



Cell Theory

Cell theory is one of the fundamental principles of biology. It was developed in the 19th century and has three main tenets:

1. **All living organisms are composed of one or more cells:** This means that the cell is the basic unit of life in all living things.
2. **The cell is the basic unit of structure and function in living organisms:** Cells are the smallest unit that can carry out the processes that define life.
3. **All cells arise from pre-existing cells:** This principle states that new cells are formed only by the division of existing cells, highlighting the continuity of life.

These principles were established by scientists such as Matthias Schleiden, Theodor Schwann, and Rudolf Virchow.

Classification of Cells

Cells can be classified into two main categories based on their structure and complexity:

1. Prokaryotic Cells

- **Characteristics:**
 - Lack a true nucleus; instead, they have a nucleoid region where the DNA is located.
 - Do not have membrane-bound organelles.
 - Generally smaller and simpler than eukaryotic cells.
 - Examples include bacteria and archaea.
- **Components:**
 - **Cell membrane:** A lipid bilayer that encloses the cell.
 - **Cell wall:** Provides structure and protection; in bacteria, it contains peptidoglycan.
 - **Cytoplasm:** Gel-like substance where cellular processes occur.
 - **Ribosomes:** Structures responsible for protein synthesis.
 - **Nucleoid:** Region where the cell's DNA is located.



2. Eukaryotic Cells

- **Characteristics:**
 - Have a true nucleus enclosed by a nuclear membrane.
 - Contain membrane-bound organelles, each with specific functions.
 - Generally larger and more complex than prokaryotic cells.
 - Examples include cells of animals, plants, fungi, and protists.
- **Components:**
 - **Cell membrane:** A lipid bilayer that encloses the cell.
 - **Nucleus:** Contains the cell's DNA and controls its activities.
 - **Mitochondria:** Powerhouses of the cell, responsible for energy production.
 - **Endoplasmic Reticulum (ER):** Network of membranes involved in protein and lipid synthesis; can be rough (with ribosomes) or smooth (without ribosomes).
 - **Golgi apparatus:** Modifies, sorts, and packages proteins and lipids for transport.
 - **Lysosomes:** Contain enzymes for digestion of cellular waste.
 - **Cytoskeleton:** Provides structural support and aids in cell movement.
 - **Chloroplasts (in plant cells):** Sites of photosynthesis, converting solar energy into chemical energy.

Differences between Prokaryotic and Eukaryotic Cells

Feature	Prokaryotic Cells	Eukaryotic Cells
Nucleus	No true nucleus	True nucleus present
Size	Smaller (1-10 μm)	Larger (10-100 μm)
Organelles	No membrane-bound organelles	Membrane-bound organelles
DNA Structure	Circular DNA	Linear DNA
Examples	Bacteria, Archaea	Animals, Plants, Fungi, Protists

Understanding cell theory and the classification of cells provides the foundation for studying the structure and function of all living organisms.