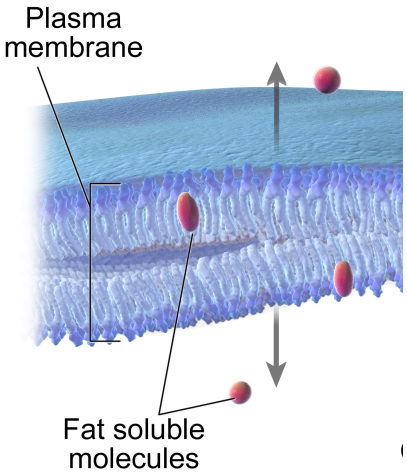
CONCEPT: PASSIVE TRANSPORT: DIFFUSION AND OSMOSIS

Diffusion

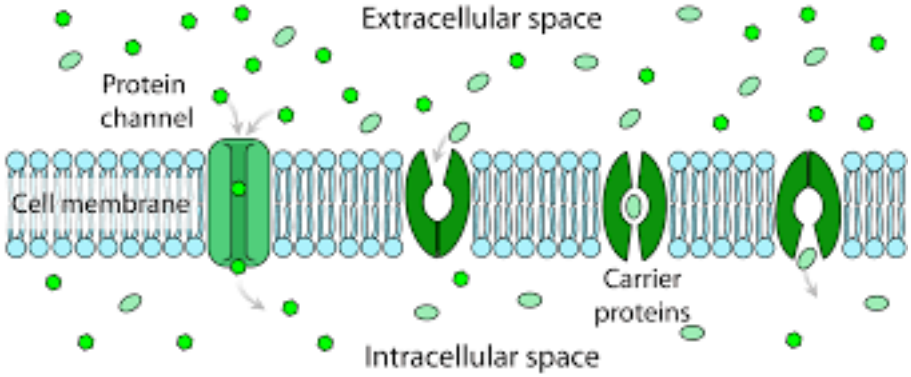
- **Diffusion** is movement of molecules _____ equilibrium (depends on free energy)
- **Simple diffusion** is the unassisted (passive) movement of molecules
    - □ Limited to small, uncharged, nonpolar molecules
        - **Partition coefficient** measures ratio of nonpolar solubility in a nonpolar solvent and water
            - Greater lipid solubility = faster diffusion
    - □ Requires _____ energy input (exergonic)
    - □ Moves molecules from areas of high concentrations to areas of low concentration

EXAMPLE: Simple diffusion across



- **Facilitated diffusion** is the _____ movement of molecules
    - □ Moves molecules from areas of high concentrations to areas of low concentration
        - Kinetics can be measured using the *michaelis-menten* equation used for enzymes
    - □ Assistance is provided through two classes of proteins: channel proteins and carrier proteins
        - **Channel proteins** move molecules by providing a channel through which they pass
        - **Carrier proteins** move molecules by undergoing conformational changes

EXAMPLE: Carrier and channel proteins

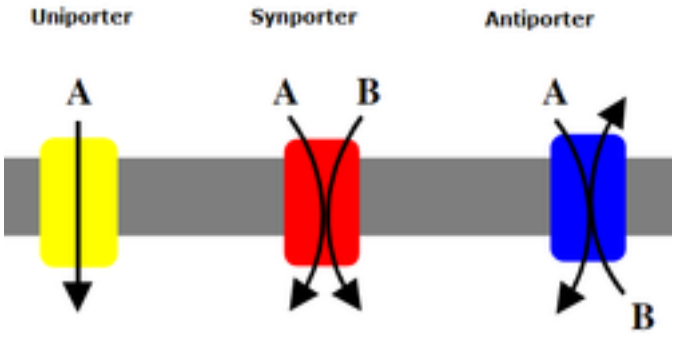


□ Transport proteins are further classified by how _____ molecules they transport at once

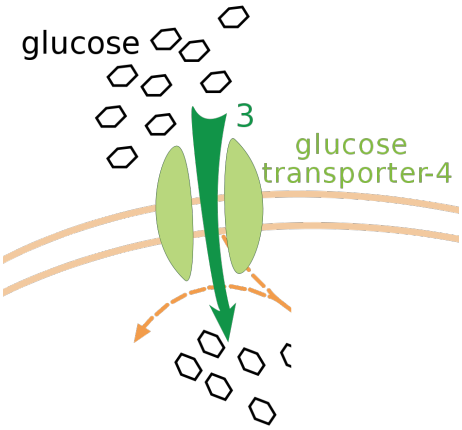
- **Uniport** proteins transport one molecule at a time. Fastest method of facilitated diffusion
- **Symport** proteins transport two molecules in the same direction
- **Antiport** proteins transport two molecules in opposite directions

□ Facilitated diffusion only transports specific molecules

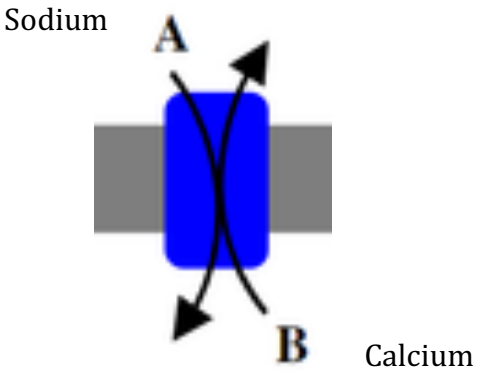
EXAMPLE: Comparison of uniporter, symporters, and antiporters



EXAMPLE: Glucose transporter (GLUT1 uniport) moves glucose from an area of high concentration to lower concentration



EXAMPLE: Sodium Calcium Antiporter regulates muscle contraction



Osmosis

- **Osmosis** is the diffusion of water across semi-permeable membranes
  - □ Water movement is dependent on _____ concentrations
    - Water moves from lower solute concentration (high water) to higher solute concentration (low water)
    - When in a **hypotonic** solution (low solute) cells swell, whereas in **hypertonic** (high solutes) they shrink
    - **Isotonic** solutions have similar solute concentrations in cells and their environment

□ **Osmotic pressure** is the pressure required to stop water flow across membranes

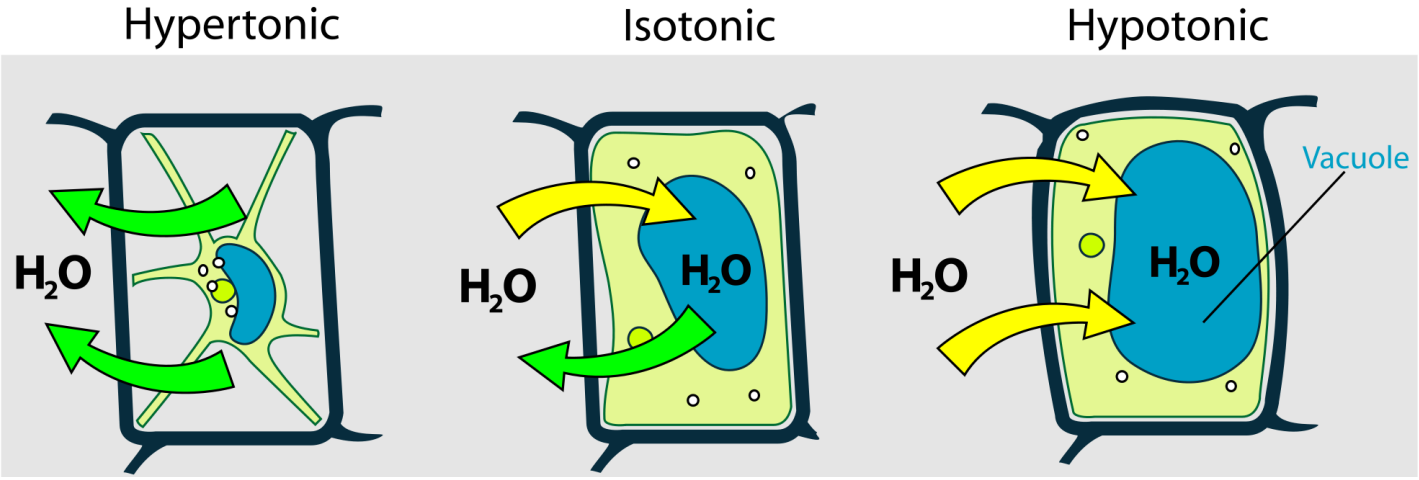
□ **Aquaporins** are channel proteins that allow _____ to cross the membrane

- Move water through the channel by forming hydrogen bonds with amino acids to displace other water

- No conformational changes are need – leads to fast transport

- Different cell types and organisms have different amounts of aquaporins – controls permeability levels

EXAMPLE: Comparison of water movement in hypertonic, isotonic, and hypotonic solutions



PRACTICE

1. Which of the following describes the diffusion of water across a membrane?
   a. Simple Diffusion
   b. Facilitated Diffusion
   c. Osmosis
   d. Uniporters

2. True or False: The plasma membrane by itself is impermeable to all charged molecules.
    a. True
    b. False

3. Which of the following transport proteins transports two molecules across the membrane in the same direction?
    a. Uniport
    b. Symport
    c. Antiport
    d. Biport

4. True or False: Carrier proteins that transport molecules via facilitated diffusion require energy from ATP.
    a. True
    b. False

5. Isotonic is a term that describes what?
    a. The cytoplasmic side of a membrane has a higher solute concentration
    b. The extracellular side of a membrane has a higher solute concentration
    c. Both sides of a membrane have equal solute concentrations