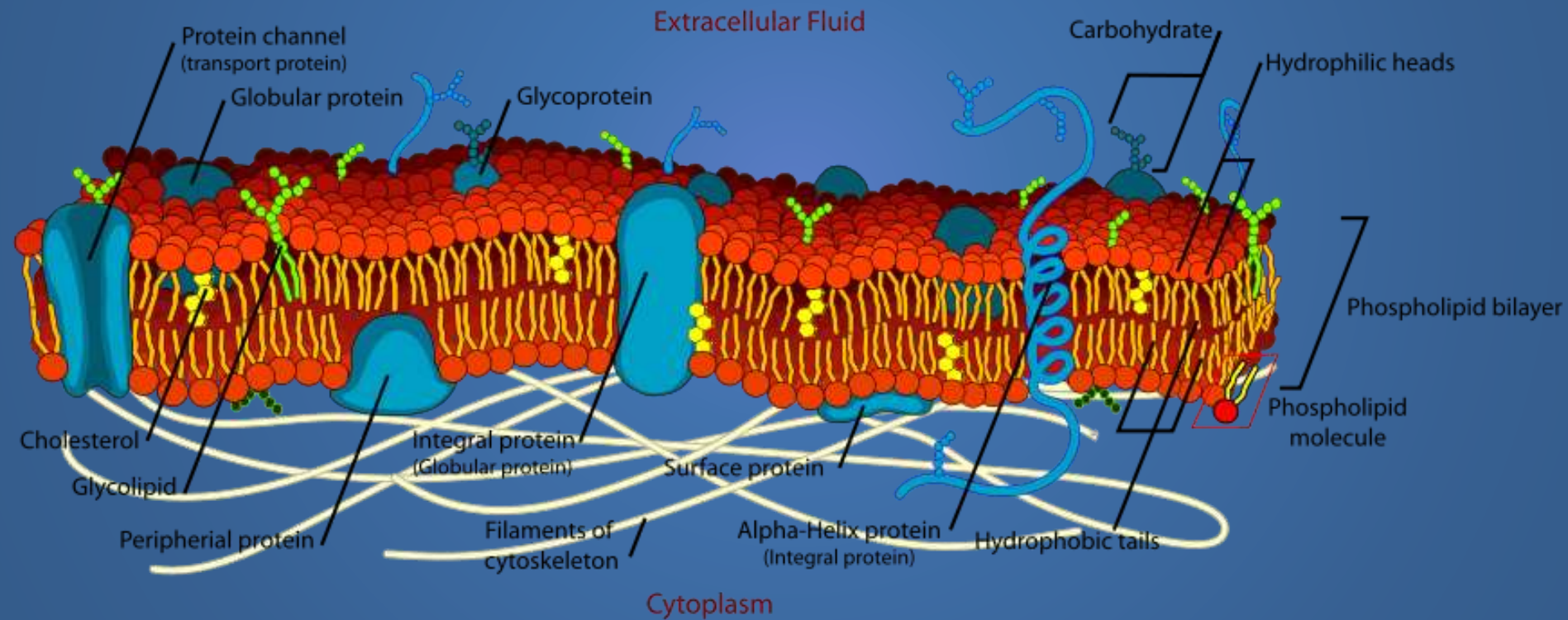


# **Cell Membrane and Membrane Transport**

# 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

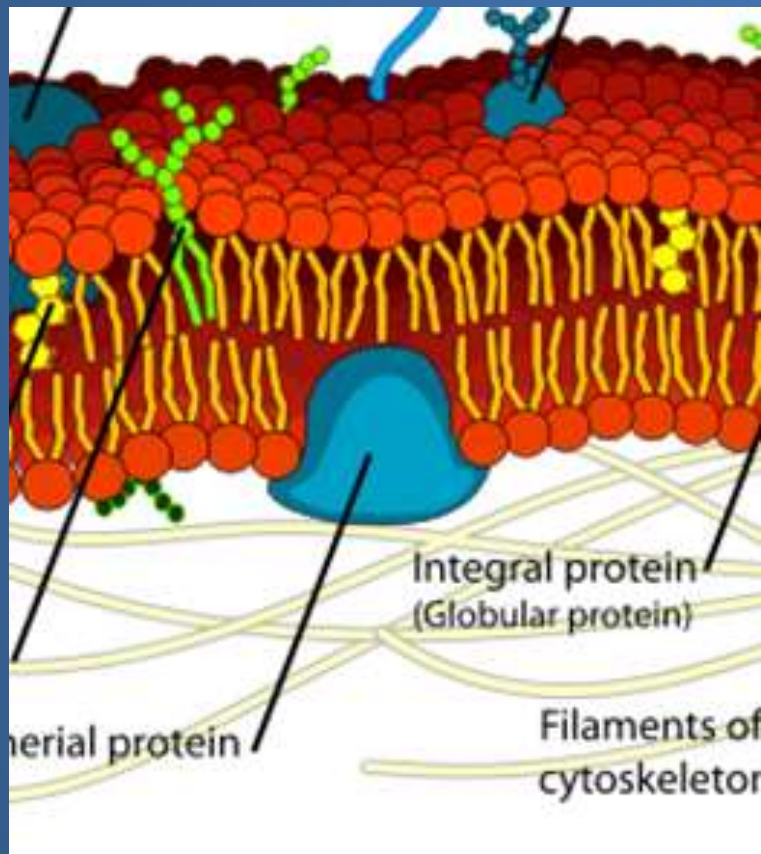


# Functions of Membrane Proteins

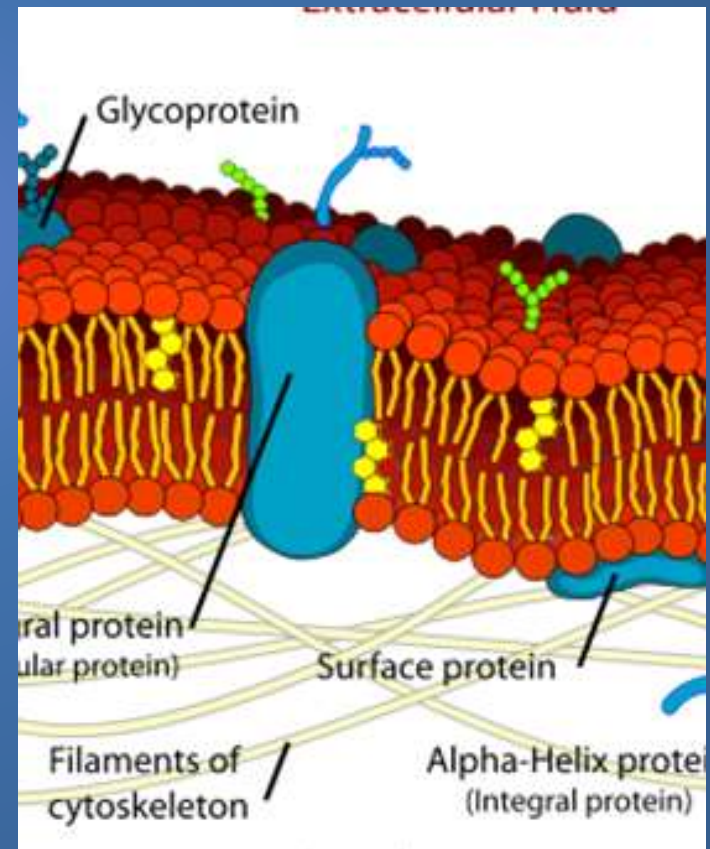
- Can be peripheral or integral
- **Ion channels** – allow flow of ions in and out of cell
- **Carriers** – selectively move POLAR substances across membrane (transporters)
- **Receptors** – specific to various molecules
  - Ligand – substance that binds to receptor
- **Linkers** – help anchor cells 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

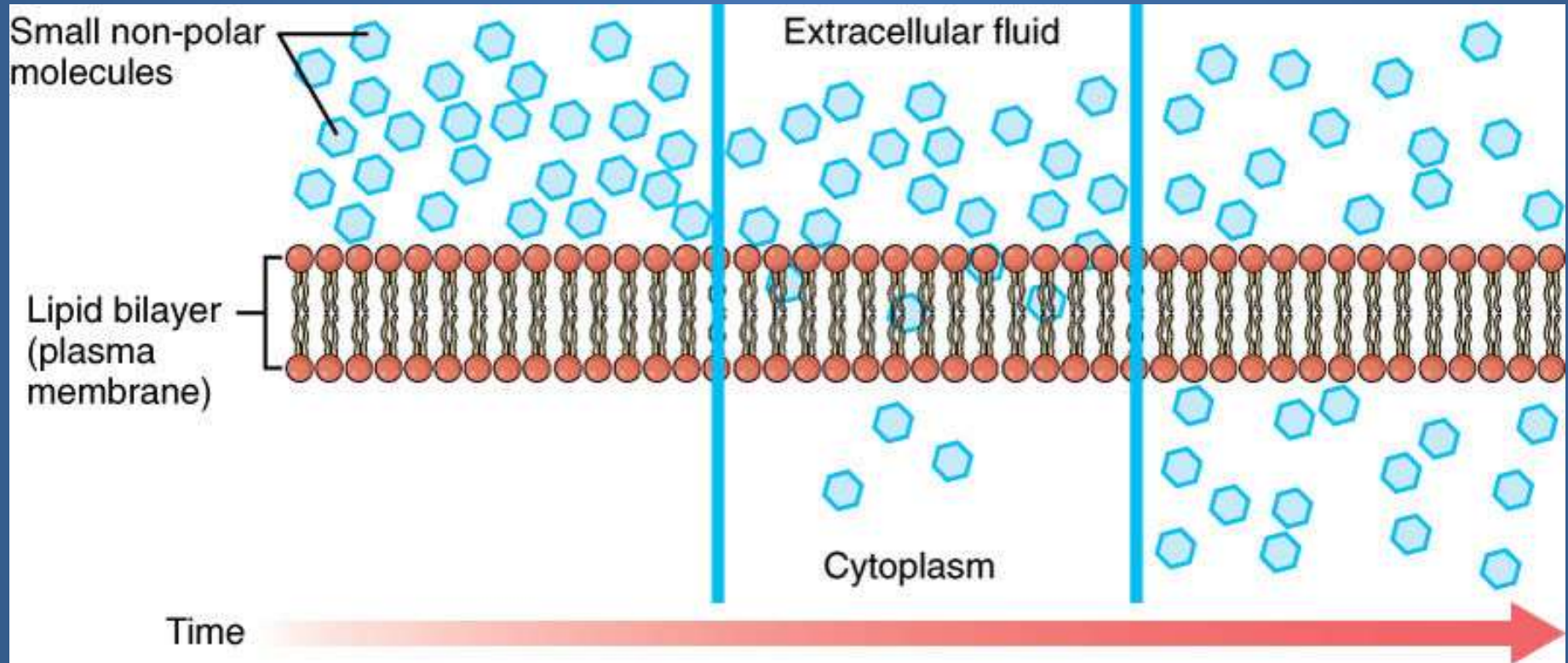
# Membrane Transport - Diffusion

- 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

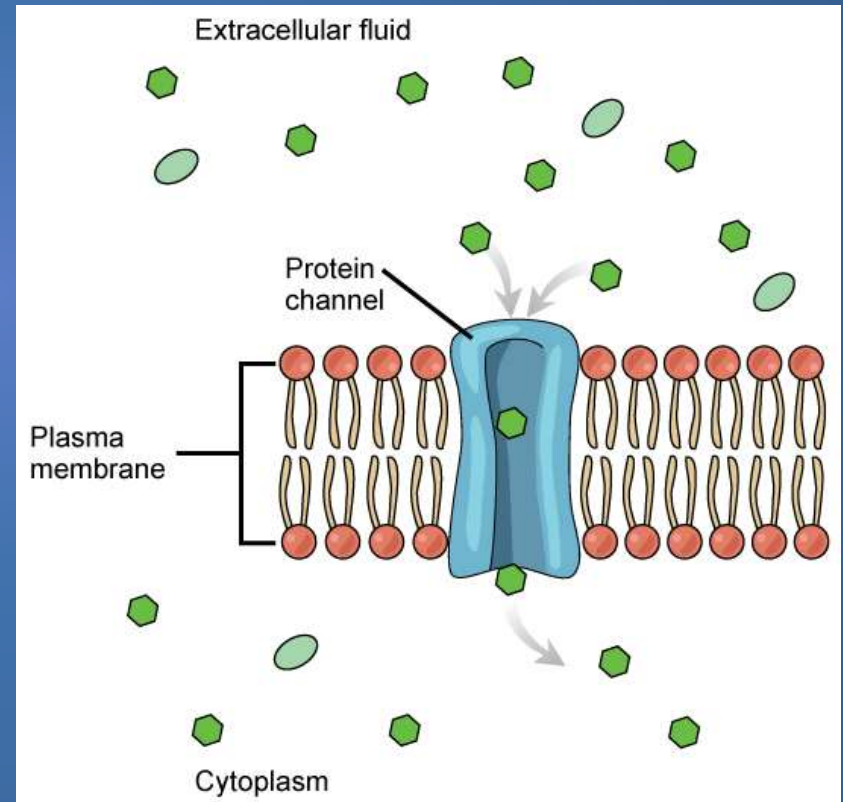
- **Simple Diffusion** – substances move FREELY across cell membrane (important for wastes and gas exchange)
  - Nonpolar, hydrophobic, small uncharged polar – oxygen, CO<sub>2</sub>, N gases, fatty acids, steroids, fat soluble vitamins, water, urea, small alcohols
- **Facilitated Diffusion** – using a membrane protein to “hitch” a ride across membrane
  - Too polar or highly charged

# Membrane Transport – Simple Diffusion



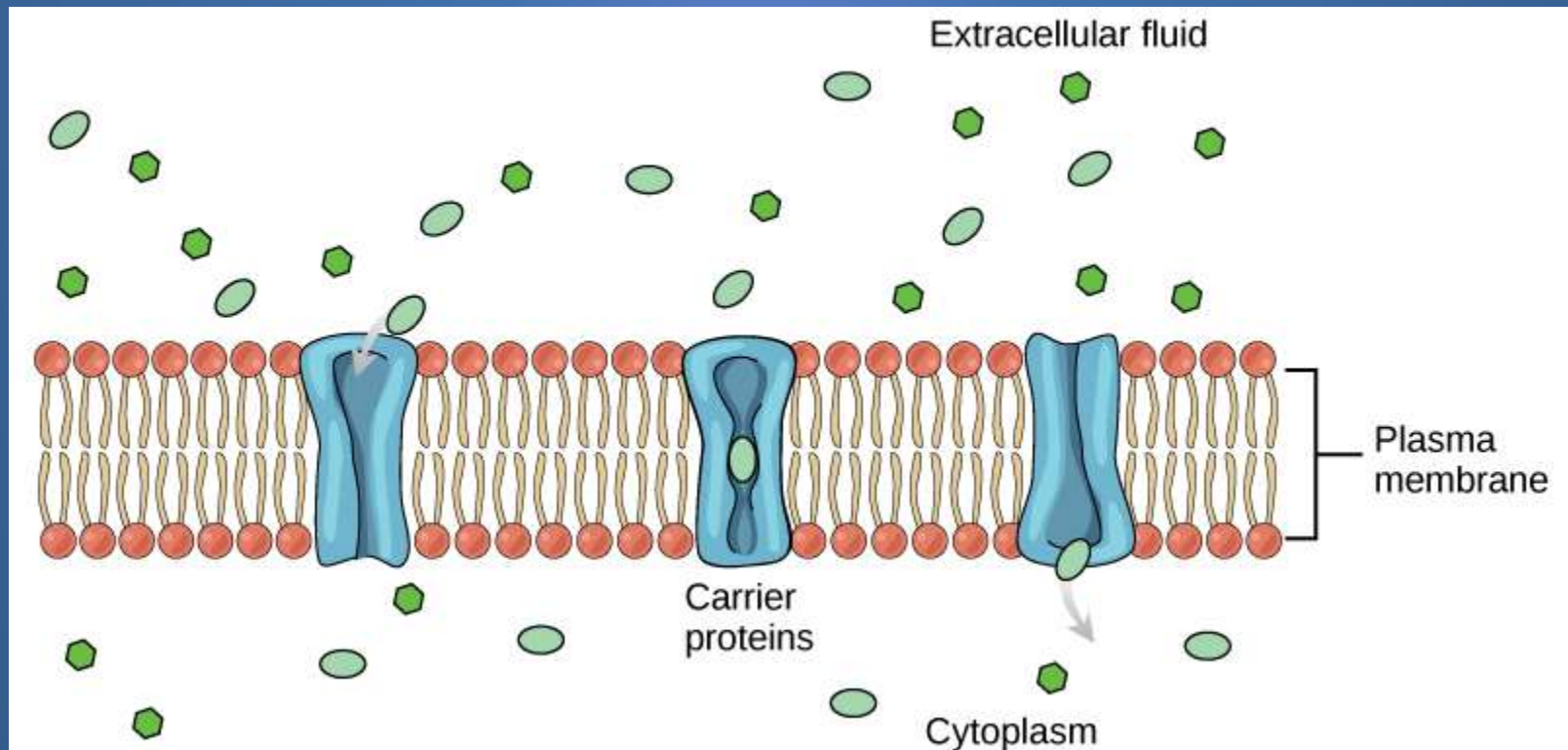
# Membrane Transport – Types of Facilitated Diffusion

- **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



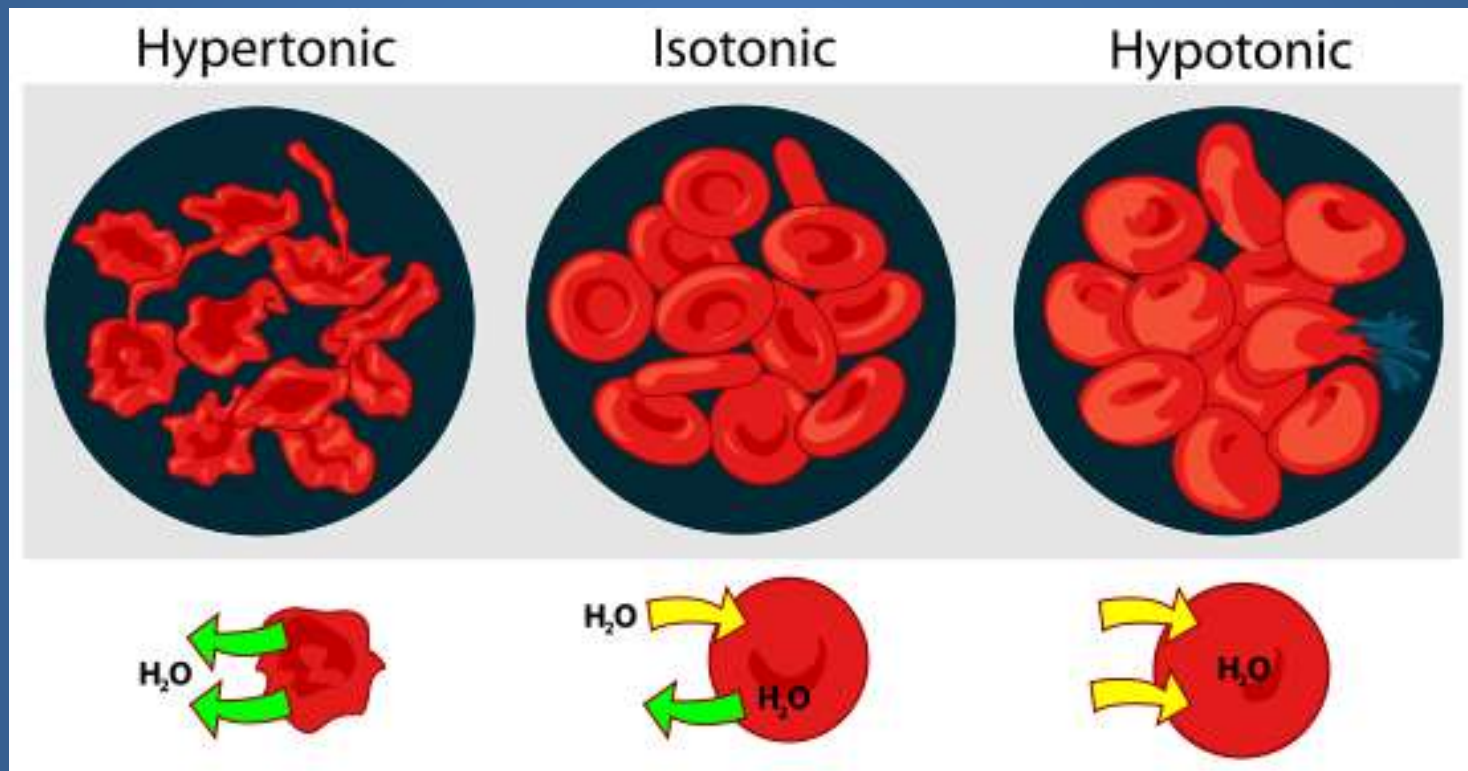
# Membrane Transport – Osmosis

- **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

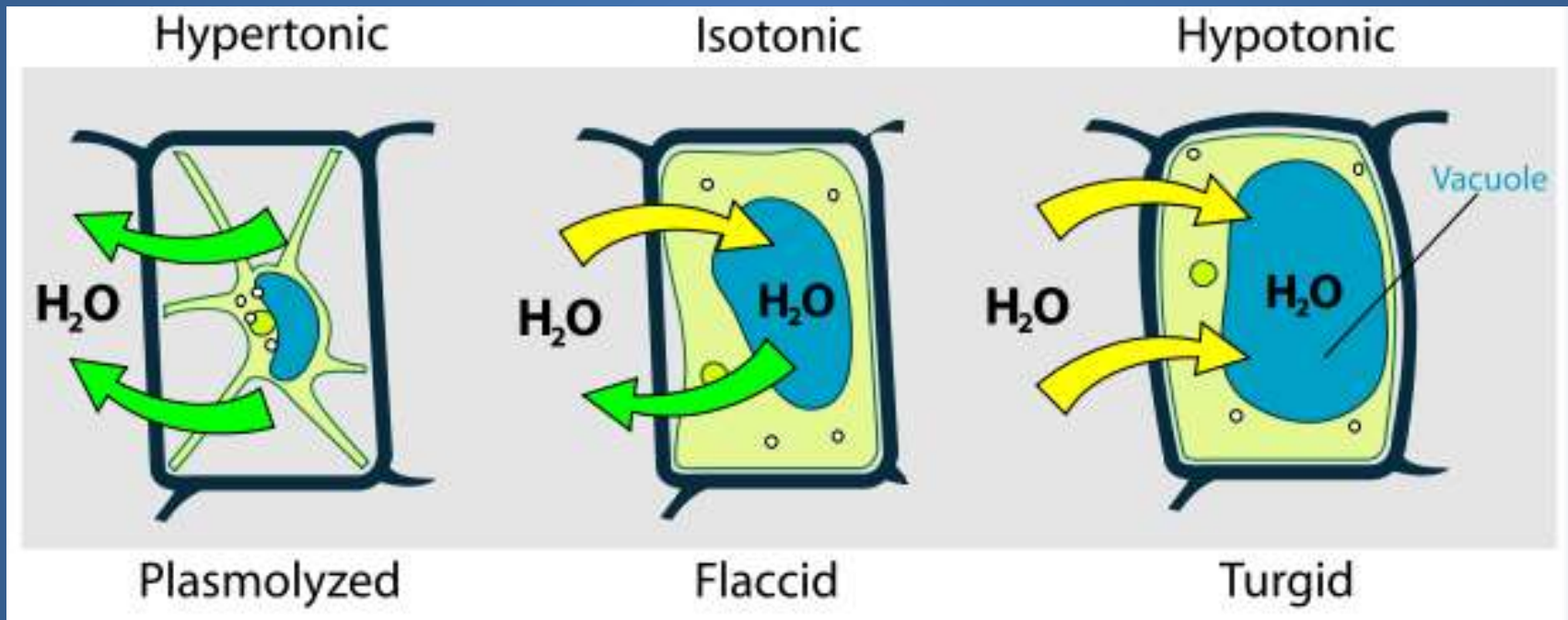
# Membrane Transport - Osmosis

- **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  $\text{Na}^+$  or  $\text{H}^+$  gradient used to drive another substance across membrane
- When carrier protein binds to  $\text{Na}^+$  or  $\text{H}^+$  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