# CELL THE UNIT OF LIFE

**Introduction:**
A cell is the structural and functional unit of life. It is the basic unit of life".
**Cytology:** It is a branch of science that deals with the study of cells with its components and functions.

**Story of Microscope:**
**Anton van Leeuwenhoek**- The first man to make and use a real microscope.
**There are broadly two types of microscopes**:
- Compound microscope and
- Electron microscope

**Compound Microscope:**
An optical instrument that consists of two convex lenses of short focal lengths is known as a compound microscope.
**Magnification:** 1000X

**Electron Microscope:**
A microscope that uses electron beams to illuminate a specimen object is known as electron microscope.
Magnification: **2, 00,000 times** more than that of an ordinary compound microscope.

**Discovery of Cell:**
**Robert Hooke** discovered the cell in 1665. Robert Hooke observed a piece of bottle cork under a compound microscope and noticed minuscule structures that reminded him of small rooms. Consequently, he named these "rooms" as cells. However, his compound microscope had limited magnification, and hence, he could not see any details in the structure. Owing to this limitation, Hooke concluded that these were non-living entities.
Later **Anton Van Leeuwenhoek** observed cells under another compound microscope with higher magnification. This time, he had noted that the cells exhibited some form of movement (motility). As a result, Leeuwenhoek concluded that these microscopic entities were "alive." Eventually, after a host of other observations, these entities were named as animalcules. In 1883, Robert Brown, a Scottish botanist, provided the very first insights into the cell structure. He was able to describe the nucleus present in the cells of orchids.

**The Cell Theory:**
- **Matthias Jakob Schleiden** (1838) and **Theodar Schwann** (1839) gave the 'cell theory'.
- However, the cell theory failed to explain how new cells arise.
- **Rudolf Virchow** (1855) stated in Latin- '**omnis cellula e cellula'**. It meant that new cells come from the pre- existing cells.

**The Three Postulates of Cell Theory are:**
- All living organisms are made of cells.
- A cell is the fundamental and **basic unit** of living organisms.
- All cells arise from **pre- existing cells.**

**Exceptions to Cell Theory are:**
**Viruses**: They contain only genetic material. **Protoplasm** is absent. Active or show signs of life only in a living cell.

**Types of Organisms:**
**(1) Unicellular Organisms:** These organisms are **single-celled organisms. In** which a single cell performs all the functions. **Example**: Amoeba, paramecium, bacteria.

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

**Shape and Size of Cell:**
(1) Cells vary in shape and size. They may be oval, spherical, rectangular, spindle shaped, or totally irregular like the nerve cell.
(2) The size of cell also varies in different organisms. Most of the cells are microscopic in size like red blood cells (RBCs) while some cells are fairly large like nerve cells.

### Types of cells:

There are two types of cells:
(1) Prokaryotes
(2) Eukaryotes

| Prokaryotes | Eukaryotes |
|---|---|
| Cells of organism lack nuclear membrane. | Cells of organism have nuclear membrane. |
| Nucleolus is absent. | 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. |
| Centriole is absent. | Centriole is present only in animals' cell. |
| Cell division is by binary fission. | Cell division is by mitosis or meiosis. |
| **Example:** Bacteria, Blue green algae, etc. | **Example:** Fungi, Plant cell, Animal cell etc. |

### Prokaryotic cell

### Modifications of cell envelop

- **Slime layer:** Glycocalyx in form of loose sheath.
- **Capsule:** Glycocalyx in form of thick and tough sheath.
- **Mesosomes:** Extension of plasma membrane. These can be in the form of vesicles, tubules and lamellae.
- **Functions:** Cell wall formation, DNA replication and distribution to daughter cells, respiration, secretion processes, to increase surface area of plasma membrane and enzyme content.
- **Flagella:** Extension of cell wall. It is composed of three structure-filament, hook and basal body. It help in motility of bacteria.
- **Pili and fimbriae:** Surface structure of some bacteria which attaches them to rocks in streams and to host tissues.
- **Genetic Material:** It is not covered by nuclear envelope. In addition to the genomic DNA (the single chromosome/circular DNA), many bacteria have small circular self replicating, double straned DNA which is called as plasmid, plasmid contain genes like antibiotic resistance.

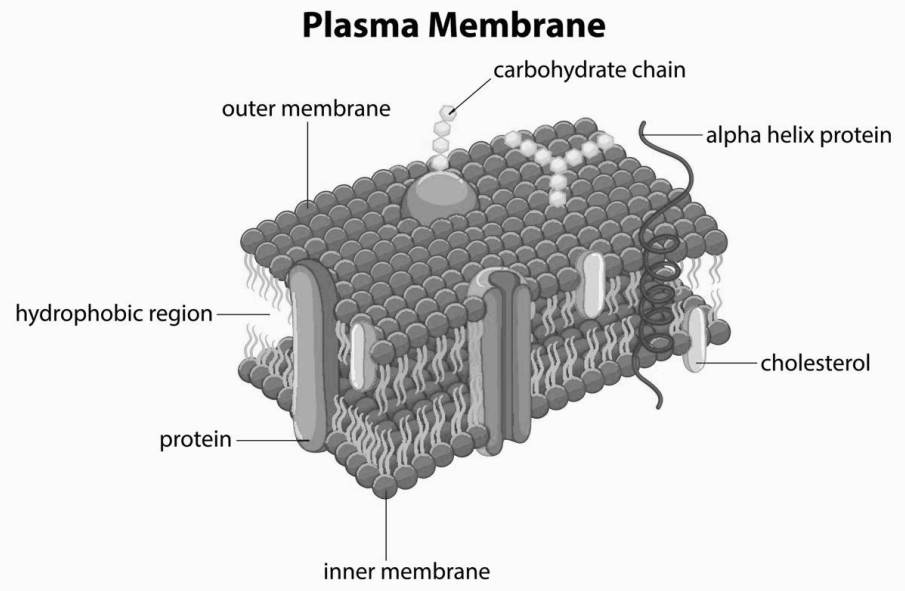
### Gram Positive and Gram Negative Bacteria

According to Christian Gram (1884) various types of reactions are shown by the cell walls of different bacteria. Thus, on the basis of the differences in the cell wall and the response to the staining procedure developed by Gram, bacteria are classified into following two types

**(i) Gram positive (+ve) bacteria** are those that take up the Gram stain and retain blue or purple colour, e.g., Bacillus subtilis, Clostridium, etc.
**(ii) Gram negative (-ve) bacteria** are those that do not take up Gram stain and loose the blue or purple icolour, e.g., Escherichia coli, (E.coli), Acetobacter, etc.

### Plasma Membrane or Cell Membrane:

- The **outermost covering** of the cell that 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.




**Fluid Mosaic Model:**

- The fluid mosaic model was proposed by **S.J. Singer and Garth L. Nicolson.**
- This model explains the structure of the plasma membrane of animal cells as a mosaic of components such as **phospholipids, proteins, cholesterol, and carbohydrates.**
- These components give a fluid character to the membranes.

**Description:**

- A phospholipid bilayer comprises two layers of phospholipid.
- Each phospholipid is composed of a hydrophilic head and a hydrophobic tail.
- **Hydrophilic head**: Attracted to the water in the cytoplasm of the cell as well as to the water of the surroundings of the cell.
- **Hydrophobic tail**: Repelled by water and are attracted to each other.

It is because of this attraction and repulsion that the bilayer is stable in spite of its fluidity.
The model is called mosaic as it suggests that the membrane is made up of many different constituents like proteins, carbohydrates and lipids which resembles the tiles of an ordinary mosaic.

**Transfer of Substances through Plasma Membrane:**

The passage of substances across the cell membrane takes place by three modes listed as follows.

**(1) Passive Transport:**

Passive transport is a mode of transport that takes place without the expenditure of energy: It takes place either by **diffusion or osmosis**.

**(a) Diffusion:** The process of movement of substances (solid, liquid & gas) from the region of its higher concentration to the region of its lower concentration to spread uniformly in the given space is called diffusion.

**Diffusion across Cell Membrane:**

- Metabolic gases $CO_2$ and $O_2$ move out and into the cells through **diffusion**.
- Respiration of the cell produces carbon dioxide. As the concentration of $CO_2$ (which is cellular waste) increases inside the cell as compared to the outside, $CO_2$ diffuses out of the cell into the external medium.
- Similarly, the concentration of oxygen is always higher in the external medium as compared to the cell where it is being consumed in respiration. Therefore, oxygen +diffuses from outside to the inside of the cell.

**(b) Osmosis:** Osmosis is the movement of a water molecule or solvent across a semi-permeable membrane from the region of lower concentration to the region of higher concentration. Osmosis is a **selective process** since the membrane does not allow all molecules to pass through it. Water is usually the only free-flowing molecule across this membrane.

**Cell Placed in Solution:**

Plant and animal cells placed in salt or sugar solution will behave in one of the following ways depending upon the concentration of an external solution:

- **Isotonic solutions** are those which have the same solute and pH concentration as the surrounding body fluid or the cytoplasm.
- **Hypotonic solutions** contain a lesser amount of solute concentration compared to the surrounding fluid and can force the cell to rupture due to excess input of water into the cell.
- **Hypertonic solutions** contain a higher concentration of solute compared to the surrounding fluid and thus push water out of a cell, shrinking it.

| S.no | Name of the solution | Result |
|---|---|---|
| (1) | **Hypotonic Solution** | ▪ Cell will gain water by osmosis and is likely to swell up. |
| (2) | **Isotonic Solution** | ▪ Water crosses the cell membrane in both directions.<br>▪ Cell will stay the same size. |
| (3) | **Hypertonic Solution** | ▪ Water crosses the cell in both directions, but more water leaves the cell than enters it. |

### (2) Active Transport:

Active transport is the movement of ions and electrolytes, which takes place across the membrane **by using energy** produced by the cell.
**Example:** movement of ions into or out of the cell.

- In general, molecules move from an area of their higher concentration to an area of their lower concentration without the expense of energy by diffusion or osmosis.
- Active transport occurs when molecules move across a cell membrane from a region of their lower concentration to a region of their higher concentration.
- In order to get molecules, to move against the concentration gradient, work must be done, hence energy is required.

### (3) Bulk Transport:

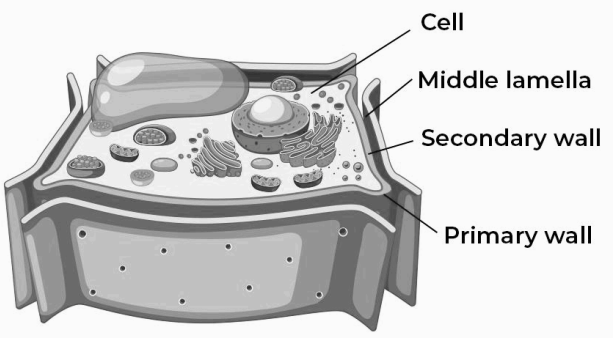
Bulk transport involves the movement of **macronutrients** such as proteins and polysaccharides which can pass only through a ruptured plasma membrane.

- **Exocytosis**: The process by which materials move from inside to outside of the cell is known as exocytosis. This is useful in releasing the secretory and excretory materials from the cell. For example, the release of the proteins and other materials formed in the cell to outside the cell.
- **Endocytosis**: The process by which materials move into the cell by engulfing the food and other substances from the external environment is known as endocytosis. For example, engulfing foreign substances, dead cells, pathogens, etc.
  Endocytosis is an umbrella term that describes two processes: Phagocytosis and Pinocytosis.

  **(1) Phagocytosis**: It means 'cell eating'. In this process, large particles, such as cells or macromolecules, are taken in by a cell. For example, when microorganisms invade the human body, neutrophils (type of WBCs) will engulf and eventually destroy them.
  **(2) Pinocytosis**: It means 'cell eating'. In this process, the bulk transport of fluid matter takes place across the cell membranes by forming small vesicles.

### Cell Wall:

The cell wall is the most prominent part of the plant's cell structure. It is made up of cellulose, hemicellulose, and pectin. The cell wall is present exclusively **in plant cells**. It **protects** the plasma membrane and other cellular components. The cell wall is also the outermost layer of plant cells. It is a rigid and stiff structure surrounding the cell membrane. It provides shape and support to the cells and protects them from mechanical shocks and injuries.




**Structure of Cell Wall:**
The cell wall is multilayered with usually three layers.
The three layers are:

1. Middle lamella
2. Primary cell wall
3. Secondary cell wall.

All plant cells invariably possess middle lamella, while primary cell wall, and secondary cell wall may or may not be present.

**(1) Middle Lamella:**

- The middle lamella serves as a cementing layer between the primary walls of adjacent cells.
- Cytoplasmic strand present in between the cells is known as **plasmodesmata**.

**Function:**

- **Pectin** helps in cell adhesion (binding)
- **Plasmodesmata** facilitates the transport of proteins and other materials between the cells.

**(2) Primary Cell Wall:**

- It is the layer inner to the **middle lamella.**
- It is the cellulose-containing layer laid down by the cells that are dividing and growing. To allow for cell wall expansion during growth, primary walls are thinner and less rigid than those of cells that have stopped growing.

**(3) Secondary Cell Wall:**

- It is formed inside the primary cell wall by the deposition of materials over the existing surface.
- Secondary walls are mainly composed of cellulose, hemicelluloses and lignin, and are deposited in some specialized cells, such as tracheary elements, fibers and other sclerenchymatous cells.
- In some cases, a substance called lignin may be deposited on the secondary walls of some cells. This process is known as lignification.

**Functions:**

- A cell wall provides a framework and definite shape to the cell.
- It gives rigidity and support to the tissues in plants.
- Cell wall gives mechanical strength to the cell to facilitate the plant to support its long and tall body.
- It helps in balancing and maintaining osmotic pressure and prevents the bursting of cells.
- It protects protoplasm against infections.
- It helps in the transport of water and minerals over long distances.

**Plasmolysis:**

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

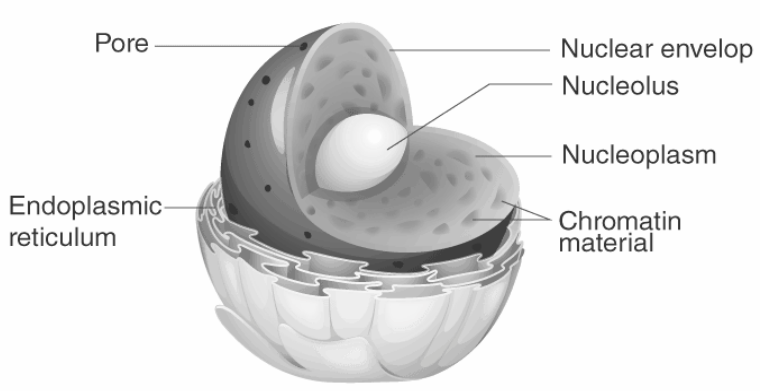
**Protoplasm:**

Protoplasm is the colorless material containing the living content of the cell. The living content includes the nucleus and the cytoplasm. Various cell organelles are found floating in the cytoplasm. These organelles are responsible for carrying out various cellular activities. Substances called cytoplasmic inclusions are also present in it.

**Nucleus:**

Discovered by - **Robert Brown (1831)**

- The nucleus is a double membrane-bound dense protoplasmic body, which controls all cellular metabolism and encloses the genetic information of cell.
- The nucleus is considered as the controller or director of the cell.




**Location:**

The nucleus is a large spherical body centrally located generally.

**Structure:**

**(1) Nuclear membrane:**

- Double layered, porous.

- Made up of lipids and proteins.
- Separates nucleus from cytoplasm.
- Transparent, dense and ground substance of nucleus.

**(2) Nucleoplasm:**
- Chromatin fibres and nucleoli suspended in it; Surrounded by a nuclear membrane.

**(3) Nucleolus:**
- Spherical, non- membranous, and vary in number; Rich in proteins and RNA molecules; Site for the formation of ribosomes.

**(4) Chromatin material:**
- Contains fine thread-like structures called chromatin fibres.
- Contain heredity material.

**Function of Nucleus:**
- Main controlling center of a cell.
- Major role in cell division.
- Regulate metabolic activities controlled by enzymes.

**Chromosomes:**
Chromosomes are thread-like structures in which DNA is tightly packaged within the nucleus.

**Functions of Chromosomes:**
- Chromosomes contain **hereditary information**.
- DNA molecules contain the information necessary for cellular activity.

**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.

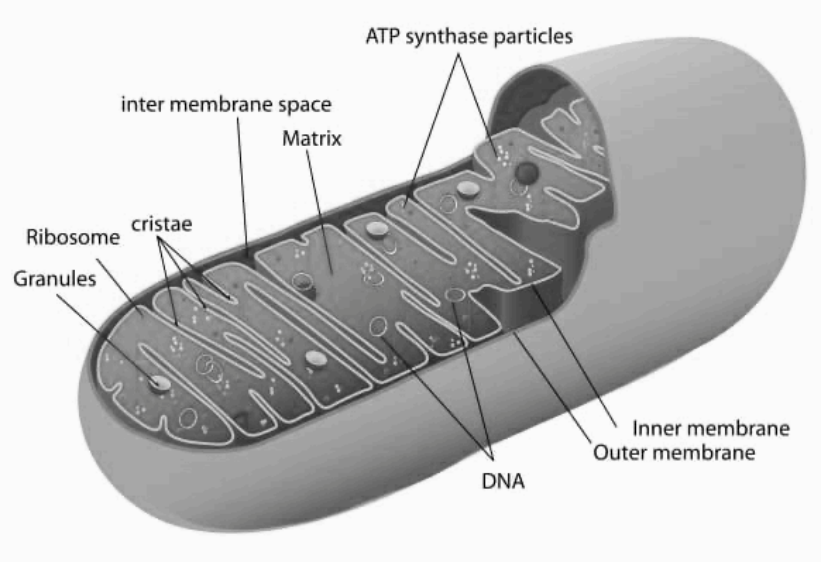
**Cytoplasm:**
The cytoplasm is a living, colourless, semi-liquid, homogeneous substance.
It occupies a major part of the cell and is constantly moving.
It is limited on the outside of the cell by the cell membrane.
About 90% component of cytoplasm is water and the remaining are amino acids, vitamins, enzymes, fats and carbohydrates.
- Contains many specialized living cell organelles.
- 90% component of cytoplasm is water.
- Part of the cytoplasm excluding the cell organelles is called **cytosol**.
- Also contains non-living cell inclusions known as **Ergastic bodies**.

**Cell Organelles:**
Organelles are small structures within the cytoplasm that carry out functions necessary to maintain homeostasis in the cell. They are involved in many processes, for example, energy production, building proteins and secretions, destroying toxins, and responding to external signals.

**(1) Mitochondria:**
- Mitochondria were first observed by **Köliker**. However, it was **Benda in 1898** who named them so.
- Mitochondria are double membrane-bound organelles of eukaryotic cells.

**Location:**

- Mitochondria are found in the cytoplasm of both plants and animals.




**Structure:**

- Mitochondria are rod-shaped structures surrounded by a **double-membrane** covering. The outer membrane is smooth and porous.
- The inner membrane is thrown into the finger-like projections called **cristae**. The cristae provide the increased surface area for more efficient metabolic activities to take place.
- Cristae bear minute, regularly spaced tennis racket shaped particles known as F1 particles or **oxysomes**. The membrane of oxysomes has various respiratory enzymes.
- The mitochondria contain enzymes that catalyze the biochemical reactions involved in respiration. The mitochondria contain their own DNA known as mitochondrial DNA.

**Functions of Mitochondria:**

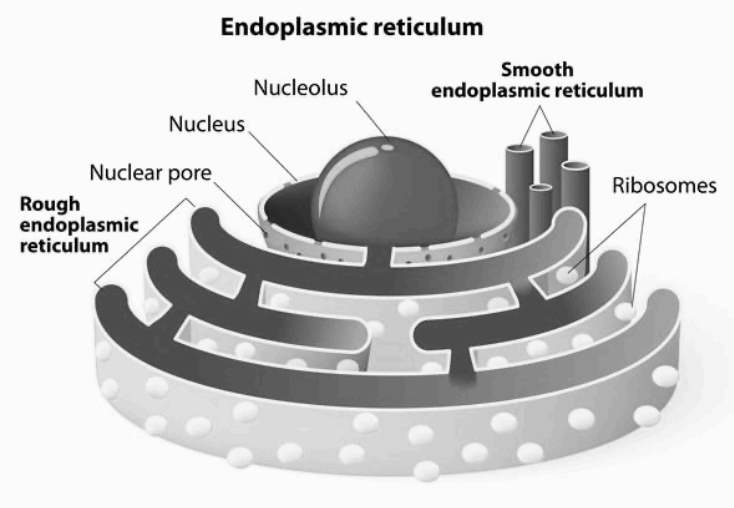
- Mitochondria provides a site for **cellular respiration** thus, releasing energy in the process. Therefore, mitochondria are known as "**Power Houses of the cell."**
- The cells use this energy for performing cellular functions.
- Mitochondria synthesize **respiratory enzymes**. These specialized enzymes and substances help in the generation of energy in the form of ATP.
- Mitochondria also regulate the calcium ion concentration in the cells by storing them and releasing them as per the need.

**(2) 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).

**Structure:**

- Endoplasmic reticulum is a complex network of membrane-bound channels or sheets, tubules and vesicles.
- The ER works closely with the Golgi apparatus and ribosomes.
- It creates a network of membranes found throughout the whole cell.
- The ER may also look different from cell to cell, depending on the cell's function.




**Types of Endoplasmic Reticulum:**

(1) Rough endoplasmic reticulum (RER)
(2) Smooth endoplasmic reticulum (SER)

**Functions of Endoplasmic Reticulum:**

- RER has ribosomes attached to its surface. The ribosomes are 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 channel for the transport of materials.

- In the liver cells, SER plays a crucial role in detoxifying many poisons and drugs.

**Difference between RER & SER:**

| Basis for Comparison | Smooth Endoplasmic Reticulum | Rough Endoplasmic Reticulum |
|---|---|---|
| **Meaning** | Smooth ER appears like containing many circular marks which are the interlocking tubular sheets and they may be varied in look and function as well. | Rough ER looks like the arrangement of the double membranes which are spotted with the ribosomes all over. They appear to consist of parallel sheets of the membrane. |
| **Found near** | Smooth ER is found near the cell membrane. | Rough ER is found near the cytoplasm. |
| **Originates from** | Rough endoplasmic reticulum by giving off the ribosomes. | From nuclear membrane. |
| **Ribosomes** | They do not have ribosomes. | They have ribosomes. |
| **Composed of** | Tubules. | Cisternae. |
| **It mainly produces** | Lipids and proteins. | Proteins. |

**(3) Ribosomes:**

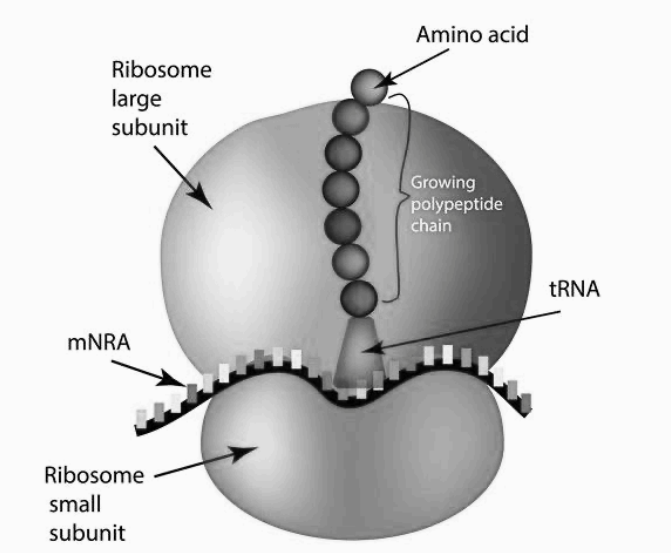
Ribosomes are small ribonucleoprotein particles. They were first observed by the cell biologist **George Emil Palade**, using an electron microscope. The term, 'ribosome' was proposed by scientist **Richard B. Roberts** in the late 1950.

**Location:**

- Ribosomes are found attached to the rough ER and in free form in the cytoplasm of the cell.
- Ribosomes are synthesized in the nucleolus inside the nucleus. After synthesis, they move out through the nuclear pores of the nuclear membrane into the cytoplasm.

**Structure:**

- They occur as small granules.
- They are single-walled dense, spherical bodies. Each ribosome is made up of two sub-units. One is a smaller sub-unit and the other one is a larger subunit.
- Each sub-unit is made up of ribonucleic acid (RNA) and proteins called ribonucleoproteins.




**Functions of Ribosomes:**

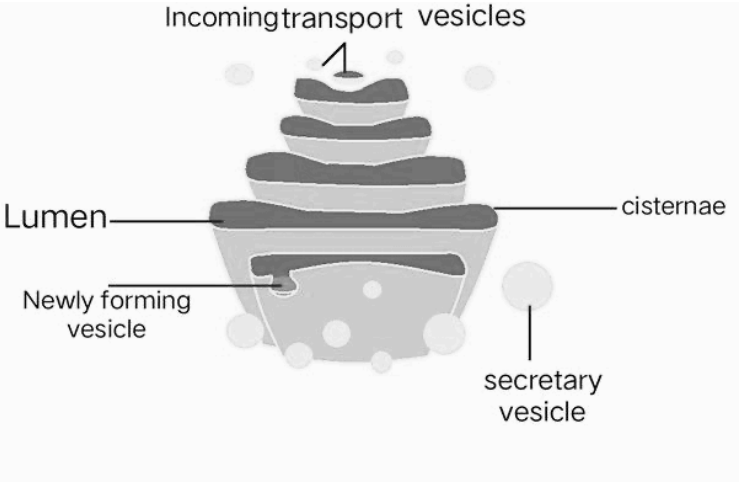
- Ribosomes are involved in the process of protein synthesis.
- They provide a site for the synthesis of proteins and hence are called protein factories of the cell.

**(4) Golgi complex or Golgi apparatus:**

Golgi apparatus was one of the first organelles to be observed in detail. It was discovered in 1898 by Camillo Golgi (Italian physician) and was named after him.

Golgi apparatus is a membranous structure that originates from smooth ER. It is also formed of cisternae, vacuoles, and vesicles.

Golgi complex has a convex, forming face (cis) and a concave, maturing face (trans). The forming face receives vesicles from ER and maturing face secretes vesicles.




**Location:**
It is located near the nucleus. Golgi bodies are pleomorphic structures, because components of Golgi body are different in structure and shape in different cells.

**Structure:**

- They are stacks of flattened double-walled membrane sacs.
- Fluid is present between both the membranes.
- Sacs are called **cisternae**.
- Cisternae are packed one above the other.
- They consist of tubules, vesicles and vacuoles.
- These are absent in RBC of mammals and sieve tubes (**transporting cells**) of plant cells.
- These are known as **dictyosomes** in a plant cell.

**Functions of Golgi complex:**

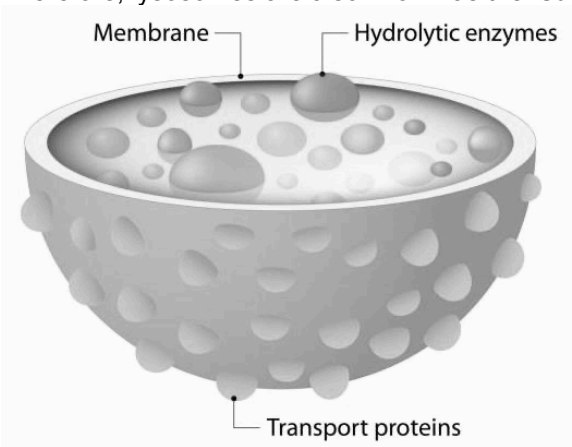
- Golgi apparatus is chiefly concerned with the function of secretion of enzymes and other substances.
- It transports the synthesized substances from the cell to the outside of the cell.
- It is involved in the formation of lysosomes, cell walls, and plasma membrane.
- It produces vacuoles which contain cellular secretions. For example, enzymes, proteins, cellulose, melanin pigment, lactoprotein (milk protein), etc.

### (5) Lysosomes:

- Lysosomes are spherical bag like structures covered by **a single membrane.**
- Lysosomes hold enzymes that were created by the cell. The purpose of the lysosome is to keep the cell clean by digesting any foreign materials as well as worn-out cell organelles.

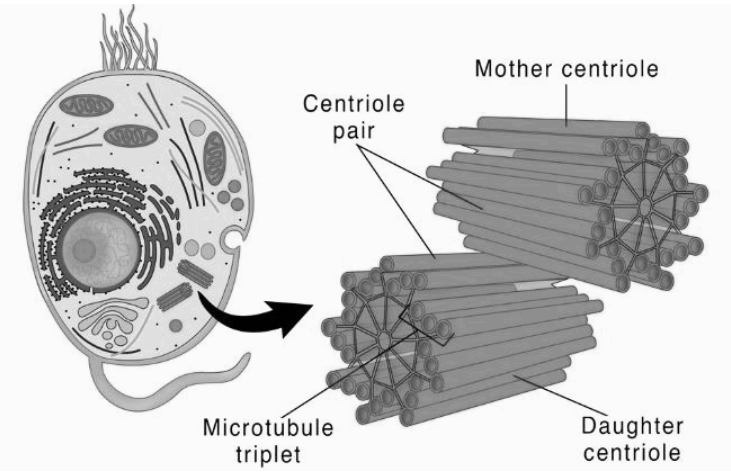
**Functions of Lysosomes:**

- Lysosomes break foreign materials entering the cell.
- They might be used to digest food or break down the cell when it dies.
- When a cell gets damaged, lysosomes may burst and the enzymes digest their own cell.
- Therefore, lysosomes are also known as the **'suicide bags' of a cell.**




### (6) Centrosome and Centriole:

A centrosome is a cellular structure involved in the process of **cell division**. Before cell division, the centrosome duplicates and then, as division begins, the two centrosomes move to opposite ends of the cell.




**Structure:**
Each centrosome contains "paired barrel-shaped organelles" called **centrioles.**
All centrioles are made of protein strands called **microtubules**.

- A centriole is typically made up of nine sets of short microtubule triplets, arranged in a cylinder.
- During cell division, two centrioles come together with some special proteins and form the centrosome.
- The role of a centrosome is to organize microtubules and provide structure for the cell, as well as assist to pull chromatids apart during cell division.

**Location:**

- They are located close to the nucleus.
- They are present only in animal cells.
- In plant cells, there are polar caps instead of centrioles.

**Functions:**

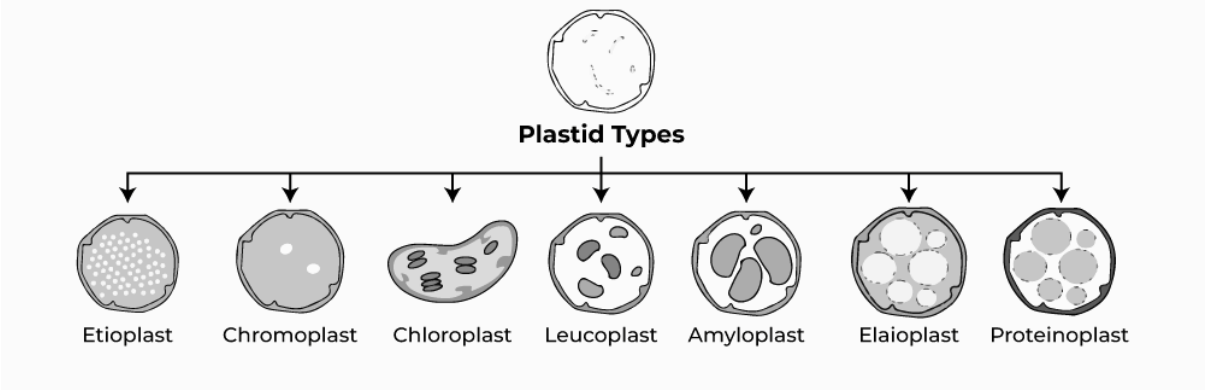
- **Centrosome** initiates and regulates cell division in animal cells.
- During cell division, the centrioles move to the poles of the cell.
- They develop many spindle fibres with the help of the asters.
- An aster is a cellular structure shaped like a star, formed around each centrosome during cell division in an animal cell.

### (7) Plastids:

Plastids are present only in plant cells.
**There are three types of plastids:**
(1) Chromoplasts (colored plastids)
(2) Leucoplasts (white or colorless plastids)
(3) Chloroplasts (contains chlorophyll)

**Structure:**

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

| Types of Plastids | Structure | Location | Function |
|---|---|---|---|

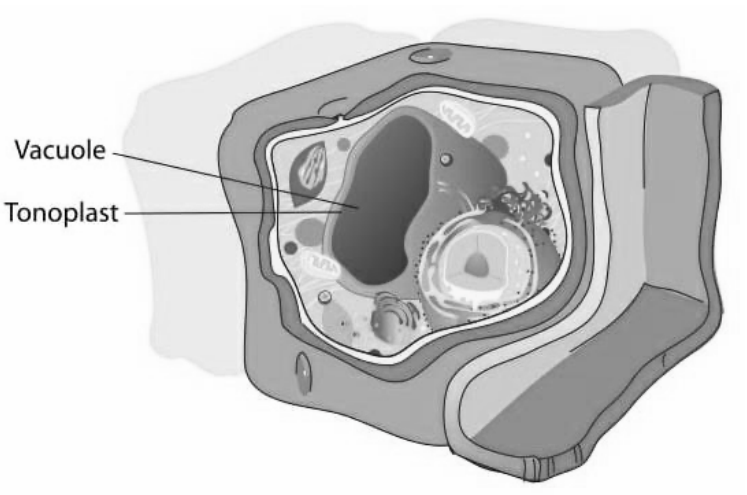
| | | | |
|---|---|---|---|
| **Chloroplasts** | Contain green pigment called chlorophyll | Present in parts of plants exposed in sunlight | Photosynthesis |
| **Chromoplasts** | Contain fat-soluble red, orange and yellow pigments such as carotenoids | Present in flowers and fruits and impart color to them | Impart colors to flower and fruits. |
| **Leucoplasts** | Colorless plastids | Present in seeds, tubers, rhizomes etc. | Storage of food materials |

**Structure of Chloroplast:**

- **Double-membrane** structure in which the outer membrane is more permeable than the inner membrane.
- The inner membrane contains more **proteins**.
- Contain a green pigment called **chlorophyll**.
- Matrix /Stroma – semi-fluid, colorless, and colloidal.
- Matrix contains DNA and RNA.
- **Thylakoids**: Membrane-bound sac-like structure that runs through the stroma, chloroplasts present within it.
- **Grana**: Stalk of thylakoids where they are arranged one above the other.

### (8) Vacuoles:

Vacuoles are membrane-bound organelles which are present in all plant and fungal cells. Vacuoles are enclosed compartments which are filled with water containing inorganic and organic molecules. **Dujardin** coined the term 'vacuole'.




**Structure:**

Vacuoles are **single-membrane-bound** storage sac-like structures. Membrane of vacuoles is called **tonoplast**.

**Location:**

- In plant cells, they are **large** and occupy almost 90% of the cell.
- They are **small** or even absent in animal cells.

**Functions:**

- They **store** dissolved material, such as amino acids, sugars, various organic acids, and some proteins. In single-celled organisms, for example, amoeba, they store the food material ingested by the organism.
- They provide **turgidity** and rigidity to the cell.
- They help to maintain the **osmotic pressure** of the cell.

### (9) Peroxisomes:

A peroxisome is a type of organelle known as a **microbody**, found in eukaryotic cells. They are involved in the catabolism of fatty acids. Peroxisomes were identified as organelles by the Belgian cytologist **Christian de Duve**.

**Structure:**

- Peroxisomes are small spherical organelles. They are bound by a single membrane. The inner contents are finely granular.
- Sometimes a **crystalline core** is visible at the centre. The crystalline core contains a protein called **catalase enzyme**.

**Location:**

- They are found in the cytoplasm of animal cells.
- They are mostly located in the liver and kidney cells.

**Function:**
They are specialized in the **detoxification** of toxic substances from the cell.

**Difference between Plant cell and Animal Cell:**

| Animal Cell | Plant Cell |
|---|---|
| Cell wall is absent. | 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 dictyosome. |
| Vacuoles are absent. If present, they are small. | Vacuoles are present and large in size. |
| Centrosome is present with one or two centrioles. | Centrosome is absent |

# EXERCISE

1. This cell is the longest in the human body
   (a) Muscle cells (b) Nerve cells
   (c) Bone cell (d) Gland cells

2. This structure of the plant cell is non-living
   (a) Nucleus (b) cell wall
   (c) cytoplasm (d) Mitochondrion

3. This cell organelle does not contain DNA
   (a) Nucleus (b) Mitochondria
   (c) Lysosomes (d) Chloroplast

4. The main difference between human cheek cells and onion peel cells is
   (a) Presence of cell wall in onion peel cells
   (b) Presence of mitochondria in onion peel cells
   (c) Absence of endoplasmic reticulum in cheek cells
   (d) Absence of the plasma membrane in cheek cells

5. This jellylike substance inside the plasma membrane in which all cell organelles are floating is
   (a) Cytoplasm (b) Tonoplasm
   (c) Karyoplasm (d) Cell sap

6. The organelle serving as a primary packaging area for molecules that will be distributed throughout the cell is
   (a) Vacuole (b) Plastids
   (c) Mitochondria (d) Golgi apparatus

7. Animal cells are interconnected by
   (a) Plasma membrane (b) Cell wall
   (c) Desmosomes (d) Plasmodesmata

8. The Cell theory is not applicable to
   (a) Fungi (b) Algae
   (c) Virus (d) Microbes

9. Difference between the prokaryotic and eukaryotic cells in having
   (a) Cell wall (b) Nuclear membrane
   (c) Ribosome (d) None of these

10 Who proposed the theory that "cells arise only from the pre-existing cells"
   (a) Mohl (b) Virchow
   (c) Haeckel (d) Brown

11. The smallest living cells with cell wall are
   (a) Viroids (b) Algae
   (c) Bacteria (d) Mycoplasma

12. 'Micrographia' is a book authored by
   (a) Leeuwenhoek (b) Jan Swammer Dan
   (c) Robert Hooke (d) Rudolf Virchow

13. Which one of the following is a prokaryote
   (a) Agaricus (b) Salmonella
   (c) Green algae (d) Bacteriophage

14. Which of the following is not a cell organelle
   (a) Mitochondria (b) Ribosome
   (c) Golgi complex (d) Microsome

15. The main difference between plant and animal cell is
    (a) Animal cells lack cell wall
    (b) Plant cell has no cell wall
    (c) Animal cell has a rigid cell wall
    (d) Plant cells lack cell membrane

16. Cytosomes are found in
    (a) Chloroplasts
    (b) Bacteria
    (c) Mitochondria
    (d) All of these

17. With the increase in the shape of cell, its ratio of volume and surface area will be
    (a) Unaltered
    (b) Slightly increase
    (c) Decrease
    (d) Increase in many layers

18. Which one is the largest unicellular organism
    (a) Planaria
    (b) Volvax
    (c) Blue green algae
    (d) Acetabularia

19. Smallest cell organelle is
    (a) Lysosome
    (b) Dictyosome
    (c) Polysome
    (d) Monosome

20. Animal cells are interconnected by _____
    (a) Desmosomes
    (b) Cell wall
    (c) Plasmodesmata
    (d) Plasma membrane

21. The rRNA is synthesized by _____
    (a) Golgi body
    (b) Nucleus
    (c) Nucleolus
    (d) Cytoplasm

22. Sodium and potassium pumps are examples of _____
    (a) Plasmolysis
    (b) Active transport
    (c) Passive transport
    (d) Osmosis

23. Centriole takes part in the formation of _____?
    (a) Nucleus
    (b) Spindle
    (c) Cell plate
    (d) To start cell division

24. An organelle that mainly serves as a packaging area for molecules that are distributed across the cell and are called ____?
    (a) Golgi apparatus
    (b) Mitochondria
    (c) Plastids
    (d) Vacuole

25. Which structure possesses flagellin protein?
    (a) Muscles fiber
    (b) Flagellum
    (c) Pilli
    (d) all of the above

26. The cells involved in large amounts of lipid synthesis do not possess this organelle on the endoplasmic reticulum
    (a) Mitochondrion
    (b) Ribosomes
    (c) Golgi apparatus
    (d) lysosome

27. In mitochondria, it contains F-particles
    (a) Matrix
    (b) Cristae
    (c) Outer layer
    (d) all of the above

28. The materials essential for the dark reaction are located in
    (a) Circular-DNA
    (b) Thylakoids
    (c) Stroma
    (d) Ribosomes

29. Microfilaments are made up of
    (a) Fat
    (b) Protein
    (c) Carbohydrates
    (d) Nucleic acid

30. It possesses Flagella
    (a) Paramoecium (b) Euglena
    (c) Amoeba (d) Yeast

31. It directs the formation of the bipolar spindle during cell division
    (a) Golgi body (b) Centriole
    (c) Ribosome (d) Cilia

32. In humans, which cell lacks a nucleus?
    (a) Lymphocyte (b) RBC
    (c) Monocytes (d) Neutrophils

33. No membrane surrounds this organelle
    (a) Lysosome (b) Nucleolus
    (c) Golgi body (d) Nucleus

34. acteria possess small DNA other than circular DNA which is called as
    (a) Cosmid (b) Plasmid
    (c) Plastid (d) Starid

35. The cell wall of fungi is made up of which substance?
    (a) Starch (b) Chitin
    (c) Cellulose (d) Pectin

36. Which organelle is not considered as a part of the Endomembrane system?
    (a) Vacuole (b) Chloroplast
    (c) Endoplasmic reticulum (d) Lysosome

37. Who mentioned that cells had a thin layer around them?
    (a) Schwann (b) Virchow
    (c) Schleiden (d) Robert Hook

38. In some bacteria, the outermost layer is a loose sheath layer called as
    (a) Slime layer (b) Capsule
    (c) Cell membrane (d) Glycocalyx

39. What is the function of SER?
    (a) Synthesis of Steroid hormone (b) Synthesis of protein
    (c) Synthesis of enzyme (d) all of above

40. What is produced when vesicles are separated from the Golgi body?
    (a) Lysosome (b) Vacuoles
    (c) Ribosomes (d) Chloroplast

41. The area of the cytoplasm without any cytoplasm is called as
    (a) Vacuoles (b) Chloroplast
    (c) Cytoplasmic Gap (d) Mitochondria

42. Which organelle is responsible for the degradation of worn-out cells?
    (a) Lysosome (b) Golgi apparatus
    (c) Vacuoles (d) Endoplasmic Reticulum

43. Which plastid is not included as a chromoplast?
    (a) Chloroplast (b) Carotene
    (c) Xanthophyllus (d) Anthrocyanin

44. How many grana present in one chloroplast?
    (a) 40-60 (b) 42-47
    (c) 60-80 (d) 02-100

45. In the peripheral region of centriole nine triplets are arranged at which angles?
    (a) 40 (b) 60

(c) 30 (d) 90

46. This organelle possesses 9+0 structure
(a) Centriole (b) Cillia
(c) Flagella (d) all of these

47. Various colours in flower fruit and seeds are due to the presence of which pigment?
(a) Anthocyanin (b) Chlorophyll
(c) Chloroplast (d) all of the above

48. The leucoplast which stores protein is known as
(a) Aleuroplasts (b) Chloroplasts
(c) Amyloplasts (d) Elaioplasts

49. Which organelle is associated with the formation of basal granules, cilia, and flagella?
(a) Centrosome (b) Golgi apparatus
(c) Mitochondria (d) Lysosome

# ANSWER KEY

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **(1)** | (b) | **(11)** | (c) | **(21)** | (c) | **(31)** | (b) | **(41)** | (a) |
| **(2)** | (b) | **(12)** | (c) | **(22)** | (b) | **(32)** | (b) | **(42)** | (a) |
| **(3)** | (c) | **(13)** | (b) | **(23)** | (b) | **(33)** | (b) | **(43)** | (a) |
| **(4)** | (a) | **(14)** | (d) | **(24)** | (a) | **(34)** | (b) | **(44)** | (a) |
| **(5)** | (a) | **(15)** | (a) | **(25)** | (b) | **(35)** | (b) | **(45)** | (a) |
| **(6)** | (d) | **(16)** | (d) | **(26)** | (b) | **(36)** | (b) | **(46)** | (a) |
| **(7)** | (c) | **(17)** | (c) | **(27)** | (b) | **(37)** | (a) | **(47)** | (a) |
| **(8)** | (c) | **(18)** | (d) | **(28)** | (b) | **(38)** | (a) | **(48)** | (a) |
| **(9)** | (b) | **(19)** | (d) | **(29)** | (b) | **(39)** | (a) | **(49)** | (a) |
| **(10)** | (b) | **(20)** | (a) | **(30)** | (b) | **(40)** | (a) | | |