Cell Structure

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Outline

- Introduction to the Cell
- What is Cell Theory
- Types of Cells
- Comparison Prokaryotic vs. Eukaryotic Cells

Objectives

❖By the end of this lecture, students should be able to:

1. Define a cell and explain its importance as the basic unit of life.

2. Describe the cell theory and its modern concepts.

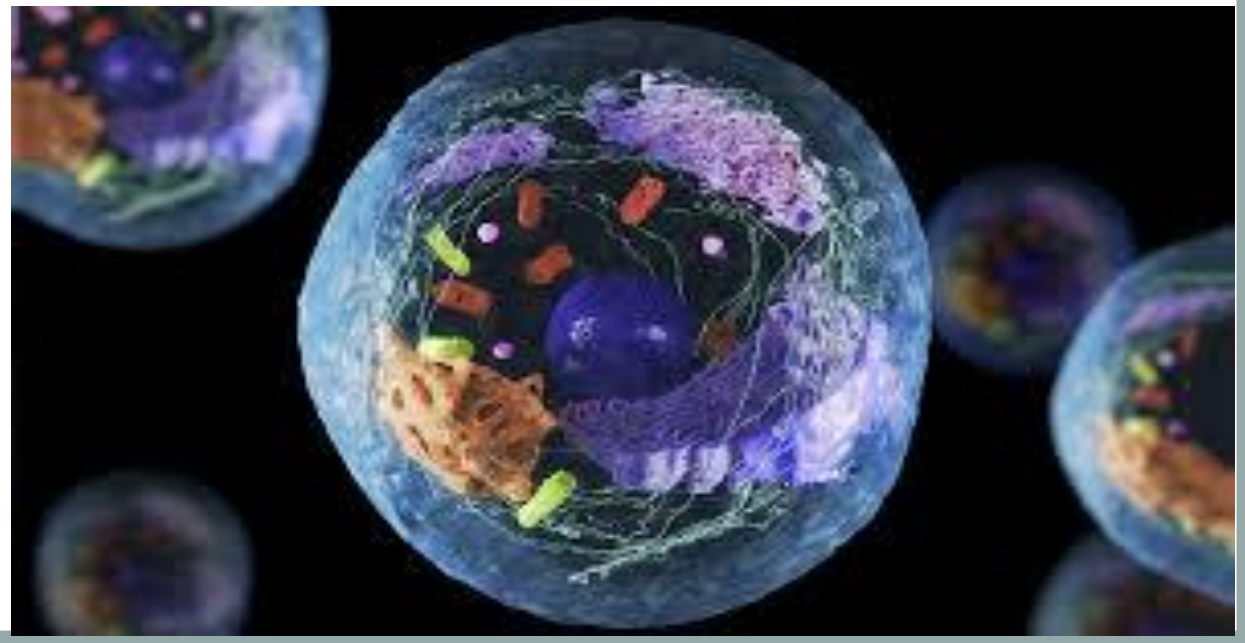
3. Distinguish between prokaryotic and eukaryotic cells.

4. Identify and describe the structure and function of major cell organelles.

❑ Introduction to the Cell?

➢ Cells are the **basic units of life** and the foundation of all **tissues**, **organs**, and body **systems**.

➢Every organism, whether **unicellular** or **multicellular**, is composed of one or more cells.



❑ What is Cell Theory

- It explains the **origin** and **importance of cells** and provides the basis for **modern biology** and **medicine**.

❖ Main Principles of Cell Theory:

1) All living organisms are made of one or more cells.
2) The cell is the basic unit of structure and function in living organisms.
3) All cells arise from pre-existing cells through cell division.

❖ Modern Additions to Cell Theory:

- The following points represent the modern additions to cell theory:

1. Cells contain genetic material (DNA) that controls structure and function.

2. Cellular metabolism and energy production occur inside cells.

3. Abnormal cell division and function lead to disease.

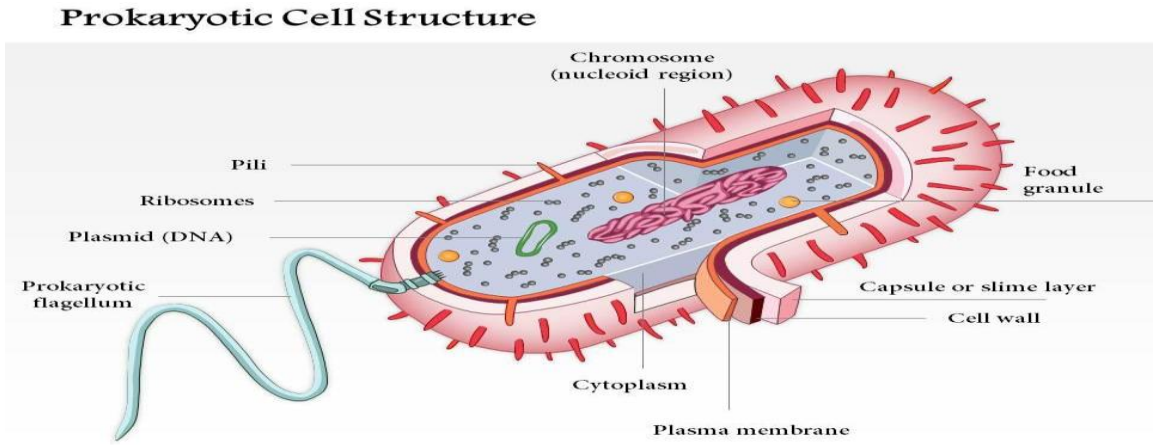
Types of Cells:

Cells are broadly classified into **prokaryotic cells** and **eukaryotic cells** based on their structural complexity.

Prokaryotic Cells: Are simple cells that lack a **true nucleus** and **membrane-bound organelles**. They are typically **unicellular**. E.g. Bacteria & Archaea

General Characteristics:

1. Small size (0.5–5 µm).
2. No nuclear membrane.
3. Genetic material is circular DNA



❖ Structure of a Prokaryotic Cell:

1. **Cell wall:** Provides shape and protection .
2. **Plasma membrane:** Controls movement of substances.
3. **Cytoplasm:** Contains enzymes and ribosomes.
4. **Ribosomes (70S):** Protein synthesis
5. **Flagella:** Movement
6. **Capsule (optional):** Protection and virulence

➢ Eukaryotic Cells:

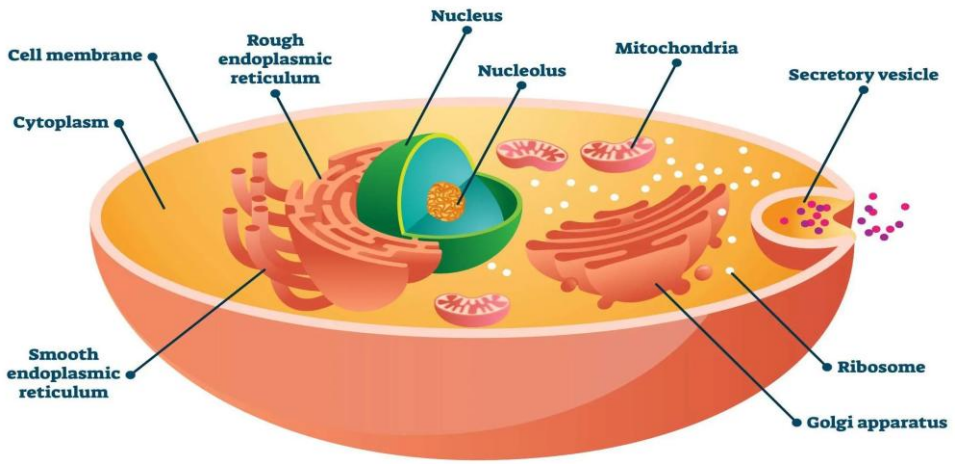
Definition: Eukaryotic cells are complex cells that contain a **true nucleus** and **membrane-bound organelles**.

Examples:

1. Animal cells.
2. Plant cells.
3. Fungal cells

General Characteristics:

1. Larger size (10–100 µm).
2. Linear DNA enclosed in a nucleus.
3. Presence of specialized organelles
4. Cell division by mitosis and meiosis



EUKARYOTIC CELL

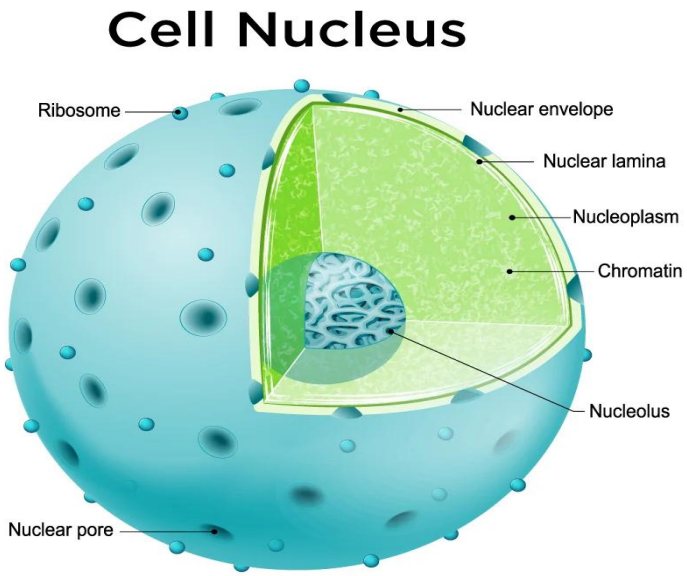
❖ Comparison: Prokaryotic vs. Eukaryotic Cells:

Feature	Prokaryotic Cells	Eukaryotic Cells
Nucleus	Absent	Present
DNA	Circular, naked	Linear, with histones
Organelles	Absent	Present
Ribosomes	70S	80S
Cell size	Small	Larger
Examples	Bacteria	Animals, plants

❖ Cell Organelles and Their Functions:

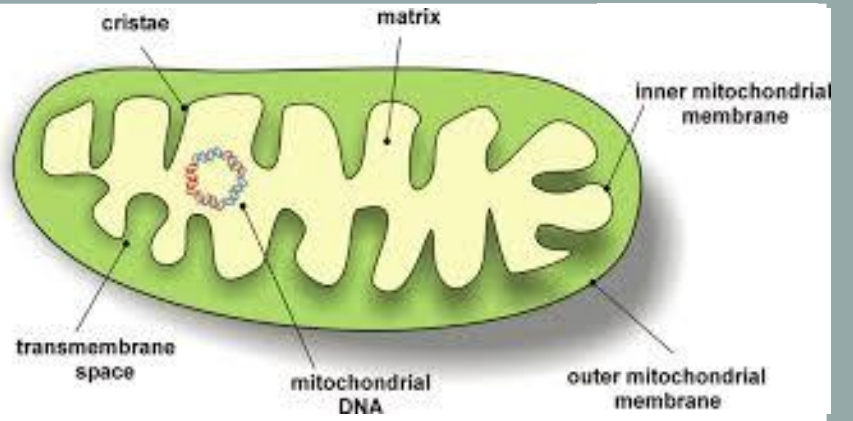
1. Nucleus:

- Control center of the cell
- Contains DNA
- Regulates gene expression and cell division



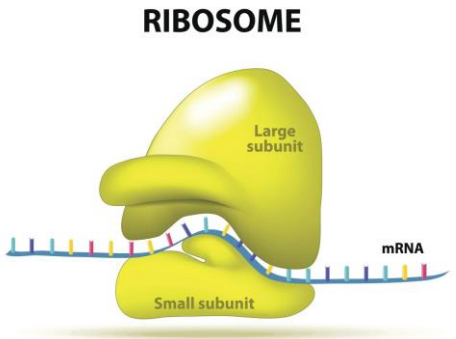
2. Mitochondria:

- Site of cellular respiration
- Produces ATP (energy)
- Known as the “powerhouse of the cell”



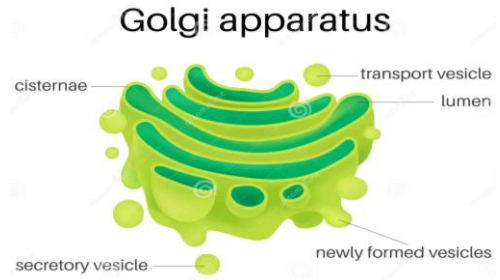
3. Ribosomes:

- Site of protein synthesis
- Found free in cytoplasm or attached to rough ER



4. Golgi Apparatus:

- Modifies, packages, and transports proteins and lipids



5. Endoplasmic Reticulum (ER):

- Rough ER: Protein synthesis and modification
- Smooth ER: Lipid synthesis, detoxification, calcium storage

6. Lysosomes (mainly in animal cells):

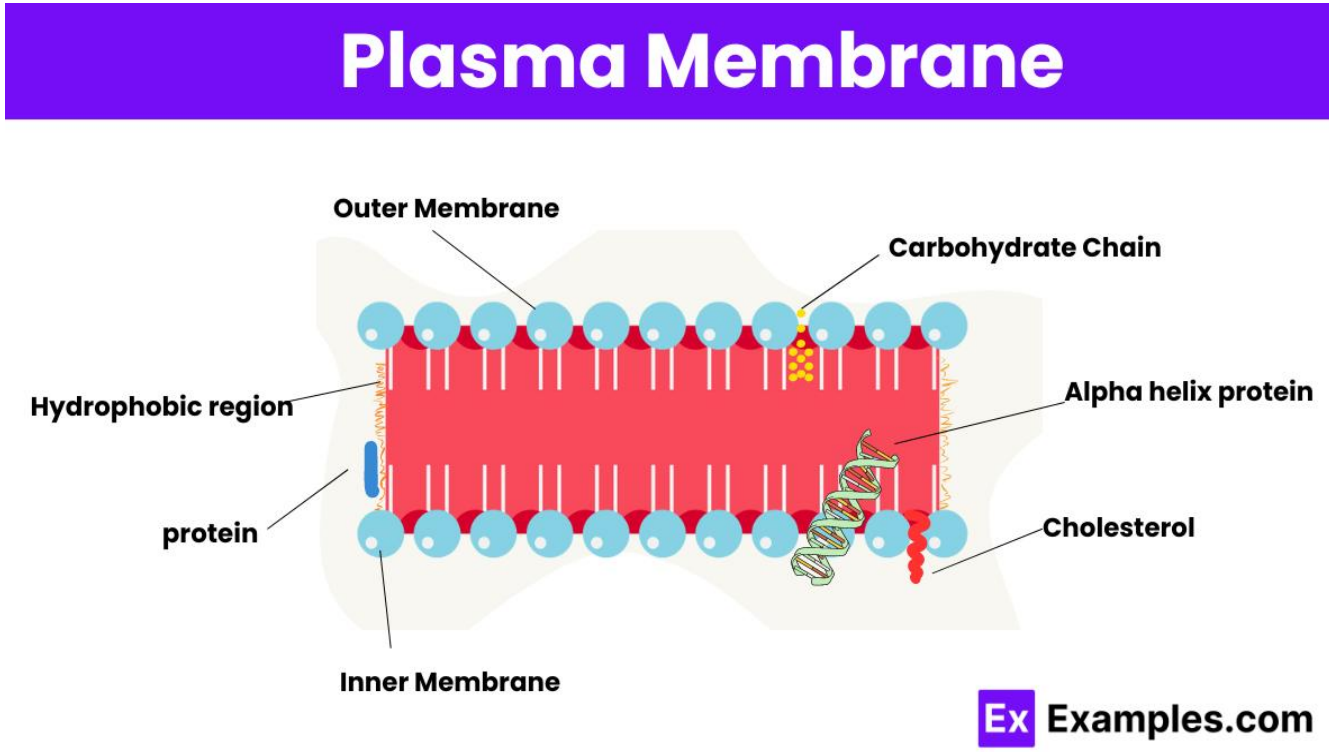
- Contain digestive enzymes
- Break down waste materials and old organelles

7. Vacuole:

- Storage of water, nutrients, and waste
- Large central vacuole in plant cells maintains turgor pressure

❖ Plasma Membrane Structure:

- Is a **thin**, **flexible**, **selectively permeable barrier** that surrounds the cell and separates the **internal cellular environment** from the **external environment**.



❖ Fluid Mosaic Model:

- The plasma membrane is described by the fluid mosaic model, proposed by **Singer** and **Nicolson** (1972).

- Describes membrane as a dynamic structure of lipids and proteins

- Allows movement of components within the membrane

❖ Main Components of the Plasma Membrane:

1. Phospholipid bilayer.
2. Proteins.
3. Carbohydrates
4. Cholesterol

❖ Functions of the Plasma Membrane:

- Protects the cell
- Maintains internal environment
- Controls movement of substances in and out
- Enables cell communication
- Supports cell shape and structure

References

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Thanks