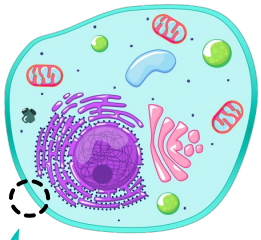
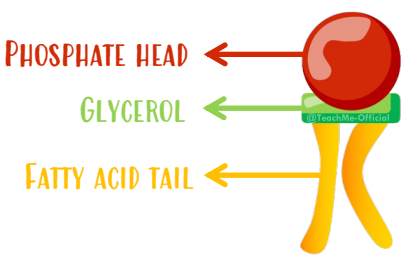
B2.1

Membrane Structure





Hydrophilic — Loving Water

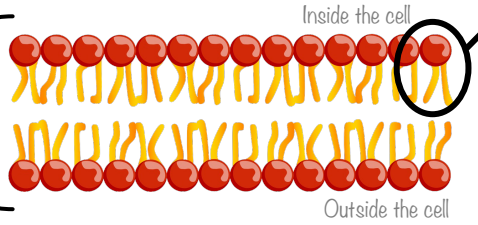
+

Hydrophobic — Fear Water

Amphipathic (having BOTH hydrophobic and hydrophillic components)

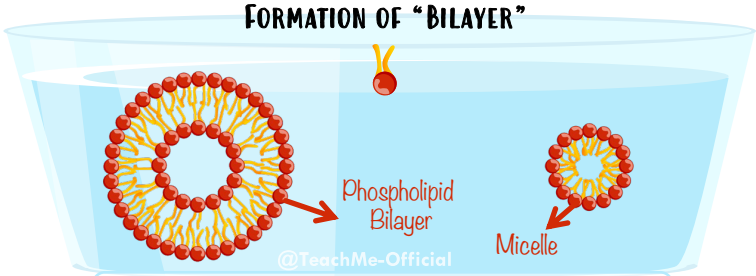
Phospholipid

Phospholipid bilayer (10nm)



↳ Provides shape & activity with the outside

Formation of "bilayer"

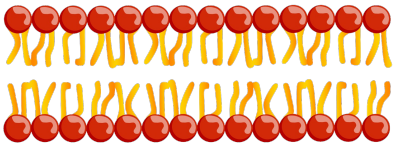


Fatty acids tails (hydrophobic) avoid contact with water, and the **phosphate head** (hydrophobic) contact with water.

History of membrane structure

Over time, different models of the cell membrane were proposed:

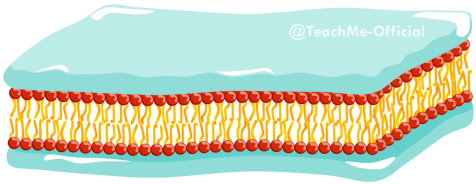
Garter-Grendel Model (1925)



Includes a phospholipid bilayer but no protein

Fat Sandwich Model

Davson-Danielli Model (1935)

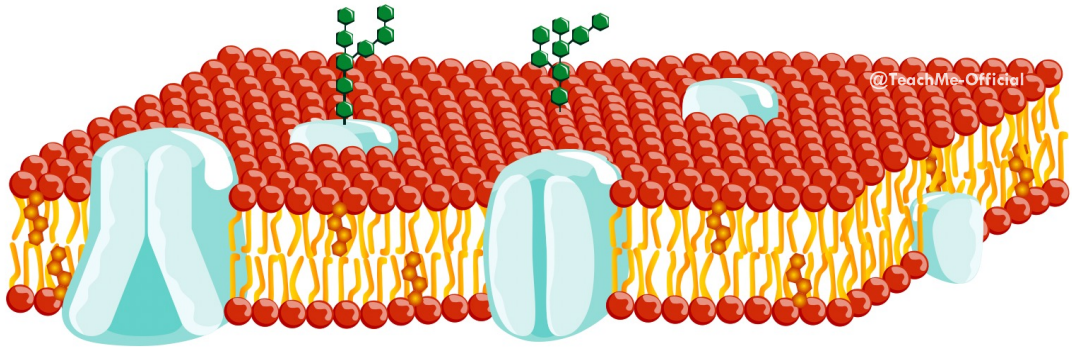


Previous theory (1925) was improved by acounting for the proteins present as a sandwich (a phospholipid bilayer sandwiched between two layers of protein).

It was rejected by a technique, **freeze-etching** which showed the presence of protein within the phospholipid bilayer.

Fluid Mosaic Model

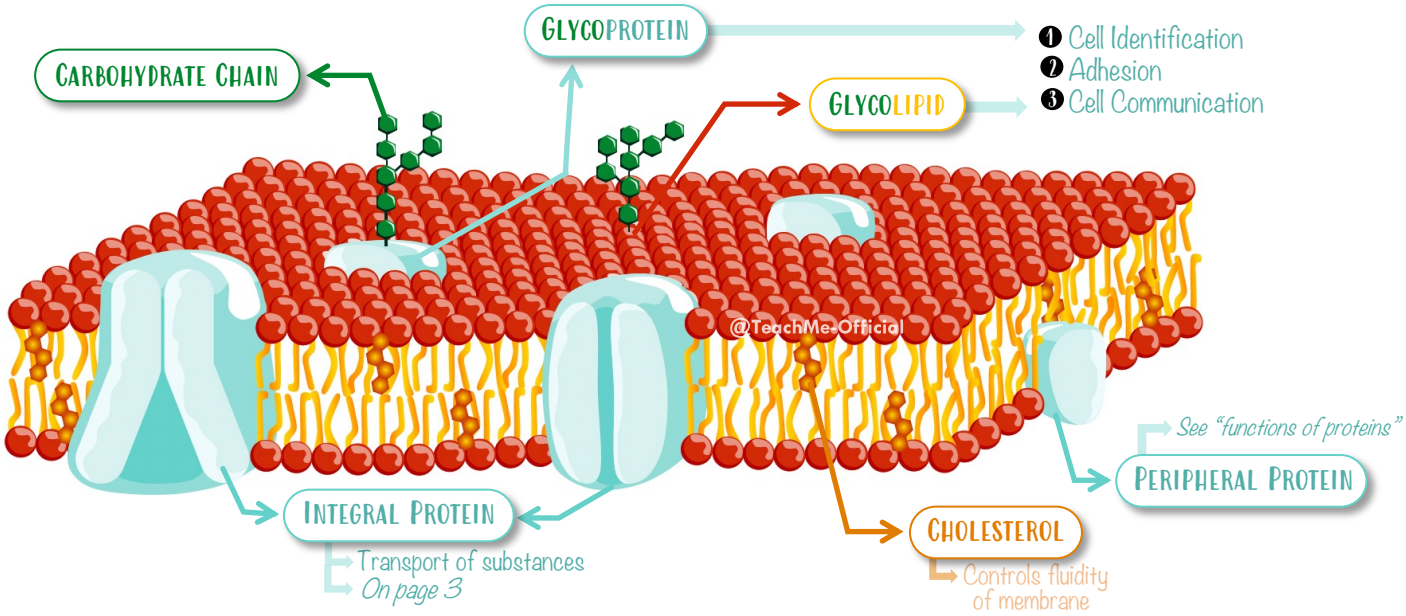
Singer-Nicolson Model (1972)



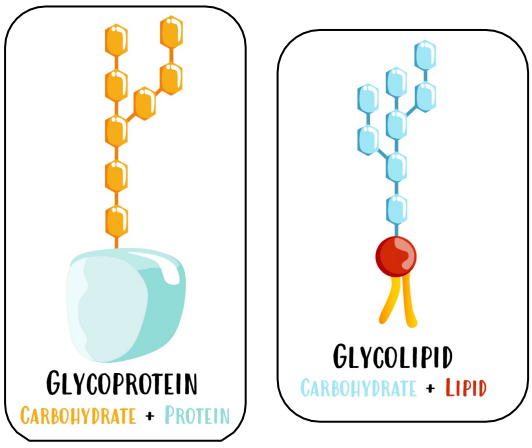
Includes a phospholipid bilayer with proteins interspead within the lipid bilayers (thus the "mosaic" name). Now widely accepted.

Membrane Structure

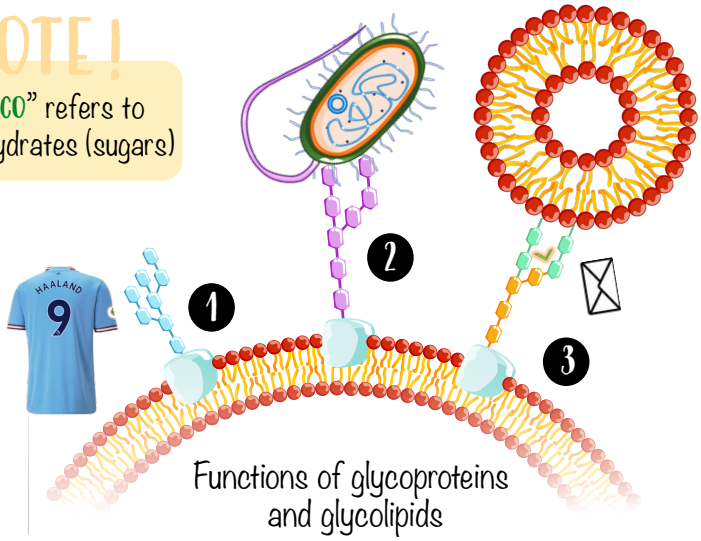
Fluid Mosaic Model



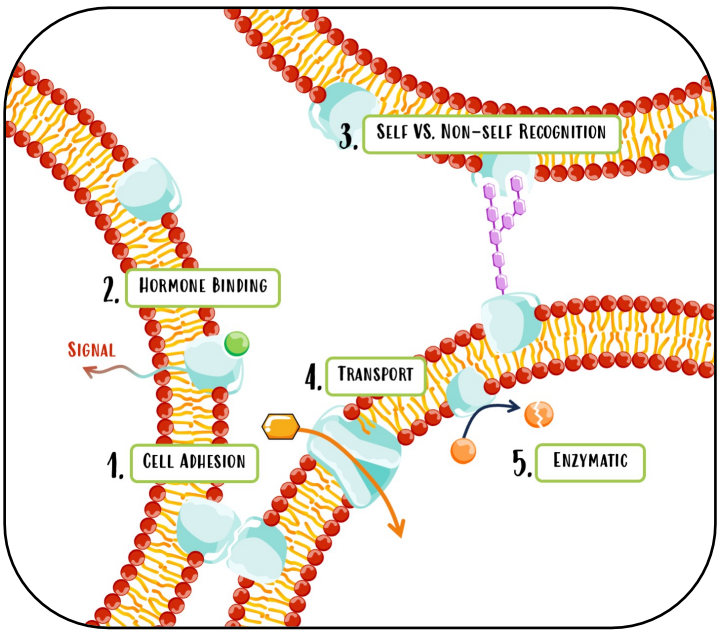
Conjugated Carbon Molecules



NOTE!
"Glyco" refers to carbohydrates (sugars)



Functions Of Proteins



1. These proteins can form physical connections (Junctions).
2. Protein has a specific shape to bind something (molecule etc). Upon binding, it can cause a signal to be transmitted into the cell to cause a reaction.
3. They provide an identification label so that cells can distinguish between *self* & *non-self*.
* 4. **Channels** - Spanning through the membrane and serving as passageways for things to enter or exit.

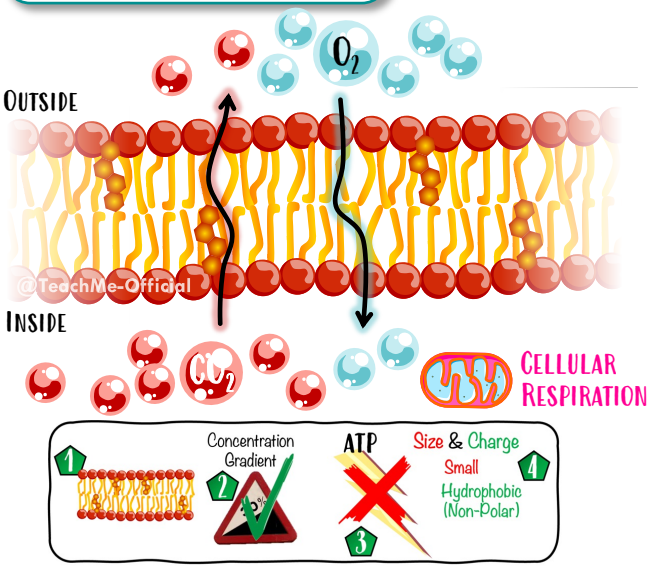
   Pumps - Transports substances from one side of the membrane to another, and in the process expends energy (ATP).
5. Assist in metabolic reactions.

* Explained in more detail from page 3

B2.1

Membrane Transport

I. Passive Transport



A. Simple Diffusion

- The passive movement of molecules from an area of **higher concentration** to an area of **lower concentration**
- Across a membrane, without the need for a transporter
- Without energy input (**no ATP**)
- Used by **small** and **hydrophobic** (non-polar) molecules
- It is non-selective

e.g., O_2 and CO_2 from cell respiration

NOTE!

Diffusion – term used to describe the process of things moving from where there is a lot to where there is a little.

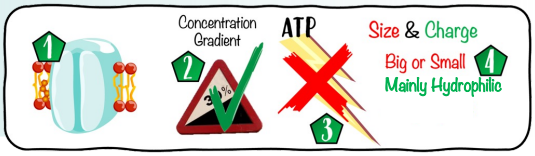
B. Facilitated Diffusion

Facilitate = To make quicker/easier

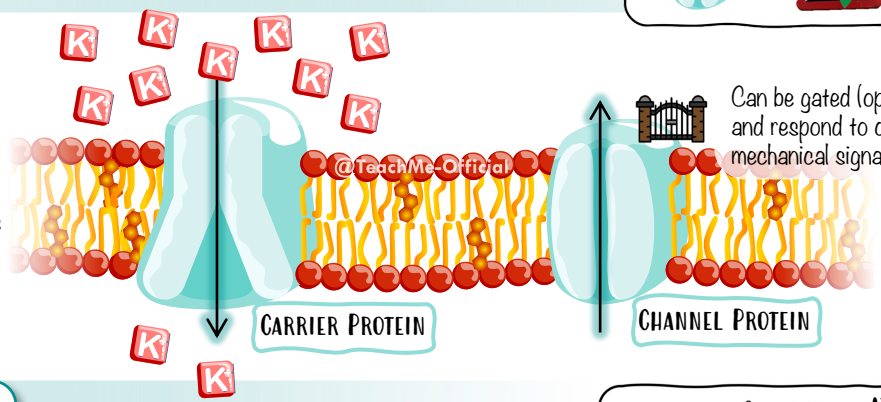
- The passive transport of molecules from an area of **higher concentration** to an area of **lower concentration**
- Across a membrane via specific **protein carriers** (selective) or **channels** (non-selective)
- Without energy input (**no ATP**)

e.g., Cl^- and K^+ transport, glucose transport (for energy)

- Used by **big or small** and mainly **hydrophilic** molecules
- The rate is impacted by the concentration gradient and the number of channels
- It is selective (selectively permeable - specific)

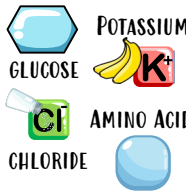


The carrier protein undergoes a conformation change (changes shape)



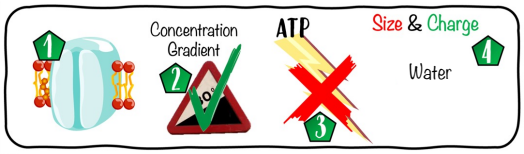
Can be gated (open or closed) and respond to chemical or mechanical signals

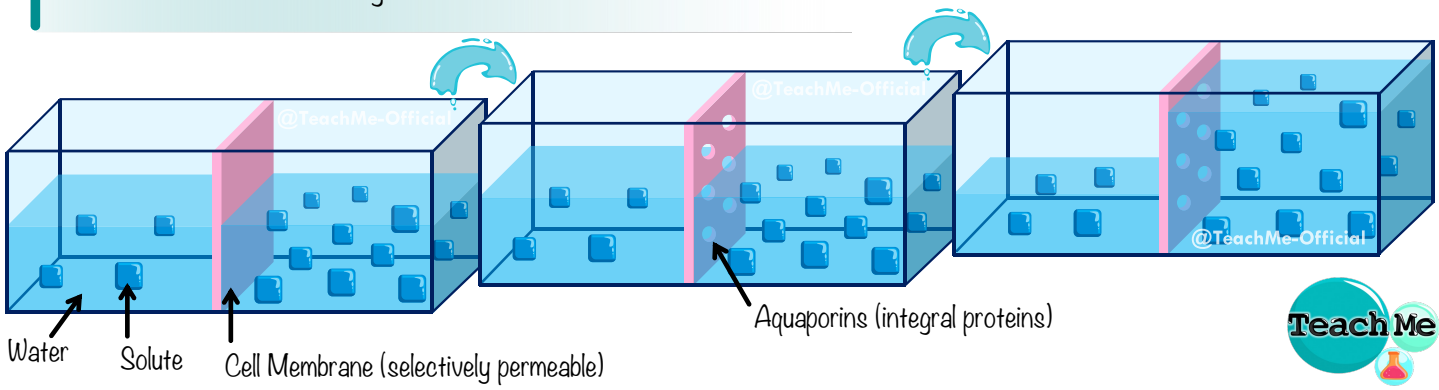
Common examples;



C. Osmosis

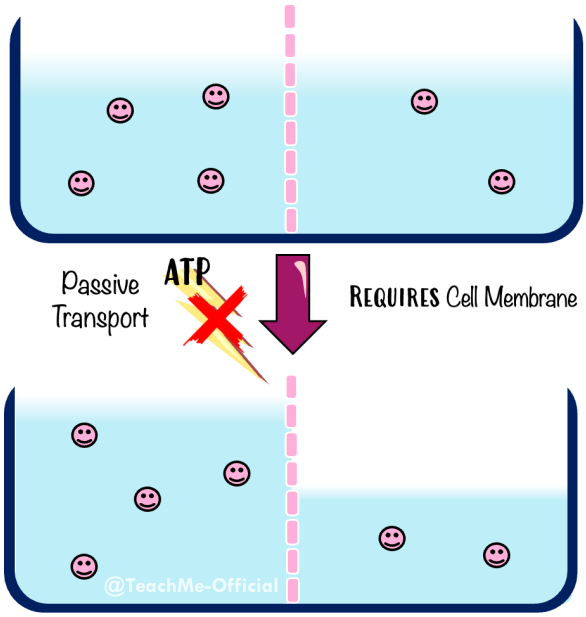
The movement of **water** from an area of low solute concentration to area of high solute concentration.





Membrane Transport

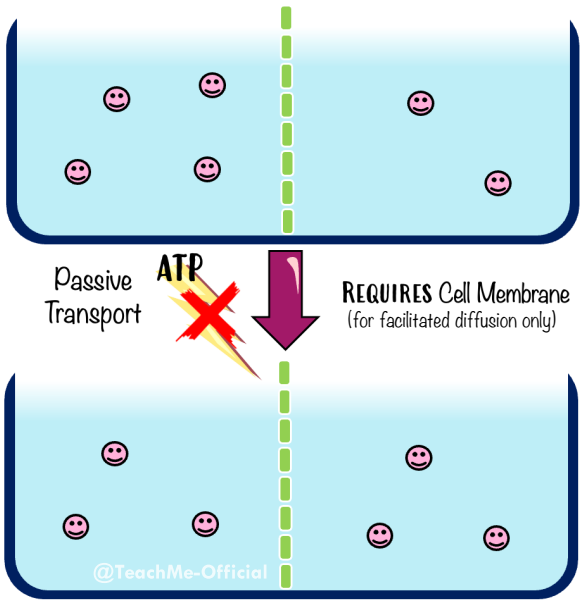
Osmosis



The movement of **WATER** from an area of low solute concentration to area of high solute concentration.

VS.

Simple Diffusion / Facilitated Diffusion



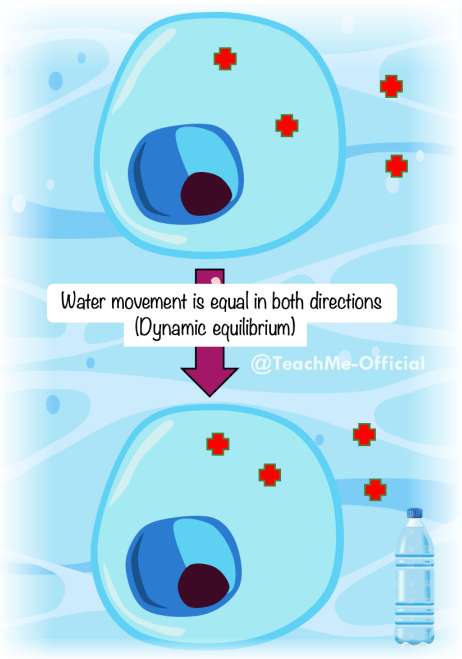
The movement of substances (**SOLUTES**) down a concentration gradient from an area of high concentration to an area of low concentration.

When placing a cell in an environment with different tonicities, osmosis causes cellular strutcural changes.

Isotonic

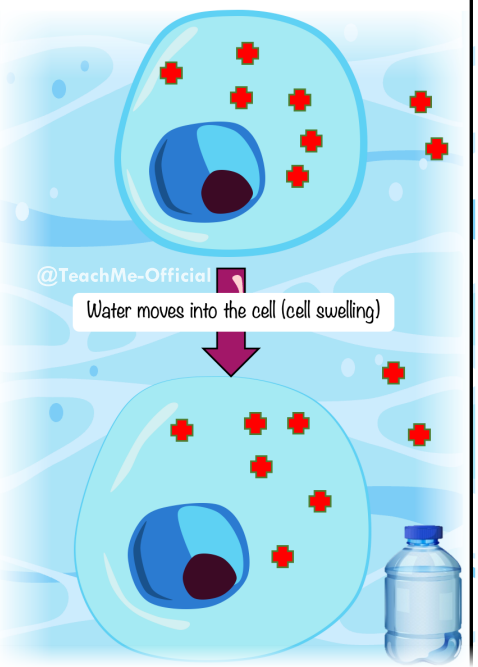
Environment Tonicity

ISO = EQUAL CONCENTRATION COMPARED TO CELL



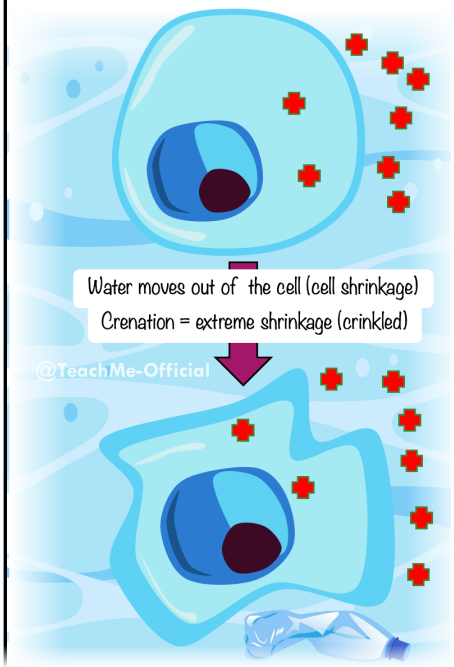
Hypotonic

HYPO = LOW CONCENTRATION COMPARED TO CELL



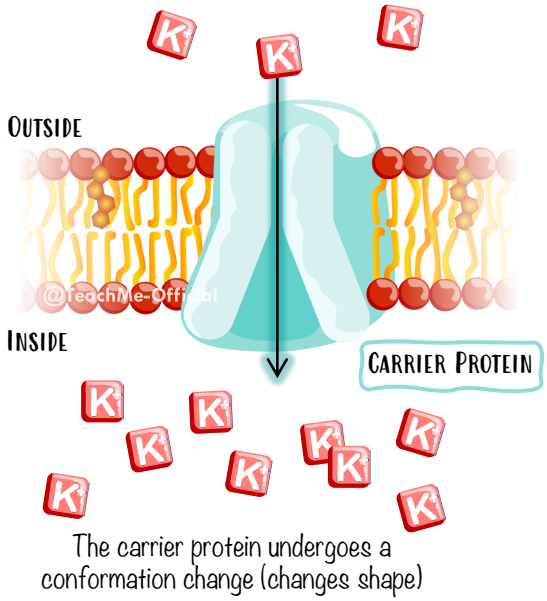
Hypertonic

HYPER = HIGH CONCENTRATION COMPARED TO CELL



Isotonic solutions are used to preserve organs for organ transplantation, eye drop solutions and many more...

Membrane Transport

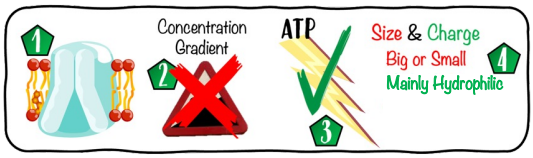


The carrier protein undergoes a conformation change (changes shape)

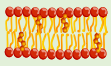
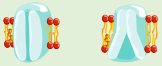
II. Active Transport

- The active movement of molecules from an area of **lower concentration** to an area of **higher concentration**
- Across a membrane, with the need for a transporter (**carrier**)
- With energy input (**ATP**)
- Used by **small or large** and mainly **hydrophilic** molecules
- It is selective (specific)
- Sometimes equality is not wanted (purposely create a gradient)

e.g., Sodium-Potassium pump (Na^+-K^+) [more detail in HL]



Summary

Category	Type	Membrane Protein	Concentration Gradient	Energy	Molecule Size & Charge
Passive Transport	Simple Diffusion		 Down/along		Small Non-polar
	Facilitated Diffusion				Small or Big Polar
	Osmosis				Small Polar
Active Transport	Active Transport		 Against		Small or Big Polar

NOTE!

Polar = Hydrophilic
Non-polar = hydrophobic