TOPIC 1.4: MEMBRANE TRANSPORT

Properties of Membranes

Cell membranes have two key properties

- Semi-permeable (only certain things can cross)
- Selective (membranes can regulate material passage)

Types of Membrane Transport

Membrane transport can either be:

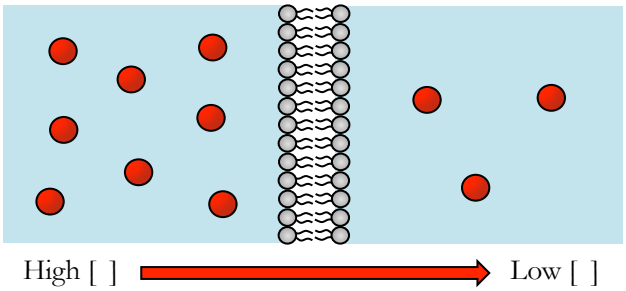
- Passive (along concentration gradient, no ATP expenditure)
- Active (against concentration gradient, ATP is required)

Passive Transport

Simple Diffusion

The net movement of particles from a region of higher concentration to a region of lower concentration (i.e. along the gradient) until equilibrium is reached

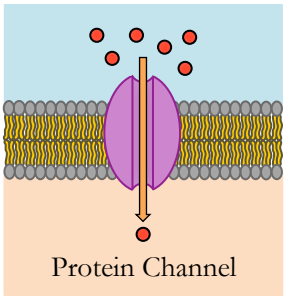
- Involves small / lipophilic molecules (e.g. O_2, CO_2, steroids)

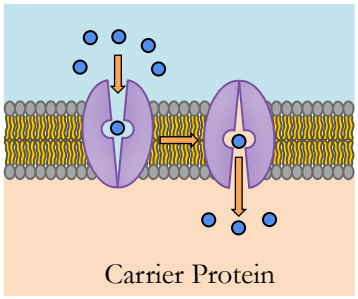


Facilitated Diffusion

The passive movement of molecules across a cell membrane via the aid of a membrane protein (carrier / channel protein)

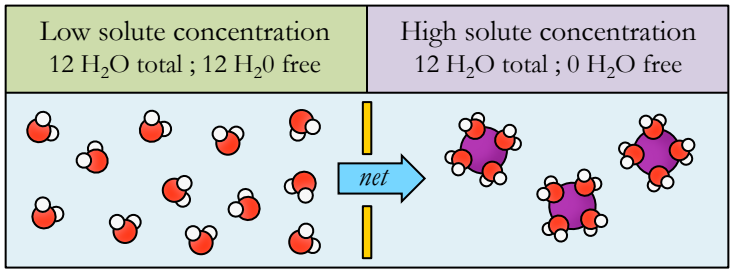
- Involves large / charged molecules (e.g. ions, glucose, etc.)
- **E.g.** Voltage-gated channels control the flow of ions in neurons





Osmosis

The net movement of water molecules across a semi-permeable membrane from a region of low solute concentration to a region of higher solute concentration (diffusion of free water molecules)

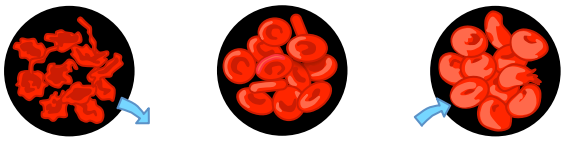


Osmolarity

Osmolarity is a measure of solute concentration

Solutions can be measured as:

- Hypertonic: High solute concentration (gains water)
- Hypotonic: Low solute concentration (loses water)
- Isotonic: Same solute concentration (no net flow)



Active Transport

Active transport uses energy (ATP) to move molecules against a concentration gradient (i.e. from low to high)

- Molecule binds to a transmembrane protein pump
- Hydrolysis of ATP causes a conformational change, translocating the molecule across the membrane
- **E.g.** Sodium-potassium pumps move ions in neuron

Sometimes molecules are passively coupled to an actively transported molecule (co-transport)

- Symport: Both molecules move the same direction
- Antiport: Molecules move in opposite directions

Vesicular Transport

The fluidity of the plasma membrane allows it to break and reform around certain materials (this process requires ATP)

- Exocytosis: Materials released from a cell via vesicles
- Endocytosis: Materials internalised within a vesicle

Intracellular vesicles can move materials between cell organelles

- **E.g.** rough ER → Golgi complex → plasma membrane