



Department of biology



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((Botany))

First Stage

LEC- ((3))

Cell Wall & Cell Membrane

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Introduction

The plant cell is surrounded by structures that protect it and regulate the movement of substances between the cell and its environment. Two important structures involved in these functions are the cell wall and the cell membrane.

Both structures play essential roles in maintaining the integrity and proper functioning of plant cells.

Cell Wall

The cell wall is a rigid outer layer that surrounds the plant cell. It is located outside the cell membrane and provides structural support and protection to the cell. The cell wall is mainly composed of cellulose, which is a complex carbohydrate forming strong fibers.

The cell wall gives plant cells their characteristic shape and helps maintain the overall structure of plant tissues. It also protects the cell from mechanical damage and prevents excessive expansion when water enters the cell.



Structure of the Cell Wall

The plant cell wall is mainly composed of cellulose fibers embedded in a matrix of other polysaccharides and proteins. These components form a strong but flexible structure that supports the plant cell.

The cell wall is not completely solid; it contains tiny pores that allow water and small molecules to pass through. These pores help facilitate the movement of materials between neighboring cells.

Functions of the Cell Wall

- Provides mechanical support to the plant cell
- Maintains the shape of the cell
- Protects the cell from physical damage
- Prevents the cell from bursting due to water intake

Cell Wall Permeability

Unlike the cell membrane, the cell wall is fully permeable, meaning it allows most substances such as water and dissolved minerals to pass through freely.



This property helps in the easy movement of materials between plant cells.

Cell Membrane

The cell membrane, also known as the plasma membrane, is a thin flexible layer located just inside the cell wall. It surrounds the cytoplasm and separates the internal environment of the cell from the external environment.

The cell membrane is composed mainly of phospholipids and proteins. One of its most important characteristics is selective permeability, meaning that it allows some substances to pass through while restricting others.

The cell membrane is selectively permeable, meaning it allows some substances to enter and leave the cell while preventing others. This selectivity depends on factors such as the size and type of molecules, where small and lipid-soluble substances can pass easily, while larger or charged molecules require special transport mechanisms. This property is essential for maintaining the internal balance of the cell, as it enables the cell to take in necessary nutrients, remove waste products, and protect itself from harmful substances, ensuring proper cellular function and survival.



Functions of the Cell Membrane

- Controls the movement of substances into and out of the cell.
- Maintains the internal balance of the cell.
- Protects the internal components of the cell.
- Allows communication between the cell and its environment.

Permeability of the Cell Membrane

One of the most important characteristics of the cell membrane is its selective permeability. This means that the membrane allows certain substances to pass through it while restricting others. Small molecules such as water, oxygen, and carbon dioxide can move across the membrane easily, while larger molecules may require special transport mechanisms.

This selective movement of substances helps maintain the internal balance of the cell and ensures that essential materials such as nutrients enter the cell while waste products are removed. In plant cells, this process is very important for maintaining normal cellular activities and supporting growth and metabolism.



Types of Transport Across Membrane

Substances move across the membrane in different ways depending on their size and concentration.

1-Passive Transport

Does not require energy:

- Diffusion
- Osmosis

2-Active Transport

Requires energy (ATP) to move substances against the concentration gradient.

Relationship Between Cell Wall and Cell Membrane

In plant cells, the cell wall and cell membrane work together to maintain cell stability and regulate the movement of materials. The cell wall provides strength and protection, while the cell membrane controls the exchange of substances.

This coordination allows plant cells to maintain their structure while still interacting with their environment.