CELL The Unit of Life

8 Chapter

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.
Ans: The incorrect statement is (a) Robert Brown discovered the cell.

2. New cells generate from
(a) bacterial fermentation
(b) regeneration of old cells
(c) pre-existing cells
(d) abiotic materials
Ans: New cells generate from (c) pre-existing cells

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

Ans:

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

4. Which of the following is correct?

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

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

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

(d) Cells are formed de novo from abiotic materials

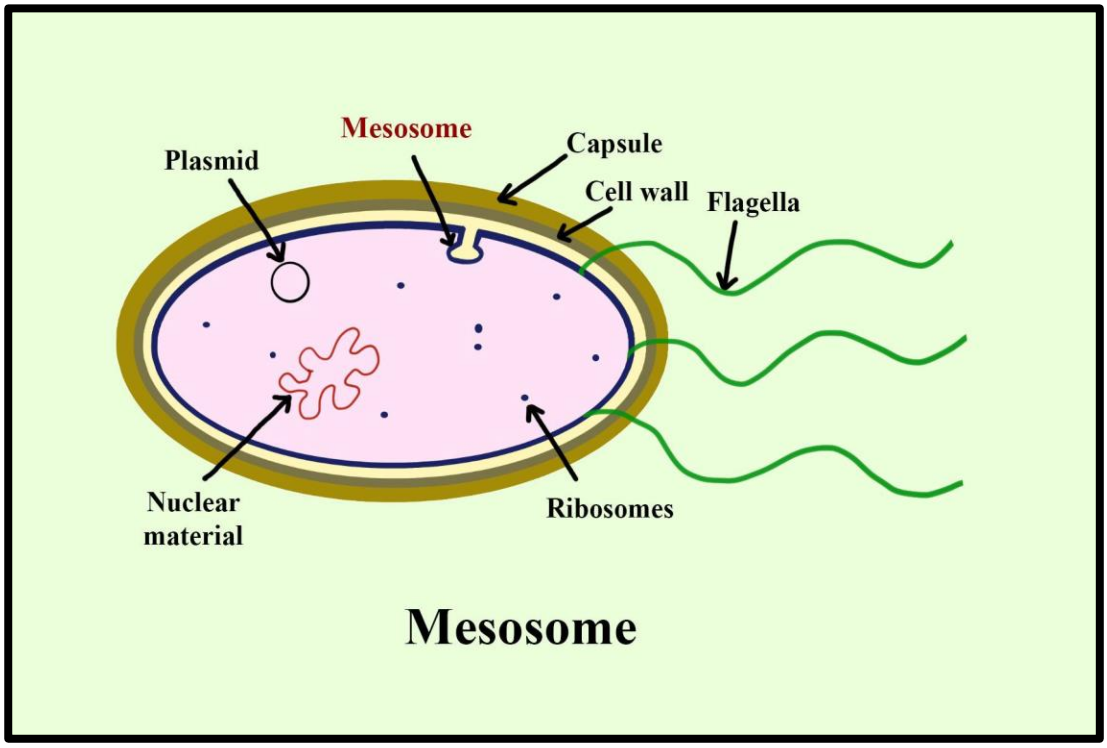
Ans: The correct statement is (c) In prokaryotes, there are no membrane-bound organelles.

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

Ans: Mesosomes are formed by the infoldings of plasma membranes. They are mainly found in bacteria. Functions of Mesosomes are listed below:

i) These extensions help in cell wall formation and DNA replication and distribution of equal chromosomes in daughter cells.

ii) They contain enzymes for aerobic respiration and also helps in secretion processes and to increase the surface area of the plasma membrane and enzymatic content



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?

Ans: Neutral solutes do not carry any charge because they move across the plasma membrane through osmosis. while polar molecules are charged molecules so they cannot pass through the non-polar membrane. To cross the non-polar membrane they require a carrier protein that facilitates its transport inside the cell. If this transport takes place against the concentration gradient, it will require energy in the form of ATP.

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

Ans: Mitochondria and chloroplasts are the two double membranous organelles. They both are also called semi-autonomous organelles because they contain their own DNA molecules. They also have 70S types of ribosomes that are found in the cytoplasm.

Characteristics of Mitochondria are:

1) Mitochondria are rod-shaped structures and generally found in the cytoplasm of cells with other organelles.

2) They are principally concerned with energy generation in the form of ATP by converting chemical energy.

3) Mitochondria are surrounded by two membranes – outer and inner where the outer membrane covers the organelle. However, the inner membrane is folded and forms a layered structure. This layered structure contains several finger-like projections called cristae.

4) The inner mitochondrial membrane also possesses F0F1 particles called oxysomes. These oxysomes are responsible for ATP generation by using electron transport systems.

5) The Citric Acid cycle takes place in the inner mitochondrial membrane that encloses a mitochondrial matrix.

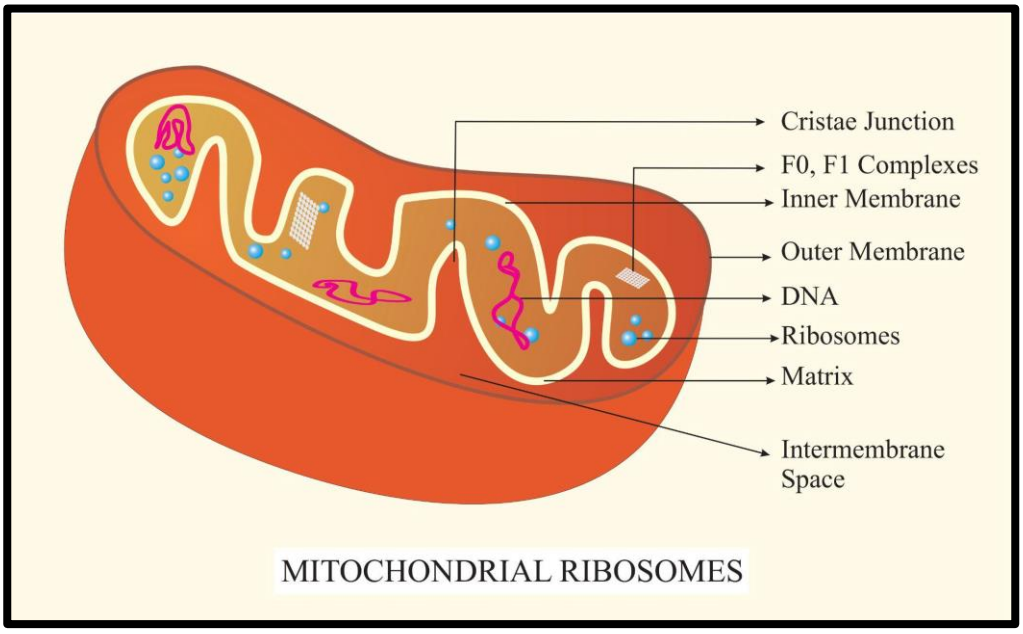
Functions of Mitochondria are:

1) Mitochondria are called the powerhouse of a cell because it generates ATP by cellular respiration.

2) They provide energy in the form of ATP to perform all the important activities of living cells.

3) They are regarded as semi-autonomous organelle because they have their own DNA and ribosomes.

4) Citric acid cycle taking place in the matrix of mitochondria where it generates several metabolic intermediates. These intermediates are required for the biosynthesis of various amino acids and proteins.



Characteristics of Chloroplast are:

1) The Chloroplasts are also double membrane-bound organelles and are found all over the cytoplasm of plant cells.

2) They contain chlorophyll that makes them appear green in color.

3)The chloroplast is made up of two membranes i.e., inner and outer. The space limited by the inner membrane of the chloroplast is known as the stroma that contains metabolic enzymes and multiple copies of the chloroplast genome.

4) There are a number of organized flattened membranous sacs called the thylakoids present in the stroma.

5) These thylakoids are stacked one over the other to form a granum that looks like a stack of coins.

6) Apart from this, there are flat membranous tubules called the stroma lamellae. They connect the thylakoids of the different grana.

7) A lumen is a space that is formed by the membrane of the thylakoids.

Functions of Chloroplast are:

Chloroplasts are also known as the kitchen of the cell.

1) They trap solar energy and utilize it for manufacturing food for plants. They are involved in the process of photosynthesis.

2) Chloroplast contains the enzymes required for the synthesis of carbohydrates and proteins

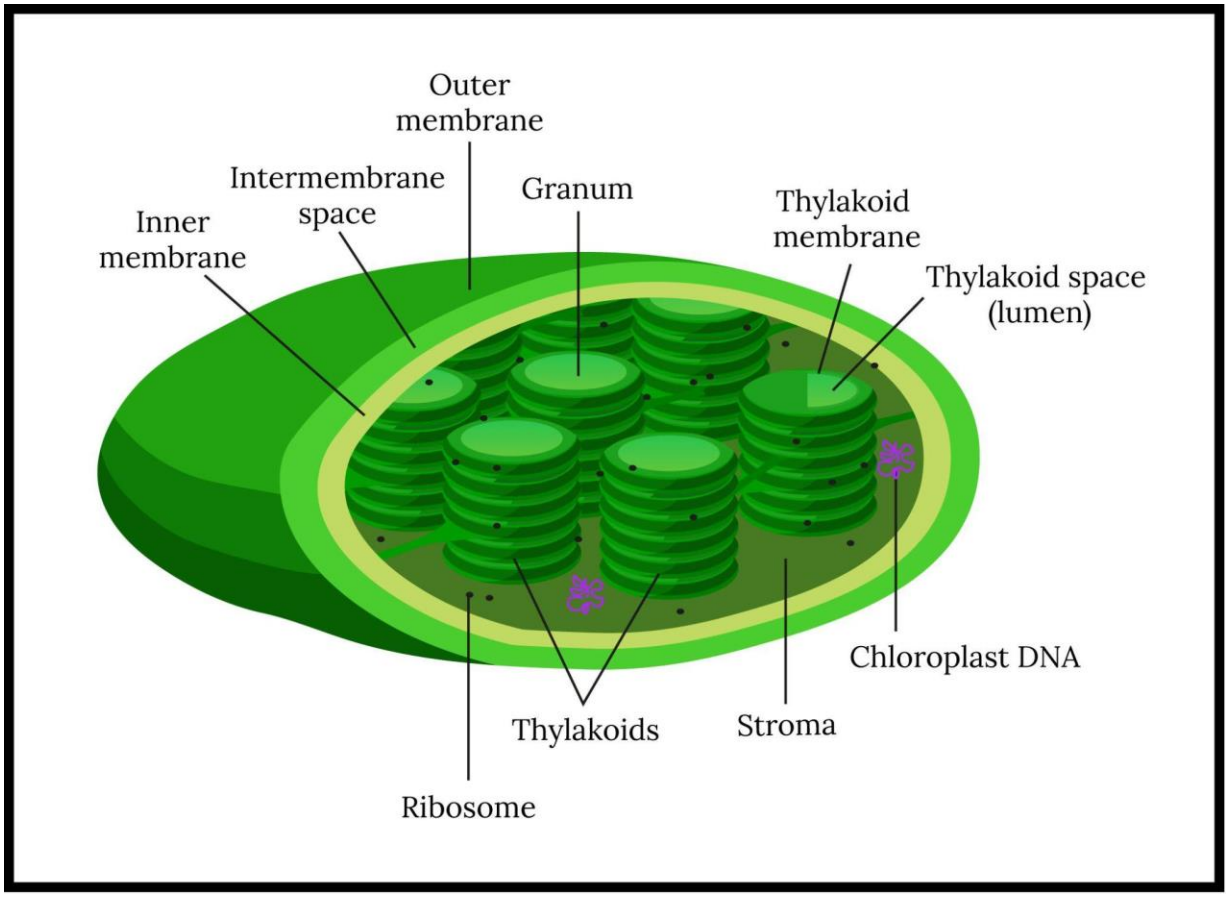


Diagram of a Chloroplast

8. What are the characteristics of prokaryotic cells?

Ans: In prokaryotic terms **pro** means 'primitive' and **karyon** means 'nucleus', which means prokaryotic cells have a very primitive and less defined nucleus. They do not possess any membrane-bound organelles like mitochondria, chloroplast, Golgi body, Endoplasmic reticulum, etc. Examples include archaea and bacteria. Other characteristics of prokaryotic cells are given below:

1) Most of the prokaryotic cells are unicellular.

2) The size of a prokaryotic cell varies from 0.5 – 5 µm and is generally small in size.

3) The nuclear region of a prokaryotic cell is poorly defined and the genetic material is present in the region of the cytoplasm.

4) In prokaryotic cells, the DNA is found naked which means DNA is not associated with histone proteins.

5) They have single, circular chromosomes as genetic material. except for the genomic DNA, they also contain circular plasmid DNA.

6) Mesosomes are the specialized membranous structures that are found in prokaryotic cells. It is formed by the invagination of the cell membrane and these extensions help in

the synthesis of the cell wall and replication of DNA.
7) Prokaryotic cells contain cell walls as an outer covering that gives shape to the cells.

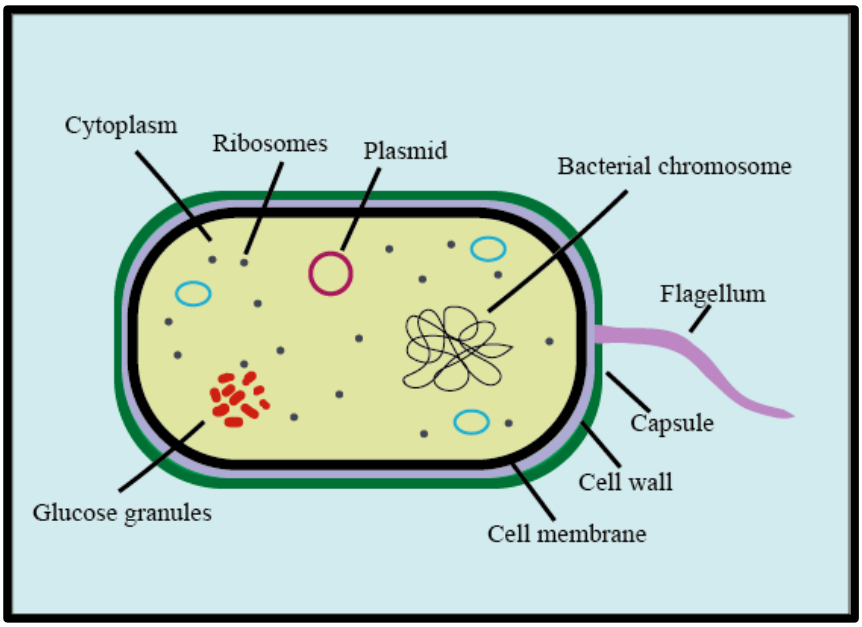


Diagram of a prokaryotic cell.

9. Multicellular organisms have a division of labor. Explain.
Ans: A multicellular organism has cells as a basic structural unit in its body. The cells are arranged in a manner to form tissues like blood, bone, etc. and these tissues are arranged in a manner to form organs like the heart, kidney, or other body organs. These organs form an organ system such as the digestive system, reproductive system, and respiratory system, etc. and various organ systems of the organism perform together to form a complete individual.

10. Cells are the basic unit of life. Discuss in brief.
Ans: There are several organ systems that function together to form an organism. Each organ system like the nervous system, digestive system, circulatory system, etc., includes several organs. And these organs are formed by several types of tissues. A tissue is formed combinedly by the cells that interconnect with each other and perform a shared function. A cell can do all an organism can do this is the reason the cells are called the basic building blocks of all organisms.

11. What are nuclear pores? State their function.
Ans: Nuclear pores are small holes present in the nuclear envelope of the nucleus. This nucleus envelope is formed by the fusion of two nuclear membranes. These small holes

only allow some specific substances to be transferred into the cell cytoplasm and back to the nucleus. However, they allow few molecules like RNA and proteins to move in both directions between the nucleus and the cytoplasm.

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

Ans: Both lysosomes and vacuoles are single membranous structures and both perform different types of functions. Lysosomes can hydrolyze all types of organic substances, except cellulose because it contains hydrolytic enzymes that work under acidic pH. They perform phagocytic functions and hence, are known as suicidal bags. However, the vacuoles are non-cytoplasmic sacs covered by a membrane. It is found in animal and plant cells both that contain sap, water, excretory substances, etc. The membrane surrounding the vacuole is called tonoplast which is semi-permeable in nature. Vacuole separates harmful substances from cell cytoplasm and maintains osmotic pressure or turgidity. Some freshwater invertebrates like Amoeba, Paramecium, etc. contain contractile vacuoles. This contractile vacuole performs several functions like osmoregulation and excretion. The other type of vacuole is known as food vacuole. It stores the food while gas vacuoles store metabolic gases and take part in buoyancy regulation.

13. Describe the structure of the following with the help of labeled diagrams.

(i) Nucleus

(ii) Centrosome

Ans: The nucleus is a membrane-bound organelle that controls all the cellular activities of the cell. It plays an important role in cell division. It is relatively large and spherical in shape and is composed of the following structures:

Nucleoplasm: It is the matrix of the nucleus that contains the nucleolus and chromatin. The nucleolus is made up of protein and RNA molecules and is the site for ribosome formation. It is a spherical structure that is not bound by any membrane. The chromatin reticulum found within the nucleoplasm is made up of DNA and histone proteins. It is highly entangled but at the time of cell division chromatin reticulum condenses into chromosomes.

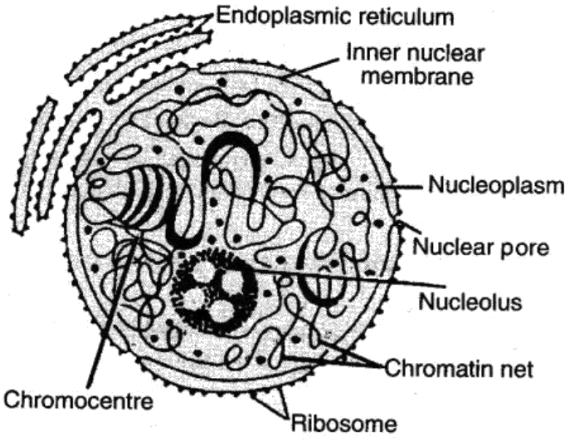
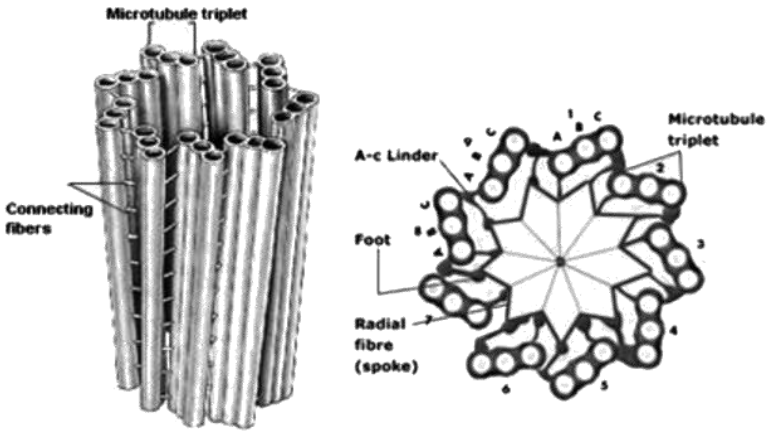
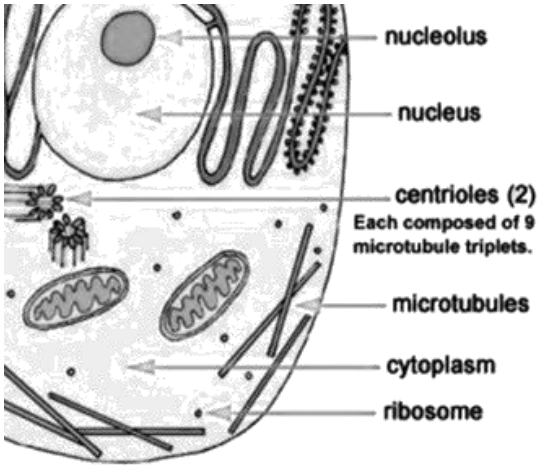
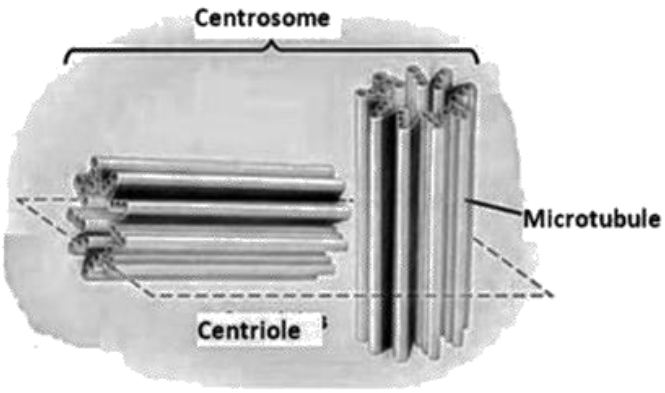


Fig. Eukaryotic nucleus

Centrosome: The centrosome is made up of two cylindrical structures that lie perpendicular to each other called centrioles. These centrioles are linked with each other by interconnected fibers. Each centriole has a cartwheel-like arrangement which is made up of microtubule triplets that are evenly placed in a ring. A proteinaceous hub is present in the central part of a centriole which is connected to the triplets via radial spokes. The centrioles play a vital role in forming the spindle fibers and astral rays during cell division and also forms the basal body of cilia and flagella







14. 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.

Ans: Chromosomes are found in the nucleus of each cell. It is a thread-like structure that is not visible in the cell's nucleus. But at the time of cell division, it becomes more tightly packed, and then only it is visible under a microscope. Each chromosome joined at the centromere or the primary constriction and hence consists of two chromatids. These centromeres are the point of attachment of spindle fibers and play a vital role in cell division.

On the basis of the position of the centromere, chromosomes are classified into the following types:

(1) Acrocentric chromosome: In this type of chromosome, the centromere is present at the sub-terminal. In the Anaphase stage chromosomes are J-shaped.

(2) Sub-metacentric chromosome: In this type of chromosome, the centromere is sub-median and the anaphasic chromosome appears L-shaped.

(3) Metacentric chromosomes: In this type of chromosome, the centromere is present in the middle and divides the chromosome into two equal parts. The chromosome appears V-shaped.

(4) Telocentric chromosome: In this type of chromosome, the centromere is present at the terminal. The anaphasic stage appears l-shaped.

Depending upon the number of centromeres, a chromosome is of different types.

(i) Monocentric: with a single centromere

(ii) Dicentric: with two centromeres

(iii) Polycentric: with many centromeres

(iv) Acentric chromosome: there is no centromere