

The Fundamental Unit of Life

➤ **Cell:** The building block of life is known as a cell. It is the smallest unit of a living organism. There are 2 kinds of organisms that exist in the nature depending on the number of cells.

- **Uni-cellular Organism:** All such organisms that can exist only with a single cell in the nature are called uni-cellular or single celled organism. Ex: Amoeba, Chlamydomonas, Paramecium and bacteria. They have simple body design based on the different functions.
- **Multi-cellular Organism:** All h organisms that are made up of multiple cells are termed as multi-cellular organisms. Ex: Humans, animals, plants. They are complex body design based on the various functions they perform.

➤ **Discovery of Cell:**

- 1) The cell was discovered for the very first time by **Robert Hooke** in **1665**. With help of a primitive microscope he observed cell in a cork slice.
- 2) In **1674**, **Leeuwenhoek** discovered free living cells in pond water with the improved microscope.
- 3) The discovery of nucleus was lead by **Robert Brown** in **1831**.
- 4) The fluid substance in the cell was termed as the 'protoplasm' by **Purkinje** in **1839**.
- 5) Two biologists **Schleiden (1838)** and **Schwann (1839)** presented the cell theory, that *'All the plants and animals are composed of cells and that the cell is the basic unit of life'*.
- 6) **Virchow in 1855** further modified the cell theory by suggesting that all cells arise from pre-existing cells.
- 7) In **1940**, with the invention of the electron microscope it was possible to observe and understand the complex structure of the cell and its various organelles.

➤ **Components of the Cell:**

Every single living cell has a capacity to perform the specific function. In multicellular organisms there is the division of labour so that different parts of the human body could perform different functions. Each such cell has got certain specific components within it known as **cell organelles**. Almost every single cell consists of 3 basic cell organelles - plasma membrane, nucleus and cytoplasm.

1) Plasma membrane or Cell membrane:

- The outermost layer of the cell that covers the plasma (the fluid in the cell). It is also termed as the **selectively permeable membrane** as it allows the entry and exit of only selected materials in and out of the cell.
- This membrane also allows the gases like Carbon dioxide and Oxygen to move across and this process is called **diffusion**. In this process the gas from the high concentration rushes towards the low concentration.
- The diffusion is also followed by the water as well and that's why it is known as **osmosis**. There are 3 cases of osmosis they are:
 - a) When the concentration is higher outside the cell then water will move inside the cell and this is called **hypotonic solution**.
 - b) When the concentration is equal outside and inside the cell then water will not move anywhere and this is called **isotonic solution**.
 - c) When the concentration is lower outside and higher inside the cell then water will move outside the cell and this is called **hypertonic solution**.

2) Cell Wall:

- Only plant cell has an additional covering outside the cell membrane that helps them to stand still and this is termed as the **cell wall**. It is made up of **cellulose** (complex substance and provides structural strength to plants).
- The phenomenon of osmosis in the plants where the plants shrink when they lose water is known as **plasmolysis**.

3) Nucleus:

- The centrally located cell organelle with a specialized structure is known as a **nucleus**. It is covered by double layers called **nuclear membrane** that has pores which allow the transfer of material from inside the nucleus to its outside, that is, to the cytoplasm.
- The nucleus contains chromosomes, which are visible as rod-shaped structures only when the cell is about to divide.
- Chromosomes contain information for inheritance of characters from parents to next generation in the form of **DNA (Deoxyribo Nucleic Acid)** molecules.
- DNA molecules contain the information necessary for constructing and organizing cells. Functional segments of DNA are called **genes**.
- In an undivided cell the DNA is present as a **chromatin material**, that is visible as entangled mass of thread like structures.
- An undefined nuclear region containing only nucleic acids is called a **nucleoid**.
- The organism whose cells lack a nuclear membrane, are called **prokaryotes**. These types of cells also lack most of the other cytoplasmic organelles present in eukaryotic cells.
- The organisms with cells having a nuclear membrane are called **eukaryotes**.

4) Cytoplasm:

- The cytoplasm is the fluid content inside the plasma membrane that also includes many specialized cell organelles.
- The cell organelles are enclosed by membranes. Prokaryotes lack the membrane-bound cell organelles whereas eukaryotic cells have the membrane-bound cell organelles.

5) Cell organelles:

In multicellular organisms there are many functions that are need be carried out and for all such functions a cell has various organelles within them. Some of these organelles are only visible under the microscope. Below

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mentioned cell organelles are important because they carry out some very crucial functions in cells.

a) Endoplasmic Reticulum(ER): is a large network of membrane-bound tubes and sheets. There are two types of ER- rough endoplasmic reticulum (RER) and smooth endoplasmic reticulum (SER). RER has particles called ribosomes (the sites of protein manufacture) attached to its surface. The SER helps in the manufacture of fat molecules, or lipids, important for cell function and also plays a crucial role in detoxifying many poisons and drugs.

Membrane Biogenesis is the process in which proteins and lipids help in building the cell membrane.

b) Golgi Apparatus: consists of a system of membrane-bound vesicles (flattened sacs) arranged approximately parallel to each other in stacks called cisterns. Its functions include the storage, modification and packaging of products in vesicles. It is also involved in the formation of lysosomes.

c) Lysosomes: are membrane bound sacs filled with enzymes made by RER. They are kind of waste disposal system of the cell it help to keep the cell clean by digesting any foreign material as well as worn-out cell organelles. They are known as suicide bags as the lysosomes may burst and enzymes digest their own damaged cell.

d) Mitochondria: Mitochondria are known as the powerhouse of the cell that has 2 membranes the outer one is porous while the inner membrane is deeply folded. It releases the energy in the form of ATP (Adenosine triphosphate) molecules known as the energy currency of the cell. Mitochondria have their own DNA and ribosomes.

e) Plastids: are present only in plants and can be further categorized in 2 types - chromoplasts (coloured plastids) and leucoplasts (white or colourless plastids). Chromoplasts containing the pigment chlorophyll are known as chloroplasts that are important for photosynthesis. Chloroplasts contain various yellow or orange pigments in addition to chlorophyll. Leucoplasts are primarily organelles in which materials

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such as starch, oils and protein granules are stored.

f) Vacuoles: are storage sacs for solid or liquid contents they are small in animals while larger in plants.

➤ **Cell Division:**

The process of formation of new cells is known as cell division which has two methods: mitosis and meiosis.

1) Mitosis:

The process in which the mother cell divides into two identical daughter cells that have the same number of chromosomes as mother cell. It helps in growth and repair of tissues in organisms.

2) Meiosis:

It is the different type of process which involves two consecutive cell divisions. It divides the mother cell in 4 new cells that only have half the number of chromosomes than that of the mother cells.

