

CBSE CLASS 9 SCIENCE STUDY MATERIAL

Session: 2026–2027 (Latest NCERT)

Book: Science – Exploration

Chapter: 2 – Cell: The Building Block of Life

CHAPTER OVERVIEW

- **Board:** CBSE (2026–2027 Session)
- **Class:** 9 (Science – Exploration)
- **Chapter Weightage:** High (Core Foundation for Biology)

LEARNING OBJECTIVES

- Understand the structural and functional unit of life.
- Learn the history of cell discovery and Cell Theory.
- Differentiate between Prokaryotic and Eukaryotic cells, and Plant and Animal cells.
- Explore cell organelles, their structures, and specific functions.
- Master transport mechanisms across the cell membrane (Diffusion and Osmosis).
- Understand Cell Division (Mitosis and Meiosis) and its biological significance.

INTRODUCTION

All living organisms are made up of microscopic units called **cells**. Just like a brick wall is built from individual bricks, the entire body of a plant, animal, or human is built from cells. The cell is the fundamental, structural, and functional unit of all known living organisms.

COMPLETE EXPLANATION OF EACH TOPIC

1. Discovery of the Cell and Origin

- **Robert Hooke (1665):** Examined a thin slice of cork under a primitive microscope and observed honeycomb-like box compartments. He named them **cells** (Latin: *cella* meaning a small room).
- **Antonie van Leeuwenhoek (1674):** Observed living cells (bacteria, protozoa, red blood cells) for the first time using an improved microscope.
- **Robert Brown (1831):** Discovered the **nucleus** inside the cell.

- **Purkinje (1839):** Coined the term **protoplasm** for the fluid substance of the cell.

★ **Most Important NCERT Line:** "Cell is the structural and functional unit of life."

2. Cell Theory

Proposed by **Matthias Schleiden** (1838) and **Theodor Schwann** (1839), and later expanded by **Rudolf Virchow** (1855).

- All living organisms are composed of cells and products of cells.
- All cells arise from pre-existing cells (*Omnis cellula e cellula*).

3. Plasma Membrane (Cell Membrane)

- **Definition:** The outermost delicate, flexible, living membrane that separates the contents of the cell from its external environment.
- **Composition:** Made of lipids and proteins. It is **selectively permeable** (allows only useful substances to enter/exit and prevents harmful ones).
- **Diffusion:** Movement of molecules from a region of **higher concentration to lower concentration** (e.g., exchange of CO_2 and O_2 across cell membranes).
- **Osmosis:** Movement of water molecules through a selectively permeable membrane from a region of **higher water concentration (dilute solution) to lower water concentration (concentrated solution)**.

4. Cell Organelles

- **Nucleus:** Double-layered membrane enclosing nucleoplasm, nucleolus, and chromatin network. Controls all cellular activities; contains DNA carrying hereditary information via chromosomes.
- **Mitochondria ("Powerhouse of the Cell"):** Double-membrane bound with folds called **cristae** to increase surface area. Generates chemical energy as **ATP** via cellular respiration.
- **Endoplasmic Reticulum (ER):** Network of membrane-bound tubes. **RER** is covered with ribosomes for protein synthesis; **SER** lacks ribosomes and synthesizes lipids.
- **Golgi Apparatus:** System of membrane-bound vesicles (cisternae). Modifies, packages, and dispatches materials synthesized by the ER.
- **Lysosomes ("Suicide Bags"):** Membrane-bound sacs filled with powerful digestive enzymes acting as a waste disposal system.
- **Plastids:** Found only in plant cells. Includes **Chloroplasts** (site of photosynthesis), **Chromoplasts** (pigments), and **Leucoplasts** (storage).
- **Vacuoles:** Storage sacs for solid or liquid contents. Large and central in plant cells, providing turgidity and rigidity.

COMPARISON TABLES

Plant Cell vs. Animal Cell

Feature	Plant Cell	Animal Cell
Cell Wall	Present (made of cellulose)	Absent
Plastids	Present	Absent
Vacuole	Large, central permanent vacuole	Small, temporary vacuoles
Shape	Fixed, rectangular shape	Irregular, rounded shape

Prokaryotic vs. Eukaryotic Cell

Feature	Prokaryotic Cell	Eukaryotic Cell
Size	Generally small (1–10 μm)	Generally large (5–100 μm)
Nucleus	Absent (Nucleoid present)	Well-defined nucleus with membrane
Membrane-bound Organelles	Absent	Present
Example	Bacteria, Blue-green algae	Plants, Animals, Fungi

EXAM REVISION SHEET (QUICK POINTS)

- **1. Powerhouse:** Mitochondria
 - **2. Suicide Bags:** Lysosomes
 - **3. Brain of Cell:** Nucleus
 - **4. Kitchen of Plant Cell:** Chloroplast
 - **5. Control Center:** Nucleus
- **6. Protein Factory:** Ribosome
 - **7. Lipid Synthesis:** Smooth ER
 - **8. Packaging Center:** Golgi Apparatus
 - **9. Turgidity in Plants:** Central Vacuole
 - **10. Selective Barrier:** Plasma Membrane