

## Introduction

“Cell is the structural and functional unit of life. It is the basic unit of life”.

It was discovered by Robert Hook in 1831 in a cork slice.

Leeuwenhoek (1674) discovered the free-living cells in pond water.

## The cell theory

Cell is the basic unit of life, and was presented by two biologists, Schleiden and Schwann.

The cell theory by Virchow suggests that all cells arise from pre-existing cells.

## Types of organisms

(i) **Unicellular Organism:** These organisms are single-celled which perform all the functions. Examples: **Amoeba, paramecium, bacteria.**

(ii) **Multicellular Organism:** Many cells are grouped together to perform a different function in the body and also form various body parts. Examples: **fungi, plants, animals.**

## Types of cells

There are two types of cells:

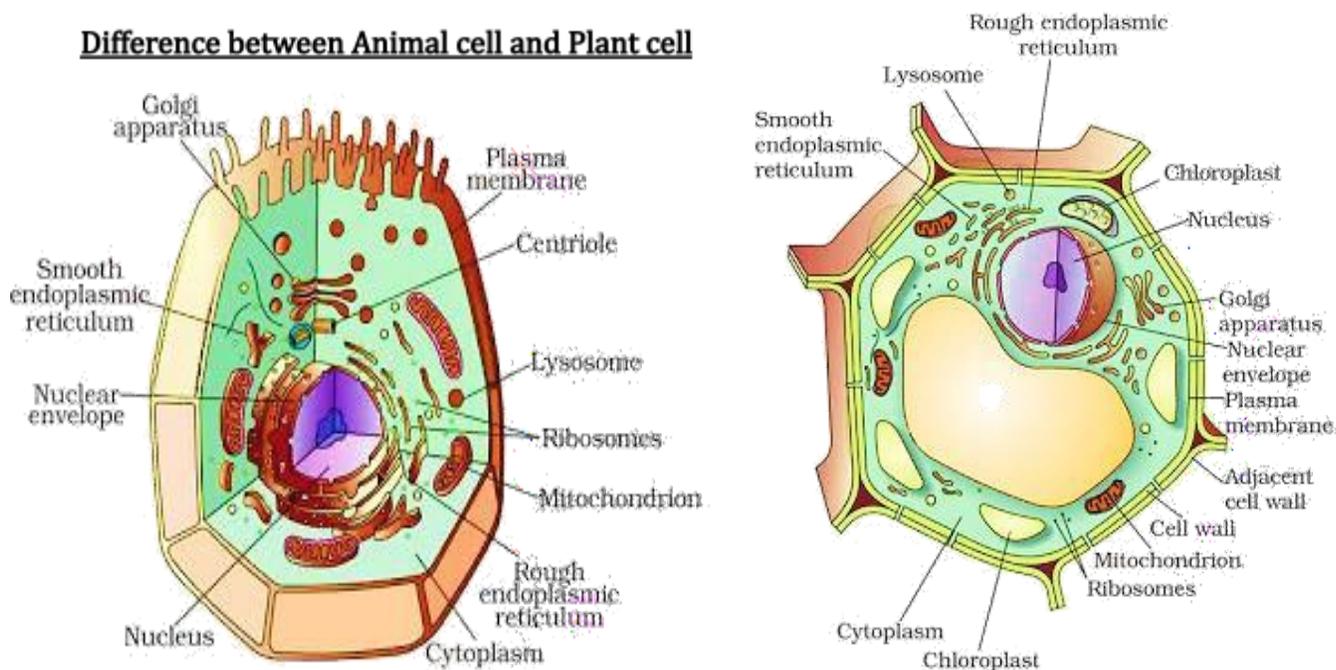
(i) **Prokaryotes**

(ii) **Eukaryotes**

<b>Prokaryotes</b>	<b>Eukaryotes</b>
Cells of organisms <b>lack nuclear membrane.</b>	Cells of an organism <b>have a nuclear membrane.</b>
The nucleolus is absent.	The nucleolus is present.
Single chromosomes.	Single or multi chromosomes
Reproduction is always asexual.	Reproduction is both sexual and asexual.
Always unicellular.	Often multicellular.
Membrane-bound cell organelles are absent.	Membrane-bound organelles are present like mitochondria.
The centriole is absent.	The centriole is present only in animal cells.

Cell division is by binary fission.	Cell division is by mitosis or meiosis.
Example: Bacteria, Blue-green algae, etc.	Examples: Fungi, Plant cells, Animal cells, etc.

## Difference between Animal cell and Plant cell



Animal Cell	Plant Cell
The cell wall is absent.	The cell wall is present.
Plastids are absent.	Plastids are present.
Centrioles are present.	Centrioles are absent.
Golgi bodies are present.	Golgi bodies are present and called dictyosomes.
Vacuoles are absent. If present, they are small.	Vacuoles are present and large in size.
A centrosome is present with one or two centrioles.	Centrosome is absent

## Diffusion

The random movement of a substance from a region of **high concentration to the region of**

**low concentration** is called diffusion.

Some substances like carbon dioxide or oxygen can move across the cell membrane by a process called diffusion. The cell also obtains nutrition from the environment.

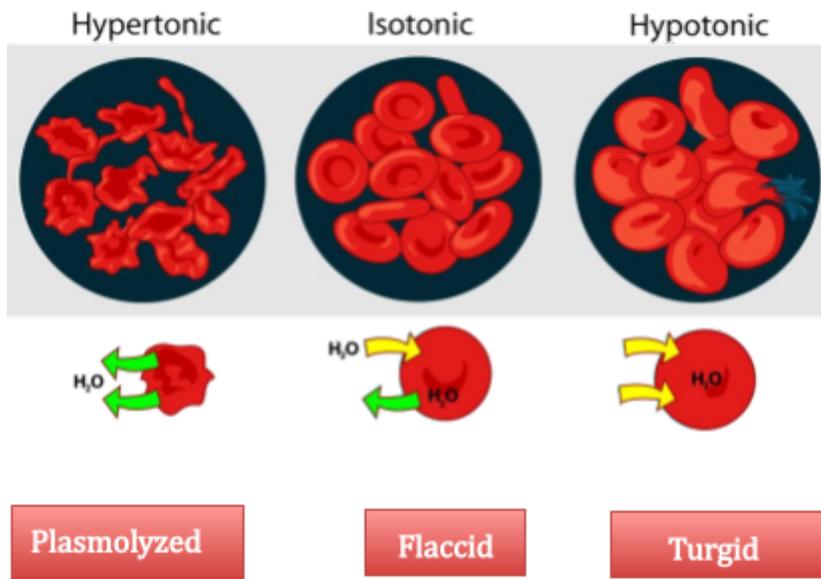
## Osmosis

The **movement of water molecules** through the selectively permeable membrane along the concentration gradient is called osmosis.

Plant cells tend to obtain water through osmosis.

### Behave of cell in Hypotonic or Hypertonic or Isotonic solution

Name of the solution	Condition	Result
<b>Hypotonic solution</b>	The medium surrounding the cell has a higher water concentration than the cell.	The cell will gain water by osmosis and is likely to swell up.
<b>Isotonic solution</b>	Medium has exactly the same water concentration as the cell.	Water crosses the cell membrane in both directions. The cell will stay the same size.
<b>Hypertonic solution</b>	Medium has a lower concentration of water than the cell.	Water crosses the cell in both directions, but more water leaves the cell than enters it.



## Plasma membrane or Cell membrane

Outermost covering of the cell separates the contents of the cell from the external environment.

It regulates the entry and exit of substances through the cell (**selectively permeable membrane**).

It is made up of lipid and protein.

## Cell Wall

Cell wall is another **rigid outer covering** in addition to the plasma membrane found in **a plant cell**.

The plant cell wall is mainly composed of cellulose.

## The function of Cell wall

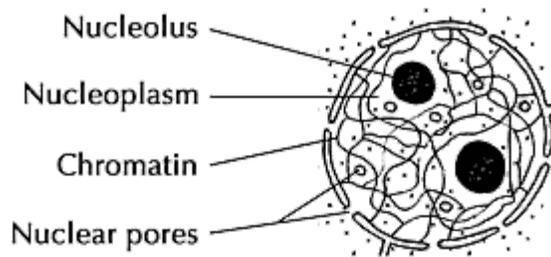
Cell wall permits plants, fungi, and bacterial cells to withstand hypotonic external media without bursting.

**Prevent cells** from the extreme condition.

## Plasmolysis

When a living plant cell loses water through osmosis, it causes shrinkage or contraction of the cell away from the cell wall. This phenomenon is known as plasmolysis.

## Nucleus



## Composition of Nucleus

- ☑ The nucleus has a **double-layered covering** called a nuclear **membrane**.
- ☑ The nuclear **membrane has pores** that allow the transfer of material.  
The nucleus contains **chromatin fiber**, (Chromosomes are visible in a dividing cell).  
Chromosomes are composed of DNA and protein.

## Functions of chromosomes

- ☑ Chromosomes contain hereditary information.
- ☑ DNA molecules contain the information necessary for cellular activity.
- ☑ Functional segments of DNA are called **genes**.

## Functions of Nucleus

- ☑ The nucleus plays a central role in **cellular reproduction**.
- ☑ It **directs the chemical activities** of the cell.

## Nucleoid

In some organisms like bacteria, the nuclear region of the cell may be poorly defined due to the absence of a nuclear membrane.

Such an undefined nuclear region containing only nucleic acids is called a **nucleoid**.

## Cytoplasm

The cytoplasm is the fluid inside the plasma membrane.

It also contains many specialized cell organelles.

## Function of Cytoplasm

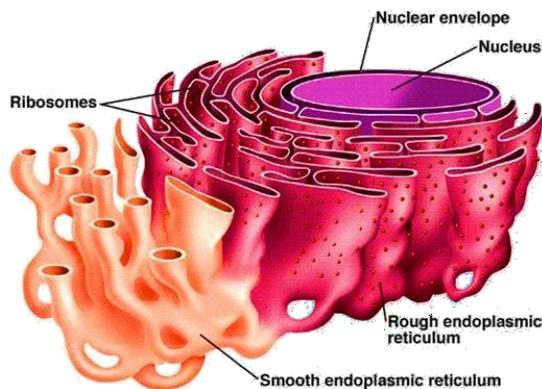
It helps in the **exchange of material** between cell organelles.

It **stores vital chemicals** such as amino acid, glucose, vitamins, and iron, etc.

It is the site of certain metabolic pathways such as glycolysis.

## Endoplasmic Reticulum (ER)

The endoplasmic reticulum (ER) is a large network of membrane bound sheets. It looks like long tubules or round or oblong bags (vesicles).



## Types of Endoplasmic Reticulum

- (i) Rough endoplasmic reticulum (RER)
- (ii) Smooth endoplasmic reticulum (SER)

## Functions of Endoplasmic Reticulum

RER has ribosomes attached to its surface. Ribosomes are the main site of protein synthesis.

The SER helps in the synthesis of lipids.

Some of these proteins and lipids help in building the cell membrane. This process is known as **membrane biogenesis**.

- ☑ Some other proteins and lipids function as **enzymes and hormones**.
- ☑ One function of the ER is to serve as **channels for the transport of materials**.
- ☑ In the **liver cells**, SER plays a crucial role in **detoxifying many poisons and drugs**.

## Golgi Apparatus

- ☑ The Golgi apparatus consists of membrane-bound vesicles arranged parallel to each other in stacks called **cisterns**.

These membranes often have connections with the membranes of ER.

## The function of Golgi Body

The material synthesized near the ER is packaged and dispatched to various targets

inside and outside the cell through the Golgi apparatus.

Its functions include the storage, modification, and packaging of products in vesicles.

The Golgi apparatus is also involved in the **formation of lysosomes**.

## Lysosomes

They keep the cell clean by digesting any foreign material.

Lysosomes have a membrane-bounded structure filled with digestive enzymes.

## Functions of Lysosomes

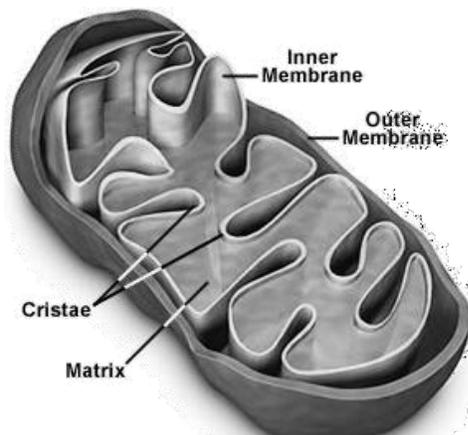
Lysosomes break foreign materials entering the cell.

When a cell gets damaged, lysosomes may burst and the enzymes digest their own cells.

Therefore, lysosomes are also known as the **'suicide bags'** of a cell.

## Mitochondria

Mitochondria are known as the powerhouses of the cell



## Structure of mitochondria

Double membrane structure,

The outer membrane is very porous.

Inner membrane is deeply folded to increase surface area

## Functions of mitochondria

Released energy by respiration in the form of ATP (Adenosine triphosphate) molecules.

Mitochondria have their own DNA and ribosomes. Therefore, mitochondria can make some of their own proteins.

## Plastids

- ☑ Plastids are present only in **plant cells**.

There are three types of plastids:

- Chromoplasts (colored plastids).
- Leucoplasts (white or colorless plastids).
- Chloroplasts (contains chlorophyll).**

## Structure of Plastids

- ☑ The internal structure consists of numerous membrane layers embedded in the **stroma**.
- ☑ Plastids also have their own DNA and ribosomes like mitochondria and are similar to their structure.

## Function of Plastids

**Chloroplasts** are important for **photosynthesis** in plants.

Leucoplasts are primarily organelles in which materials such as starch, oils, and protein granules are stored.

## Vacuoles

Vacuoles are storage sacs for solid or liquid contents.

They are small-sized in animal cells while **plant cells have very large vacuoles**.

## Function of vacuoles

- ☑ In plant cells vacuoles are full of cell sap and provide **turgidity and rigidity to the cell**
- ☑ Many important substances are stored in vacuoles like amino acids, sugars, and proteins.
- ☑ In single-celled organisms like **Amoeba**, the **food vacuole contains the food items** that the Amoeba has consumed.