

The Fundamental Unit of Life (Cell)

A **cell** is the smallest structural and functional unit of life. All living organisms are made up of cells, and all life processes take place within cells.

Example: The human body is made up of billions of cells, while organisms like Amoeba consist of only one cell.

Discovery of Cell

The cell was discovered by **Robert Hooke in 1665**. He observed a thin slice of cork under a microscope and saw small box-like structures which he called **cells** because they looked like tiny rooms.

Example: Cork cells observed by Hooke appeared like a **honeycomb** structure.

Cell Theory

The **cell theory** was proposed by **Matthias Schleiden** and **Theodor Schwann (1838–39)**. It was later expanded by **Rudolf Virchow in 1855**.

Main points of Cell Theory:

1. All living organisms are made up of cells.
2. The cell is the basic unit of life.
3. All cells arise from pre-existing cells ("*Omnis Cellula e Cellula*").

Example: New skin cells are formed from existing skin cells.

Protoplasm

The term **protoplasm** was given by **Jan Evangelista Purkyně** in 1839. It is the living substance of the cell that includes cytoplasm and nucleus.

Example: The jelly-like material inside a cell is called protoplasm.

Nucleus Discovery

The nucleus was discovered by **Robert Brown**.

Example: In plant cells, the nucleus controls cell activities.

Types of Organisms

(a) Unicellular Organisms

- Organisms made up of a single cell are called unicellular organisms.

- A single cell performs all life functions like digestion, respiration, etc.
- Examples: Amoeba, Paramecium, Bacteria, Chlamydomonas

(b) Multicellular Organisms

- Organisms made up of many cells are called multicellular organisms. They show division of labour.
- Different cells perform different functions (e.g., nerve cells for signaling).
- Examples: Humans, plants, animals, fungi

Shape and Size of Cells

- The shape and size of cells depend on their function.
- Examples:
 - ❖ Amoeba → irregular shape (changes shape)
 - ❖ Nerve cell → long and branched for transmitting signals
 - ❖ Red blood cell → round for carrying oxygen

Cell Organelles

- Cell organelles are specialized structures inside the cell that perform specific functions.
- Example: Mitochondria produce energy, lysosomes digest waste.

Structure of Cell

A cell has three main parts:

(i) Plasma Membrane (Cell Membrane)

- Outermost layer of the cell
- **Selectively permeable** (allows some substances to pass)
- Made of **lipids and proteins**
- Example: It allows **oxygen to enter and carbon dioxide to leave the cell**.

(ii) Cytoplasm

- **Jelly-like** substance inside the cell
- **Contains organelles**
- Example: Site where many **chemical reactions occur**.

(iii) Nucleus

- **Controls all activities** of the cell
- Contains **DNA and chromosomes**
- Example: Determines traits like eye color.

(iv) Endoplasmic Reticulum (ER)

- RER → has ribosomes, **makes proteins**
- SER → **makes lipids**
- Example: **Protein production** in cells.

(v) Golgi Apparatus

- Discovered by **Camillo Golgi**
- **Modifies, stores, and packages substances**
- Example: **Packaging proteins for transport.**

(vi) Lysosomes

- Contain **digestive enzymes**
- **Break down waste and damaged organelles**
- Called **suicide bags**
- Example: **Destroy damaged cell parts.**

(vii) Mitochondria

- Known as the **powerhouse of the cell**
- **Produces energy** in the form of ATP
- Example: Energy production for body activities.

(viii) Plastids (Plant Cells Only)

- Chloroplast → photosynthesis
- Chromoplast → color
- Leucoplast → storage
- Example: Chloroplast helps plants make food using sunlight.

(ix) Vacuoles

- **Store water, food, and waste**
- Large in plant cells
- Example: **Maintains pressure in plant cells.**

Diffusion

Diffusion is the movement of substances from a region of **higher concentration to lower concentration.**

Example: Oxygen enters cells and carbon dioxide leaves through diffusion.

Osmosis

Osmosis is the movement of water across a **semi-permeable membrane from higher water concentration to lower concentration.**

Example: Water absorption by plant roots.

Cell Wall (in Plants)

- Present outside the plasma membrane in plant cells
- Made of cellulose (in plants) and chitin (in fungi)
- Provides strength and protection
- Example: Gives rigidity to plant cells.

Types of Cells

(a) Prokaryotic Cells

- No true nucleus
- No membrane-bound organelles
- Examples: Bacteria, blue-green algae

(b) Eukaryotic Cells

- True nucleus present
- Membrane-bound organelles present
- Examples: Plants, animals

Cell Division

(i) Mitosis

- Produces two identical cells
- Helps in growth and repair
- Example: Skin cell division.

(ii) Meiosis

- Produces four cells
- Important for reproduction
- Example: Formation of gametes (sperm and egg).