

Core Course II: Biomolecules and Cell Biology
Course Code: BOTACOR02T

Unit: 4 The Cell (Part 1)

❖ **Cell the Unit of Life:**

Cell is the structural and functional unit of life; it is membrane bound protoplasmic structure having the potentiality to divide to increase the population.

➤ **Brief history of discovery of cell:**

Name of the discoverer	Year of discovery	Discovery / Proposal
Aristotle	-	Proposed - All living organisms are composed of same components.
Leonardo de Vinci	-	Discovery of Lens.
Francis Janssen & Zacharis Janssen	1590	Discovery of compound microscope.
Galileo Galilei	1613	Discovery of microscopic plants and animals.
Robert Hooke	1665	Discovery of cells (plant).
Leeuwenhoek	1831	Discovery of microbes (bacteria, protozoa etc.)
Wagner	1832	Discovery of Nucleus.
Dujardin	1835	Discovery of jelly like substance surrounding Nucleus, named as "Sarcode". (Cytoplasm)
Parkinje	1839	Renamed sarcode as Protoplasm. (Nucleus + Cytoplasm)
Schleiden	1838	Proposed – Cell is the structural and functional unit of plants.
Schwann	1839	Proposed – Cell is the structural and functional unit of animals.
Haeckel	1866	Proposed – Cell contains "genetic materials" which is responsible for the inheritance.
Flemming	1880	Discovery of cell division (mitosis)
Waldeyer	1890	Discovery of Chromosomes.

➤ **Cell Theory:**

Cell is the smallest unit of life, it is a membrane bound structure, its internal component is known as protoplasm. **Protoplasm** is composed of two components **nucleus and cytoplasm**. Cytoplasm is the matrix of the cell which contains nucleus and other **cell organelles**. Cell organelles sometimes **organism specific** (like plastid only present in plants but absent in animal cells), some organelles having **membrane bound** structure (e.g. Plastid, Mitochondria, Golgi body, Endoplasmic Reticulum, Lysosome etc.) some **naked** (e.g. Ribosome, Centrosome etc.) Again cells have different **size and shapes** based on the organism and its function. So, although there are many differences, some features are common in all cells. Based on those common features cell theory was proposed.

- The Cell theory was proposed by **Schleiden and Schwann (1839)**. According to them-
 1. All living organisms are composed of one or more cells.
 2. The cell is the most basic unit of life.
 3. All cells arising from pre-existing cells.
 Actually first two theory was proposed by Schleiden and Schwann (1839).
 Third statement was proposed by Rudolf Virchow (1855).



- Modern scientists **explained the cell theory on the basis of biochemical and physiological properties of the cell.** –
 1. Cell is the structural and physiological unit of life.
 2. Organisms having specified body organs because of presence of different kinds of cells in same organism.
 3. All cells are derived from its parental ones and gene is the main reason behind the inheritance.
 4. Cell is the smallest unit of life.
 5. All organisms are composed of numerous cells (except unicellular organisms) and all cells are developed from a single cell.
- Cell theory also have some **exceptions** –
 1. Virus (nucleic acid + protein coat), Viroid (only nucleic acid) and Prion (only protein) have no protoplasmic structure.
 2. Some algae (e.g. Vaucharia sp.) and fungi (e.g. Mucor sp.) contain numerous nuclei in their body without any kind of separation of the cell.

➤ **Cell types:**

Features	Prokaryotic	Eukaryotic
Shape	Various types – Rod (Bacillus), Round (Coccus), Comma (Vibrio), Spiral etc.	Plant cells have definite structures because of presence of cell wall but animal cells have no definite shape.
Size	1-10 μ	10-100 μ
Cell organization	Mostly unicellular, rarely multicellular.	Mostly multicellular, rarely unicellular.
Cell wall	Present in maximum members, composed of mucopolysaccharide.	Present only in plant cells, composed of cellulose. (In case of fungi chitin)

Nucleus	Absent.	Present.
Genetic material	ds, circular DNA. Present in naked condition at cytoplasm known as nucleoid/ genophore. In bacterial cell, apart from nucleoid, a small ring like ds DNA present known as Plasmid.	ds, linear DNA. Present inside of nucleus.
Cell division	Binary fission.	Mitosis and Meiosis.
Cell organelles	Only non membrane bound.	Both membrane bound and naked ones present.
Chromosome formation	Absent, because of absence of histone protein in the cell.	Present.
Endocytosis and Exocytosis	Absent.	Present.
Flagella	Simple structure composed of flagellin protein.	Complex structure (9+2 arrangement), composed of tubulin protein.
Photosynthetic pigments	Present in few cells (Photosynthetic bacteria and Cyanobacteria); Chlorophyll a and Bacteriochlorophyll (only in photosynthetic bacteria)	Present only in plant cells; Chlorophyll a & Chlorophyll b.
Respiratory organ	Mesosome. (Part of cell membrane remain in folded condition towards the cytoplasm)	Mitochondria.
Respiratory process	Both Aerobic (O ₂ dependent) and Anaerobic (O ₂ independent).	Only aerobic.

