Class 9th

BIOLOGY

THE FUNDAMENTAL UNIT OF LIFE

- The cell is the basic structural and fundamental unit of life.

I. Who Discovered Cell and How?

- Cell was discovered by Robert Hooke in 1665, he observed the thin slice of cork (the bark of a tree) and found little rooms in the structure of a honeycomb. Later on, they were known as cells.
- Cell theory was proposed by J.M. Schleiden and T. Schwann in 1838-39.
- The cell theory was further expanded by R. Virchow (1855) by stating, "Omnis Cellula e Callula" which means all cells arise from pre-existing cells.
- Purkinje in 1839 coined the term for the fluid substance of the cell, "protoplasm".
- The scientist Robert Brown discovered the nucleus of the cell.

II. Classification of organisms:

On the basis of number of cells present in organisms, they are classified into two categories.

1. **Unicellular Organisms:** The organisms which are made up of single cells and perform all the essential activities of life. A single cell may form a whole organism as in *Amoeba, Paramecium, Chlamydomonas* and Bacteria, etc.
2. **Multicellular Organisms:** The organisms which are made of a group of cells and perform different function to sustain the life organism is called multicellular organisms. Fungi, plants, and animals are multicellular organisms.

III. Types of cells:

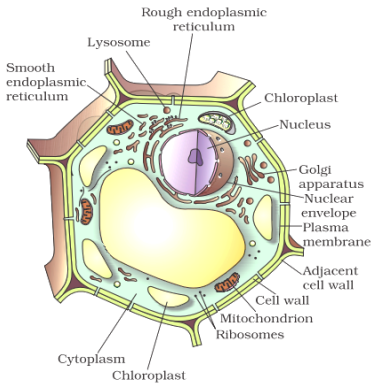
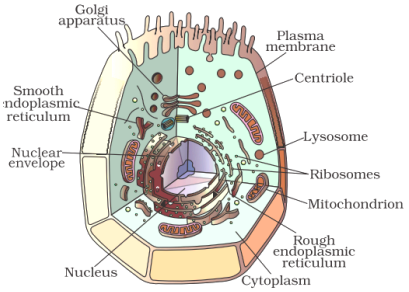
A. Various cells of the human body vary in structure according to their function. Based on origin and cellular structure, there are two types of cells.

1. Prokaryotic cells
2. Eukaryotic cells

S.no	Features	Eukaryotic cell	Prokaryotic cell
(i)	Size	Generally large(5-100μm)	Generally small (1-10μm)

(ii)	Nucleus	They have a well-defined nucleus.	A well-defined nucleus is absent. They have nuclear material called nucleiod.
(iv)	Cell wall	Present in plant and fungal cells, while absent in animal cells.	It is made up of peptidoglycan.
(v)	Cell organelles	Membrane-bround cell organelles are present.	Membrane-bound cell organelles are absent.
(vi)	Chromosomes	Single or multiple chromosomes are present	A single chromosome is present.

B. The differences between plant cells and animal cells are listed below:

Plant cell	**Animal cell**
1. A plant cell is surrounded by a rigid cell wall. It is made up of cellulose.	1. An animal cell does not have a cell wall.
2. The presence of a large vacuole is seen in plant cells.	2. Whereas there are very small vacuoles as compared to plant cells are seen in animal cells.
3. Larger in size.	3. Smaller in size.
4. Plant cells have plastids.	4. Animal cells do not have plastids.
5. Centrosomes are absent in plant cells	5. Animal cells have centrosomes.
6. Plant cells do not have cilia.	6. Animal cells have cilia.
7. Lysosomes are very rare in plant cells.	7. Animal cells have lysosomes.
	

IV. The Shape of the Cell

- The shape and size of cells are related to the specific function they perform. Some cells like *Amoeba* have changing shapes while in some cases, cell shape could be more or less fixed. For example: nerve cells.
- Every cell has a certain specific component within it known as a cell organelle. These organelles carry out some very important functions in cells, e.g. making new cell organelle, clearing up waste material from cells, and so on.

V. The Structure of Cell: Each cell is divided into three functional regions –

[2]

(i) Plasma/cell membrane

(ii) Nucleus

(iii) Cytoplasm.

All activities inside and outside of the cell are possible due to these features.

(i) Plasma Membrane:

- It is the outermost covering of the cell.
- It permits the entry and exit of some materials so it is called a selectively permeable membrane.
- It helps in osmosis and diffusion.
- It is made up of lipids and proteins.

Transport of substances:

Transport of substances across the plasma membrane can vary depending upon the requirement of cellular energy. Types of transport are below:

- **Diffusion:** It is the movement of substances from high concentration to low concentration. For instance, exchange of gases through stomata some substances like carbon dioxide or oxygen can move across the cell membrane by diffusion.
- **Osmosis:** It is the movement of water molecules from a region of higher concentration to a lower concentration through a semipermeable membrane. The movement of water molecules by osmosis is a special case of diffusion. It could be endosmosis or exosmosis.

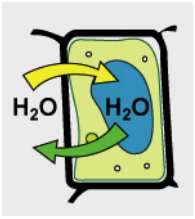
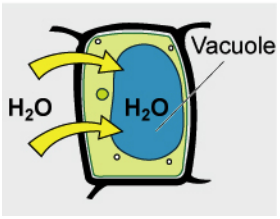
Endosmosis: Endosmosis is the movement of solvent into the cell.

Exosmosis: Exosmosis is the movement of solvent out of the cell.

Endoosmosis and exosmosis processes take place on the basis of a concentration gradient.

There are three types of solution on the basis of concentration:

(i) Isotonic solution	(ii) Hypotonic solution	(iii) Hypertonic solution
If a cell is placed in a medium that has exactly the same water concentration as the cell, there will be no net movement of water across the cell membrane. Such a solution is known as an isotonic solution. Water crosses the cell membrane in both directions, but the amount going in is the same	If a cell is placed in a medium surrounding the cell that has a higher water concentration than the cell, i.e. the outside solution is very dilute, and then the water enters the cell from the external solution by endosmosis. Such a solution is known as a hypotonic solution.	If a cell is placed in a medium that has a lower concentration of water than the cell, then the water will move outside and the cell will lose water by exosmosis. Such a solution is known as a hypertonic solution. In this, the cell will shrink.

as the amount going out, so there is no overall movement of water. The cell will stay the same size. Isotonic condition 	In this, the cell is likely to swell up. Hypotonic condition 	Hypertonic condition 

- In addition to the plasma membrane, plants have another rigid outer covering called a cell wall.

  It is made up of cellulose. In fungus, it is made up of chitin.

(ii) Nucleus: It has a double-layered nuclear membrane having nuclear pores for the transfer of material and chromosomes. The chromosomes contain information for the inheritance of features from parents to the next generation in the form of DNA and protein molecules.
The functional segments of DNA are called genes.

(iii) Cytoplasm: It is a fluid content inside the plasma membrane. It contains many special cell organelles. The nucleus and cytoplasm are together called protoplasm. It stores important chemicals such as amino acids, glucose, vitamins, and iron, etc.

VI. Cell organelle:

To keep the cells alive and functional, a different part of the cell carries different functions. These parts are said to be cell organelles.

· Various cell organelles are as follows :

(i) Endoplasmic Reticulum (ER): ER is a large network of membrane-bound tubular structures scattered in the cytoplasm. It is often termed as a system of the membrane. There are two types of Endoplasmic Reticulum – Rough or Smooth. RER has ribosomes on its surface. It helps in protein synthesis. SER helps in the manufacturing of fat molecules or lipids.

(ii) Golgi Apparatus: It was first designed by Camillo Golgi. It consists of membrane-bound, fluid-filled vesicles arranged parallel to each other in stacks called cisterns.
It helps in the storage modification and packaging of products in vesicles. It is also involved in the formation of lysosomes.

(iii) Lysosomes: These are membrane-bound sacs filled with digestive enzymes. It helps in removing any dead or old worn-out cell organelles by digesting them and making space for new organelles. During the disturbance in cellular metabolism, e.g. when the cells get damaged, lysosomes may burst and release the powerful digestive enzymes which digest their own cell. Lysosomes are called suicide bags of cells.

[4]

(iv) Mitochondria: It is known as the powerhouse of the cell. The energy required for various chemical activities needed for life is released by mitochondria in the form of ATP molecules.

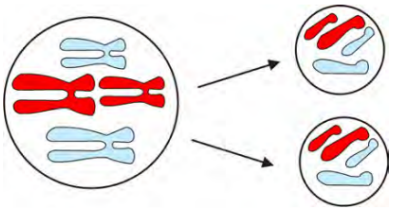
Mitochondria have double membranes called the outer and inner membranes. Mitochondria have their own DNA and ribosomes.

(v) Plastids: Plastids are found only in plant cells. These are of two types –
(a) Chromoplast (coloured) and (b) Leucoplast (colourless).
The most important chromoplasts are chloroplast which contain green pigment called chlorophyll.
It helps in the synthesis of food in plants by photosynthesis.
Plastids also have their own DNA and ribosomes.

(vi) Vacuoles: These are fluid or solid-filled membrane-bound sacs in the cytoplasm. In animal cells, they are small but in plant cells, a single, prominent large vacuole is present.
Many important substances for the life of plants are stored in vacuoles.
It is helpful in expelling excess water.

VII. Cell Division:

There are two types of cell division – Mitosis and Meiosis.
The process in which most of the cells divide for growth is called mitosis.



The process that produces four new cells instead of just two, is called meiosis.