Membrane Transport

Diffusion:

- Solution=solvent(water) and solute (dissolved molecules)
- Due to random movement (thermal energy), solute molecules will show net movement from region of high concentration to a region of low concentration; solute moves down the concentration gradient
- Rate of diffusion:
  - Increases with temperature
  - Increases with concentration gradient
  - Increases with surface area of membrane
  - Decreases with distance
- If solute molecules can penetrate the membrane then diffusion can occur across the membrane
  - Lipids, small gas molecules, ions through protein channels in membrane, nonpolar molecules

Osmosis:

- Diffusion of water across a semipermeable membrane; through aquaporin channels in plasma membrane
- Water moves from low solute concentration solution to high solute concentration solution(water diffuses from high water concentration to low water concentration)
- Water will diffuse by osmosis across the membrane until solute concentration is the same on both sides of the membrane
- Osmotic pressure: how strongly a concentrated solution pulls water by osmosis across the membrane
  - Pure water=0
  - Equal osmotic concentration=isotonic
  - Less concentrated=hypotonic
  - More concentrated=hypertonic

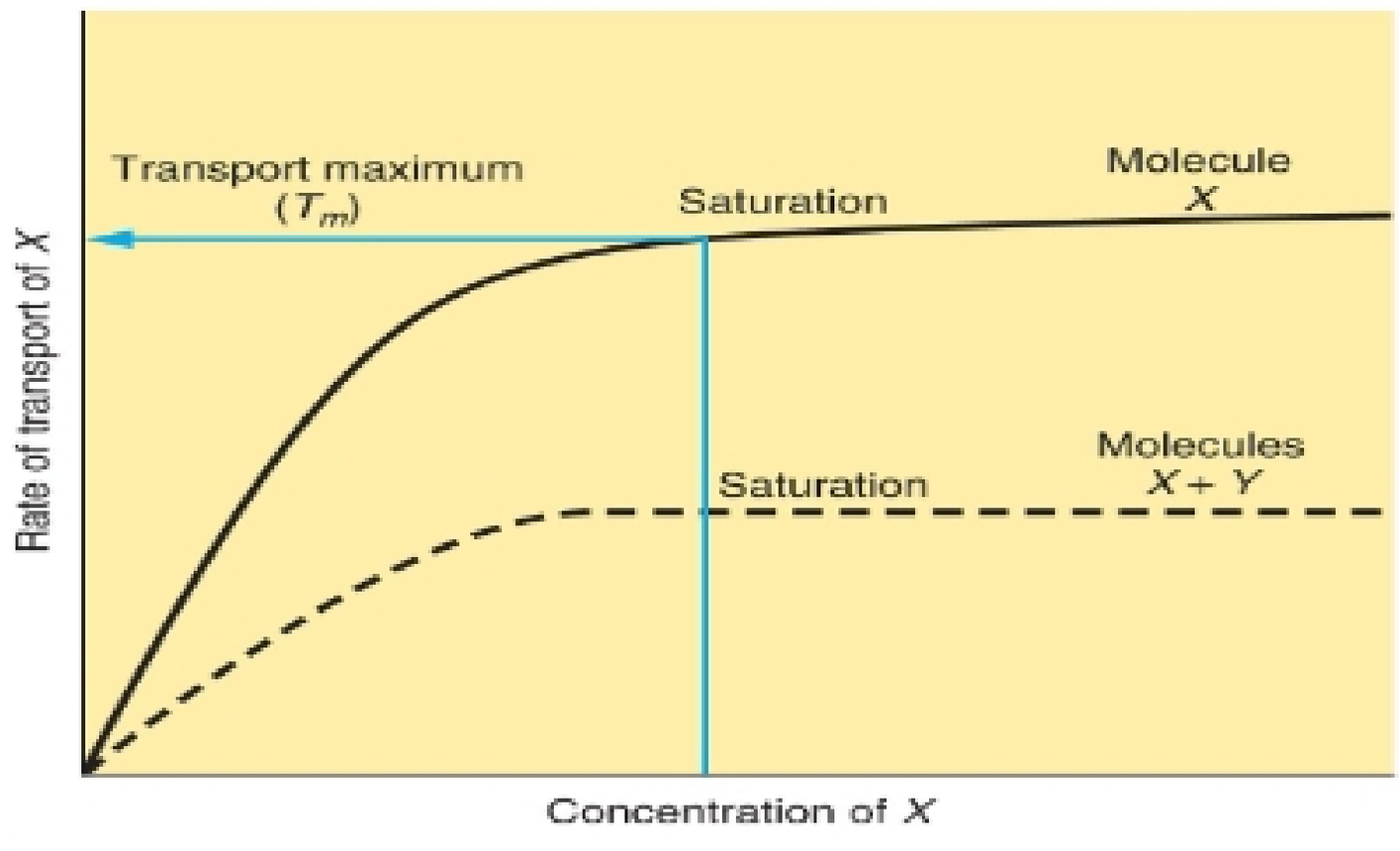
- If pure water moves into the cell, it will cause the cell to swell and burst (lyse)

Osmolality vs molality

- Molality is the number of compound molecules per liter of water
- Osmolality is the number of solute particles per liter

Carrier-Mediated Transport Mechanisms:

- Mediated by carrier proteins that span the plasma membrane
- Properties:
    - Specificity for a specific molecule
    - Limited number of transporters can be saturated, with a max transport rate
    - Closely related molecules can compete to transporters on the cell surface



- Facilitated diffusion:
    - Transported molecule is moved down its concentration gradient
    - Doesn't require extra energy from the cell
    - Because facilitated diffusion requires using a limited number of transporters, transport can be regulated by increasing or decreasing the number of transporters
- Primary active transport:

    - Membrane carrier protein is an ATPase that breaks down ATP to release energy
    - Energy is used to transport molecule against its concentration gradient(up the gradient will require energy)
    - Ca2+ ATPase pump: hydrolysis of ATP and release of ADP causes conformational change in transporter, releasing Ca2+ outside the cell (moves calcium from low to high)
    - If you run out of ATP the transport will no longer take place
- Coupled active transport:
    - Cell uses energy to establish steep concentration gradient for molecule 1
    - Co-transporter allows molecule 1 to move down concentration gradient
    - Couples energy of first molecule to co-transport molecule 2 up its gradient
    - Most cells maintain a steep Na+ and K+ gradient across their membranes
    - Na+/K+ ATPase pump:
        - 3 Na+ ions bind to inside of carrier protein
        - ATP is hydrolyzed
        - Release of ADP moves 3 Na+ to outside of cell
        - Release of Pi moves 2 K+ to inside of cell
    - Cotransport/ symport: both molecules move in the same direction
    - Countertransport/ antiport: molecules move in opposite directions