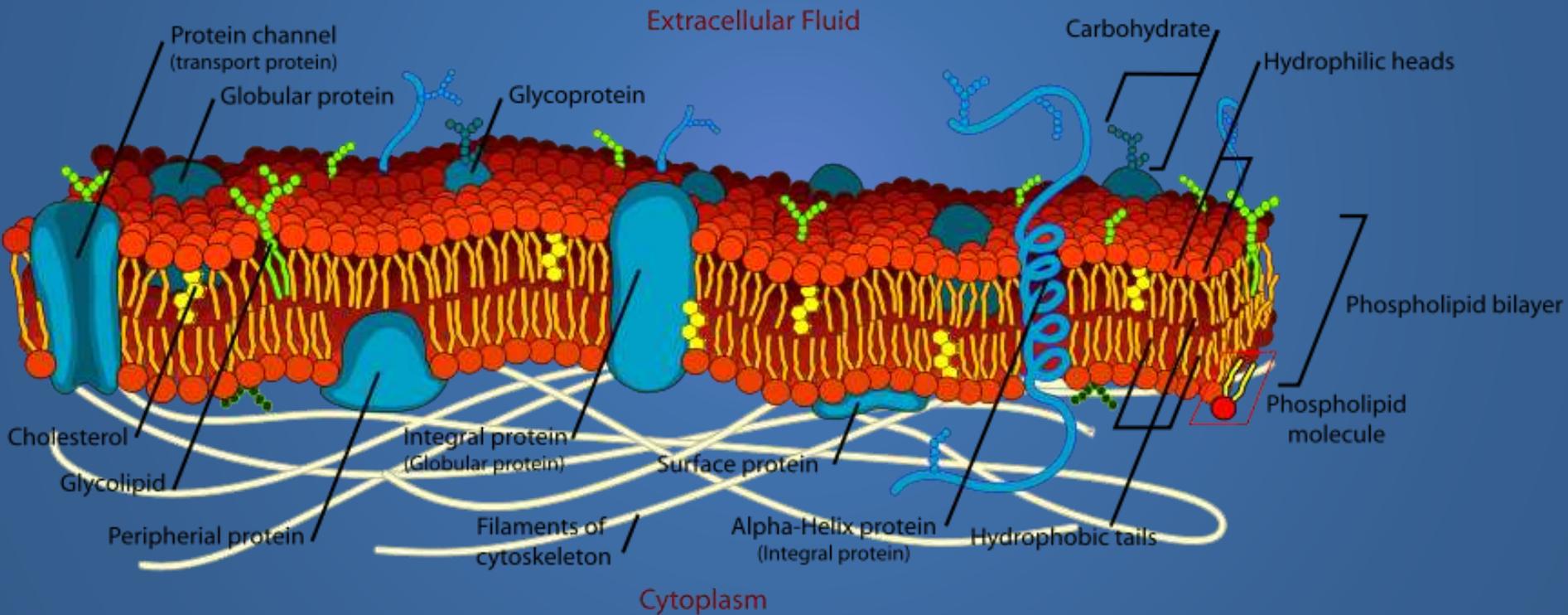


Cell Membrane and Membrane Transport

Plasma Membrane

- **Function**
 - Separate cell from environment
 - Transport substances in and out of cell
 - Receive and respond to stimuli
- **Properties**
 - Hydrophobic and hydrophilic
 - Selectively permeable
- **Structure**
 - Fluid Mosaic Model
 - Lipid bi-layer – phospholipids (75%), cholesterol (20%), glycolipids (5%)

Structure of Plasma Membrane



Fluid Mosaic Model

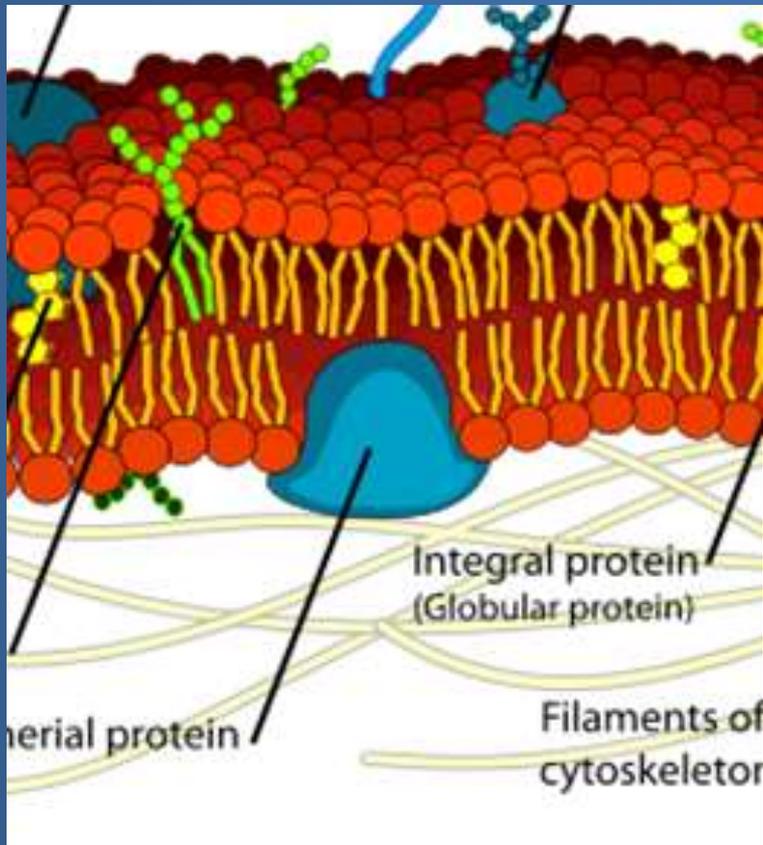


Functions of Membrane Proteins

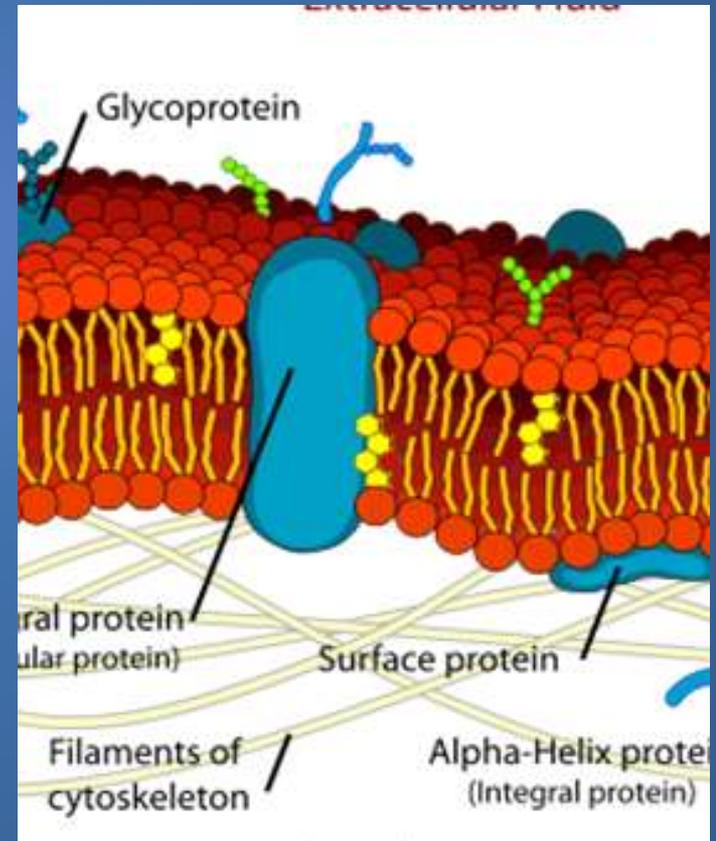
- Can be peripheral or integral
- **Ion channels** – allow flow of ions in and out of cell
- **Carriers** – selectively move POLAR substances across membrane (transporters)
- **Receptors** – specific to various molecules
 - Ligand – substance that binds to receptor
- **Linkers** – help anchor cells together by bonding proteins or filaments together
- **Cell-Identity Markers** – mainly glycoproteins and glycolipids
 - Recognize other similar cells in tissue formation
 - Recognize foreign cells (ABO blood types)

Membrane Structure and Function

Peripheral



Integral



Membrane Permeability

- **Selectively Permeable** – only some substances can pass across membrane
 - **Permeable** - Nonpolar, uncharged molecules
 - Oxygen, Carbon dioxide, steroids
 - **Non-Permeable** – Ions, large polar molecules
 - **Slightly Permeable** – small uncharged polar molecules
 - Water, urea

Membrane Transport

- **Passive Transport** – Does NOT require energy
 - Substance moves down concentration/electrical gradient
 - Moves from HIGH concentration to LOW concentration
 - Brownian Motion
- **Active Transport** – Uses energy to get substances across membrane
 - Moves AGAINST concentration gradient
 - Endo/Exocytosis – use of vesicles to transport substances in or out of cell

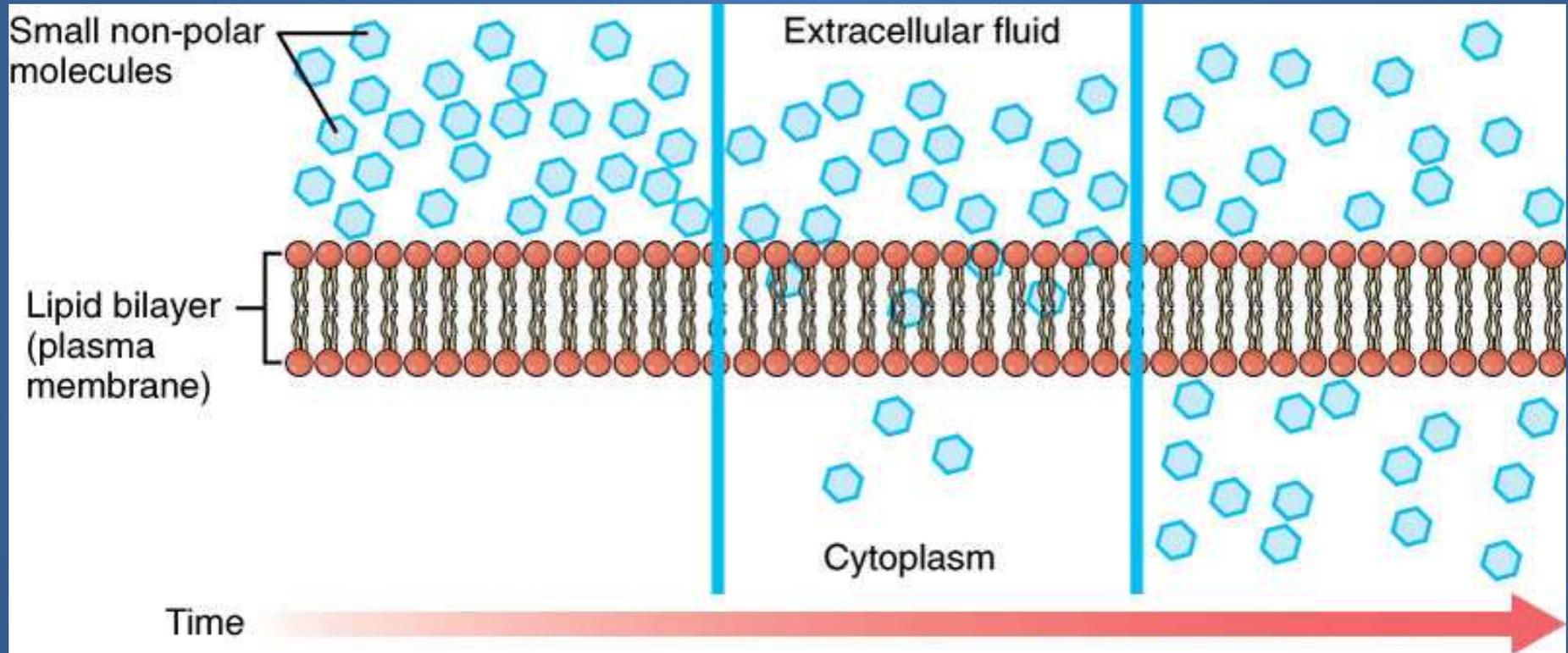
Membrane Transport - Diffusion

- Movement of substances down a concentration gradient
 - Steepness of concentration gradient
 - Temperature
 - Mass of diffusing substance
 - Surface area diffusing across
 - Diffusion distance

Membrane Transport – Types of Diffusion

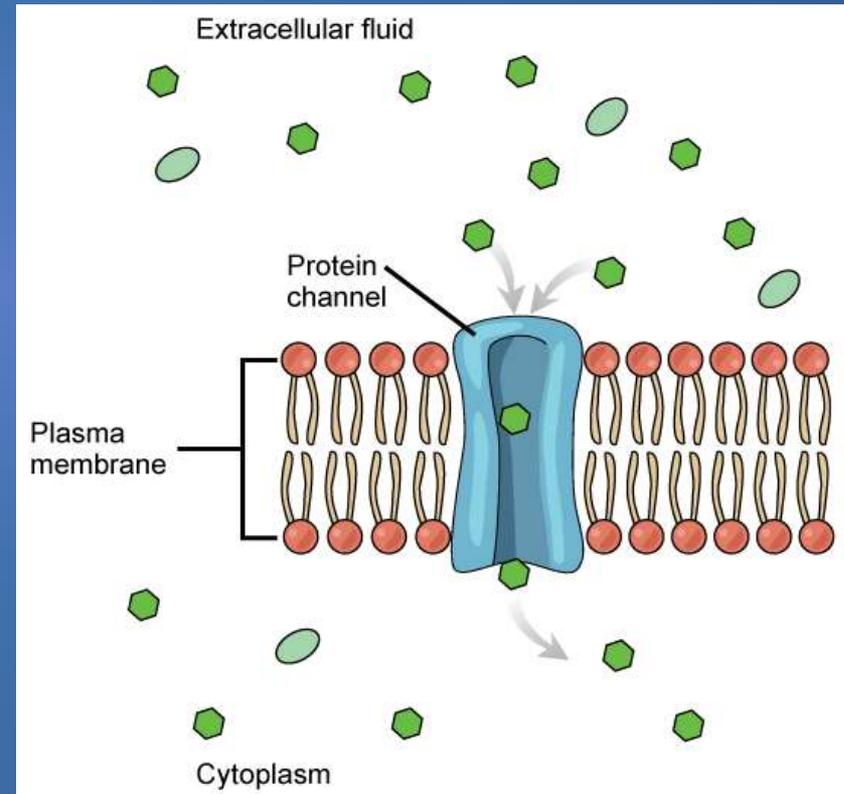
- **Simple Diffusion** – substances move FREELY across cell membrane (important for wastes and gas exchange)
 - Nonpolar, hydrophobic, small uncharged polar – oxygen, CO₂, N gases, fatty acids, steroids, fat soluble vitamins, water, urea, small alcohols
- **Facilitated Diffusion** – using a membrane protein to “hitch” a ride across membrane
 - Too polar or highly charged

Membrane Transport – Simple Diffusion



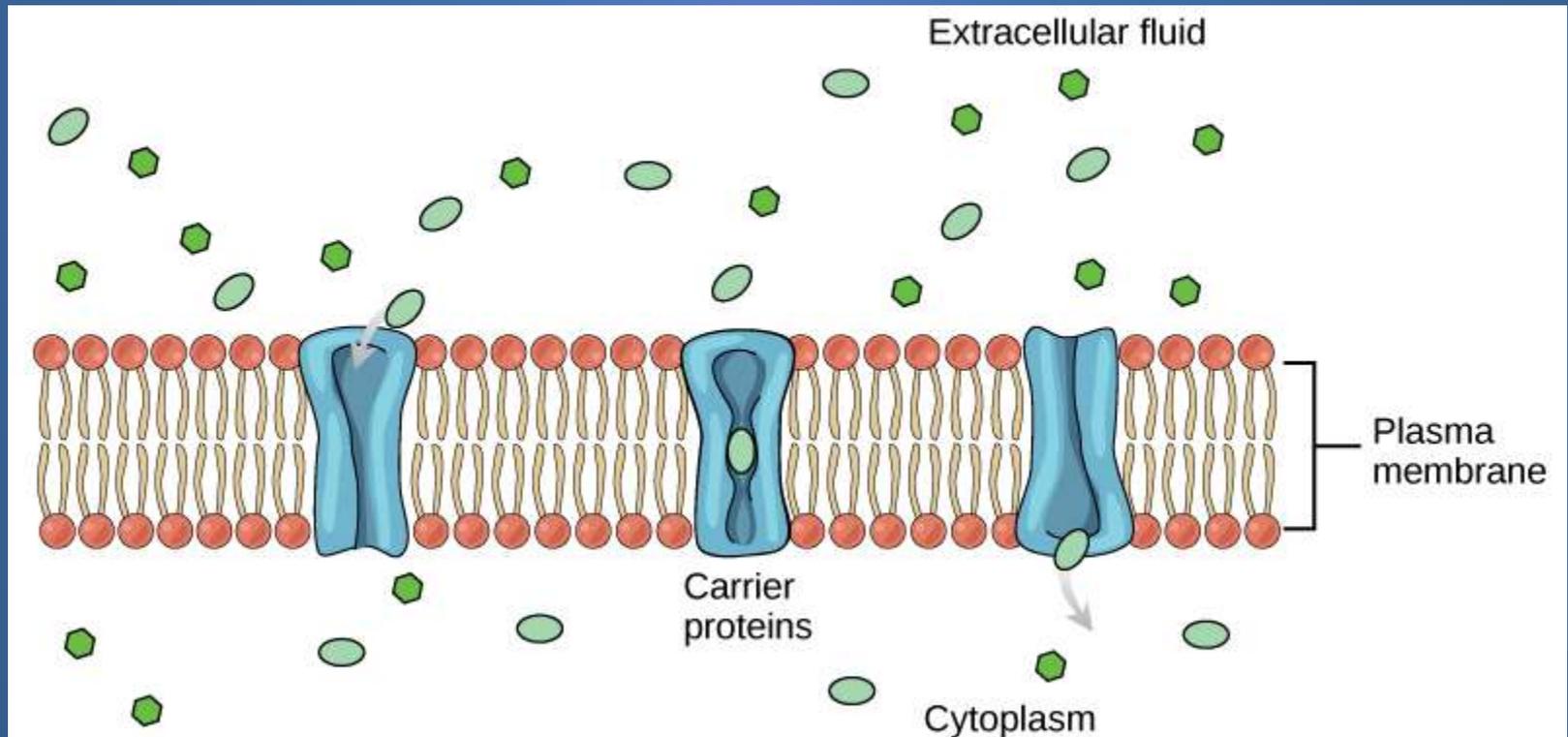
Membrane Transport – Types of Facilitated Diffusion

- **Channel Mediated** –
moves down
concentration
gradient THROUGH a
channel protein (ion
channel)



Membrane Transport – Types of Facilitated Diffusion

- **Carrier Mediated** – moves down concentration gradient ON a carrier protein
 - Glucose, fructose, some vitamins



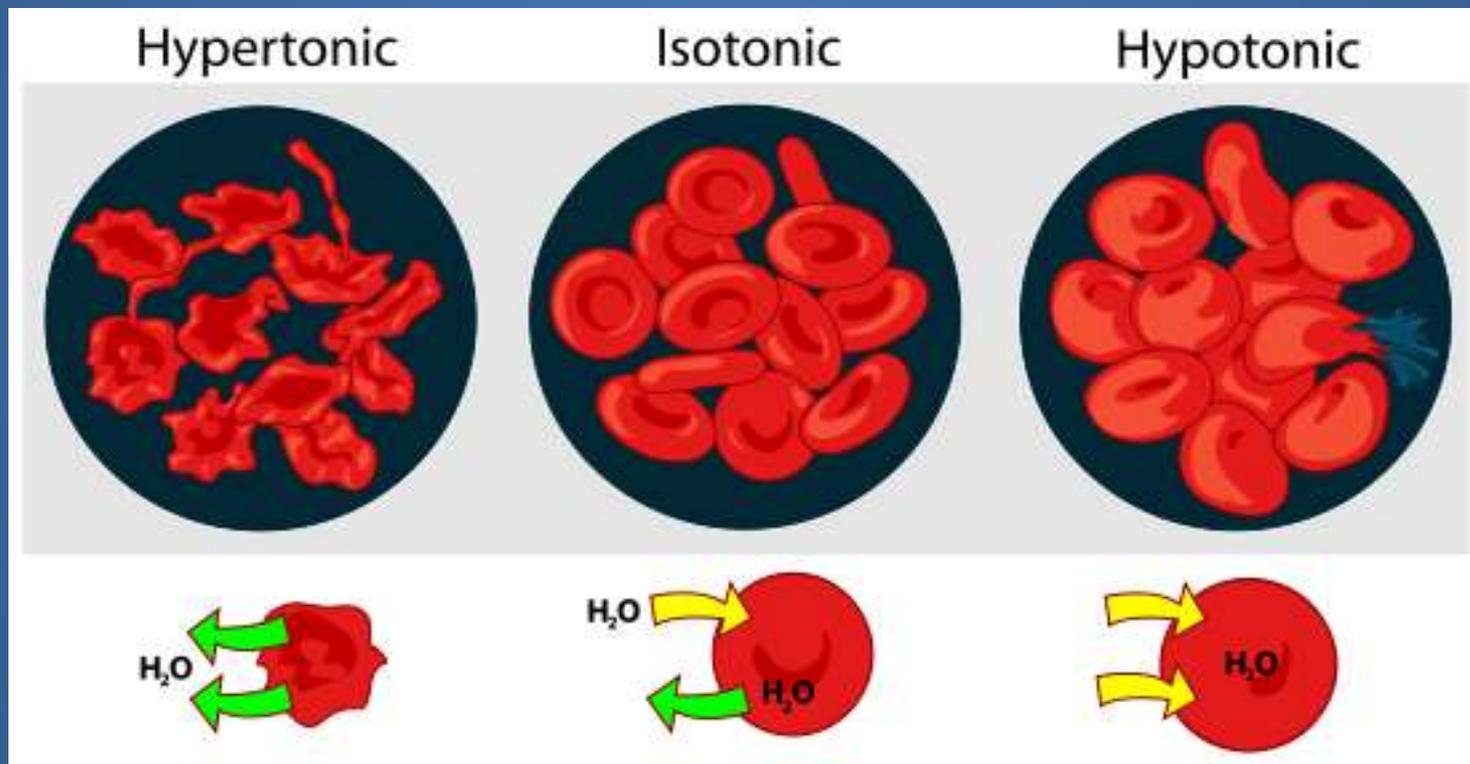
Membrane Transport – Osmosis

- **Osmosis** – special type of passive diffusion
 - Water moves from high to low concentration
 - So.....low solute to high solute concentration
- Water can move in 2 different ways
 - 1. between lipid molecules
 - 2. through aquaporin channels (integral proteins)
- Water moves until equilibrium reached on both sides of membrane
 - Uses hydrostatic and osmotic pressure

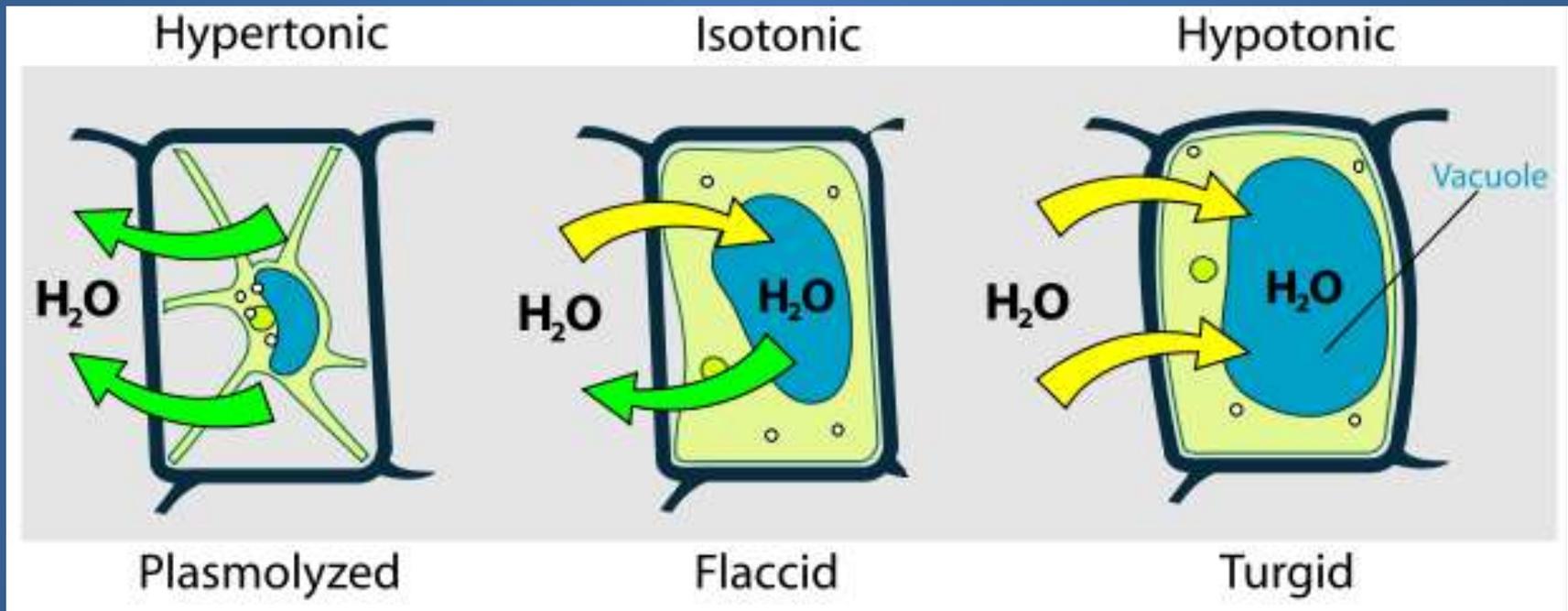
Membrane Transport - Osmosis

- **Solution Tonicity** – measure of solution's ability to change volume of cells by changing water content.
 - **Isotonic** – Same amount of water on both sides of membrane
 - **Hypotonic** – more water, less solutes
 - **Hypertonic** – less water, more solutes

Membrane Transport – Osmosis in Animal Cells



Membrane Transport – Osmosis in Plant Cells

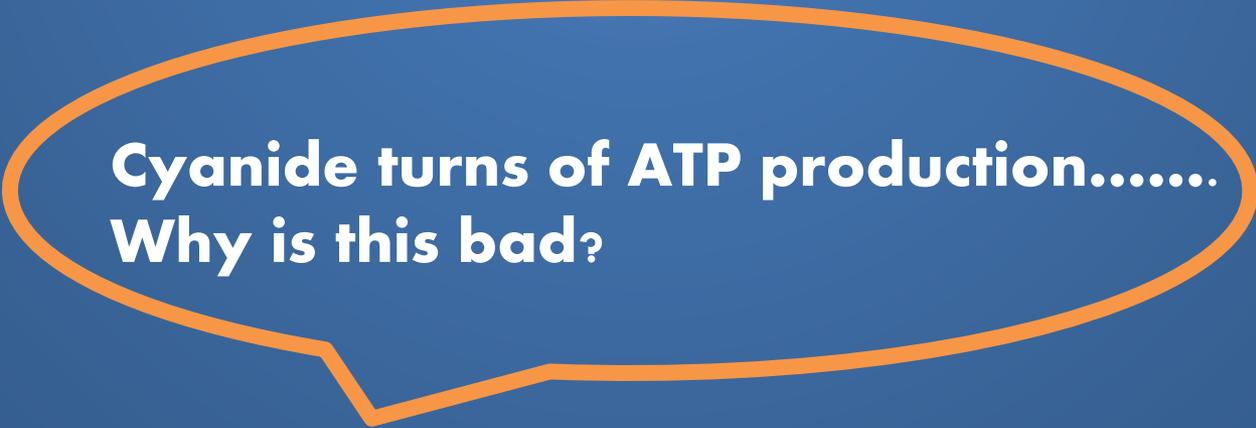


Membrane Transport – Active Transport

- **Active Transport** – movement of molecules across membrane AGAINST concentration gradient requiring energy
 - Sources of Energy
 - Hydrolysis of ATP
 - Energy stored in ionic concentration gradient (secondary active transport)
 - Ions, amino acids, monosaccharides

Membrane Transport – Primary Active Transport

- Energy from ATP changes shape of carrier protein
 - Use 40% of your ATP for this
- Carrier proteins = Pumps
- Sodium-Potassium Pump



**Cyanide turns off ATP production.....
Why is this bad?**

Membrane Transport – Secondary Active Transport

- Co-Transport
- Uses energy stored in Na^+ or H^+ gradient used to drive another substance across membrane
- When carrier protein binds to Na^+ or H^+ will bind to another substance and carry across membrane



What important process uses a proton gradient?

Membrane Transport – Bulk Transport

- Use of membrane bound vesicles to bring substances in and expel
- **Endocytosis** – Bringing materials into cell
 - **Phagocytosis** – solid materials
 - **Pinocytosis** – non-specific fluid
 - **Receptor-Mediated** – specific materials
- **Exocytosis** – Releasing materials from cell