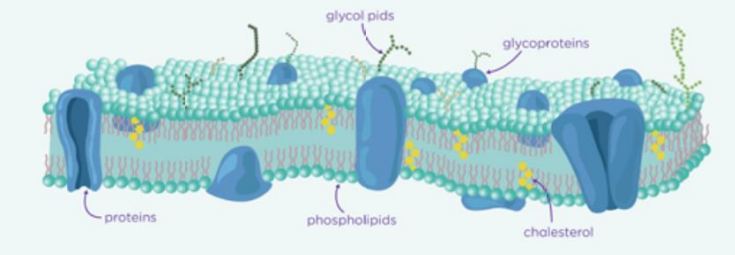
science

biology

A-Level Transport across cell membranes

The Cell Membrane

- The arrangement and any movement of phospholipids, proteins, glycoproteins and glycolipids in the fluid-mosaic model of membrane structure.
- Cholesterol may also be present in cell membranes where it restricts the movement of other molecules making up the membrane.



Movement across membranes occurs by:

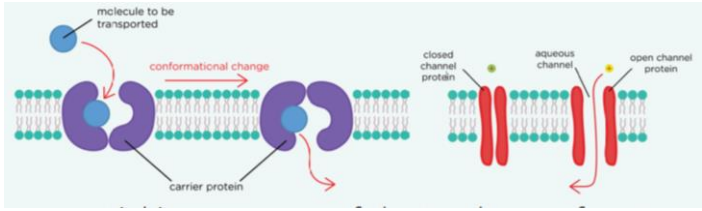
- **simple diffusion** (involving limitations imposed by the nature of the phospholipid bilayer)
- **facilitated diffusion** (involving the roles of carrier proteins and channel proteins)
- **osmosis** (explained in terms of water potential)
- **active transport** (involving the role of carrier proteins and the importance of the hydrolysis of ATP)
- **co-transport** (illustrated by the absorption of sodium ions and glucose by cells lining the mammalian ileum).

Passive Transport

Passive transport involves exchange of substances without requiring metabolic energy from the cell.

• **Simple Diffusion** is the net movement of particles from an area of higher concentration to an area of lower concentration (down their concentration gradient).

• **Facilitated diffusion** is the net movement of particles down their concentration gradient across a partially permeable cell membrane via carrier or channel proteins.



• **Osmosis** is the net movement of water from an area of higher water potential to an area of lower water potential across a partially permeable membrane.

• **Water potential** is a measure of the tendency of water molecules to move from one area to another area and describes the pressure created by these water molecules; the more dilute a solution, the higher (less negative) the water potential (Ψ).

Increasing the rate of diffusion

The rate of diffusion can be increased by increasing the:

- number of channel & carrier proteins,
- the surface area of the cell membrane,

and/ or

- reducing the diffusion distance, and
- creating a steeper concentration gradient.

Active transport

This is the movement of particles from an area of low concentration to an area of high concentration (against their concentration gradient) across a cell membrane, using **ATP** and **carrier proteins**.

Co-transport

This occurs when the transport of one substance is coupled with the transport of another substance across a membrane.

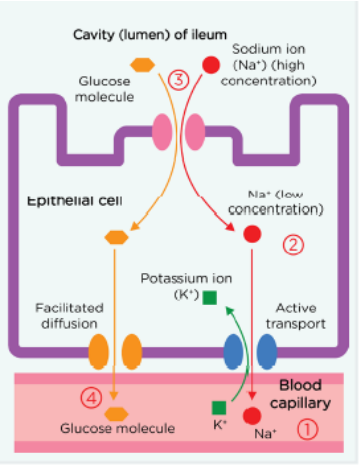
Glucose & sodium are co-transported via this method:

1. Na+ ions are actively transported out of epithelial cells through a protein carrier molecule.
3 Na+ ions are transported out of the epithelial cells into the bloodstream in exchange for 2 K+ ions.

2. The movement gives a higher concentration of Na+ ions in the lumen of the intestine rather than inside of the cell. This maintains the concentration gradient.

3. Na+ ions move down the concentration gradient using a co-transport protein. Both Na+ and glucose can bind to the protein (the binding of one makes the other more effective). 2 Na+ and a glucose molecule must bind before they can be transported across the membrane.

4. The glucose moves into the blood plasma using facilitated diffusion and a uniporter.



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