8. Cell: The Unit of Life

Question 1. Which of the following is not correct?

(a) Robert Brown discovered the cell.

(b) Schleiden and Schwann formulated the cell theory.

(c) Virchow explained that cells are formed from pre-existing cells.

(d) A unicellular organism carries out its life activities within a single cell.

Answer: Robert Brown did not discover the cell. The cell was discovered by Robert Hook.

Question 2. New cells generate from

(a) bacterial fermentation (b) regeneration of old cells

(c) pre-existing cells (d) abiotic materials

Answer: According to the biogenic theory, new cells can only arise from pre-existing cells. Only complete cells, in favourable conditions, can give rise to new cells.

Question 3. Match the following

Column I	Column II
(a) Cristae	(i) Flat membranous sacs in stroma
(b) Cisternae	(ii) Infoldings in mitochondria
(c) Thylakoids	(iii) Disc-shaped sacs in Golgi apparatus

Answer:

Column I	Column II
(a) Cristae	(ii) Infoldings in mitochondria
(b) Cisternae	(iii) Disc-shaped
(c) Thylakoids	(i) Flat membranous sacs in stroma

Question 4. Which of the following is correct?

(a) Cells of all living organisms have a nucleus.

(b) Both animal and plant cells have a well-defined cell wall.

(c) In prokaryotes, there are no membrane bound organelles.

(d) Cells are formed de novo from abiotic materials

Answer: Membrane-bound organelles are organelles surrounded by a double or a single membrane like Nucleus, mitochondria, chloroplasts, Lysosomes, ER, Golgi bodies etc. are examples of such organelles. These cell organelles are absent in prokaryotes.

Question 5. What is a mesosome in a prokaryotic cell? Mention the functions that it performs.

Answer: Mesosome is a complex membranous structure formed by the infoldings of the plasma membrane in prokaryotic cells. The functions performed by mesosome are as follows:

1. Mesosomes play important roles in cell wall formation, DNA replication etc.

2. Mesosomes are folded structures, this quality helps to increase the surface area of the plasma membrane to carry out enzymatic activities.

3. Mesosome also helps in cellular respiration and secretion.

Question 6. How do neutral solutes move across the plasma membrane? Can the polar molecules also move across it in the same way? If not, then how are these transported across the membrane?

Answer: Plasma membrane is the outermost covering of the cell and regulates the movement of substances into the cell and out from it. It allows the entry of only some substances and prevents the movement of other materials. Hence, the membrane is selectively-permeable.

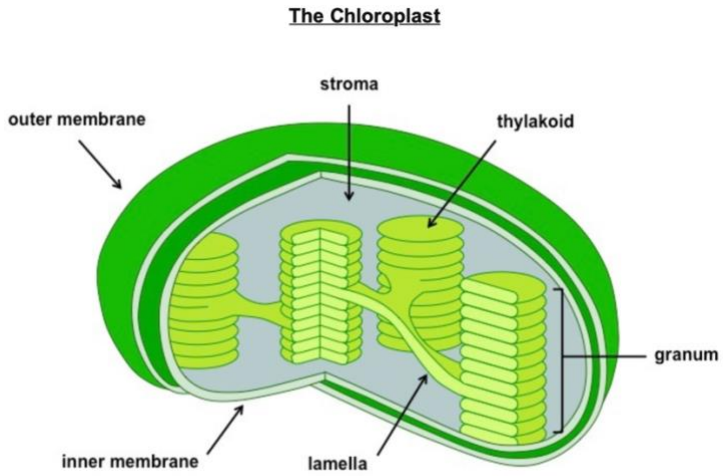
Movement of neutral solutes across the cell membrane – Neutral molecules move across the plasma membrane by simple passive diffusion. Diffusion is the movement of molecules from a region of higher concentration to a region of lower concentration.
Movement of polar molecules across the cell membrane – The cell membrane is made up of a phospholipid bilayer and proteins. The movement of polar molecules across the non-polar lipid bilayer requires carrier-proteins. Which are integral protein particles having certain affinity for specific solutes. As a result, they facilitate the transport of molecules across the membrane.

Question 7. Name two cell-organelles that are double membrane-bound. What are the characteristics of these two organelles? State their functions and draw labelled diagrams of both.

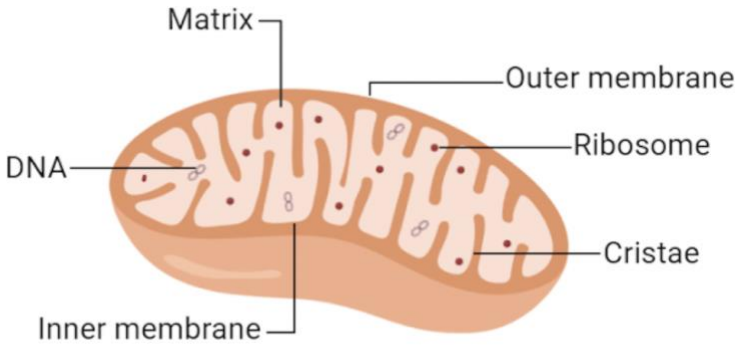
Answer: Cell organelles that are double membrane-bound are

- Mitochondria
- Chloroplast

(a) Mitochondria: It is a double membrane-bound structure with the outer membrane and the inner membrane dividing its lumen distinctly into two aqueous compartments i.e. outer compartment and inner compartment. The inner compartment is called ‘matrix’. The inner membrane forms a number of infolding called the cristae towards the matrix. Two membranes have their own specific enzymes associated with the mitochondrial function. Mitochondria are the sites of aerobic respiration. They produce cellular energy in the form of ATP and called ‘power house’ of the cell. The matrix also possesses single circular DNA molecule, a few RNA molecules, ribosomes (FOS) and the components required for the synthesis of proteins.



(b) Chloroplast: Chloroplasts are the plastids that contain chlorophyll pigments which are present in plant cells and euglenoids. The space limited by the inner membrane of the chloroplast is called the 'stroma'. Stroma contains number of organised flattened membranous sacs called the thylakoids. Thylakoids are arranged in stacks called 'grana'. Different grana are connected by flat membranous tubules called stroma lamellae. Space inside thylakoids is called lumen. The stroma of the chloroplast contains enzymes required for the synthesis of carbohydrates and proteins. It is the site of dark reaction. Chlorophyll pigments are present in the thylakoids which along with carotenoid pigments are responsible for trapping light energy essential for photosynthesis. Grana is the site of light reaction.



Question 8. What are the characteristics of prokaryotic cells?

Answer: Prokaryotic cells do not possess a membrane bound nucleus. The characteristics are:

(i) They are small in size 0.1mm to 10mm.

(ii) They do not have membrane bound nucleus.

(iii) They have a circular DNA as the genetic material.

(iv) They have mesosomes for respiration.

(v) They can be autotrophs or saprotrophs.

Question 9. Multicellular organisms have division of labour. Explain.

Answer: Multicellular organisms are made up of millions and trillions of cells. All these cells perform specific functions. All the cells specialised for performing similar functions are grouped together as tissues in the body. Hence, a particular function is carried out by a group of cells at a definite place in the body. Similarly, different functions are carried out by different groups of cells in an organism and this is known as division of labour in multicellular organisms.

Question 10. The cell is the basic unit of life. Discuss in brief

Answer: All organisms begin their life in a single cell. Certain organisms complete their life cycle as a single cell. They are called unicellular or acellular organisms, e.g., *Amoeba, Chlamydomonas* bacteria and yeast. In other organisms, the single cell undergoes divisions to form multicellular body. Body of human being, is made up of trillion of cells. All the cells of an organism carry the same genetic material, develop from same pre-existing cells and possess several organelles to perform various life activities. The cells are therefore, basic unit of life and structural unit of an organism.

Question 11. What are nuclear pores? State their function.

Answer: Nuclear pores are the pores present in the nuclear membrane. They are formed by the fusion of two membranes. The functions are:

(i) The materials are exchanged between cytoplasm and nucleus through the nuclear pores.

(ii) The proteins are passed in and out of the nucleus.

(iii) The enzymes for synthesis of DNA and RNA are passed into nucleus.

(iv) Ribosomal subunits and RNA are passed out from nucleus.

(v) mRNA and tRNA are passed out into cytoplasm.

Question 12. Both lysosomes and vacuoles are endomembrane structures, yet they differ in terms of their functions. Comment.

Answer: Endomembrane system is the system of membranes within a cell that serves as a single functional and developmental unit.
(a) The isolated lysosomal vesicles have been found to be very rich in almost all type of hydrolytic enzymes such as lipase, proteases, carbohydrases. These enzymes are optically active at the acidic pH and capable of digesting carbohydrates, proteins, lipids and nucleic acids.
(b) On the other hand the vacuoles contains water, sap, excretory product etc. In Amoeba, contractile vacuole is important for excretion.

Question 13. Describe the structure of the following with the help of labelled diagrams.

(i) Nucleus (ii) Centrosome

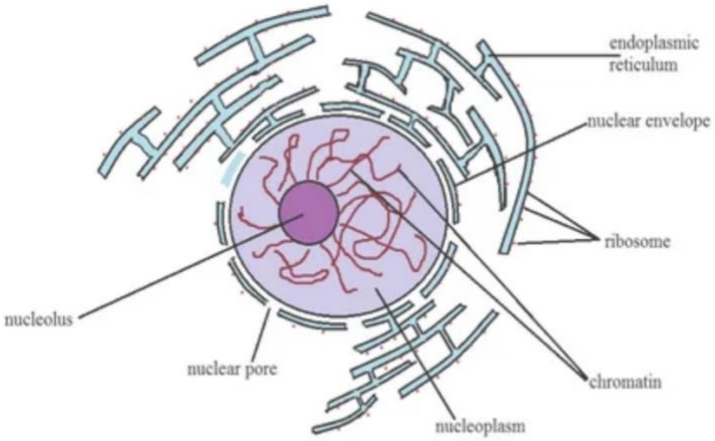
Answer:

(i) **Nucleus**

It controls all the cellular activities of the cell. It is spherical in shape. It is composed of the following structures:

Nuclear membrane: It is a double membrane separating the contents of the nucleus from the cytoplasm. The narrow space between the two membranes is called the perinuclear space. Nuclear membrane has tiny holes called nuclear pores. These holes allow specific substances to be transferred into a nucleus and out from it.

Nucleoplasm/Nuclear matrix: It is a homogenous granular fluid present inside the nucleus. It contains the nucleolus and chromatin. Nucleolus is a spherical structure that is not bound by any membrane. It is rich in protein and RNA molecules, and is the site for ribosome formation. Chromatin is an entangled mass of thread-like structures. It contains DNA and some basic proteins called histones.



(ii) Centrosome

Centrosome consists of two cylindrical structures called centrioles. Centrioles lie perpendicular to each other. Each has a cartwheel-like organisation.

A centriole is made up of microtubule triplets that are evenly spaced in a ring. The adjacent triplets are linked together. There is a proteinaceous hub in the central part of a centriole. The hub is connected to the triplets via radial spokes. These centrioles help in organising the spindle fibres and astral rays during cell division. They form the basal body of cilia and flagella as well.

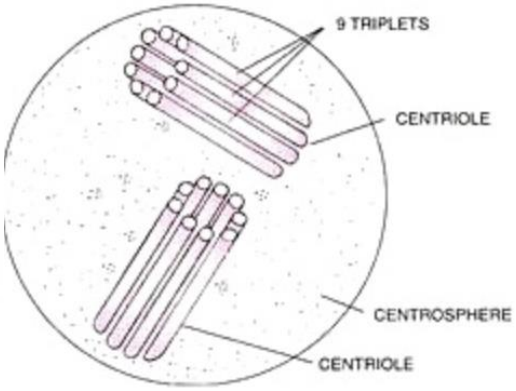


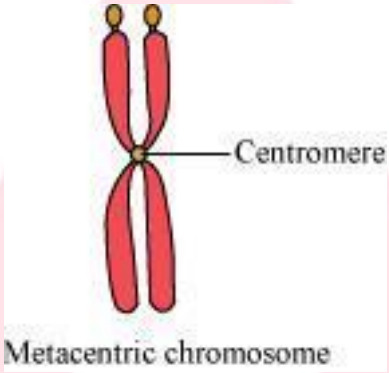
Fig. 8.49. Centrosome with pair of centroles (Diplosome).

Question 14. What is centromere? How does the position of centromere form the basis of classification of chromosomes? Support your answer with a diagram showing the position of the centromere on different types of chromosomes.

Answer: Centromere is a constriction present on the chromosomes where the chromatids are held together.
Chromosomes are divided into four types based on the position of the centromere.

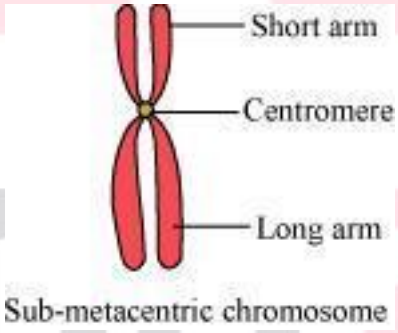
(i) Metacentric chromosome

The chromosomes in which the centromere is present in the middle and divides the chromosome into two equal arms is known as a metacentric chromosome. During anaphase, they appear V-Shaped.



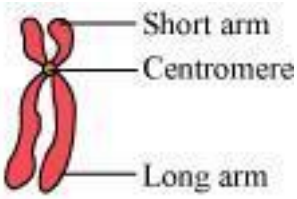
(ii) Sub-metacentric chromosome

The chromosome in which the centromere is slightly away from the middle region is known as a sub-metacentric chromosome. In this, one arm is slightly longer than the other. During anaphase, they appear L-Shaped.



(iii) Acrocentric chromosome

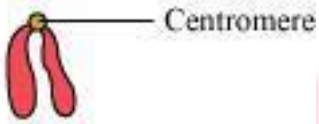
The chromosome in which the centromere is located close to one of the terminal ends is known as an acrocentric chromosome. In this, one arm is extremely long and the other is extremely short. During anaphase, they appear J-Shaped.



Acrocentric chromosome

(iv) Telocentric chromosome

The chromosome in which the centromere is located at one of the terminal ends is known as a telocentric chromosome. During anaphase, they appear i-Shaped.



Telocentric chromosome