

CHAPTER – 8

CELL: THE UNIT OF LIFE

EXERCISES

2 Mark Questions

Q1: Define totipotency?

Answer: Each vegetative plant cell has the potential to grow into a whole plant. The term totipotency refers to a plant's ability to reproduce itself.

Q2: Name two cell organelles that contain their own DNA?

Answer: In a cell, two organelles that contain their own DNA are mitochondria and the chloroplast.

Q3: Which cell organelle functions as a "segregation apparatus"?

Answer: Endoplasmic Reticulum (ER) is the one cell organelle present in the cytoplasm that functions as the segregation apparatus.

Q4: Which structure is called a little nucleus?

Answer: The nucleolus is a structure within the cell nucleus that is responsible for ribosome production and assembly.

Q5: What is the function of a contractile vacuole?

Answer: The contractile vacuole maintains the osmoregulation aka water balance.

Q6: Name the enzymes present in peroxisomes?

Answer: Catalase and B-hydroxy oxidase are the enzymes present in the peroxisomes.

Q7: Who gave the statement "Omnis cellula cellula"?

Answer: Rudolf Virchow gave the statement 'Omnis cellula cellula' which means new cells are generated from the pre-existing ones.

Which of the following is not correct?

Q8: (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: The answer is (a) Robert Brown discovered the cell

It is incorrect because Robert Brown discovered the nucleus in the cell.

Q9: How do neutral solutes move across the plasma membrane? Can the polar molecules also move across it in the same way? If not, how are these transported across the membrane?

Answer: The neutral solutes are lipid-soluble; hence they pass through the lipid bilayer. No, polar molecules cannot move across the plasma membrane in the same way as neutral solutes; they require particular hydrophilic areas for their passage. They get transported by three types of transport mechanisms – ions, channels, permeases and active transport utilising ATP.

4 Mark Questions

Q1: What is a mesosome in a prokaryotic cell? Mention the functions that it performs.

Answer: A mesosome is a unique membranous structure formed by the extensions of the plasma membrane into the cell. If it is found attached to the nucleoid, it is known as a septal mesosome and is known as a lateral mesosome if the mesosome is free from the nucleoid.

The functions of mesosomes are as follows:

- They help in cell-wall formation
- They help in DNA replication and distribution to daughter cells.

- They also help in respiration and secretion processes to increase the surface area of the plasma membrane and enzymatic content.

Q2: New cells generate from

- (a) bacterial fermentation
- (b) regeneration of old cells
- (c) pre-existing cells
- (d) abiotic materials
- [Answer:](#)
- The answer is (c) pre-existing cells

Q3: What are the characteristics of prokaryotic cells?

[Answer:](#) The characteristics of prokaryotic cells are listed below:

- The nuclear membrane is absent, and the genetic material is not enclosed by an envelope. The naked DNA is found to be coiled in the cytoplasm and is referred to as a genophore or nucleoid
- They lack membrane-bound organelles and membrane-bound nucleus
- The cell lumen is filled with a fluid known as cytoplasm
- Prokaryotic DNA is situated in the nucleoid of the cell
- The prokaryotic cell wall acts as a layer of protection and helps in maintaining cell shape
- The ribosome is the only cytoplasmic organelle that is found in prokaryotic cells

Q4: Multicellular organisms have a division of labour. Explain.

[Answer:](#) Cells are organised to form tissues which make organs and organ systems. A cell is an autonomous structure which is capable of carrying out functions on its

own. Hence, the division of labour is essential to carry out different functions for increased efficiency and higher survival.

Q5: The cell is the basic unit of life. Discuss in brief.

Answer: Every plant and animal cells are made of organ systems, and organ systems are made up of organs. Organs are constructed by tissues, and tissues are made up of a cluster of cells. Since cells are autonomous structures capable of carrying out functions on their own, it is said that the cell is the basic unit of life.

Q6: What are nuclear pores? State their function.

Answer: At several places, the nuclear membrane is surrounded by minute pores formed by the fusion of two membranes called nuclear pores. They are simple perforations on the nuclear envelope.

Functions:

- Retains the shape of the nucleus
- Known to preserve the stability of the genetic material by safeguarding it from respiratory breakdown occurring in the cytoplasm
- Responsible for the movement of RNA and protein molecules in both directions between the nucleus and the cytoplasm.

Q7: Both lysosomes and vacuoles are endomembrane structures, yet they differ in terms of their functions. Comment.

Answer: The endomembrane is an intercellular system responsible for the flow of materials from one part to another through vesicles. Some of its components are vacuoles, plasma membrane, endoplasmic reticulum, lysosomes and Golgi apparatus. Lysosomes are membrane-bound organelles that release lytic enzymes to digest worn-out cells; hence they are known as suicidal bags. On the other hand, vacuoles help cells to maintain their shape. Vacuoles also store food, water and waste products.

7 Mark Questions

Q1: 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.

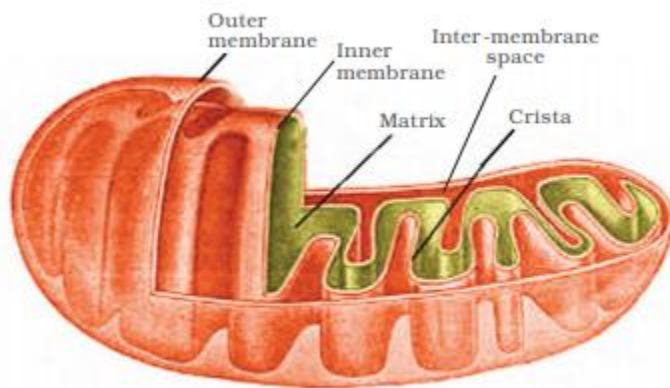
Answer:

Two organelles that are double membrane-bound are i) Mitochondria ii) Chloroplasts

Characteristics of mitochondria

The mitochondrion is a double membrane-bound structure with the outer membrane and the inner membrane dividing its lumen distinctly into two aqueous compartments, i.e., the outer compartment and the inner compartment.

- Mitochondria are semi-autonomous as they possess their own DNA.
- Mitochondria are the place of aerobic respiration.

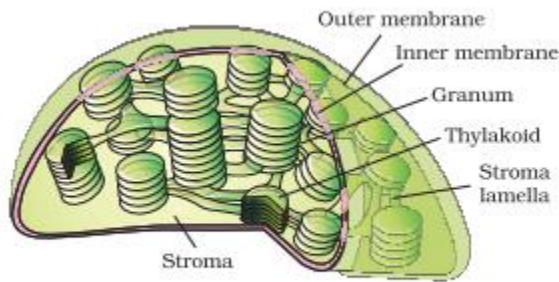


Structure of mitochondrion (Longitudinal section)

Characteristics of Chloroplasts

- They are found in plants and euglenoids, variously shaped in lower plants and disc-shaped in higher plants.
- They have specific pigments which impart colour to the leaves of the plants.
- Chloroplasts possess their own DNA.
- Pigments help to trap sunlight, thereby helping in photosynthesis.

- It consists of membrane-flattened sacs known as thylakoids located in their matrix. At some locations, thylakoids are stacked and are known as Gana.



Sectional view of chloroplast

Q2: Describe the structure of the following with the help of labelled diagrams.

(i) Nucleus (ii) Centrosome

Answer:

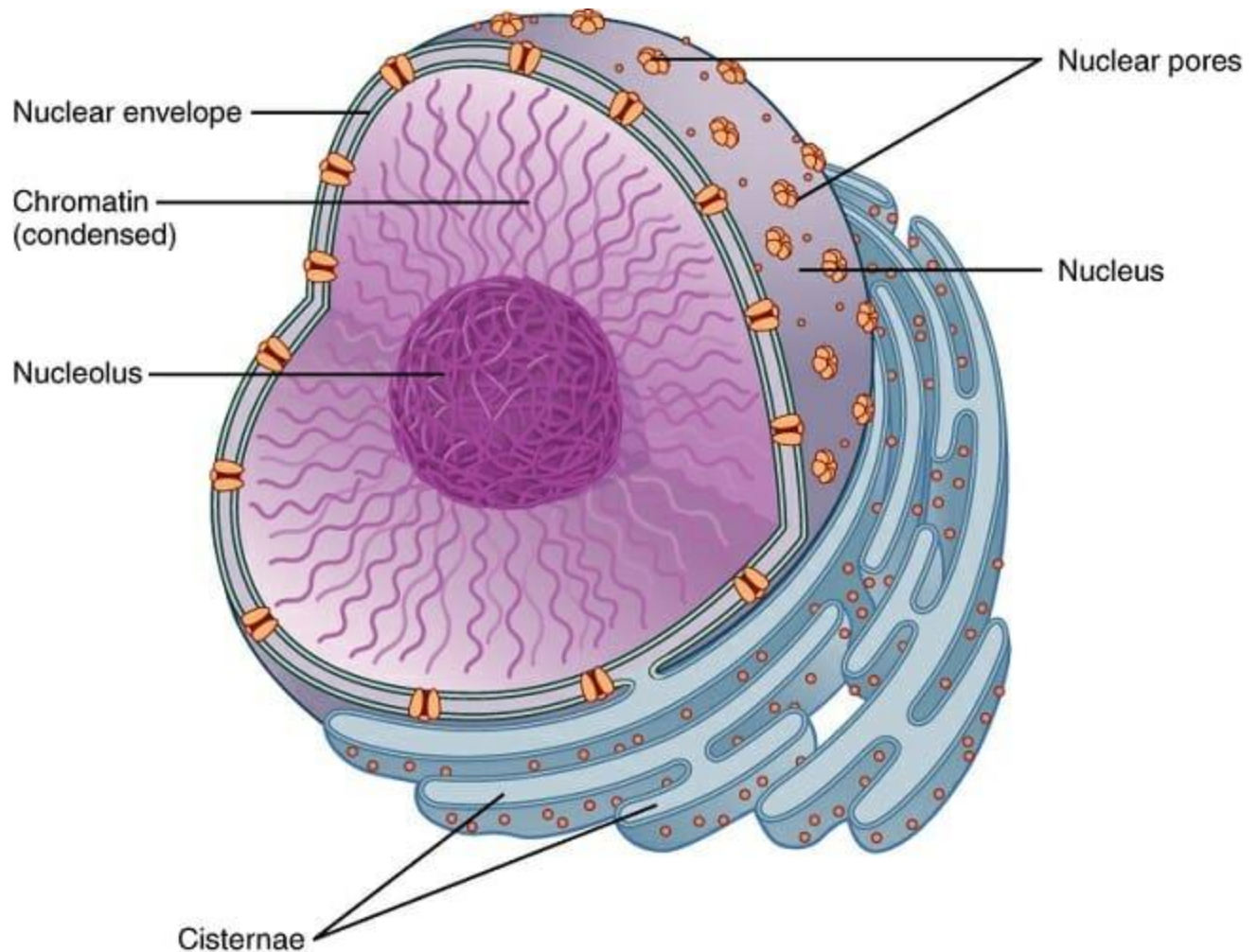
i) The nucleus is an oval-shaped or round structure having a double membrane containing the genetic material. It consists of five parts, namely – the nuclear envelope, nuclear matrix, nucleoplasm, nucleolus and chromatin.

Nuclear envelope – The nucleus is constrained by the nuclear pore, which is a double-membrane nuclear envelope having tiny pores in the membrane which serve as a channel for substances to pass in and out of the nucleus. The endoplasmic reticulum is connected to the outer membrane, which also contains ribosomes.

Nucleoplasm – It is the fluid, filled in the nucleus containing enzymes, nucleosides, proteins and other factors responsible for the functioning of the genetic material. It also embeds the chromatin fibres and nucleolus.

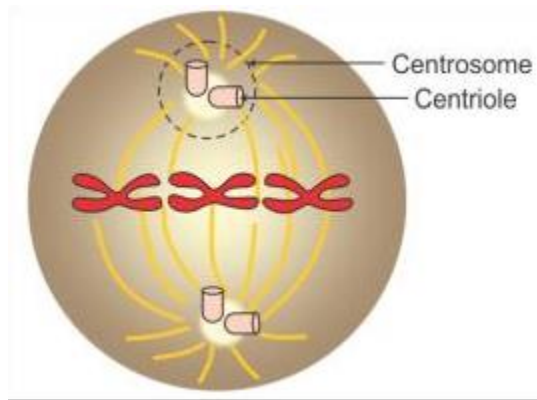
Chromatin – They are found inside the nucleus; they are a fine network of thread-like structures containing DNA and a few basic proteins such as histones, RNA and non-histone proteins. These chromatin fibres, during the process of cell division, condense to form the chromosomes.

Nucleolus – They are attached to the chromatin and are round, lightly irregular, naked structures that produce the ribosome subunits. They produce proteins.



(ii) Centrosome

- It consists of two cylindrical structures known as centrioles which lie perpendicular to one another, organised as a cartwheel
- Engirdled by amorphous pericentriolar materials
- Consists of 9 evenly spaced peripheral fibrils of the tubulin protein, wherein each is a triplet and adjacent triplets are linked to each other
- The centre of the centriole is a proteinaceous hub attached to the triplets through radial spokes
- It is critical during cell division as it organises the spindle fibres and astral rays



Q3:What is a centromere? How does the position of the centromere form the basis of the classification of chromosomes? Support your answer with a diagram showing the position of the centromere on different types of chromosomes.

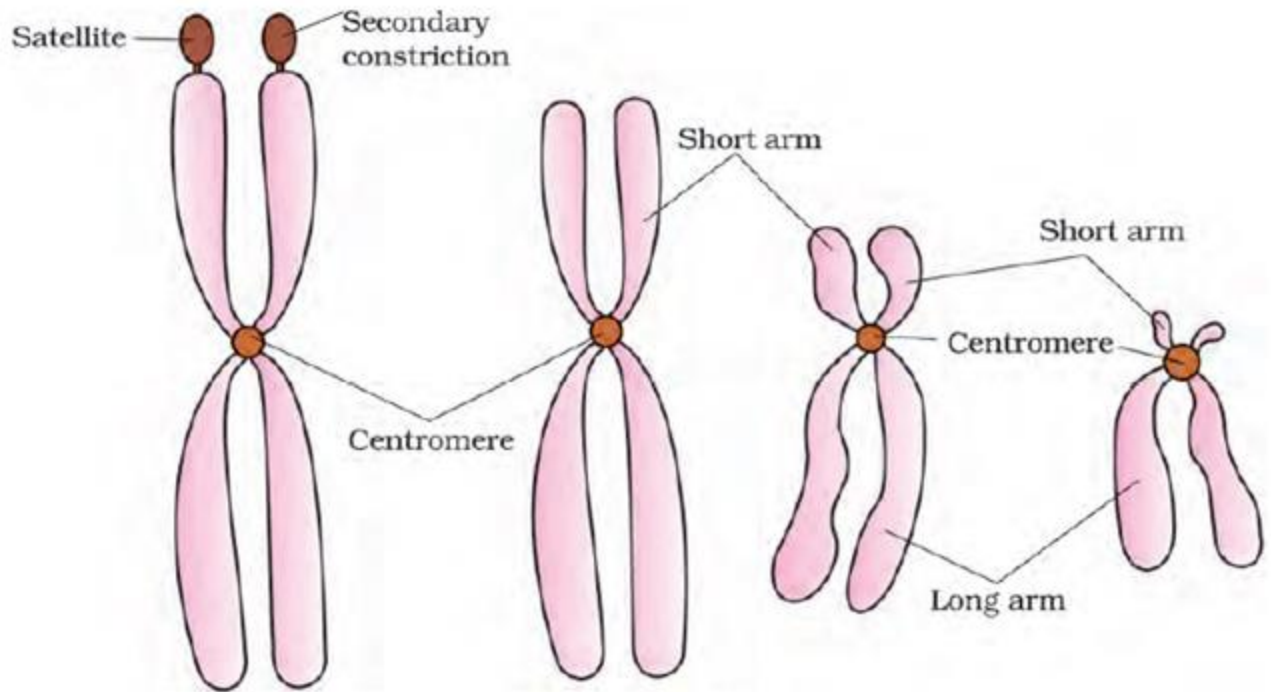
Answer:

The primary constriction present in a chromosome is called the centromere.

The centromere holds two chromatids of a chromosome.

Based on the position of the centromere, the chromosomes can be classified into four types, and they are as follows:

- The Metacentric has a middle centromere forming two equal arms of the chromosomes.
- Submetacentric chromosomes have a centromere slightly away from the middle of the chromosomes resulting in one shorter arm and one more extended arm.
- Acrocentric chromosomes have a centromere situated close to its end, forming one extremely short and one very long arm.
- The telocentric chromosome has a terminal centromere.



Types of chromosomes based on the position of centromere

Multiple Choice Questions

1. Organelles can be separated from cell homogenate through

- a) Autoradiography
- b) Differential centrifugation
- c) Chromatography
- d) X-rays diffraction

Answer: Differential centrifugation

2. Which structures perform the function of mitochondria in bacteria?

- a) Mesosomes
- b) Ribosomes

c) Cell wall

d) Nucleoid

Answer: Mesosomes

3. Which of the following are not membrane-bound?

a) Ribosomes

b) Mesosomes

c) Vacuoles

d) Lysosomes

Answer: Ribosomes

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

a) Lysosome

b) Vacuole

c) Golgi complex

d) Peroxisome

Answer: Peroxisome

5. In germinating seeds, fatty acids are degraded exclusively in the

a) Glyoxysomes

b) Proplastids

c) Peroxisomes

d) Mitochondria

Answer: Glyoxysomes

6. Ribosomal RNA is actively synthesized in

- a) Ribosomes
- b) Nucleolus
- c) Nucleoplasm
- d) Lysosomes

Answer: Nucleolus

Matchings

Match the following

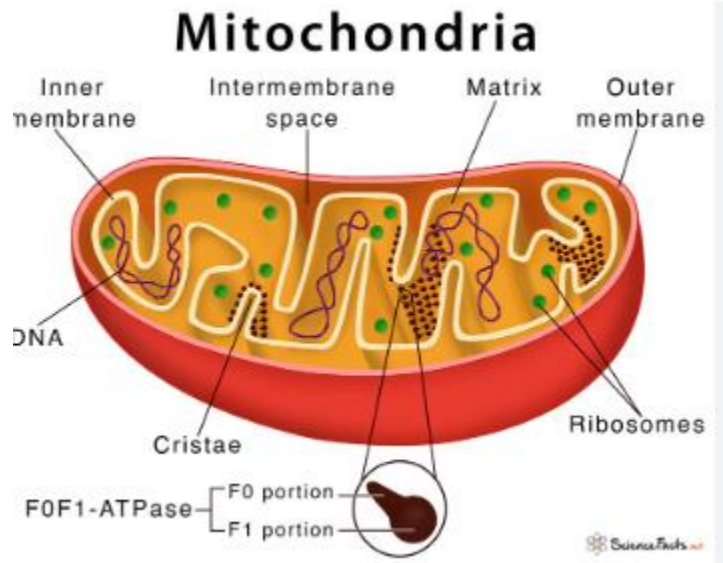
Column I	Column II
(a) Cristae	(i) Flat membranous sacs in stroma
(b) Cisternae	(ii) Infoldings in mitochondria
(c) Thylakoids	(iii) Disc-shaped sacs in Golgi apparatus

Answer:

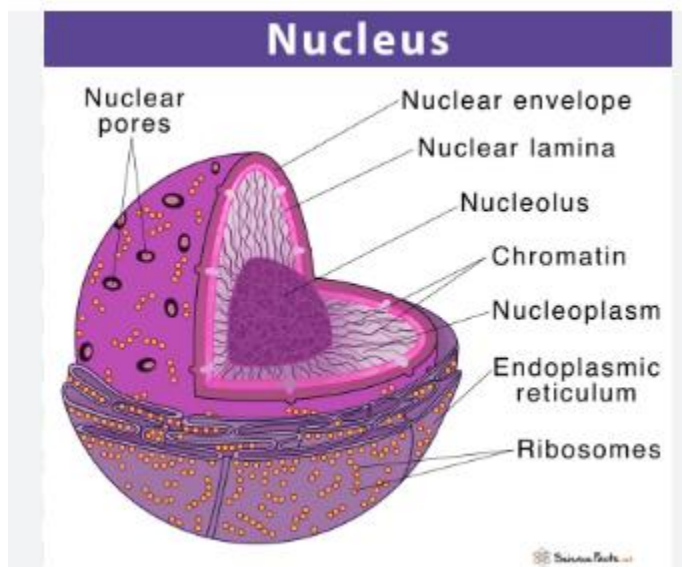
Column I	Column II
(a) Cristae	(ii) Infoldings in mitochondria
(b) Cisternae	(iii) Disc-shaped sacs in Golgi apparatus
(c) Thylakoids	(i) Flat membranous sacs in stroma

DIAGRAMS

structure of mitochondria diagram



Nucleus



SUMMARY

All organisms are made of cells or aggregates of cells. Cells vary in their shape, size and activities/functions. Based on the presence or absence of a membrane bound nucleus and other organelles, cells and hence organisms can be named as eukaryotic or prokaryotic. A typical eukaryotic cell consists of a cell membrane, nucleus and cytoplasm. Plant cells have a cell wall outside the cell membrane. The plasma membrane is selectively permeable and facilitates transport of several molecules. The endomembrane system includes ER, golgi complex, lysosomes and vacuoles. All the cell organelles perform different but specific functions.

Centrosome and centriole form the basal body of cilia and flagella that facilitate locomotion. In animal cells, centrioles also form spindle apparatus during cell division. Nucleus contains nucleoli and chromatin network. It not only controls the activities of organelles but also plays a major role in heredity. Endoplasmic reticulum contains tubules or cisternae. They are of two types: rough and smooth. ER helps in the transport of substances, synthesis of proteins, lipoproteins and glycogen. The golgi body is a membranous organelle composed of flattened sacs. The secretions of cells are packed in them and transported from the cell.

Lysosomes are single membrane structures containing enzymes for digestion of all types of macromolecules. Ribosomes are involved in protein synthesis. These occur freely in the cytoplasm or are associated with ER. Mitochondria help in oxidative phosphorylation and generation of adenosine triphosphate. They are bound by double membrane; the outer membrane is smooth and inner one folds into several cristae. Plastids are pigment containing organelles found in plant cells only. In plant cells, chloroplasts are responsible for trapping light energy essential for photosynthesis. The grana, in the plastid, is the site of light reactions and the stroma of dark reactions. The green coloured plastids are chloroplasts, which contain chlorophyll, whereas the other coloured plastids are chromoplasts, which may contain pigments like carotene and xanthophyll. The nucleus is enclosed by nuclear envelope, a double membrane structure with nuclear pores. The inner membrane encloses the nucleoplasm and the chromatin material. Thus, cell is the structural and functional unit of life.