Lecture2: Cellular membrane (plasma membrane) function and transport

Learning Objectives

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

1. Define cellular or plasma membrane
2. Explain its functions and importance in maintaining life.
3. Movement of Substances across Cell Membrane.

Diffusion

Osmosis

Active Transport

Cell membrane is a phospholipid bilayer that surround the cell and regulates the entry and exit of molecules.

It importance :

The contents of a cell are completely surrounded by its cell membrane or plasma membrane. Thus, any communication between the cell and the extracellular medium is mediated by the cell membranes. These cell membranes serve two important functions:

1. It must retain the dissolved materials of the cell so that they do not simply leak out into the environment.
2. It should also allow the necessary exchange of materials into and out of the cell.

Plasma membrane functions

1. **Protective barrier:** Acts as a protective barrier between the cell's interior and the external environment.
2. **transport**
3. **Cell communication**

Cell signaling: Contains receptor proteins that bind to external signals like hormones, triggering internal responses.

Cell adhesion: Contains proteins that help cells stick together to form tissues.

4. **Homeostasis**
5. **Flexibility:** Allows cells to change shape, which is necessary for functions like blood cells squeezing through capillaries.
6. **Structural support:** Anchors the cytoskeleton to maintain the cell's shape.

Movement of Substances Across Cell Membrane

Key features of cellular transport:

Selectively Permeable: The plasma membrane is **semi-permeable**, meaning it controls what enters and leaves the cell, which is vital for maintaining the cell's internal environment.

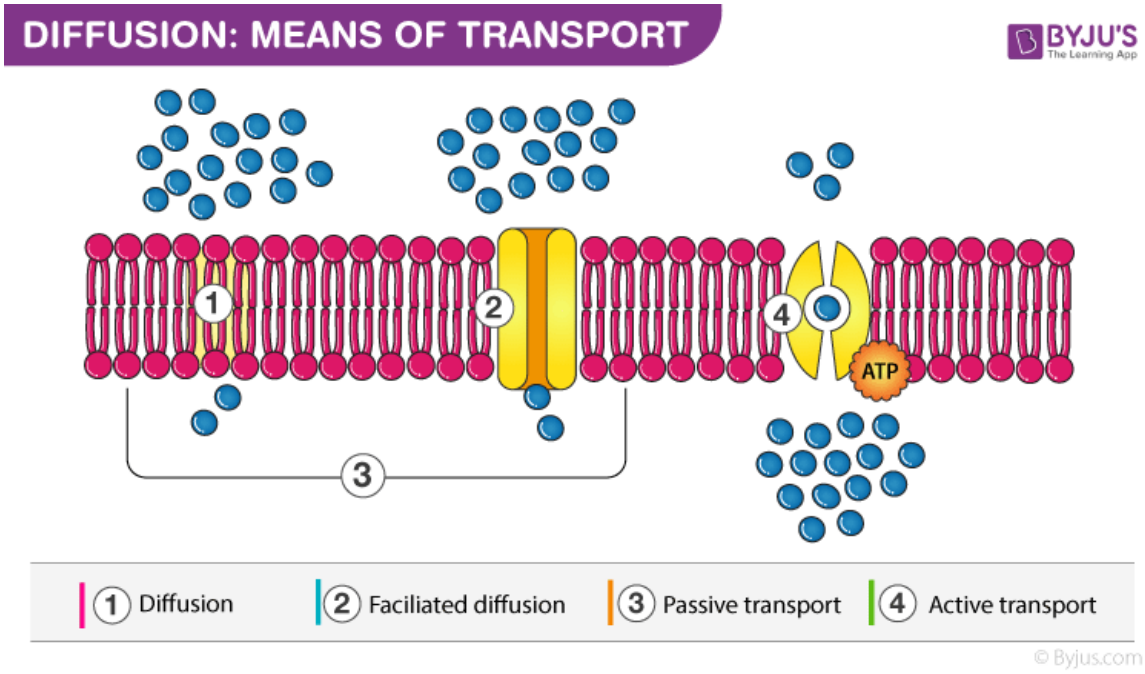
Concentration Gradient: The difference in the concentration of a substance across a membrane influences the direction of passive transport.

Cellular Homeostasis: Maintaining the stable internal conditions necessary for a cell to function properly is a key outcome of membrane transport.

There are two major methods for moving molecules across a membrane, and it is related to **whether or not cell energy is used**.

1. Passive mechanisms, require **no energy** to function
    a. Simple diffusion
    b. Facilitated diffusion
    c. osmosis

2. Active transport require **energy**.



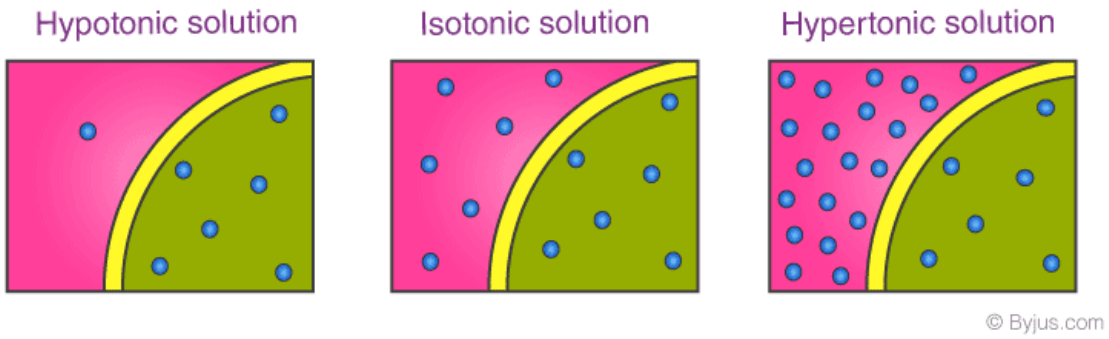
Passive Transport

No energy required: Substances move from an area of high concentration to an area of low concentration.

a. **Simple Diffusion:** Small, non-polar molecules (like oxygen and carbon dioxide) move directly across the phospholipid bilayer without assistance.
b. **Facilitated Diffusion:** Specific membrane proteins help transport specific ions or molecules across the membrane down their concentration gradient.
c. **Osmosis:** The diffusion of water across a selectively permeable membrane from a region of higher water concentration to a region of lower water concentration.

   When two compartments of different solute concentrations are separated by a semipermeable membrane, the compartment with higher solute concentration is called hypertonic relative to the compartment of lower solute concentration, which is described as hypotonic.

- If a cell is placed in a hypotonic solution, it rapidly gains water by osmosis and swells. Conversely, a cell placed into a hypertonic solution rapidly loses water by osmosis and shrinks.
- When the internal solute concentration equals the external solute concentration, it is said to be **isotonic**. Here, no net movement of water in or out of the cells occurs.



Active Transport

Two types : primary active transport

Secondary active transport

Active transport is a kind of cellular transport in which substances like amino acids, glucose and ions are transported across cell membranes to a region that already has a high concentration of such substances.

As a result, **active transport** employs **chemical energy like ATP** to move substances **against their concentration gradient**. This type of transport is commonly found in the small intestine wall and root hair cells