

College of Biomedical Engineering

Biology

First Stage

Lecture 5

Teach. assist. Namariq Aamer

The Function of the Plasma Membrane, Membrane Fluidity, Membrane Permeability, Gradients Across the Plasma Membrane.

The plasma membrane is primarily responsible for:

- **Protecting the cell:** It acts as a barrier, separating the inside of the cell from its external environment.
- **Regulating transport:** The plasma membrane controls the movement of substances into and out of the cell, allowing nutrients to enter and waste products to leave.
- **Cell communication:** The membrane has receptors that allow the cell to receive signals from other cells or the environment, which is important for processes like immune response, hormone signaling, and cellular growth.
- **Structural support:** It helps maintain the shape of the cell and anchors the cytoskeleton to the cell membrane.

2. Membrane Fluidity

Membrane fluidity refers to the ability of the lipid molecules in the membrane to move laterally within the layer. This fluidity is crucial for the functioning of the membrane because:

- It allows proteins to move and function properly.
- It enables the membrane to repair itself if damaged.
- It facilitates processes like endocytosis and exocytosis (cellular processes where cells absorb or release materials).

The fluidity of the membrane is influenced by:

- **Temperature:** Higher temperatures make the membrane more fluid, while lower temperatures make it more rigid.
- **Lipid composition:** The types of lipids in the membrane affect its fluidity. For example, unsaturated fatty acids increase fluidity because they create more space between the lipid molecules.
- **Cholesterol:** Cholesterol helps maintain membrane stability by preventing the membrane from becoming too rigid at low temperatures or too fluid at high temperatures.

3. Membrane Permeability

The plasma membrane is selectively permeable, meaning it allows some substances to pass through while blocking others. The permeability is determined by:

- **Size:** Small molecules like oxygen and carbon dioxide can pass through easily, while larger molecules, like proteins and polysaccharides, cannot.
- **Charge:** Nonpolar molecules (e.g., lipids) pass through more easily than polar molecules (e.g., water).
- **Transport proteins:** These are specialized proteins in the membrane that help transport specific molecules into or out of the cell. Examples include channel proteins, carrier proteins, and pump proteins.

Membrane permeability is essential for maintaining the internal environment of the cell and allowing it to perform its functions.

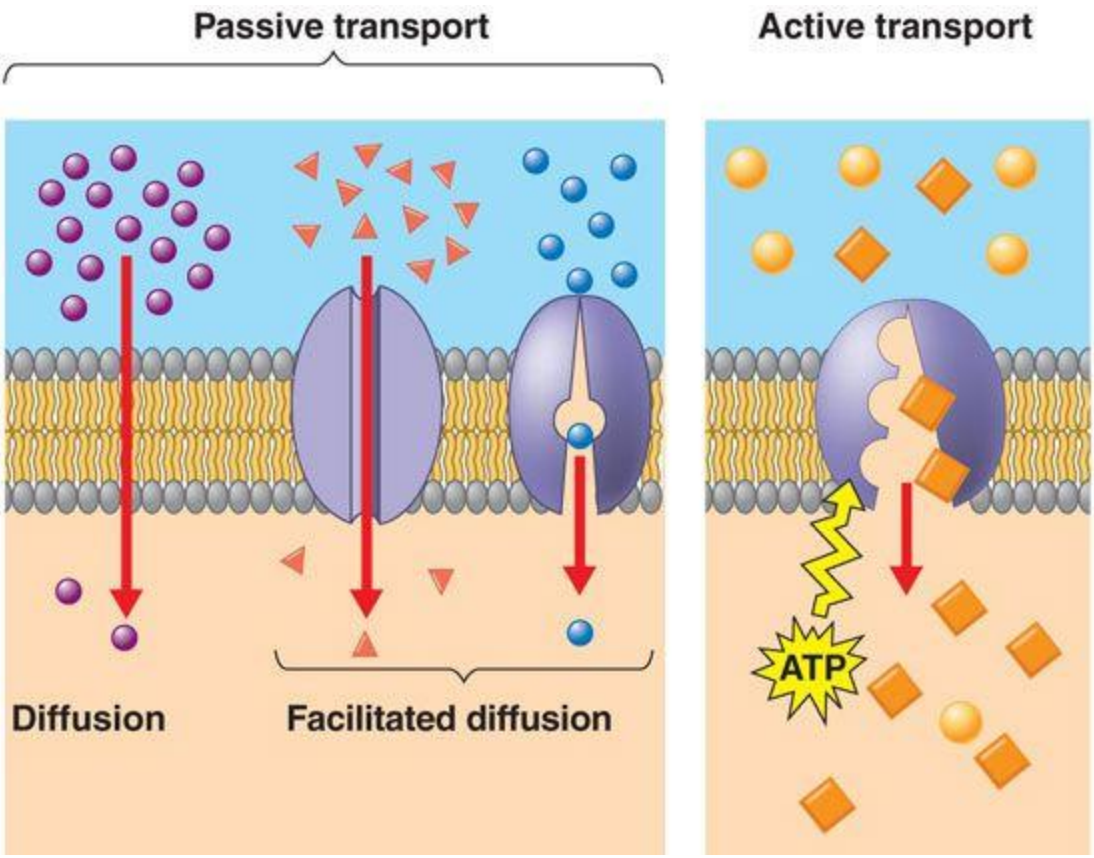
4. Gradients Across the Plasma Membrane

A gradient refers to a difference in the concentration of a substance across the membrane. There are two main types of gradients:

- **Concentration gradient:** This is the difference in the concentration of a substance (such as ions) inside and outside the cell. For example, potassium ions (K+) are concentrated inside the cell, while sodium ions (Na+) are concentrated outside the cell.
- **Electrochemical gradient:** This includes both the concentration gradient and the electrical charge difference across the membrane. This is especially important for the movement of ions, as they are affected by both the concentration and charge.

These gradients are essential for many cellular processes, such as:

- **Active transport:** Cells use energy to move substances against their concentration gradient.
- **Passive transport:** Substances move across the membrane down their concentration gradient without using energy, such as in diffusion and osmosis.


Passive transport
Active transport
Diffusion
Facilitated diffusion
ATP