Facilitated Diffusion

Understanding:

- Particles move across membranes by simple diffusion, ***facilitated diffusion***, osmosis and active transpo

Facilitated diffusion is the *passive* movement of molecules across the cell membrane via the aid of a membrane protein

- It is utilised by molecules that are unable to freely cross the phospholipid bilayer (e.g. large, polar molecules and ions)
- This process is mediated by two distinct types of transport proteins – channel proteins and carrier proteins

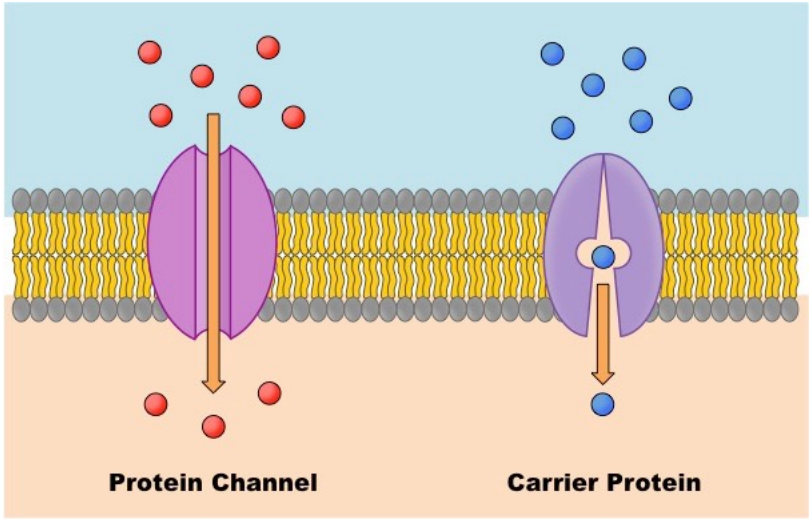
Carrier Proteins

- Integral glycoproteins which bind a solute and undergo a *conformational change* to translocate the solute across the membrane
- Carrier proteins will only bind a specific molecule via an attachment similar to an enzyme-substrate interaction
- Carrier proteins may move molecules against concentration gradients in the presence of ATP (i.e. are used in active transport)
- Carrier proteins have a much slower rate of transport than channel proteins (by an order of ~1,000 molecules per second)

Channel Proteins

- Integral lipoproteins which contain a pore via which ions may cross from one side of the membrane to the other
- Channel proteins are ion-selective and may be gated to regulate the passage of ions in response to certain stimuli
- Channel proteins only move molecules along a concentration gradient (i.e. are not used in active transport)
- Channel proteins have a much faster rate of transport than carrier proteins

Channel Proteins versus Carrier Proteins



Application:

- Structure and function of sodium-potassium pumps for active transport and ***potassium channels for facilitated diffusion*** in axons

The axons of nerve cells transmit electrical impulses by translocating ions to create a voltage difference across the membrane

- At rest, the sodium-potassium pump expels sodium ions from the nerve cell, while potassium ions are accumulated within
- When the neuron fires, these ions swap locations via facilitated diffusion via sodium and *potassium channels*

Potassium Channels

- Integral proteins with a hydrophilic inner pore via which potassium ions may be transported
- The channel is comprised of four transmembrane subunits, while the inner pore contains a selectivity filter at its narrowest region that restricts passage of alternative ions
- Potassium channels are typically voltage-gated and cycle between an opened and closed conformation depending on the transmembrane voltage

Voltage-Gated Ion Channels