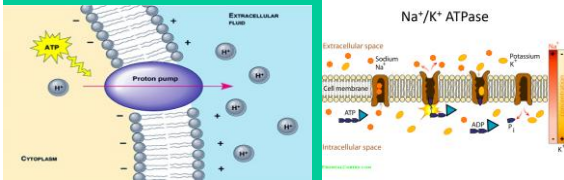


## 2.7 Facilitated Diffusion



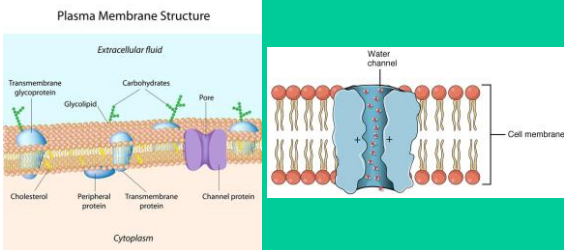
### ENDURING UNDERSTANDING

**ENE-2 Cells have membranes that allow them to establish and maintain internal environments that are different from their external environments.**

The diagram shows a cross-section of a cell membrane. The 'outer face' is at the top and the 'inner face' is at the bottom. It features a phospholipid bilayer with 'hydrophilic (polar) head of phospholipid' and 'hydrophobic (nonpolar) fatty acid tail of phospholipid'. Other components include 'sugar side chain', 'cholesterol', 'integral (intrinsic) proteins', and 'peripheral (extrinsic) protein'. © 2007 Encyclopædia Britannica, Inc.

**ENE-2.G Explain how the structure of a molecule affects its ability to pass through the plasma membrane.**

- Membrane proteins are required for facilitated diffusion of charged and large polar molecules through a membrane
  - Large quantities of water pass through aquaporins.



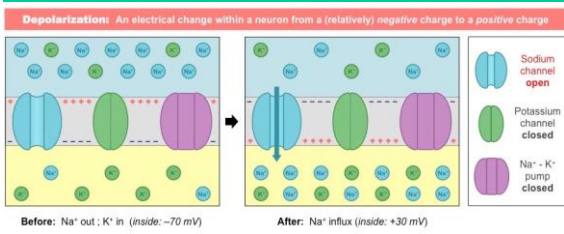
**ENE-2.G Explain how the structure of a molecule affects its ability to pass through the plasma membrane.**

- Proteins may act as selective channels.
- Carrier/Transport Proteins
  - Carrier proteins transport only one type of molecule.
  - Undergo a change in shape to move molecule across.
  - Movement is down the concentration gradient.

The diagram shows a 'Protein Channel' and a 'Carrier Protein' in a membrane. The protein channel allows red spherical molecules to pass through. The carrier protein binds to a red spherical molecule, changes shape to move it across, and then releases it.

**ENE-2.G Explain how the structure of a molecule affects its ability to pass through the plasma membrane.**

- Charged ions, including Na<sup>+</sup> and K<sup>+</sup>, require channel proteins to move through the membrane.
- Membranes may become polarized by movement of ions across the membrane.



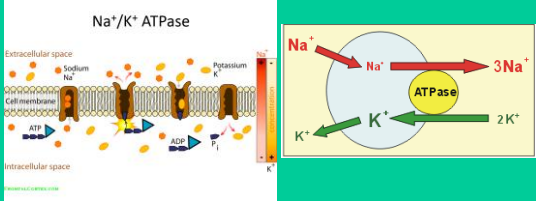
**ENE-2.G Explain how the structure of a molecule affects its ability to pass through the plasma membrane.**

- Membrane proteins are necessary for active transport
- Metabolic energy (such as from ATP) is required for active transport of molecules and/or ions across the membrane and to establish and maintain concentration gradients.

The diagram shows a 'Proton pump' in a membrane using energy from ATP to move H<sup>+</sup> ions from the cytoplasm (negative charge) to the extracellular fluid (positive charge).

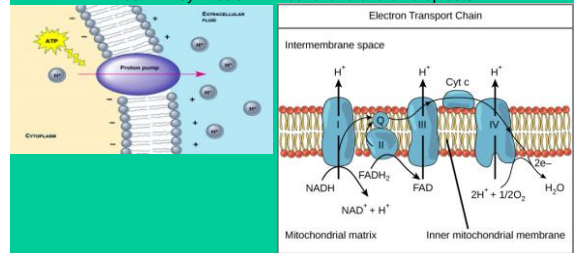
**ENE-2.G Explain how the structure of a molecule affects its ability to pass through the plasma membrane.**

- The Na<sup>+</sup>/K<sup>+</sup> ATPase (Sodium-potassium pump) contributes to the maintenance of the membrane potential.
  - Major electrogenic pump in animal cells.
  - Transport Protein changes shape, pumping three Na<sup>+</sup> out for every two K<sup>+</sup> pumped in.
  - Caused by phosphorylation by ATP



**ENE-2.G Explain how the structure of a molecule affects its ability to pass through the plasma membrane.**

- Proton pump
  - Hydrogen ions pumped out against its gradient.
  - Major electrogenic pump in plants, bacteria, and fungi.
  - Drives ATP synthesis in mitochondria and chloroplasts.



**ENE-2.G Explain how the structure of a molecule affects its ability to pass through the plasma membrane.**

- Ion Pumps are Electrogenic Pumps
  - All cells have voltages across their membranes.
  - Transport proteins generate an electrochemical gradient
  - Due to unequal distribution of anions(-) and cations(+).
  - Source of potential energy (Think battery!!!).

