

Chapter 5: The Fundamental Unit of Life – Notes

Introduction

- **Cell** is the basic structural and functional unit of life.
 - Discovered by **Robert Hooke** in 1665.
 - **Cell theory** by **Schleiden and Schwann**:
 - All living organisms are made up of cells.
 - Cell is the basic unit of life.
 - **Rudolf Virchow** later added: "All cells arise from pre-existing cells."
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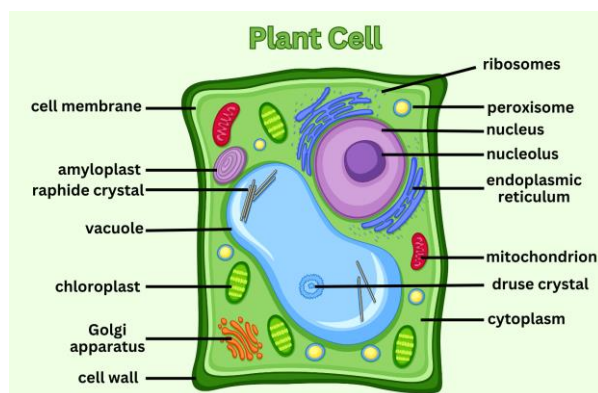
Structure of a Cell

- Cells are of two types:
 - **Prokaryotic cells** (no nucleus; example: bacteria)
 - **Eukaryotic cells** (well-defined nucleus; example: plants, animals)

Plant Cell – Detailed Explanation

A **plant cell** is a **eukaryotic cell** (with a true nucleus) that has some **unique features** not found in animal cells. It is **usually rectangular** in shape.

◆ Main Parts of a Plant Cell:

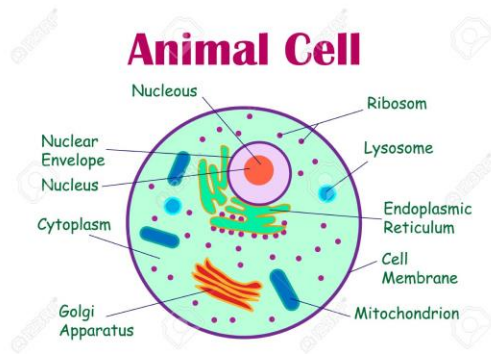


1. **Cell Wall**:
 - Outermost layer made of **cellulose**.
 - **Rigid and strong**; provides **support and protection**.

- Allows plant cells to have a **fixed shape**.
- 2. **Cell Membrane (Plasma Membrane):**
 - Inner to the cell wall.
 - **Semi-permeable**: Controls what enters and exits the cell.
 - Made of **lipids and proteins**.
- 3. **Cytoplasm:**
 - Jelly-like fluid inside the cell.
 - Contains all the **cell organelles** and helps in their **movement** and **interaction**.
- 4. **Nucleus:**
 - **Control center** of the cell.
 - Surrounded by a **nuclear membrane**.
 - Contains:
 - **Nucleolus** – helps in making ribosomes.
 - **Chromosomes** – carry **genetic information (DNA)**.
- 5. **Large Central Vacuole:**
 - Filled with **cell sap** (water, sugar, waste, etc.).
 - Maintains **turgor pressure** (keeps cell rigid).
 - Very **large** in plant cells.
- 6. **Chloroplasts:**
 - Green-colored organelles due to **chlorophyll**.
 - **Site of photosynthesis** (where plants make food).
 - Only found in **green parts** of the plant.
- 7. **Mitochondria:**
 - Called the "**powerhouse of the cell**".
 - Produces **ATP (energy)** during respiration.
- 8. **Endoplasmic Reticulum (ER):**
 - **Rough ER**: Has ribosomes; helps in **protein synthesis**.
 - **Smooth ER**: No ribosomes; helps in **lipid synthesis**.
- 9. **Golgi Apparatus:**
 - Packages and transports **proteins and lipids**.
 - Forms **vesicles** and **lysosomes**.
- 10. **Ribosomes:**
 - Small dot-like structures.
 - Site of **protein synthesis**.

Animal Cell – Detailed Explanation

An **animal cell** is also **eukaryotic**, but **does not have a cell wall or chloroplasts**. It is generally **round or irregular** in shape.



◆ Main Parts of an Animal Cell:

1. **Cell Membrane (Plasma Membrane):**
 - **Outer boundary** of the cell.
 - **Semi-permeable:** Regulates movement of substances.
2. **Cytoplasm:**
 - Gel-like fluid that supports organelles.
 - All reactions of the cell occur here.
3. **Nucleus:**
 - Surrounded by **nuclear envelope**.
 - Contains **nucleolus** and **chromosomes**.
 - Controls cell's **functions and reproduction**.
4. **Mitochondria:**
 - Generates **energy** in the form of ATP.
 - Needed for all **cell activities**.
5. **Endoplasmic Reticulum (ER):**
 - **Rough ER:** Makes proteins.
 - **Smooth ER:** Makes fats (lipids), detoxifies.
6. **Golgi Apparatus:**
 - Packages and sends substances **to other parts** of the cell or outside.
7. **Lysosomes:**
 - Contains **digestive enzymes**.
 - Break down old organelles, germs, and waste.
 - Known as "**suicide bags**".
8. **Vacuoles:**
 - **Small or absent** in animal cells.
 - Store water, food, and waste.
9. **Centrosome with Centrioles:**
 - Helps in **cell division**.
 - Present only in animal cells.
10. **Ribosomes:**
 - Help in making **proteins**.

Comparison Table: Plant Cell vs Animal Cell

Feature	Plant Cell	Animal Cell
Cell Wall	Present (cellulose)	Absent
Shape	Regular (rectangular)	Irregular (round)
Vacuole	One large central vacuole	Small or absent
Chloroplasts	Present (photosynthesis)	Absent
Plastids	Present	Absent
Centrioles	Absent	Present (helps in division)
Energy Storage	Starch	Glycogen

Important Terms

- **Osmosis:** Movement of water through a semi-permeable membrane from higher water concentration to lower water concentration.
 - **Diffusion:** Movement of molecules from higher concentration to lower concentration.
 - **Plasmolysis:** Shrinking of cell contents when placed in a hypertonic solution.
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Quick Summary

- Cells are the foundation of life.
- Cell membrane controls entry/exit.
- Nucleus controls activities.
- Organelles perform specialized tasks.
- Plant and animal cells have important differences.