

**MAIN TOPICS :-**

- Cell
- Discovery of cell
- Cell Number (Unicellular/Multicellular)
- Prokaryotic and Eukaryotic cell
- Division of labour in cells
- Shapes of cells
- Basic structure of cell
- Cell membrane or Plasma Membrane
- Nucleus
- Cytoplasm (Various cell organelles)

**Cell** :- Cell is the structural and functional unit of life. Cells differ in their number, size and shape in different organisms. The size and shape of the cells are related to the particular function they perform.

Discovery of cell :-

- In 1665, the term cell was first introduced by an English Scientist Robert Hooke
- In 1831, nucleus was discovered by Robert Brown.
- In 1838, MJ Schleiden suggested that all plants are composed of cells . In 1839, T. Schwann stated that all animals also consist of cells. Both of these discoveries formed the basic of cell theory.
- In 1839, JE Purkinje gave the theory ‘Protoplasm’ for the living content present in the cell.
- In 1855, Rudolph Virchow expanded the cell theory stating that – ‘all new cells arise from pre-existing cells.

Thus, the cell theory consists of the following postulates :-

- All living organisms are made up of cells and cell products.
- A cell is the site for all metabolic reactions. Thus a cell is the structural and functional unit of life.
- All cells arise from pre-existing cells by division of already existing cells.
- Life of every organism starts from a single cell.

**CELL NUMBER**

The Living organisms can be classified as unicellular or multicellular based on the number of cells.

Unicellular organisms:- The organisms made up of a single cell are called unicellular or single cell are called unicellular or single-celled organisms. In unicellular organisms a single cell is capable of carrying out all the essential processes of life e.g.-Amoeba, Paramecium, bacteria, yeast

Multicellular organisms:- The organisms made up of more than one cell or several cells are called multicellular organisms. E.g. Human beings, higher plants and animals

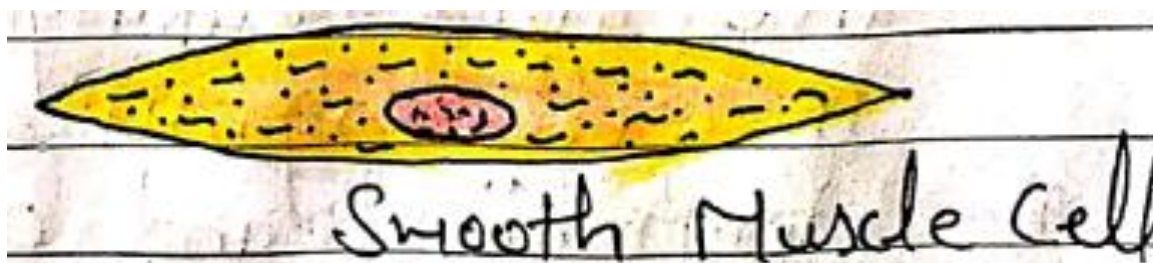
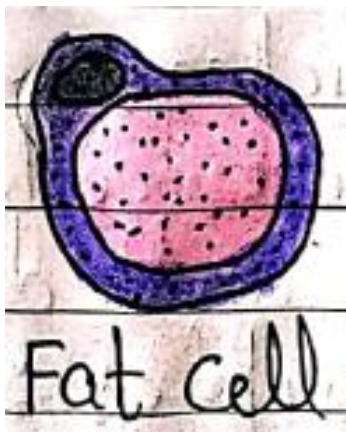
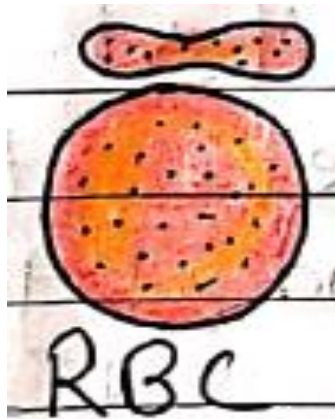
**Difference between Unicellular and Multicellular organisms**

<b>Unicellular organisms</b>	<b>Multicellular organisms</b>
Have a single cell	Consist of many cells
Size of cell is 1-10 um	Cell size is large (5-100um)
A single cell is capable of performing all the life process	A single cell carries out one or few processes
Division of labour does not exist as the single cell performs all the functions	Division of labour exists as various cells performs different functions

**Division of labour in cells** : It is the characteristic feature of cells of multicellular organisms like human being. This means that different parts of the body are responsible for performing different functions. For example the human body has lungs to respire, a heart to pump blood, a stomach to digest food and so on.

### **Shape of cells**

In living organisms, cells of various shapes are observed. Most of the plant and animal cell have a definite shape. Cells are spherical (e.g. Ovum), elongated (e.g., nerve cells), spindle shaped (e.g. muscle cells), biconcave disc-shaped (e.g., human RBCs) etc. Some cells do not have a definite shape like Amoeba and white blood cells (WBCs)



## Prokaryotic And Eukaryotic Cells

On the basis of complexity of cellular organisation, living organisms can be categorised as follows

- Prokaryotic Cells
- Eukaryotic cells

**Prokaryotic Cells** :- Primitive and incomplete cells that lack nuclear membrane around their genetic material are called Prokaryotic cells. The genetic material in these cells is in direct contact with cytoplasm and is also known as nucleoid. The prokaryotic cells contain ribosomes but they do not contain membrane bound organelles like mitochondria, endoplasmic reticulum etc. Examples, Blue-Green algae and cyanobacteria

**Eukaryotic cells**:- The cells which possess a true nucleus bounded by a nuclear membrane are called eukaryotic cells. These cells have membrane-bound organelles. Examples: Plants, Animals and Fungi

### Basic Structure of a cell

All cells consist of the following three major features.

1. Cell Membrane or Plasma Membrane
2. Nucleus
3. Cytoplasm

### Cell Membrane or Plasma Membrane:-

**Occurrence** : It is an outer covering of a cell and is present in the cells of plants, animals and microorganisms. It separates the cell from its surrounding environment. In plant cells, the cell membrane is surrounded by a rigid and tough cell wall whereas in animal cells, it is the only outermost covering of the cell.

**Structure** : The cell membrane is a living, thin, elastic and selectively permeable membrane. It is made up of lipids, proteins and carbohydrates. It has fine pores through which substances may enter or leave the cell.

### Functions :

- The plasma membrane is selectively permeable, so it regulates the entry and exit of substances in the cell.
- It gives a definite shape to the cell.
- It provides protection to the internal components of the cell and protects them from injury.
- It allows the flow of substances and information between cell organelles within the cell as well as between one cell and another
- It is flexible to engulf large molecules and food particles

**Passive transport :-** The molecules like water, gases and ions pass through the plasma membrane by passive transport. It occurs by two ways :-

- Diffusion
- Osmosis

**Diffusion:-** The process of movement of substances (solid, liquid or gas) from the region of higher concentration to the region of lower concentration is called diffusion.

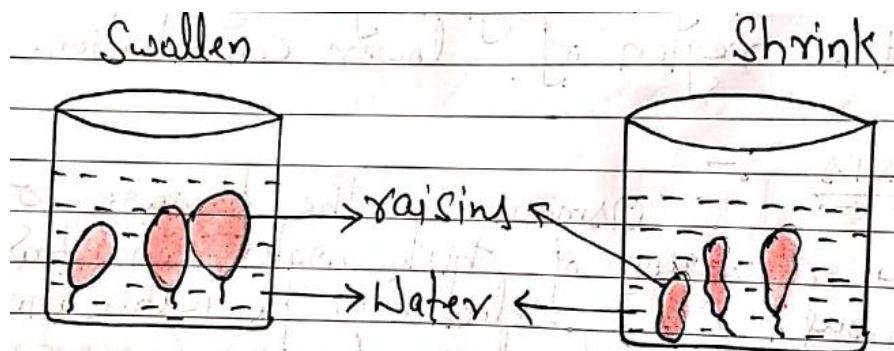
For example:- Some substances like  $\text{CO}_2$  accumulates in high concentrations inside the cell.  $\text{CO}_2$  in the external environment of the cell is very less in concentration as compared to the inside environment. Due to this difference in the concentration of  $\text{CO}_2$  inside and outside a cell, the gas moves out of the cell, i.e., the gas moves out from region of higher concentration to the region of lower concentration.

**Osmosis :-** Osmosis is the passage of water from a region of high water concentration through a selectively permeable membrane to a region of low water concentration till equilibrium is reached.

For example:- The roots of the plants absorb water from the soil by the process of osmosis.

**Types of osmosis :-** It is of two types

- Endosmosis :- The movement of solvent into the cell across a semi-permeable membrane when the cell is placed in a hypotonic solution is called endosmosis. E.g., swelling of raisins in water.
- Exosmosis :- The movement of solvent out of the cell to surrounding medium across a semi-permeable membrane when a cell is placed in a hypertonic solution is called exosmosis. For example, plant cell kept in hypertonic solution (concentrated salt or sugar solution)

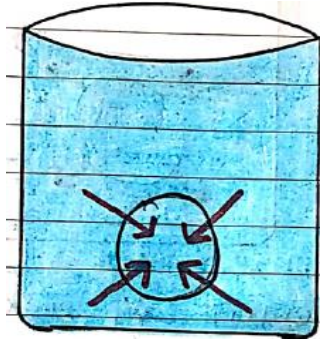


## Types of solutions :-

- (i) Hypotonic Solution
- (ii) Isotonic solution
- (iii) Hypertonic solution

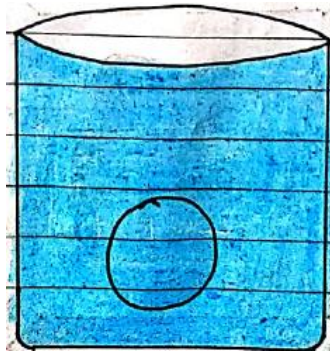
Let's understand what happens when we put an animal cell or a plant cell into a sugar or salt solution.

- (i) Hypotonic Solution :- If the solution outside the cell is dilute in comparison to cell sap, the cell will gain water by osmosis. The cell is likely to swell up.



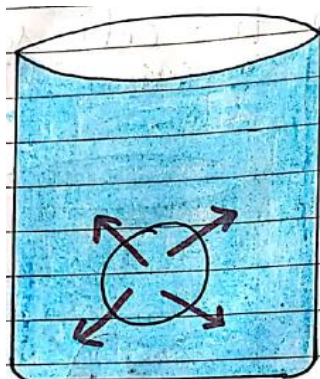
Net movement of water inside the cell

- (ii) Isotonic Solution :- If the concentration of solution outside the cell is similar to the cell sap, there will be no net movement of water across the cell membrane.



No movement of water outside the cell

- (iii) Hypertonic Solution :- If the solution outside the cell is more concentrated than the cell sap, the cell will lose water by osmosis. Therefore, the cell will shrink.

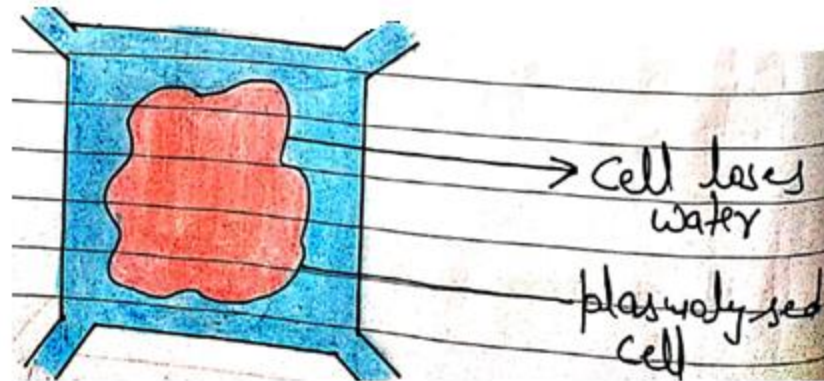


Net movement of water outside the cell

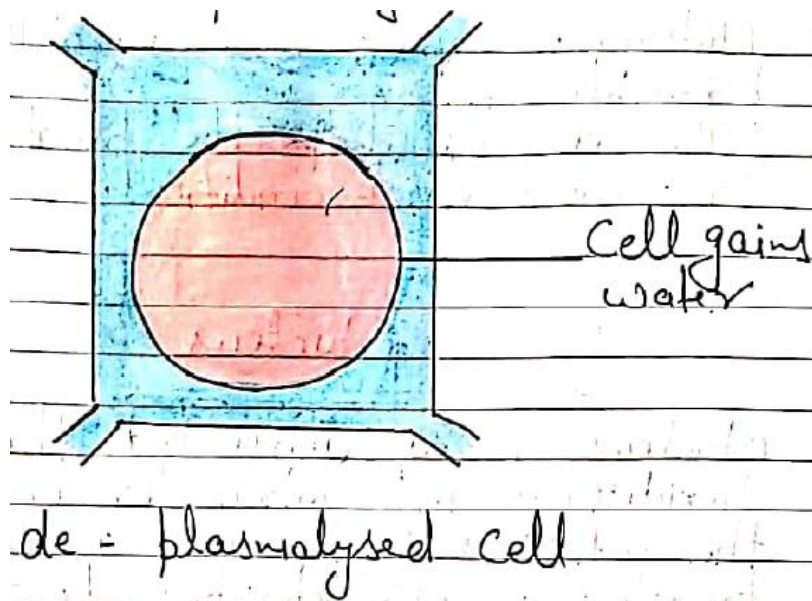


## Plasmolysis and De-plasmolysis

Plasmolysis:- When a living cell loses water through osmosis there is shrinkage of the contents of the cell away from the cell wall. This phenomenon is known as Plasmolysis.



De-Plasmolysis:- When a plasmolysed cell is put in a hypotonic solution it gains water and retains its original shape. This phenomenon is known as de-plasmolysis.



## Cell Wall

Characteristics and Functions of cell wall.

Characteristics

1. It is a rigid semi-elastic, supportive, non-living and completely permeable present outside the plasma membrane in the plant cell, fungi and some other organisms.
2. In fungi cell wall is made of chitin.
3. The plant cell wall is composed of cellulose

## Functions of cell wall:-

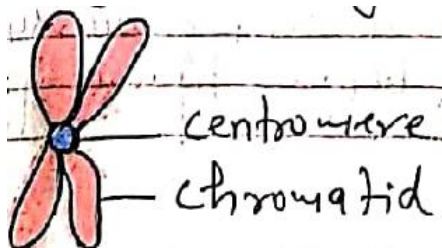
1. It maintains the shape of the cell
2. It provides protection against injury.
3. It regulates the osmotic pressure of the cell
4. Materials can pass through it due to its permeable nature
5. The cell wall helps the plant cell to survive in various harsh conditions.

## NUCLEUS

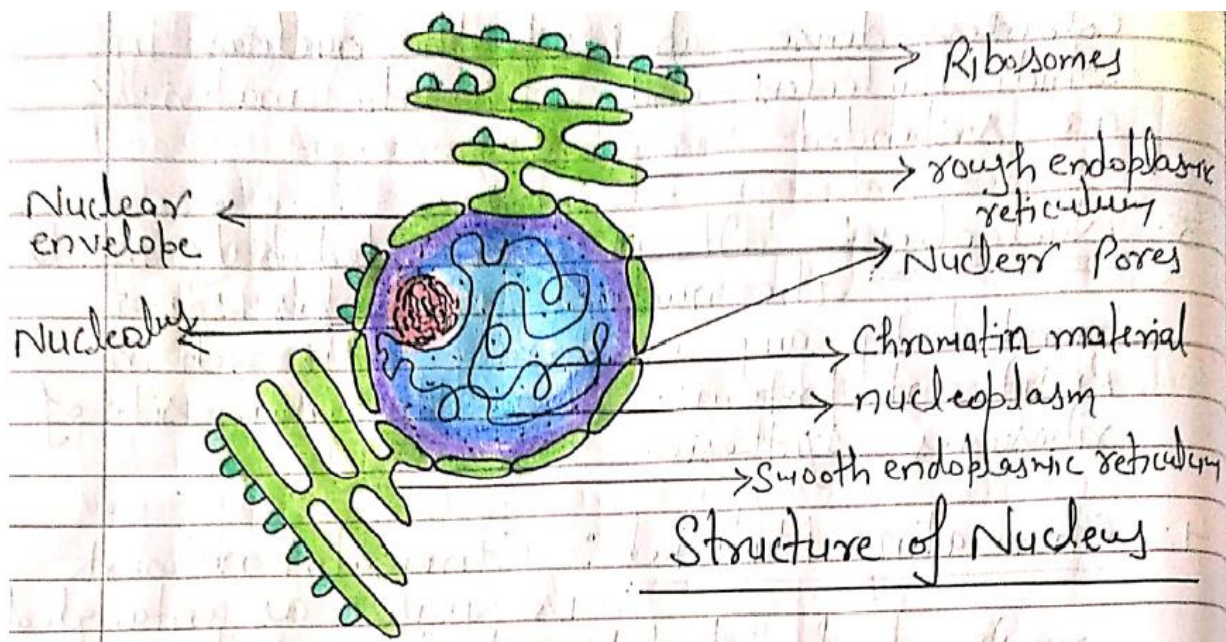
Nucleus is a dense body that contains hereditary information for controlling all the activities of the cell as well as the transfer of characteristics to the next generation. It is also known as brain of the cell or control center of the cell. It has four main parts :-

1. Nuclear membrane or nuclear envelope :- It surrounds the nucleus. It is made up of two layers which chemically consist of proteins and lipids. It has pores which allow the transfer of materials from the nucleus to cytoplasm
2. Nucleoplasm (nuclear sap) :- It is the colourless dense sap inside the nucleus in which nucleolus and chromatin materials are suspended.
3. Nucleolus:- It is a rounded body inside the nucleus. Nucleolus is not bounded by any membrane. It is the main site of ribosomes synthesis.
4. Chromatin Material :- Chromatin network is visible as entangled mass of thread like structure. Whenever the cell is about to divide, the chromatin material gets organised into chromosomes.
  - Chromosomes are rod shaped structures that contain information for inheritance of characters from the parents to the next generation in form of DNA (deoxyribonucleic acid)
  - Chromosomes are composed of two components DNA and proteins. DNA carry information necessary for protein synthesis and are known as genes.
  - Genes are the functional units of DNA and are passed from one generation to the next.

Structure of chromosome







### **Function of Nucleus :-**

1. It contains the genetic information of the whole organism in the form of genes.
2. It controls all metabolic activities of the cell.
3. Ribosomes are formed in the nucleolus.
4. It regulates cell cycle and cell division.
5. It controls the growth in cell.