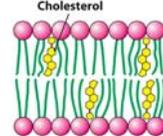
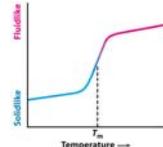


Membrane Structure and Function

Ch 12, Stryer Short Course

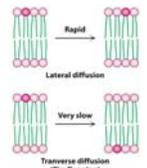
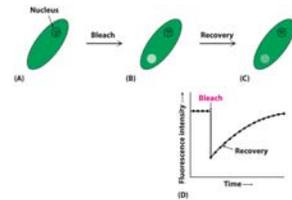
Introduction to Membranes

- Lipid structure makes a bilayer
 - Hydrophobic effect
 - Non-covalent structure
- Fluidity of membrane: liquid crystal
- Fluidity controlled by cholesterol, tail packing

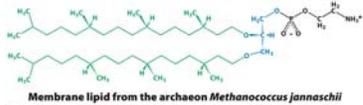
Fluidity

- Transverse vs lateral diffusion
- Bleaching experiment
- Fluid Mosaic Model

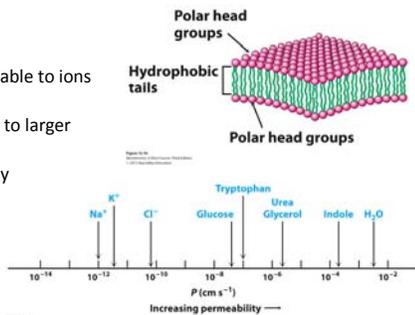
Extremophiles

- Archea: branched tails, ether linkages
 - Increased range of temperature
 - Stable to hydrolysis
 - Stable to oxidation



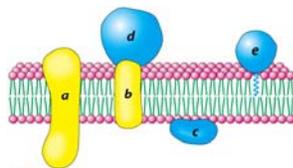
Permeability

- Membrane impermeable to ions (water shell)
- Mainly impermeable to larger polar molecules
- Water can flow slowly



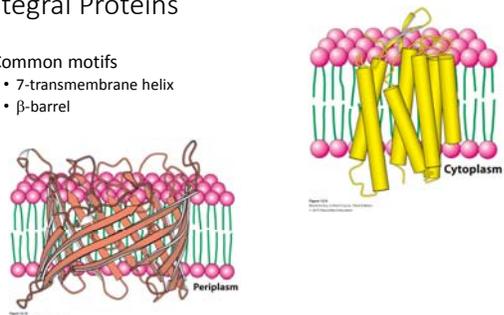
Introduction to Membrane Proteins

- Proteins carry out membrane function
 - Diversity of membranes based on protein content
- Types of proteins
 - Integral proteins
 - Peripheral proteins
 - Anchored proteins



Integral Proteins

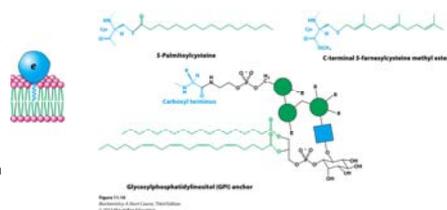
- Common motifs
 - 7-transmembrane helix
 - β -barrel



The diagram illustrates two types of integral proteins. On the left, a β -barrel protein is shown spanning a lipid bilayer, with its extracellular side in the periplasm and its cytoplasmic side in the cytoplasm. On the right, a 7-transmembrane helix protein is shown, with its seven transmembrane helices crossing the lipid bilayer, also with the periplasm on one side and the cytoplasm on the other.

Anchored proteins

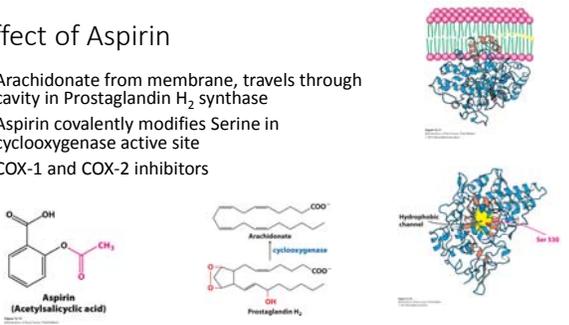
- Reversible Anchoring directs proteins to membrane
- Pathology
 - Cancer
 - Hutchinson-Progeria syndrome



The diagram shows various ways proteins are anchored to the membrane. It includes a GPI anchor (Glycosylphosphatidylinositol) which is attached to the cytoplasmic side of the membrane. Other structures shown include a protein with a covalently attached lipid chain and a protein with a GPI anchor. The diagram is labeled with '3-Palmitoyllysine', 'Covalently attached lipid', and 'Glycosylphosphatidylinositol (GPI) anchor'.

Effect of Aspirin

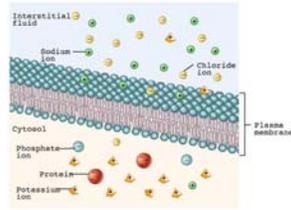
- Arachidonate from membrane, travels through cavity in Prostaglandin H_2 synthase
- Aspirin covalently modifies Serine in cyclooxygenase active site
- COX-1 and COX-2 inhibitors



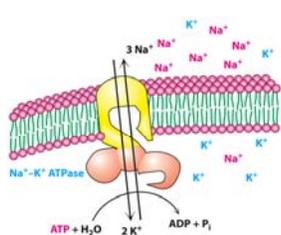
The diagram illustrates the mechanism of aspirin. On the left, the chemical structure of Aspirin (Acetylsalicylic acid) is shown. In the center, Arachidonate is converted to Prostaglandin H_2 by the enzyme cyclooxygenase. On the right, a 3D model of the cyclooxygenase active site is shown, with the hydrophobic channel and the Ser 530 residue highlighted. Aspirin is shown covalently modifying Ser 530.

Transporter Proteins

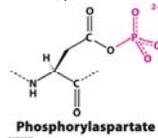
- Thermodynamic gradients
 - Concentration gradient
 - Ion gradient
- Pumps, channels, transporters
- Diffusion
 - Simple diffusion
 - Facilitated diffusion (passive transport)
 - Active Transport



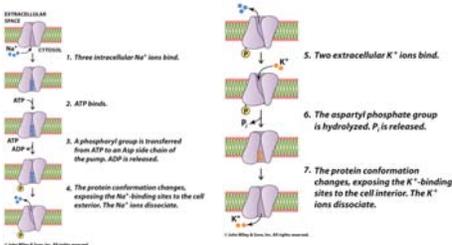
Sodium-Potassium ATPase



- Up to a third of ATP is used to create ion gradient
 - Maintain structure and function of cell
- ATP phosphorylates the pump
 - Change in conformation used to drive sodium/potassium exchange



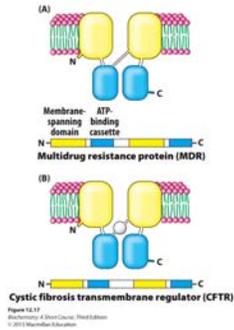
Mechanism



Digitalis blocks dephosphorylation, leading to low sodium ion gradient. This changes the calcium ion gradient, making the heart beat harder.

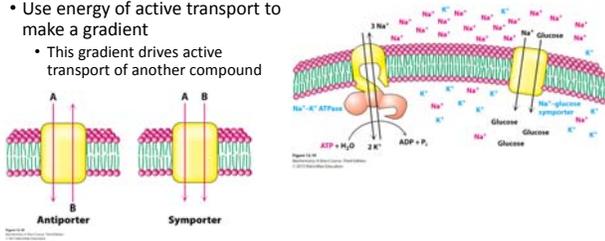
ABC transporters

- ATP-binding cassette domain
 - Large superfamily includes
- Multidrug Resistance Pump
- Cystic Fibrosis Transmembrane Regulator
 - ATP-regulated chloride channel
 - Mutation causes less fluid/salt to be pumped out of cell



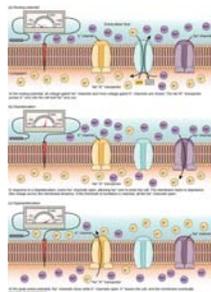
Secondary Transport

- Use energy of active transport to make a gradient
 - This gradient drives active transport of another compound



Facilitated transport: K⁺ channel

- Channels can allow specific compounds to transverse the membrane rapidly
- Nerve Impulse
- Controlled systems
 - Voltage gated
 - Ligand gated
 - mechanoselective



Structure explains specificity

- How do you block a smaller sodium ion from going through a hole that fits a larger potassium ion?
- Make up for desolvation with strong binding

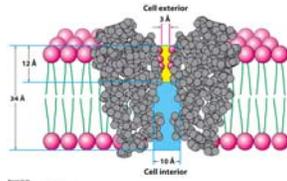


Figure 15-14
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Structure explains speed

- Four binding sites in the narrow channel
- Repulsion of neighboring ions pushes potassium through

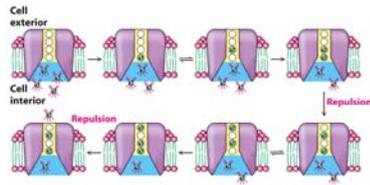


Figure 15-15
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