Cell Transport

Cells need to communicate with other cells and transport materials to keep the cell alive

Cell Membrane

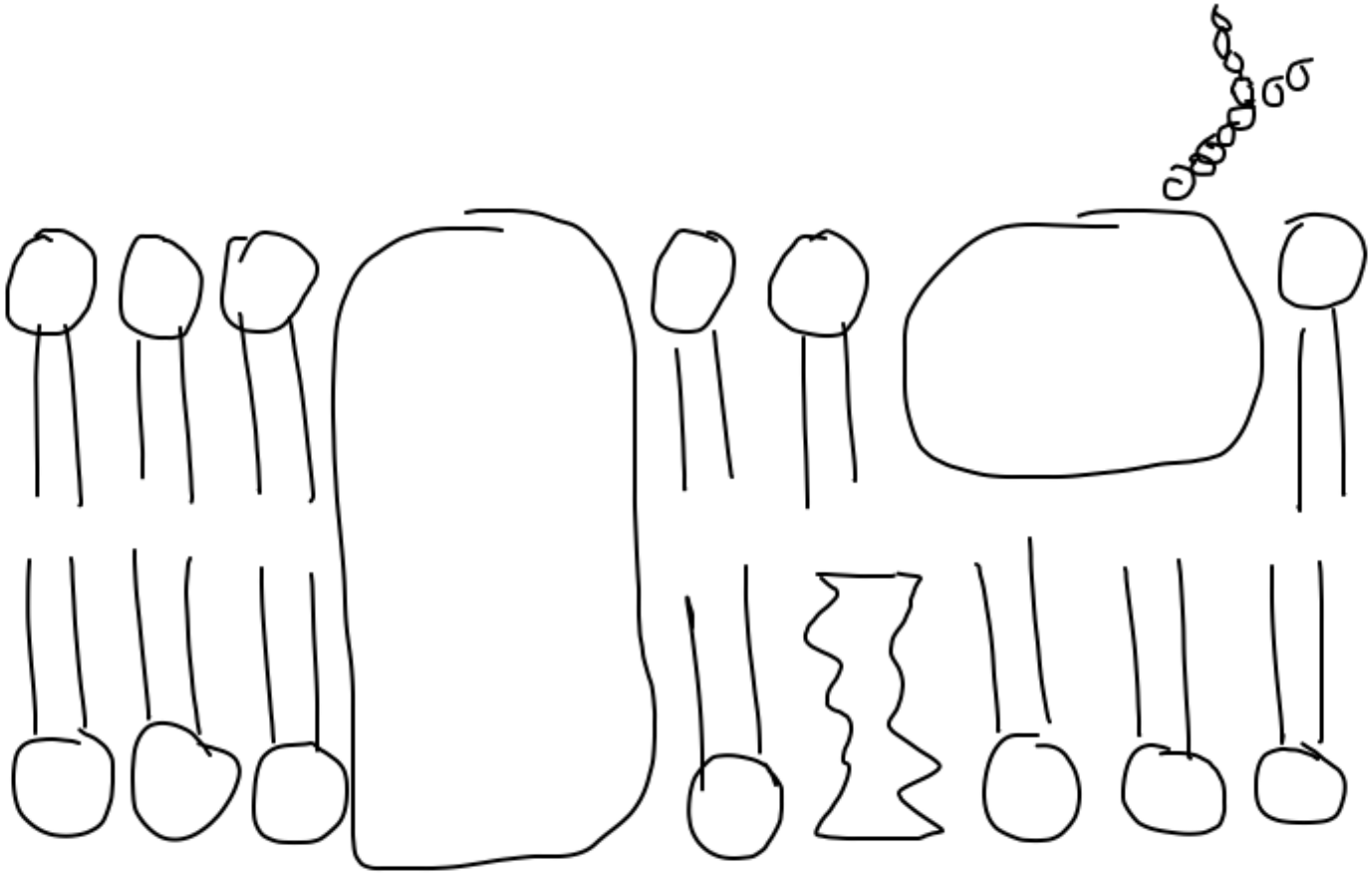
- Function = allows materials into and out of the cell
- Structure:
  - 2 main parts: proteins and phospholipids
  - Receptor proteins = site of attachment for molecules
  - Transport proteins = moves materials through the membrane

- Phospholipid = 2 layers that create the boundary of the cell
  - Head – polar side that is attracted to water (hydrophilic)
  - Tail – 2 fatty acid chains that are nonpolar (hydrophobic)

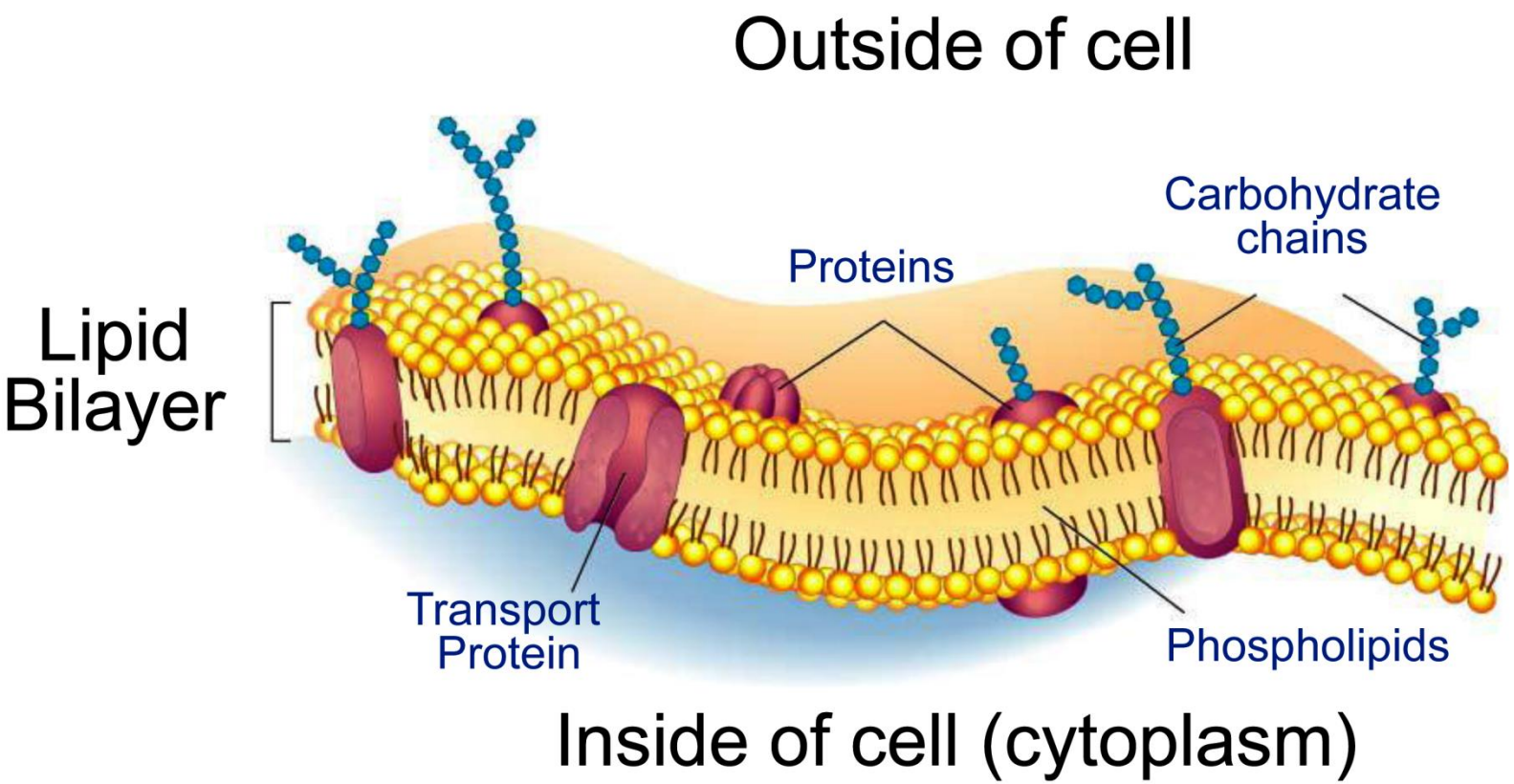
- Cholesterol = helps keep membrane fluid

- Carbohydrates = attached to phospholipid and receptor proteins to help bind materials outside the cell

- Fluid Mosaic Model = phospholipids and proteins move freely throughout the membrane in a fluid-like motion



Structure of the Cell Membrane



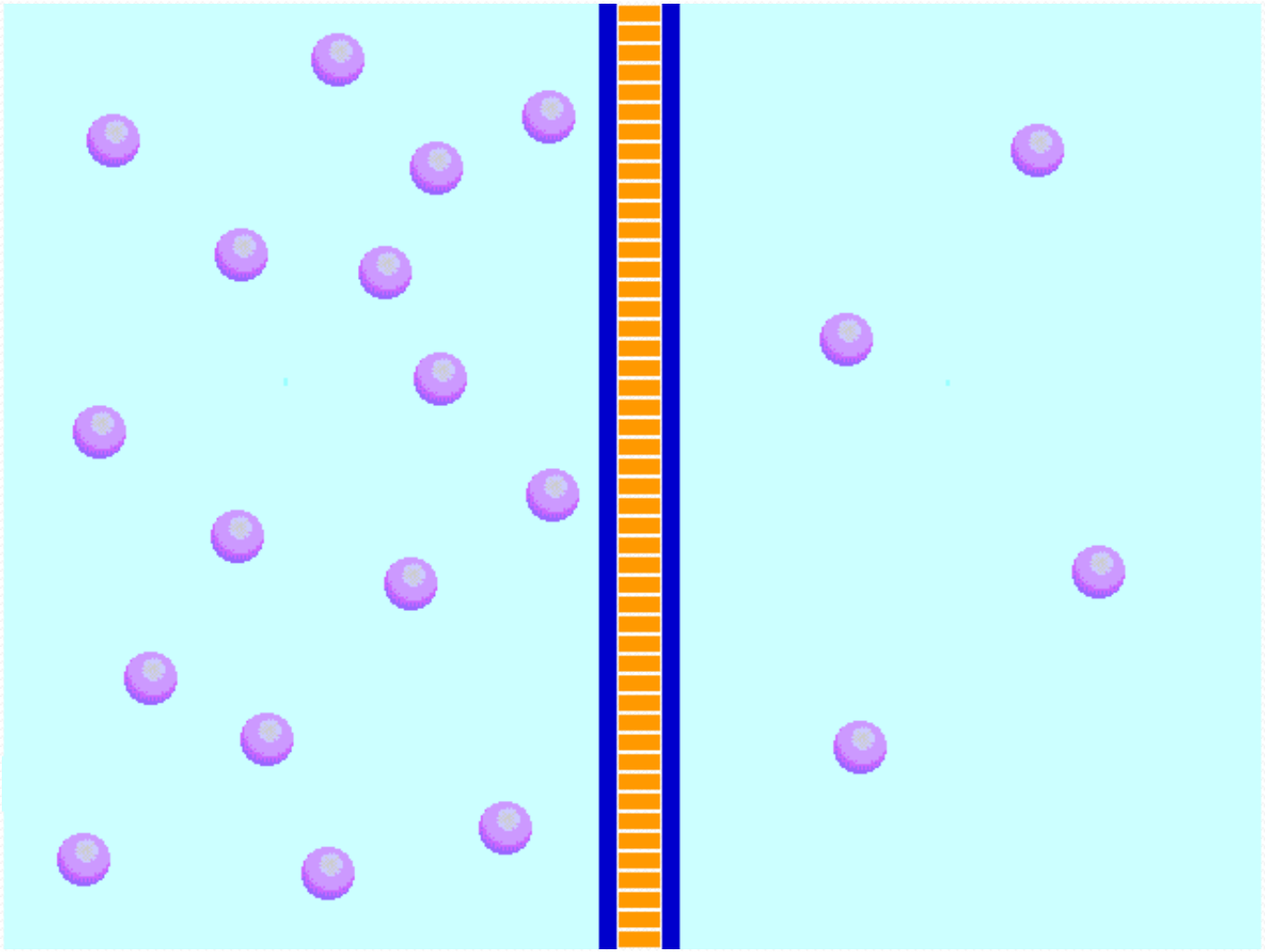
Vocabulary

- Equilibrium = a state where the concentration of substances are the same across a membrane

- Concentration gradient = a difference in the concentration of a substance across a distance

Vocabulary

- Selective Permeability = allowing certain substances in and out of a cell but not others



Passive vs Active Transport

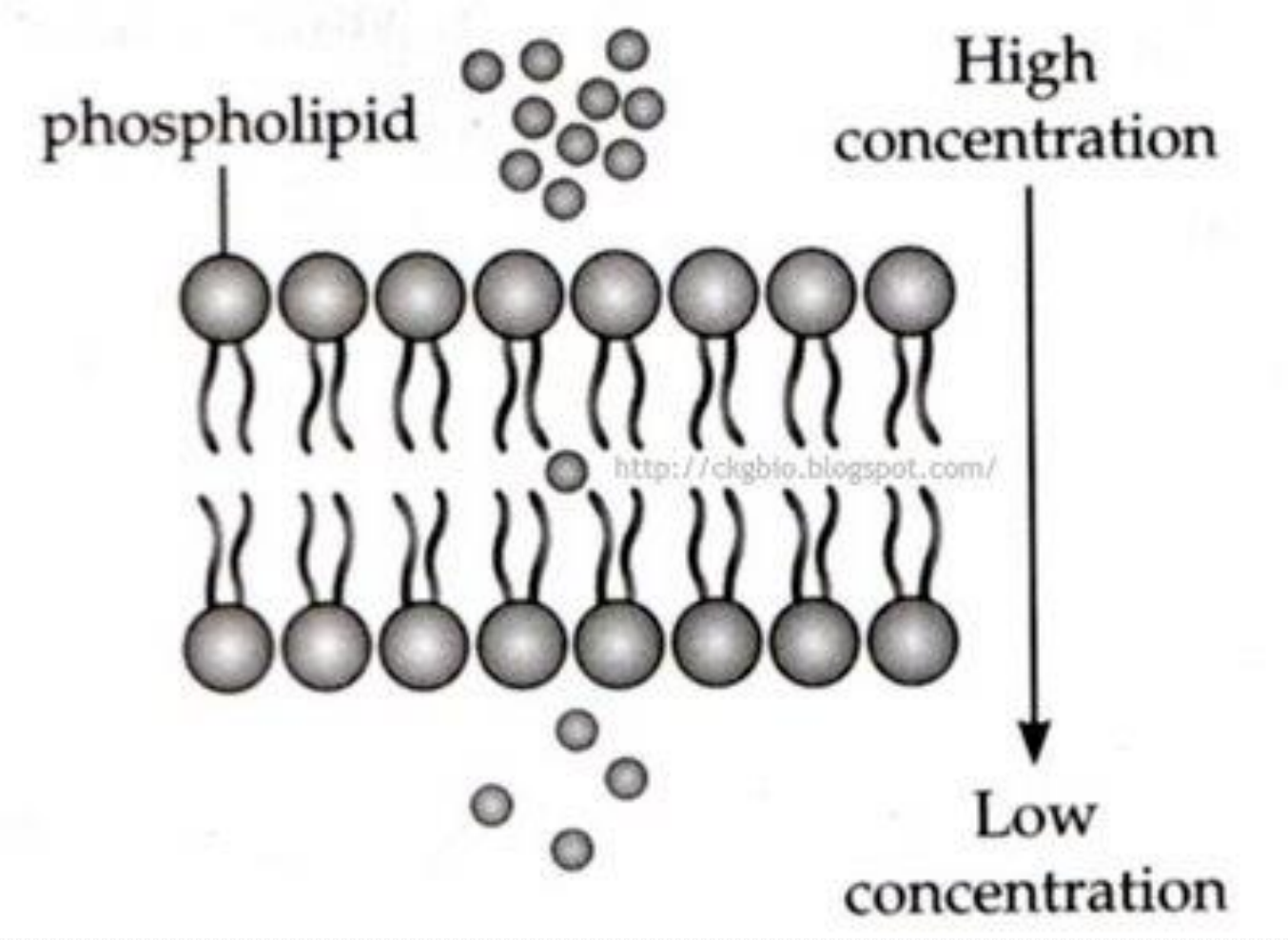
- Passive
  - No energy required
  - Molecules move from high to low concentrations
  - DOWN the concentration gradient towards equilibrium

- Active
  - Uses energy
  - Molecules move from low to high concentrations
  - AGAINST the concentration gradient

Methods of Passive Transport

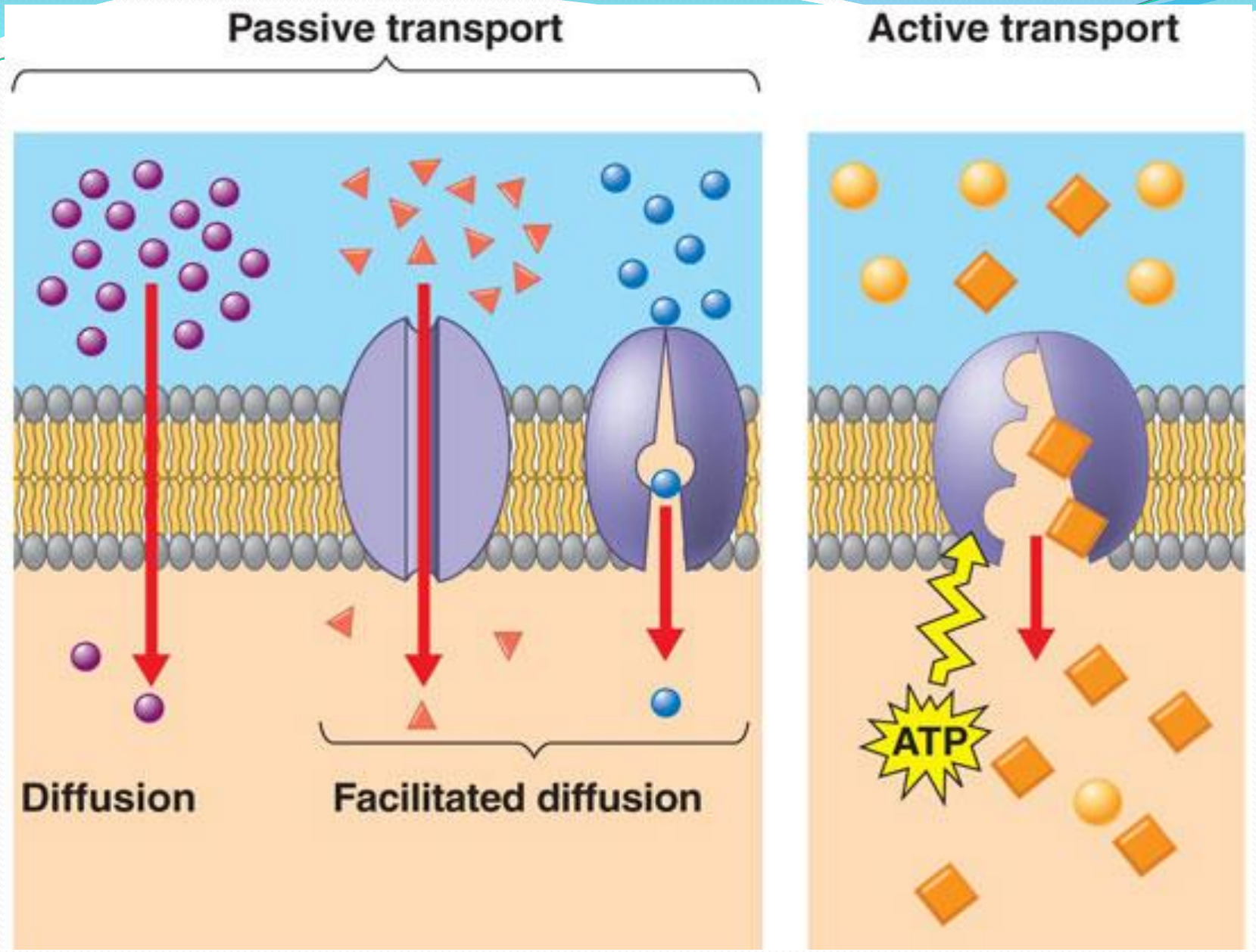
- Diffusion
  - Transports small, nonpolar molecules
    - Nonpolar = lacks a positive or negative charge on the molecule
  - Ex: CO_2 and O_2
  - Does not need a protein to move the molecules

- Osmosis
  - Transports water (H_2O) across a membrane


phospholipid
High concentration
Low concentration
http://ckgbio.blogspot.com/

Methods of Passive Transport

- Facilitated Diffusion
  - Transports larger molecules than diffusion and charged or polar molecules
  - Ex: amino acids, Ca^{2+}, Cl^{-}
  - Requires a protein to move molecules


Passive transport
Active transport
Diffusion
Facilitated diffusion
ATP

Types of Solutions or Environments that Cause Osmosis

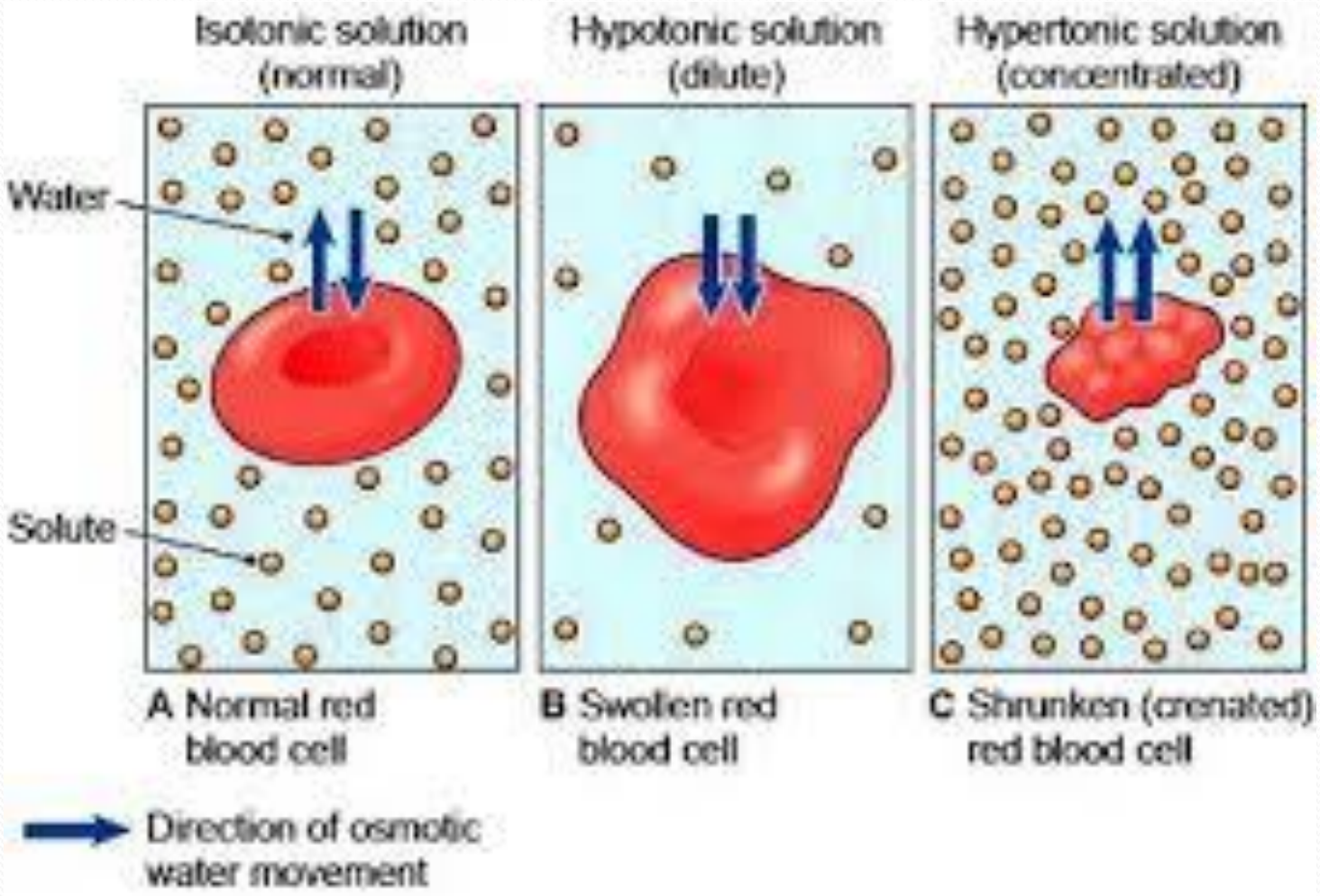
- Isotonic:
- No **NET** movement of water across the membrane because there is the same concentration of solute on each side of the membrane
  - Means that water moves, but the same amount of water moves in and out
  - Cell stays the same size
  - Homeostasis (equilibrium) is maintained

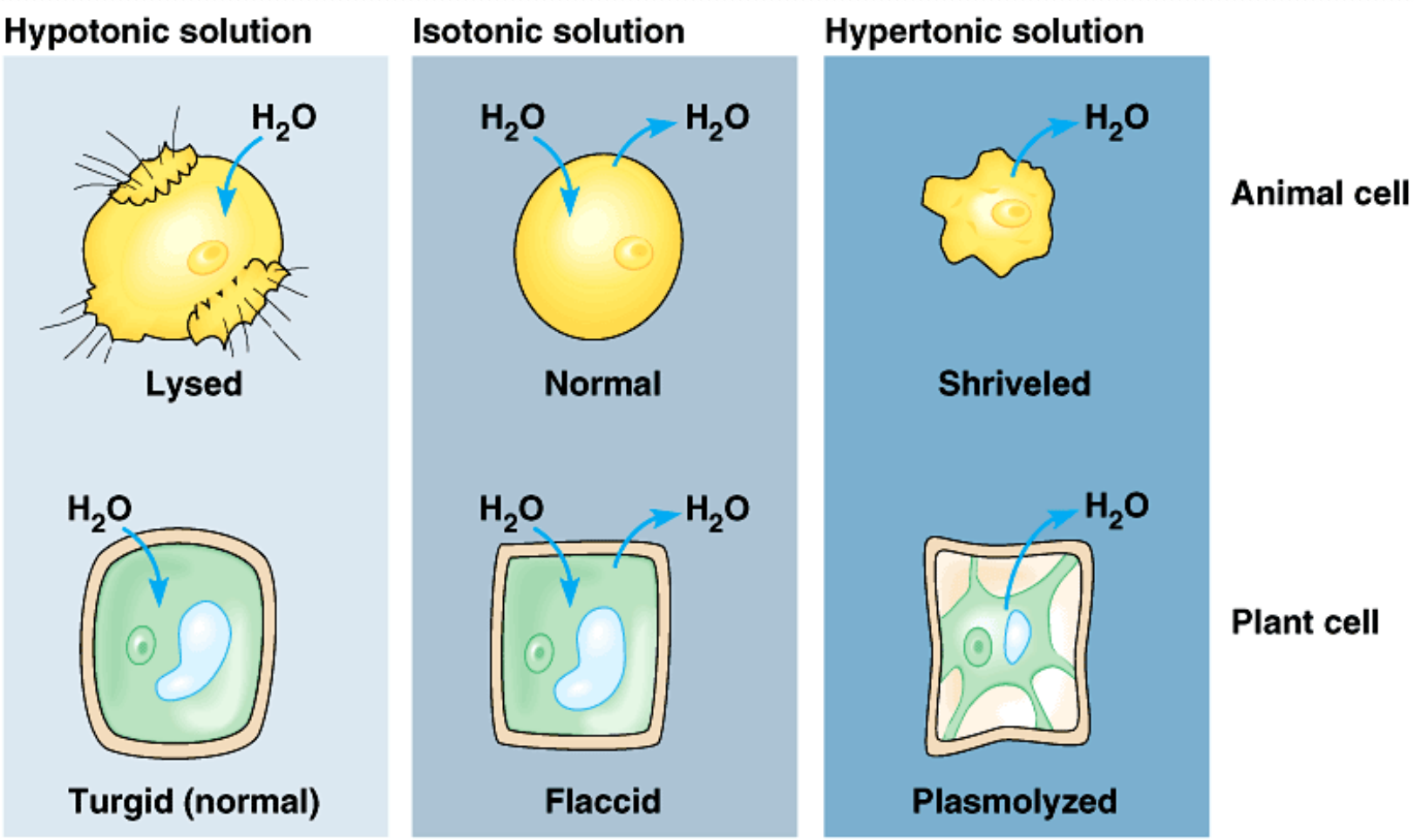
Types of Solutions or Environments that Cause Osmosis

- Hypertonic:
  - Water moves out of the cell because there is more solute outside the cell and less water
  - Size of the cell decreases
  - Can collapse the cell

Types of Solutions or Environments that Cause Osmosis

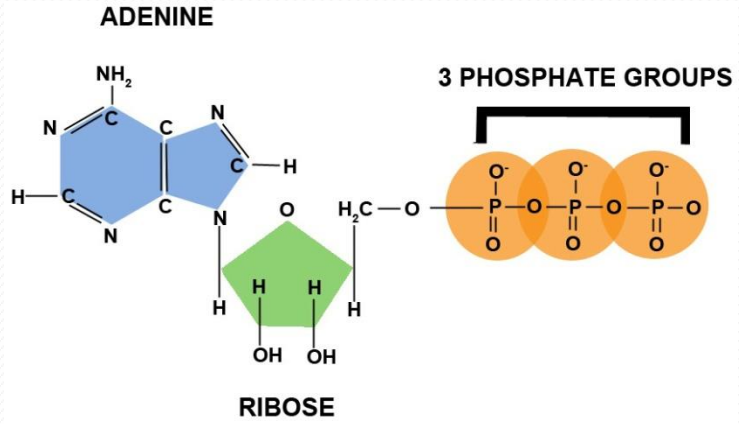
- Hypotonic:
  - Water moves into the cell because there is less solute outside the cell and more water
  - Size of the cell increases
  - Can burst the cell

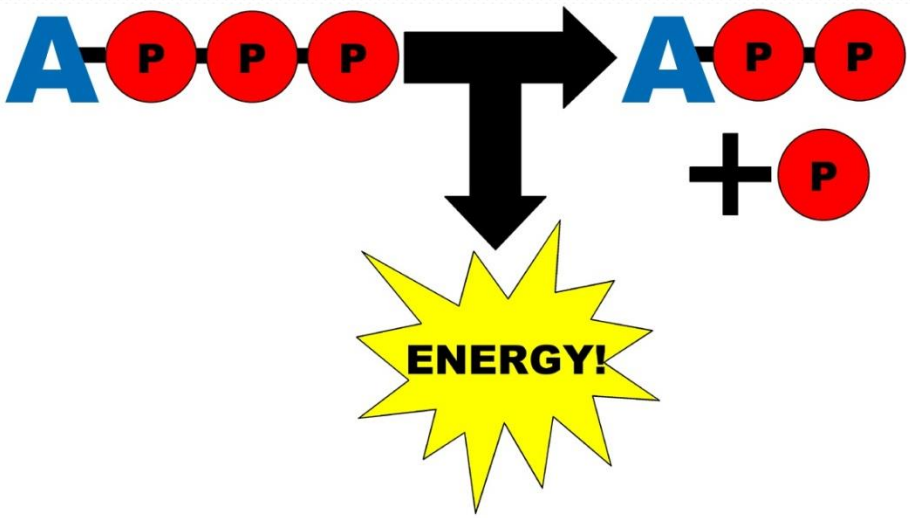

Isotonic solution (normal)
Hypotonic solution (dilute)
Hypertonic solution (concentrated)
Water
Solute
A Normal red blood cell
B Swollen red blood cell
C Shrunken (crenated) red blood cell
Direction of osmotic water movement



How Active Transport Uses Energy

- An **ATP molecule** loses one of the phosphate groups
- By breaking the covalent bond, the molecule **releases energy**
- This energy can be used by other molecules **to do work in the cell**, such as moving molecules across a membrane

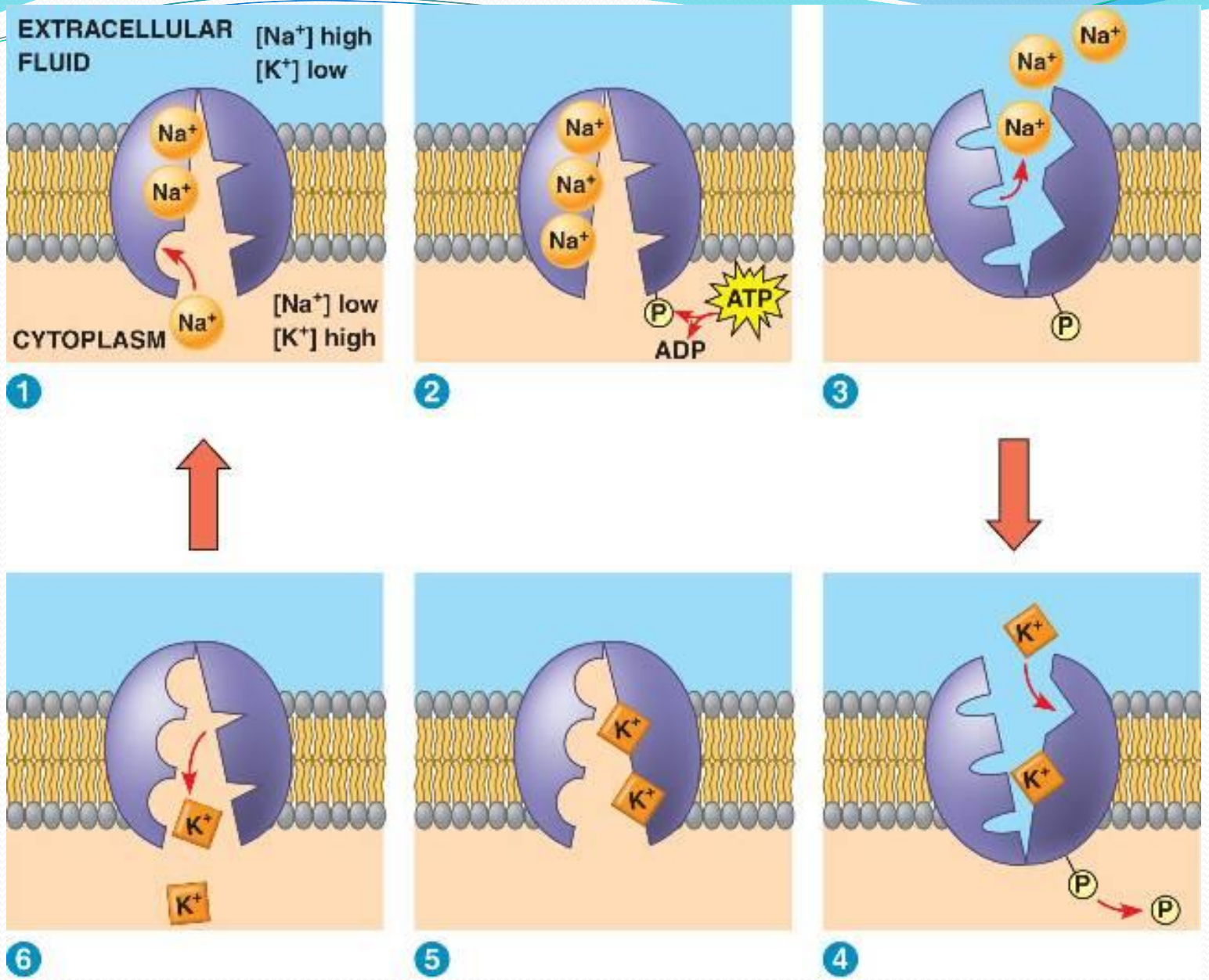




Method of Active Transport

Protein Pumps:

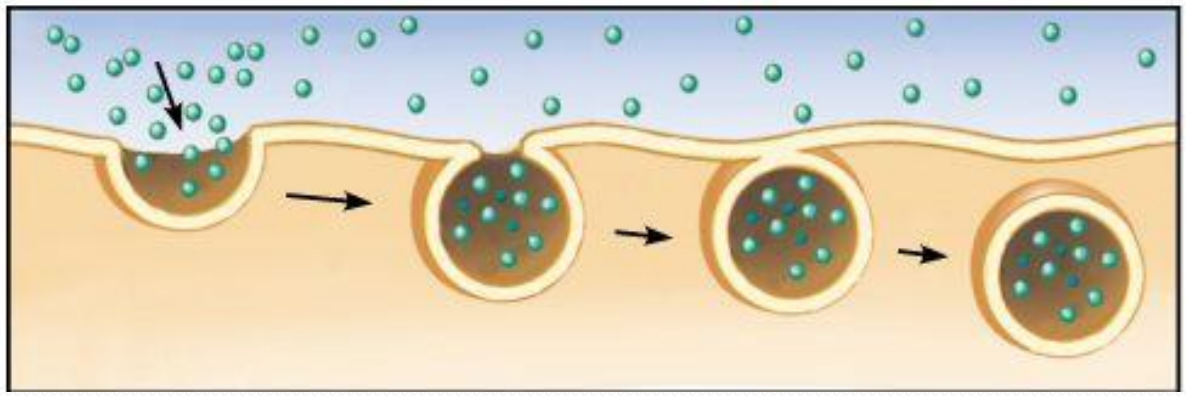
- One example is the **Sodium/Potassium Pump** (Na/K)
- Requires a protein to move the ions
- Moves Na out and K in
  - Without this pump, our bodies would not be able to send electrical signals


EXTRACELLULAR FLUID
[Na+] high
[K+] low
Na+
Na+
Na+
[Na+] low
[K+] high
CYTOPLASM
1
Na+
Na+
Na+
ATP
P
ADP
2
Na+
Na+
Na+
P
3
K+
K+
P
P
4
K+
K+
5
K+
K+
6

Method of Active Transport

Vesicles:

- **Endocytosis**
- Moves large molecules into the cell
- Pinches in the cell membrane and creates a vesicle inside the cell
- Ex: White blood cells engulfing bacteria



Method of Active Transport

Vesicles:

- **Exocytosis**
- Moves large molecules out of the cell
- Vesicles fuse with the cell membrane and release the molecules
- Ex: nerve cells releasing chemicals to communicate with other nerve cells