.
(ix) Spindle is amphiastral.

(b) Peroxisomes - They are microbodies which contain enzymes for peroxide biosynthesis. Peroxisomes were discovered by De Duve *et al*. A peroxisome is a membrane-bound cellular organelle found in both animal cells and plant cells. Peroxisomes perform important functions, including lipid metabolism and chemical detoxification. They also carry out oxidation reactions that break down fatty acids and amino acids. They are common in liver and kidney cells that break down harmful substances. The liver is the organ primarily responsible for detoxifying the blood before it travels throughout the body; liver cells contain an exceptionally high number of peroxisomes.

The peroxisomes contain oxidative enzymes like urate oxidase, D-amino oxidase, alpha and beta- hydroxy acid oxidase. Molecular oxygen is required. The reaction produces hydrogen peroxide which is immediately metabolised by another enzymes called catalase. Plant peroxisomes found in photosynthetic cells, perform photorespiration. For this, they are associated with chloroplasts and mitochondria. Peroxisomes pick up glycolate from chloroplasts. The same is oxidised with the help of oxygen to produce glyoxylate. Hydrogen peroxide is formed as by product. Glyoxylate is changed to amino acid glycine. The glycine condenses to produce amino acid serine and carbon dioxide.

BEST SELLING BOOKS FOR CLASS 11

Visit www.mtg.in for complete information