Unit 1: Cell Structure and Function
Content Outline: Movement Across Membranes (1.3)

I. Material Transport in general with regards to cells
   A. CO_2 and O_2 (both gases) diffuse across the *wet* phospholipid bi-layer.
   B. Ions (charged particles) and water move through the proteins. (Hence the name Transport proteins.)

II. **Passive Transport** (No energy is required for this process to occur.)
   A. Diffusion
      1. This process operates upon an *established concentration [ ] gradient*.
      2. Materials flow from high [ ] to low [ ] until equilibrium is achieved.
      3. This is how the *majority* of materials are transported in cells. (Because it requires no energy expenditure by the cell…which saves energy for *maintaining* homeostasis, repair, and reproduction.)

   B. **Osmosis** (The diffusion of water.)
      1. *Water always flows from* ***Hypotonic*** *to* ***Hypertonic*** *until* ***Isotonic***
      2. Terminology:
         a. Terms refer to the *material dissolved in the water. not the water itself. (That is tonic.)*
            i. "Hypo" means "very little" is dissolved in the water.
            ii. "Hyper" means "a lot" is dissolved in the water.
            iii. "tonic" referring to the water.
         b. Water flows one way and the materials dissolved in the water flow the *opposite* direction.
         c. Water molecules *never* stop moving across a membrane; even when isotonic state exists.
      3. The process of **Osmoregulation (water control)** is crucial for **all** cells to control.
         a. Pure water vs. normal water. *Pure* water is always the hypotonic.
         b. **Turgid** – This refers to a condition when there is *plenty of water* in the plant cell, so the cells are rigid and the plant is stiff.
         c. **Flaccid** – This refers to a condition when there is *not enough water* in the plant cell, so the cells are limp and the plant is wilted.
         d. **Plasmolysis** – This is when the cell membrane *rips away* from the cell wall killing the plant cell. ("Plasmo" refers to the plasma membrane; "lysis" means "the process of tearing")
      4. Water **Potential** (Represented by the Greek letter psi - Ψ) (After Poseidon's Trident.)
         a. It is basically water's *ability to perform work* while passing through the cell membrane.
         b. We state that water is moving from *high potential* (hypotonic) to *low potential* (hypertonic).
            i. This is because we do not consider water to have varying water "concentrations". Water is water.

   C. **Facilitated Diffusion** ("Facilitate" means "to help")
      1. This movement of molecules requires the *help* of a Transport Protein.
      2. Does not require energy to occur.

III. **Active Transport** (This process requires energy to occur.)
   A. This process is moving material *against the concentration [ ] gradient*. (Like pushing a car up a hill…it will require energy.)
      1. Some examples in organisms are: Proton pumps, and Na+/K+ Pumps of the nervous system.
         a. Energy from ATP by **Phosphorylation** (Attaching a phosphate ion to a structure to make it work.) **activates** the protein to grab and move molecules.
         b. Electrons can also provide energy, such as in the Electron Transport Chain of Photosynthesis or Cellular Respiration.

IV. *Large* molecule transport (These molecules are *too* big for proteins to transport.)
   A. **Exocytosis** – This is the process of moving materials *out* of a cell. (Exo means "out"; cyto means "cell"; sis means "process of")
   B. **Endocytosis** – This is the process of moving materials *into* a cell. (Endo means "in")
      1. **Phagocytosis** – This process is "cell eating". (Phage means "to eat").
      2. **Pinocytosis** – This process is "cell drinking". (Pino means " to drink").