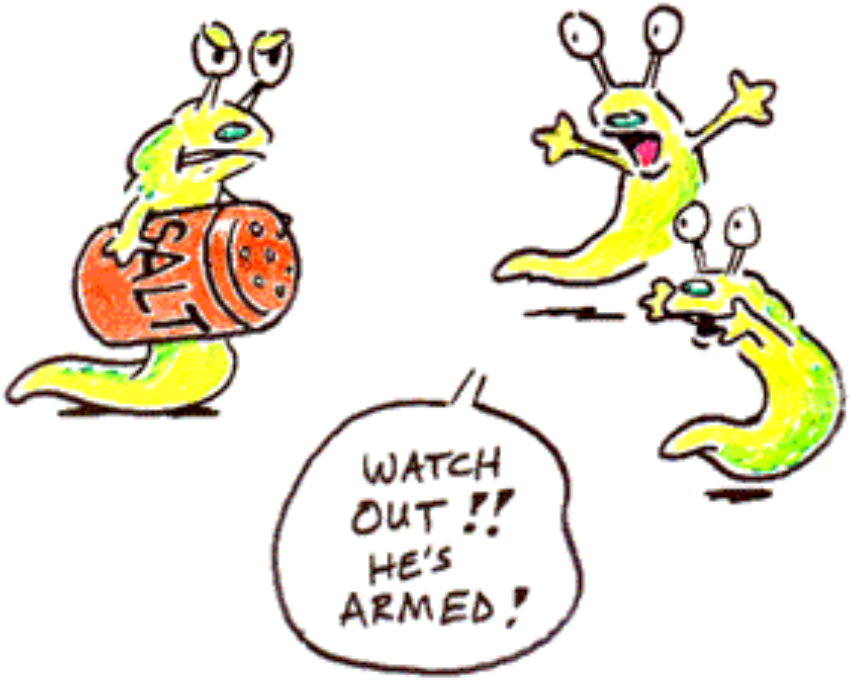
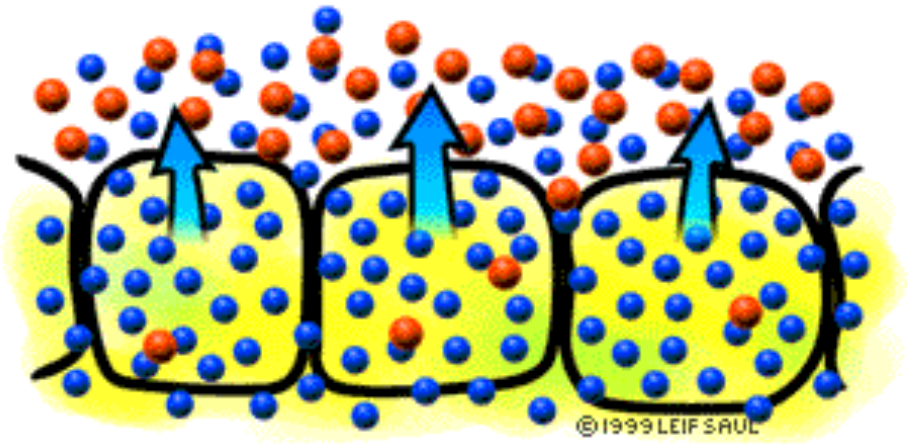
Cell Transport



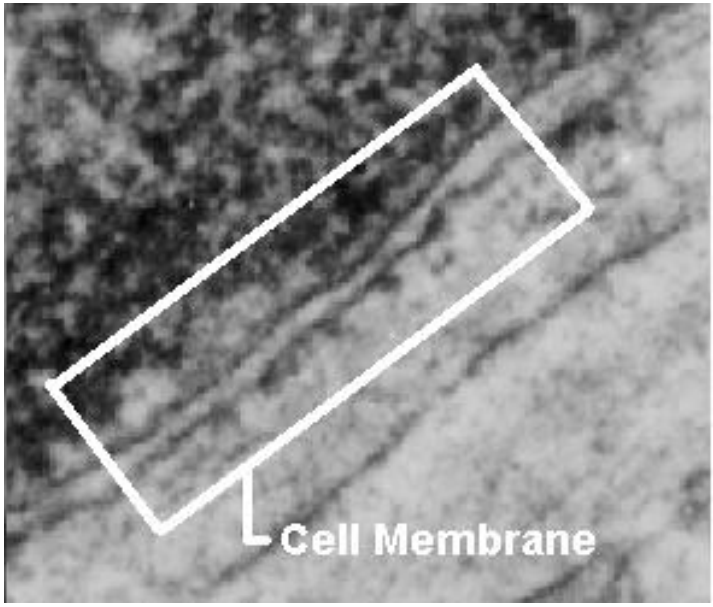


Objective

- I can differentiate between different types of cell transport.

About Cell Membranes

1. All cells have a cell membrane
2. **Functions**:
   a. Controls what enters and exits the cell to maintain an internal balance called **homeostasis**
   b. Provides protection and support for the cell



TEM picture of a real cell membrane.

About Cell Membranes (continued)

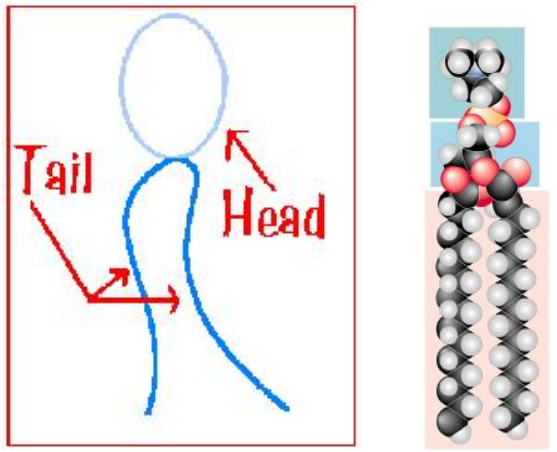
3. Structure of cell membrane

Lipid Bilayer -2 layers of phospholipids

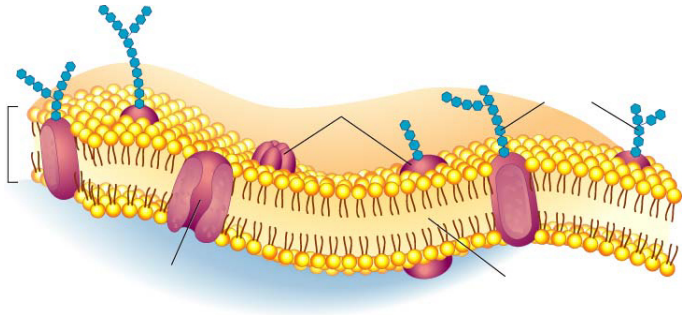
a. Phosphate head is *polar* (water loving)

b. Fatty acid tails *non-polar* (water fearing)

c. Proteins embedded in membrane



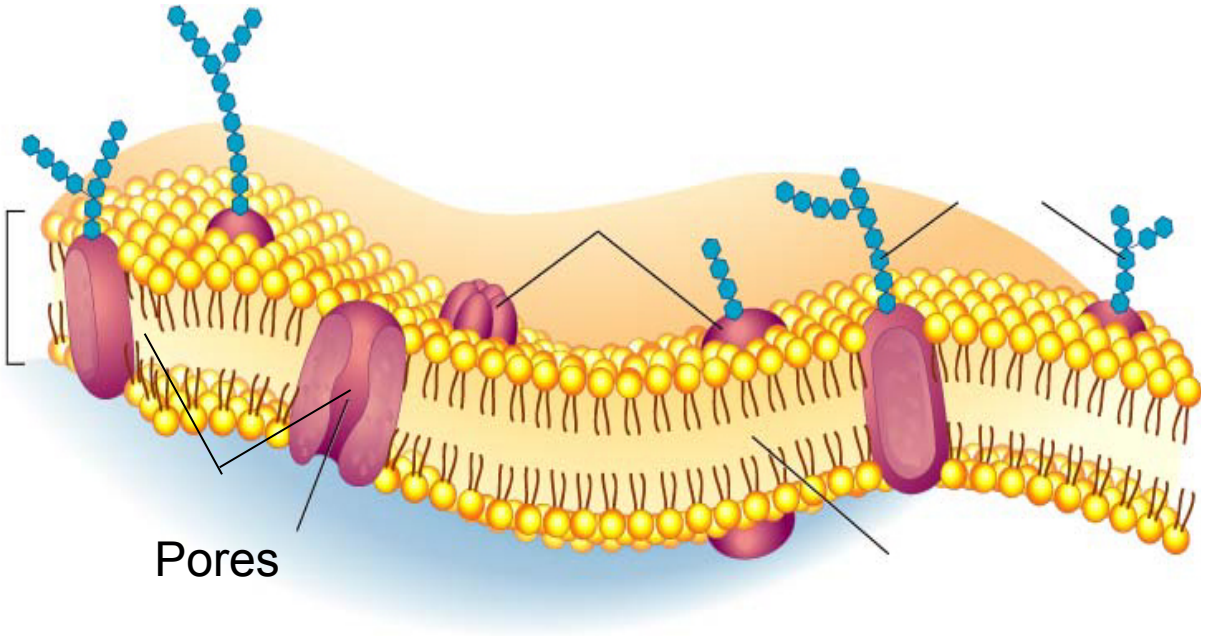
Phospholipid



Lipid Bilayer

About Cell Membranes (continued)

- 4. Cell membranes have pores (holes) in it
  - **a.Selectively permeable**: Allows some molecules in and keeps other molecules out
  - b.The structure helps it be selective!



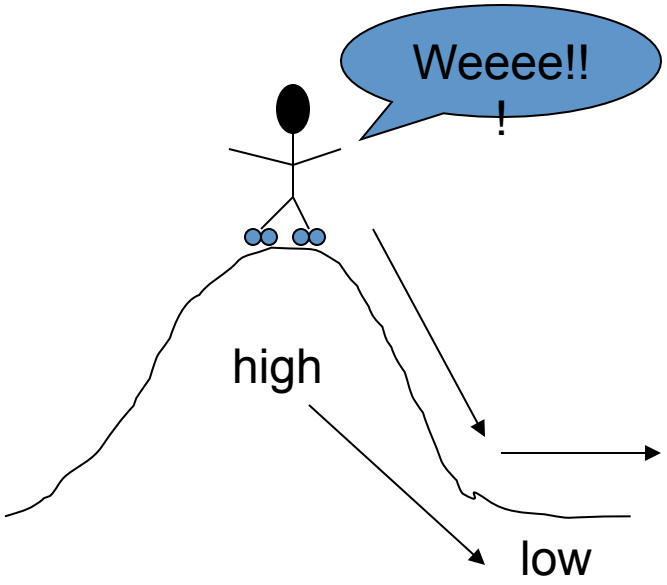
Types of Cellular Transport

•Animations of Active Transport & Passive Transport

- **Passive Transport**

  cell doesn't use energy

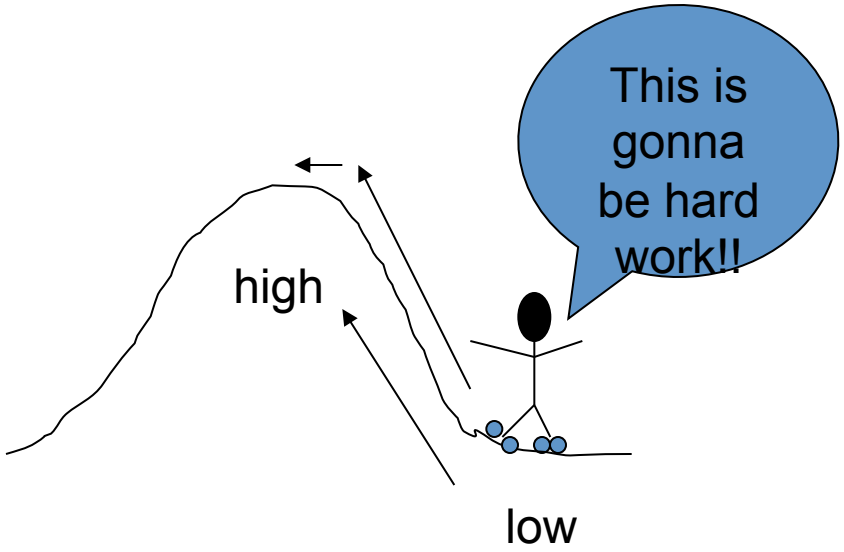
  1. Diffusion
  2. Facilitated Diffusion
  3. Osmosis



- **Active Transport**

  cell does use energy

  1. Protein Pumps
  2. Endocytosis
  3. Exocytosis



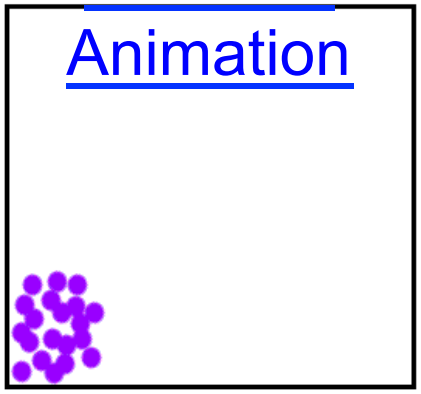
Passive Transport:
1. Diffusion

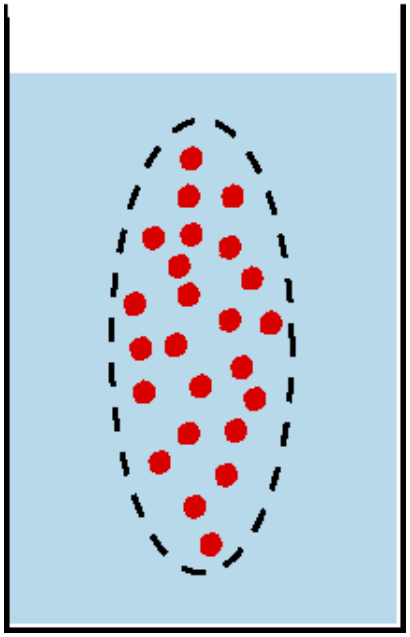
1. **Diffusion**: random movement of particles **from an area of high concentration to an area of low concentration**.

   (***High to Low***)

- Diffusion continues until all molecules are evenly spaced (**equilibrium**)-***Note:*** molecules will still move around but stay spread out. Example: Sugar or salt dissolving in water. Think Koolaid, instant coffee or tea, Crystal Lite

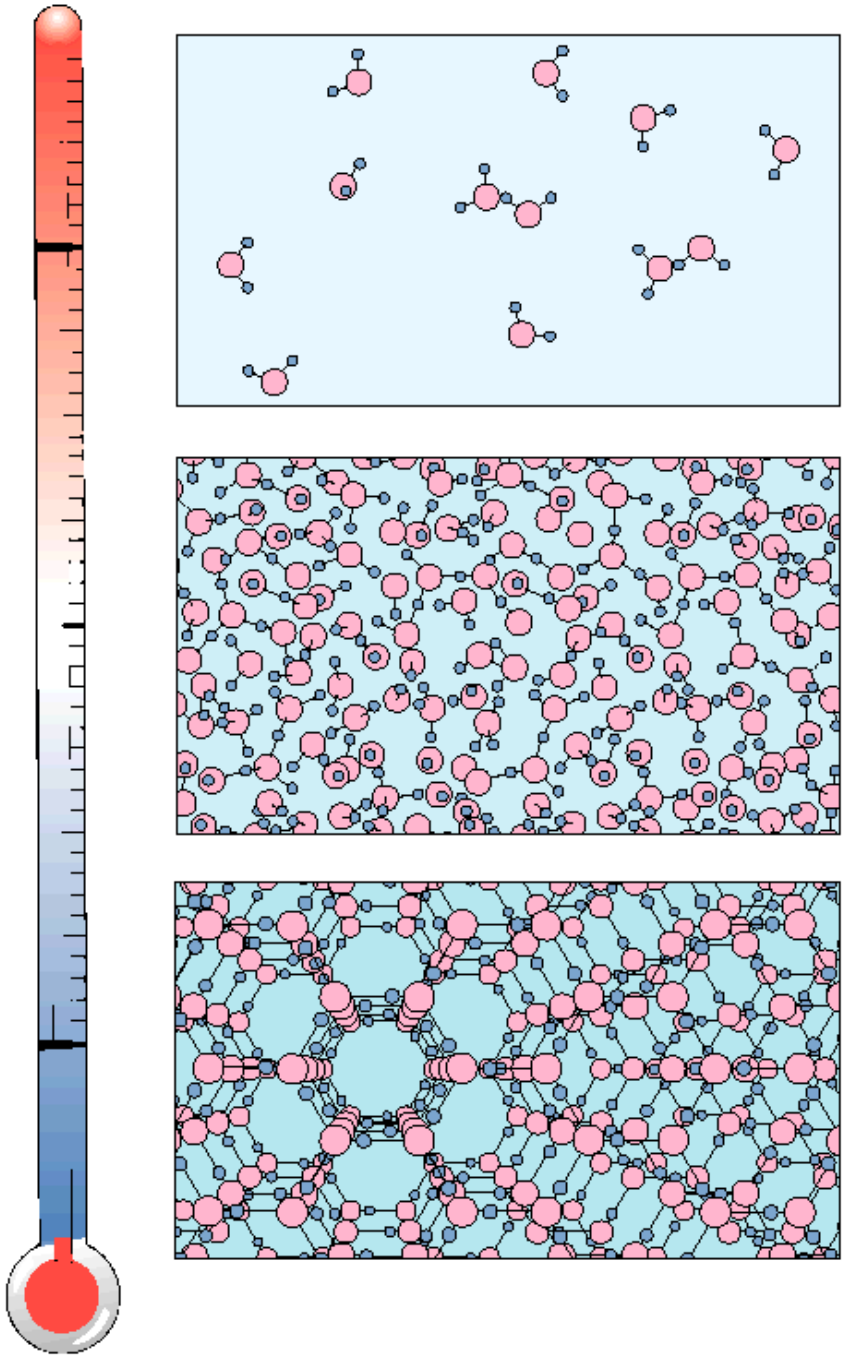
Simple Diffusion Animation





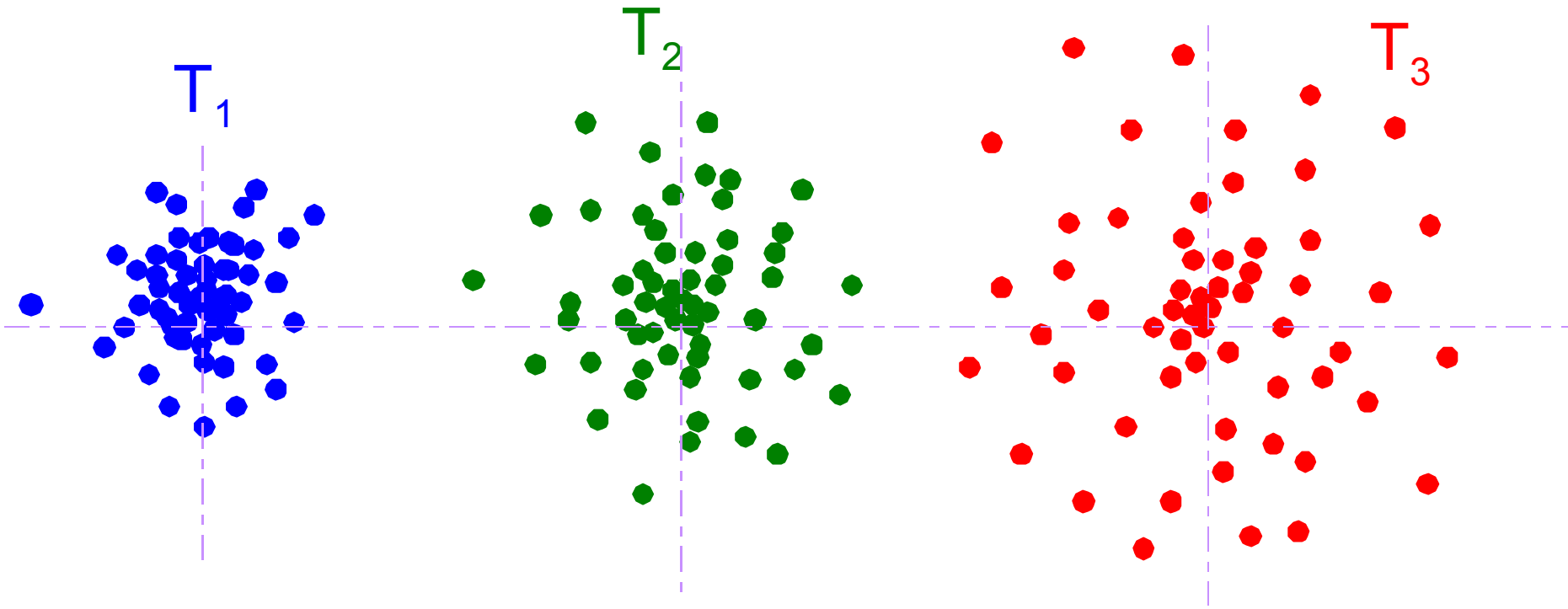
http://bio.winona.edu/berg/Free.htm

- Molecules are always in motion
- Difference between gas, liquid and solid



Diffusion

- Molecules in solution tend to slowly spread apart over time. This is *diffusion*.



Diffusion

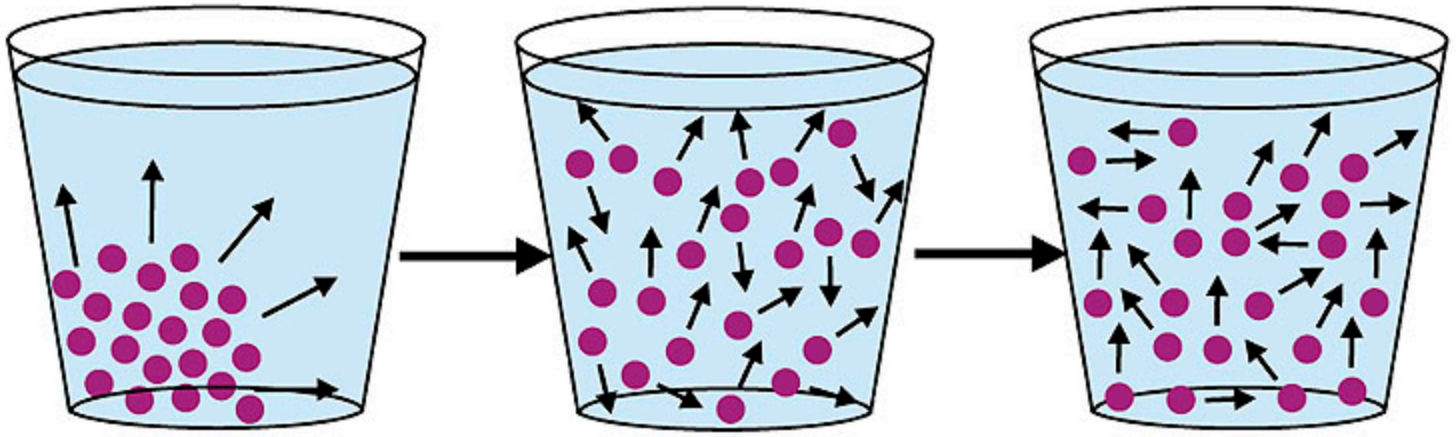


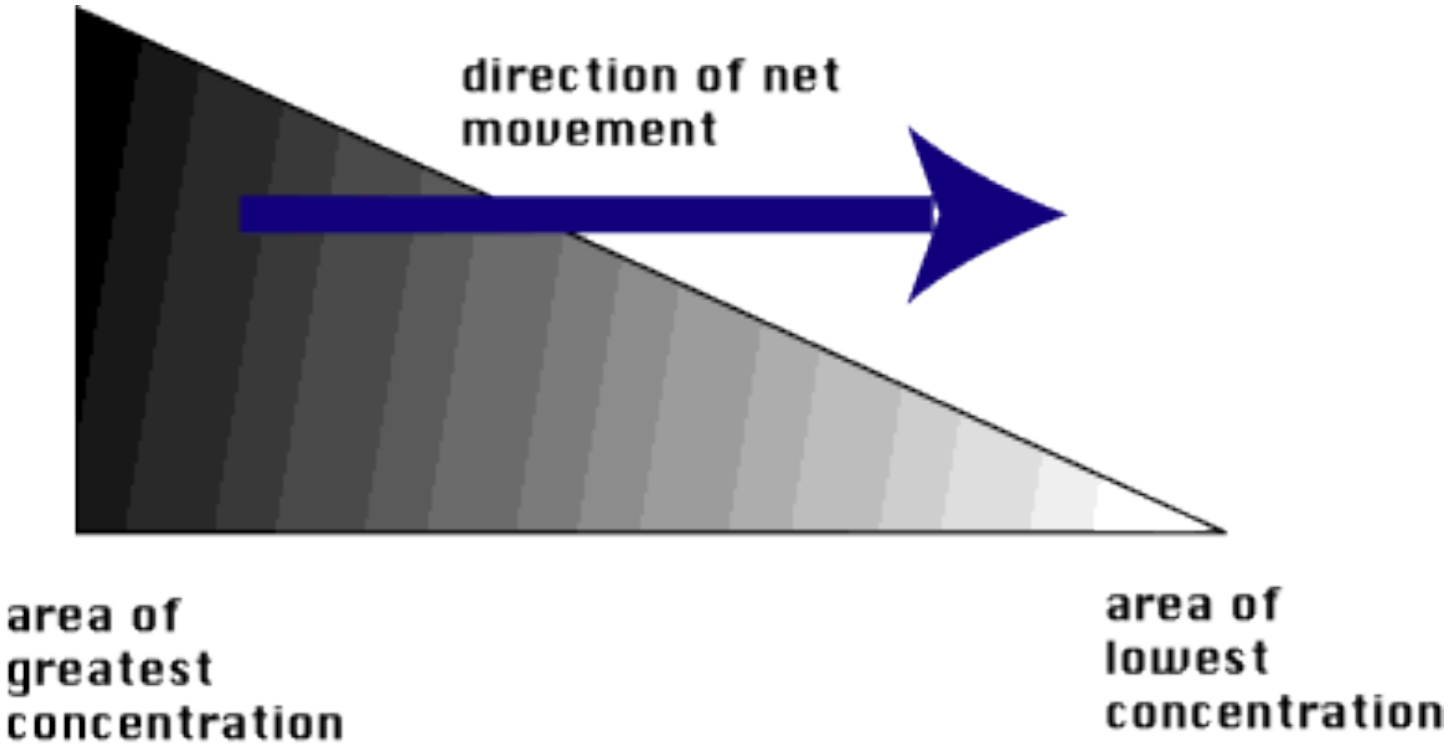
Figure 2.9 Molecular movement during diffusion. Although molecules move in every direction, the overall direction of movement is outward to areas of lower concentration. The colored circles in these figures represent molecules of dye.

concentrated, high energy molecules

[High] ⟶ [Low]

diffuse, low energy molecules

Concentration gradient

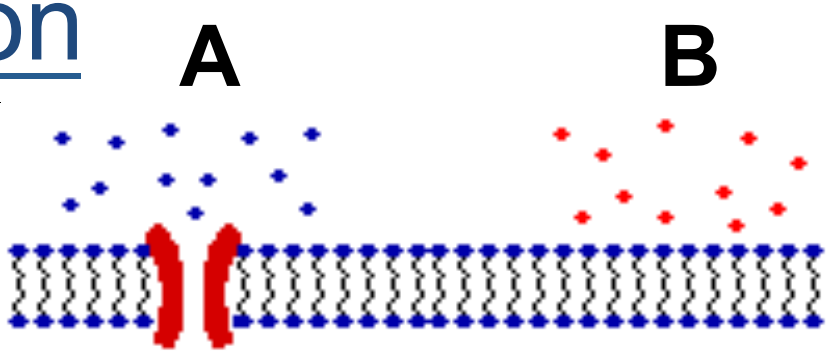


Passive Transport:
2. Facilitated Diffusion

2. Facilitated diffusion: diffusion of specific particles **through transport proteins** found in the membrane

a. Transport Proteins are specific – they "select" only certain molecules to cross the membrane

b. Transports larger or charged molecules



Facilitated diffusion (Channel Protein)

Diffusion (Lipid Bilayer)

Carrier Protein

- http://bio.winona.edu/berg/Free.htm

Passive Transport: 2. Facilitated Diffusion

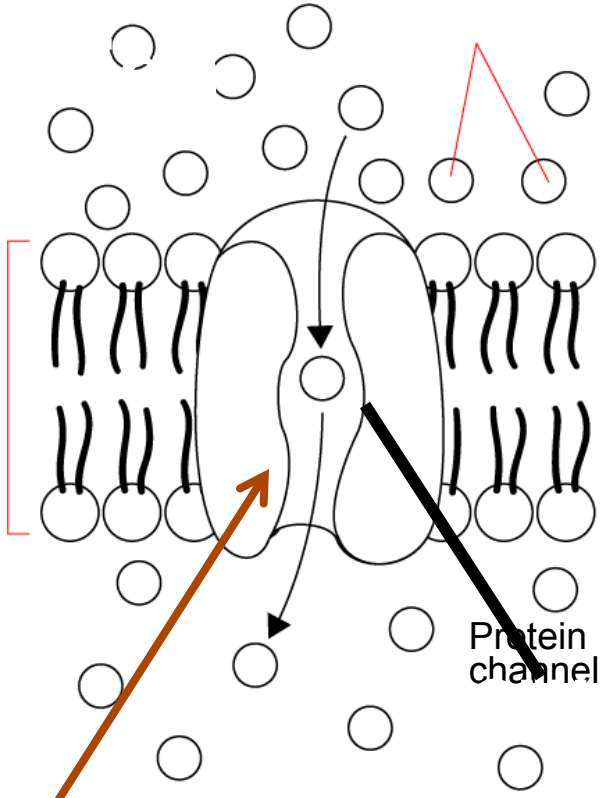
Glucose molecules

Cellular Transport From a-

High Concentration

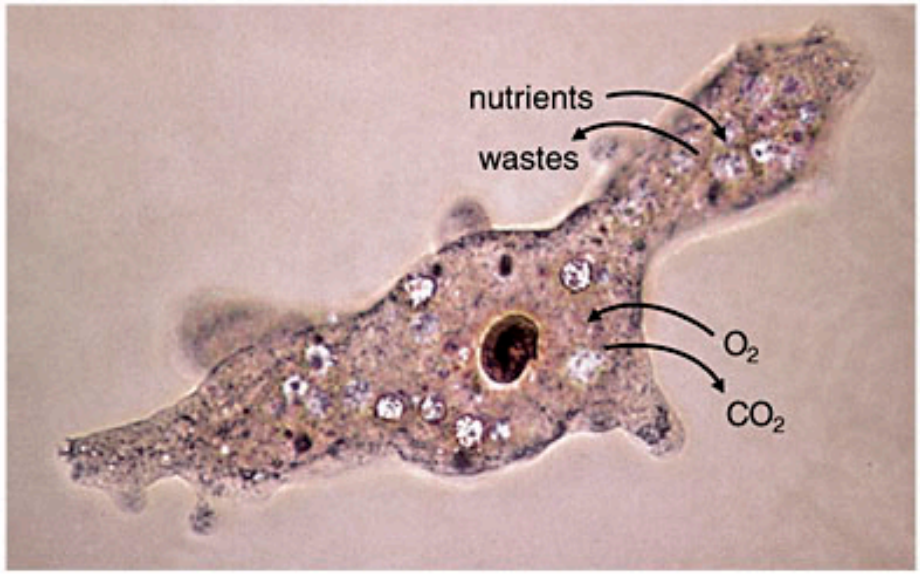
Cell Membrane

Low Concentration

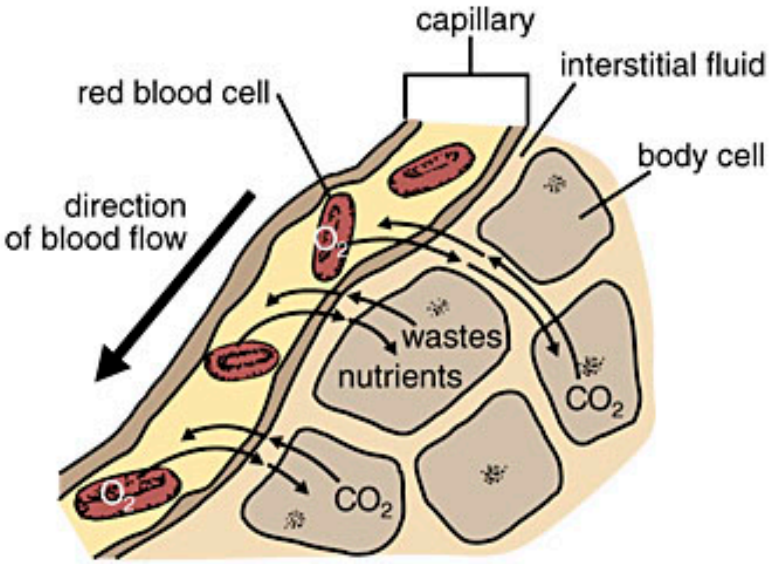


- Channel Proteins animations

Through a → Transport Protein



A.



B.

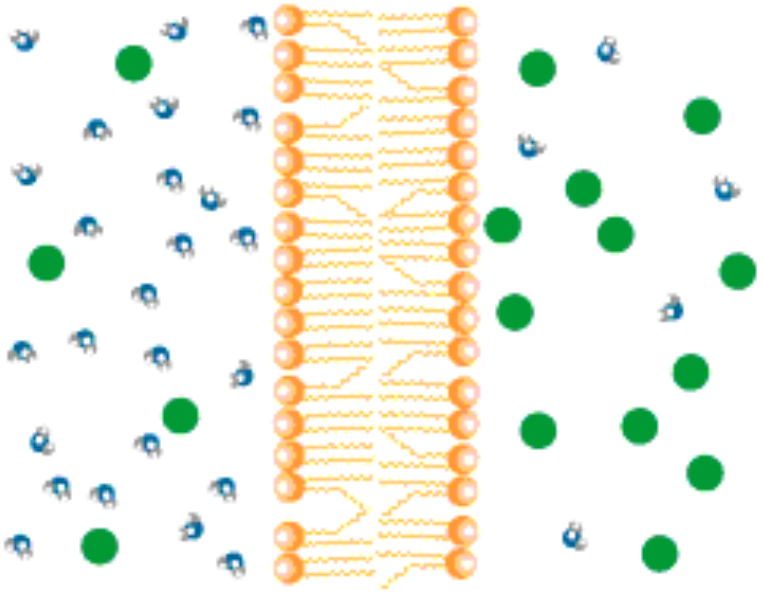
Figure 2.12 Exchanges in single-celled and multi-celled organisms. **A.** Amoebas are microscopic, single-celled organisms that do not have circulatory systems. Because amoebas are so small, diffusion can accomplish the effective exchange of substances between the amoeba and its environment. **B.** In humans and other mammals, diffusion transports substances across small distances between the blood and interstitial fluid and between interstitial fluid and cells.

In multicellular organisms,
diffusion transports substances
across small distances
between the blood and the interstitial fluid
and between the interstitial fluid and the cells

Passive Transport: 3. **Osmosis**

Osmosis animation

- 3.**Osmosis**: diffusion of *water* through a selectively permeable membrane
- Water moves from high to low concentrations



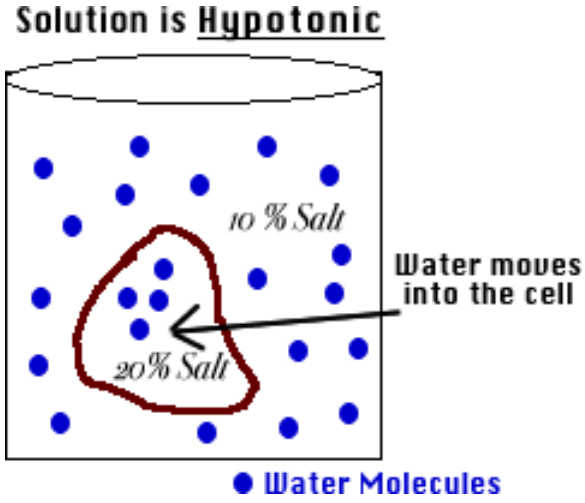
•Water moves freely through pores.

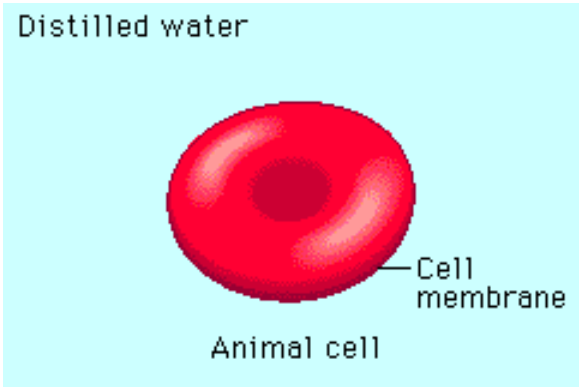
•Solute (green) to large to move across.

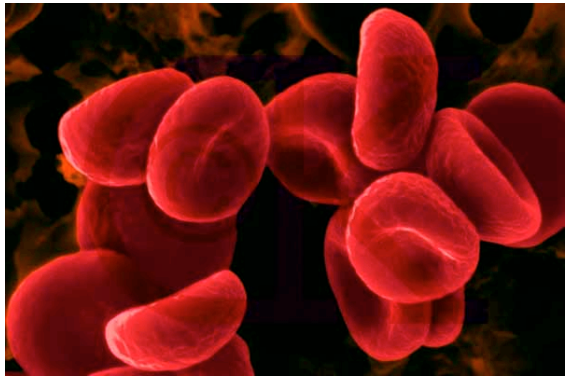
- Osmosis Animations for isotonic, hypertonic, and hypotonic solutions

Hypotonic Solution

Hypotonic: The solution has a lower concentration of solutes and a higher concentration of water than inside the cell. **(Low solute; High water)**





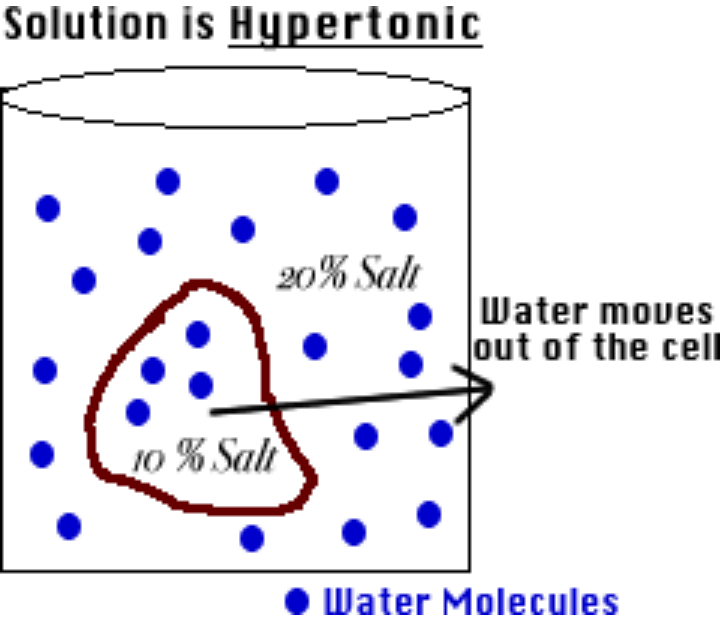


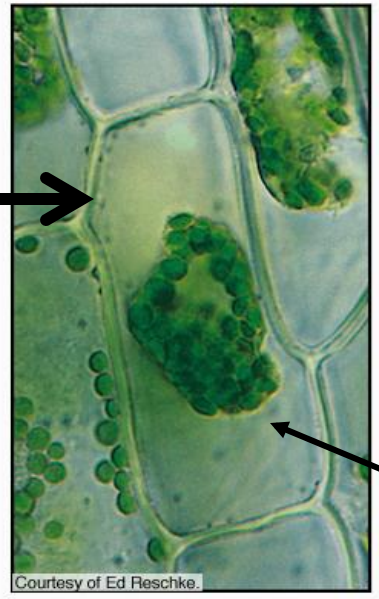
Result: Water moves from the solution to inside the cell): Cell Swells and bursts open (*cytolysis*)!

- Osmosis Animations for isotonic, hypertonic, and hypotonic solutions

Hypertonic Solution

Hypertonic: The solution has a higher concentration of solutes and a lower concentration of water than inside the cell. **(High solute; Low water)**





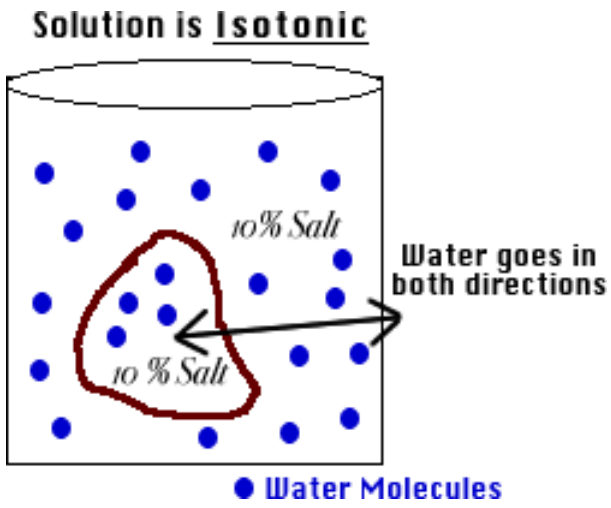
shrinks

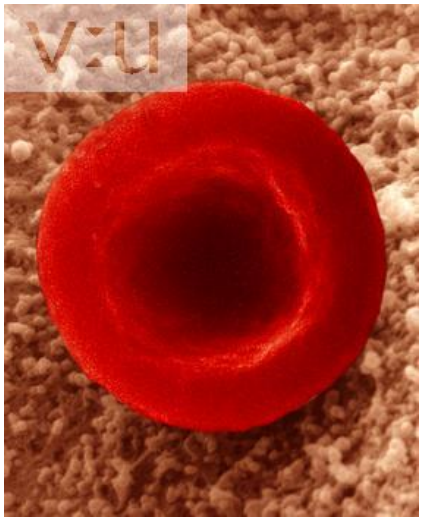
Result: Water moves from inside the cell into the solution: Cell shrinks (*Plasmolysis*)!

- Osmosis Animations for isotonic, hypertonic, and hypotonic solutions

Isotonic Solution

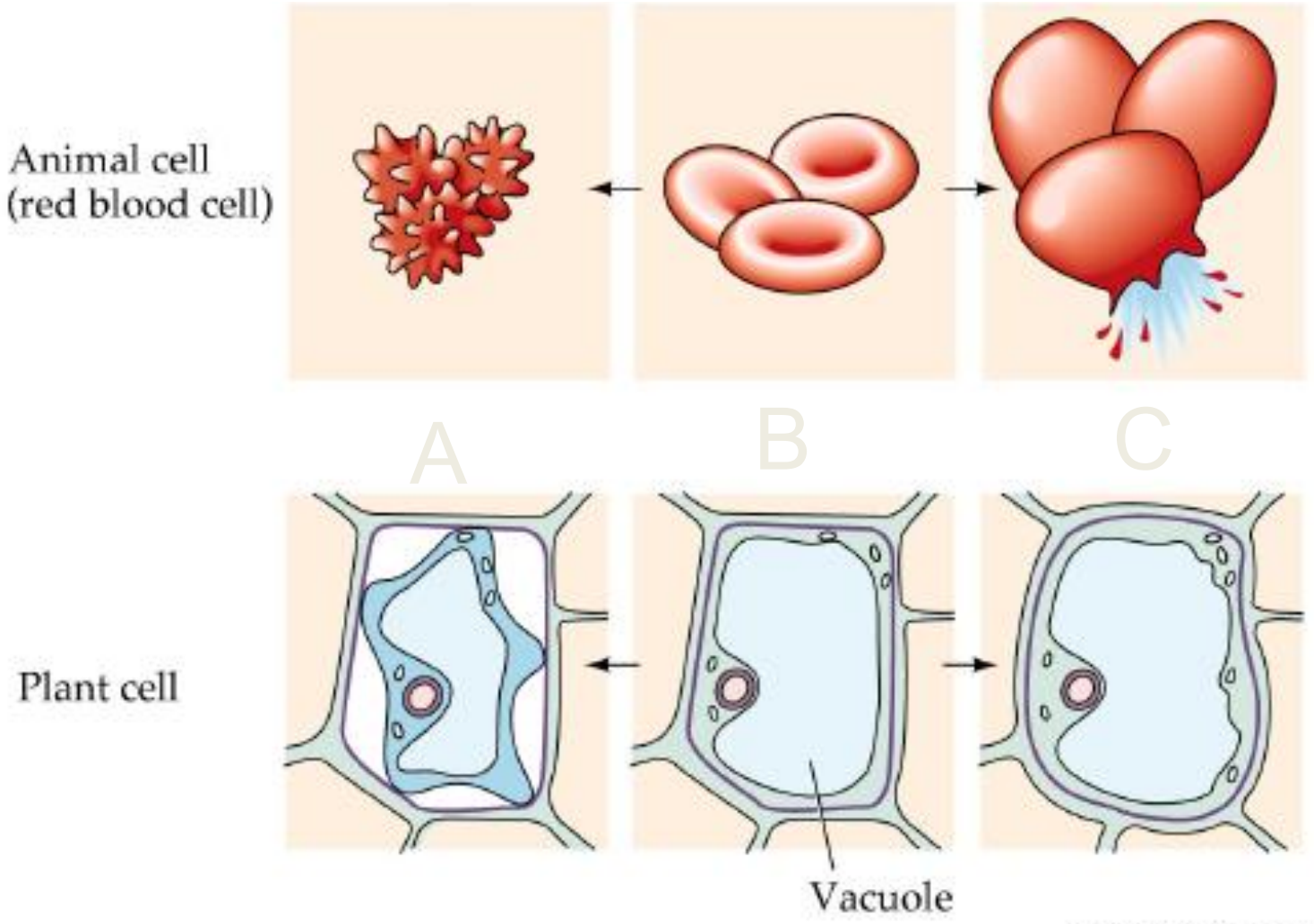
Isotonic: The concentration of solutes in the solution is equal to the concentration of solutes inside the cell.





Result: Water moves equally in both directions and the cell remains same size! (Dynamic Equilibrium)

What type of solution are these cells in?



Animal Cells and Osmosis

Solomon/Berg/Martin, Biology, 6/e
Figure 5.12

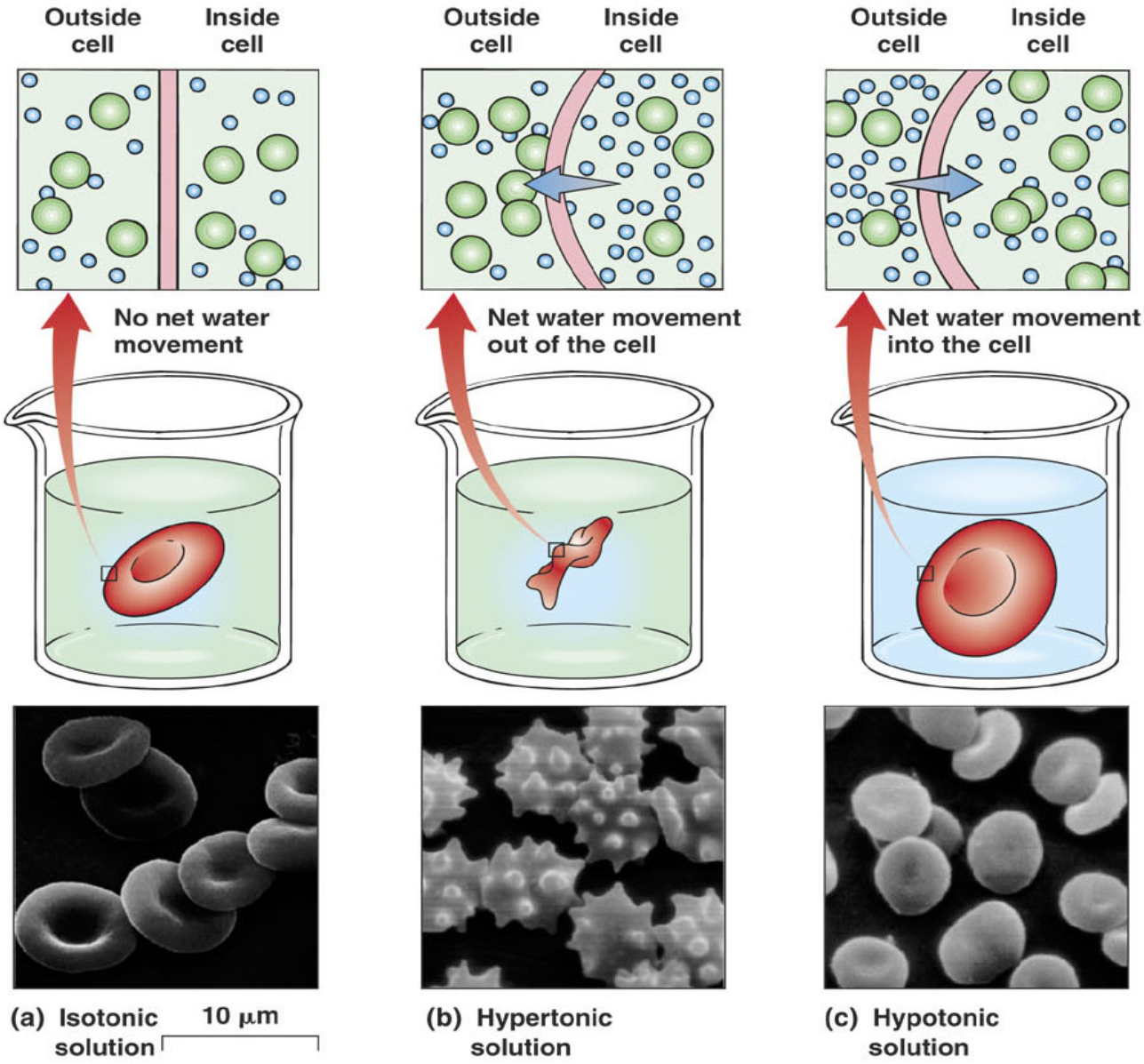
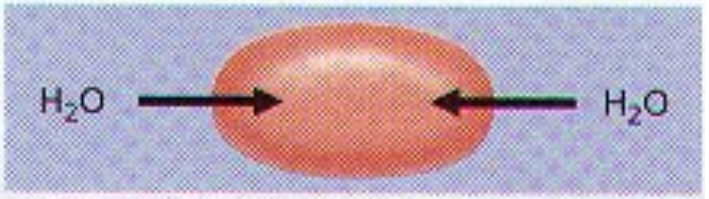
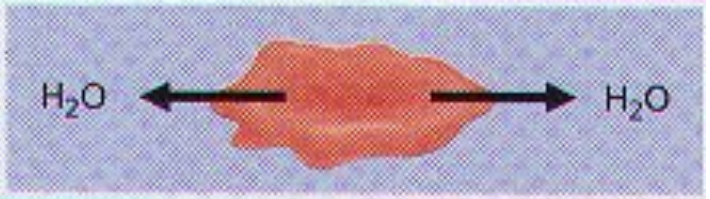
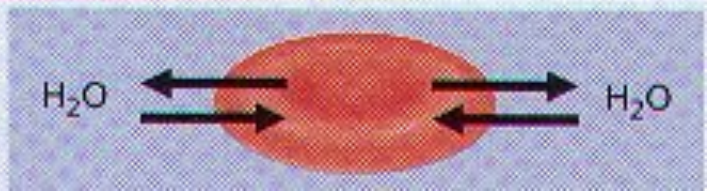
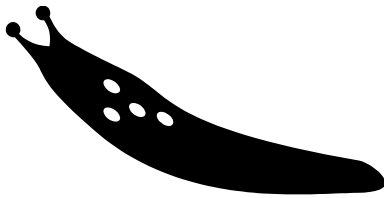


TABLE 5-1 *Direction of Osmosis*

Condition	Net movement of water	
External solution is hypotonic to cytosol	into the cell	
External solution is hypertonic to cytosol	out of the cell	
External solution is isotonic to cytosol	none	



How Organisms Deal with Osmotic Pressure

- Paramecium (protist) removing excess water video

•Bacteria and plants have cell walls that prevent them from over-expanding. In plants the pressure exerted on the cell wall is called turgor pressure.

•A protist like paramecium has contractile vacuoles that collect water flowing in and pump it out to prevent them from over-expanding.

•Salt water fish pump salt out of their specialized gills so they do not dehydrate.

•Animal cells are bathed in blood. Kidneys keep the blood isotonic by remove excess salt and water.

Active Transport

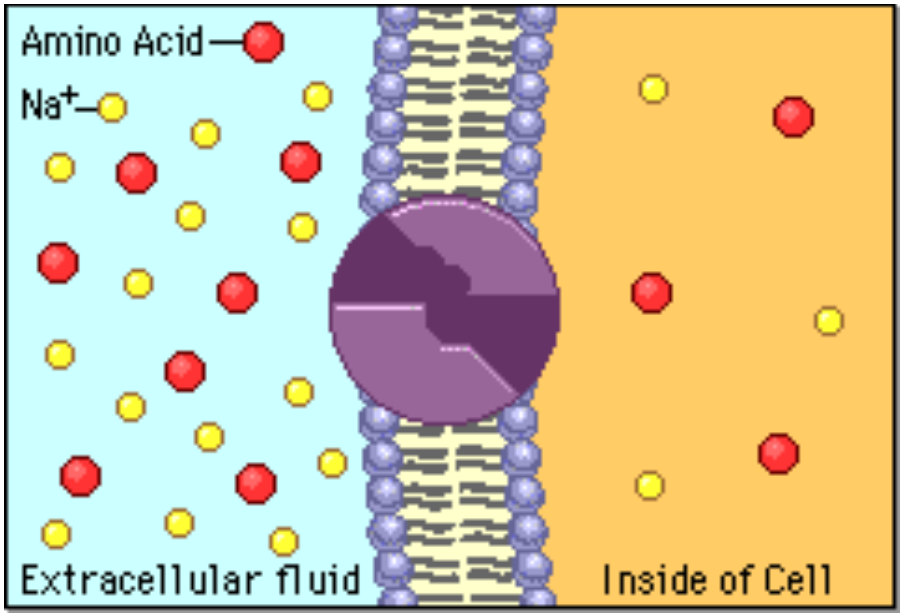
- cell **uses energy**
- actively moves molecules to where they are needed
- Movement **from an area of low concentration to an area of high concentration**
- **(Low → High)**
- Three Types:

Types of Active Transport

Sodium Potassium Pumps (Active Transport using proteins)

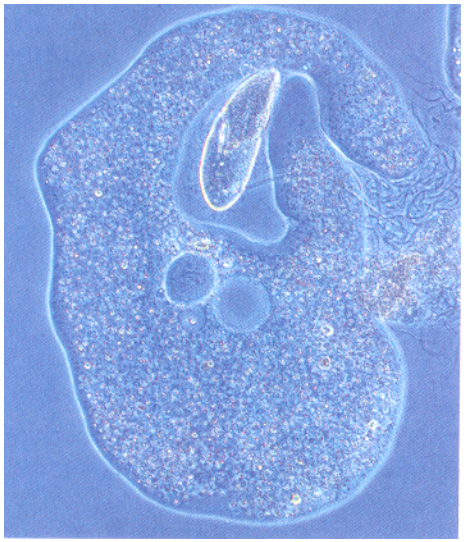
1. **Protein Pumps** - transport proteins that require energy to do work

   - Example: Sodium / Potassium Pumps are important in nerve responses.

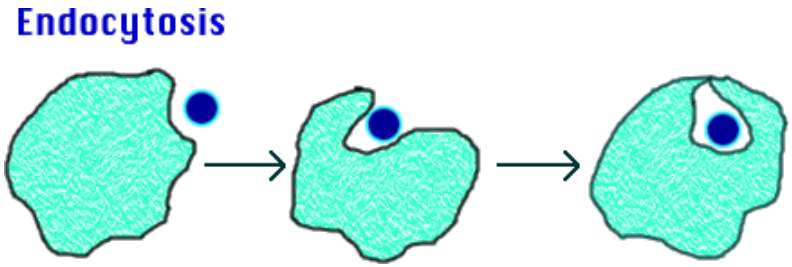


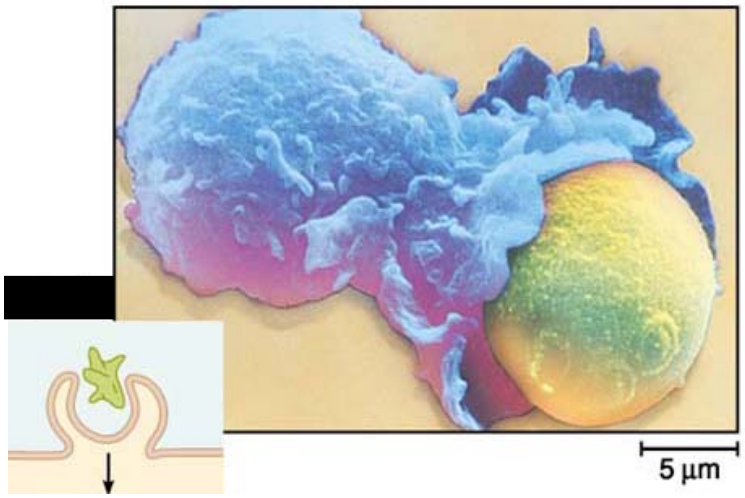
Protein changes shape to move molecules: this requires energy!

Types of Active Transport



- 2. **Endocytosis**: taking bulky material into a cell
  - Uses energy
  - Cell membrane in-folds around food particle
  - "*cell eating*"
  - forms food vacuole & digests food
  - This is how white blood cells eat bacteria!



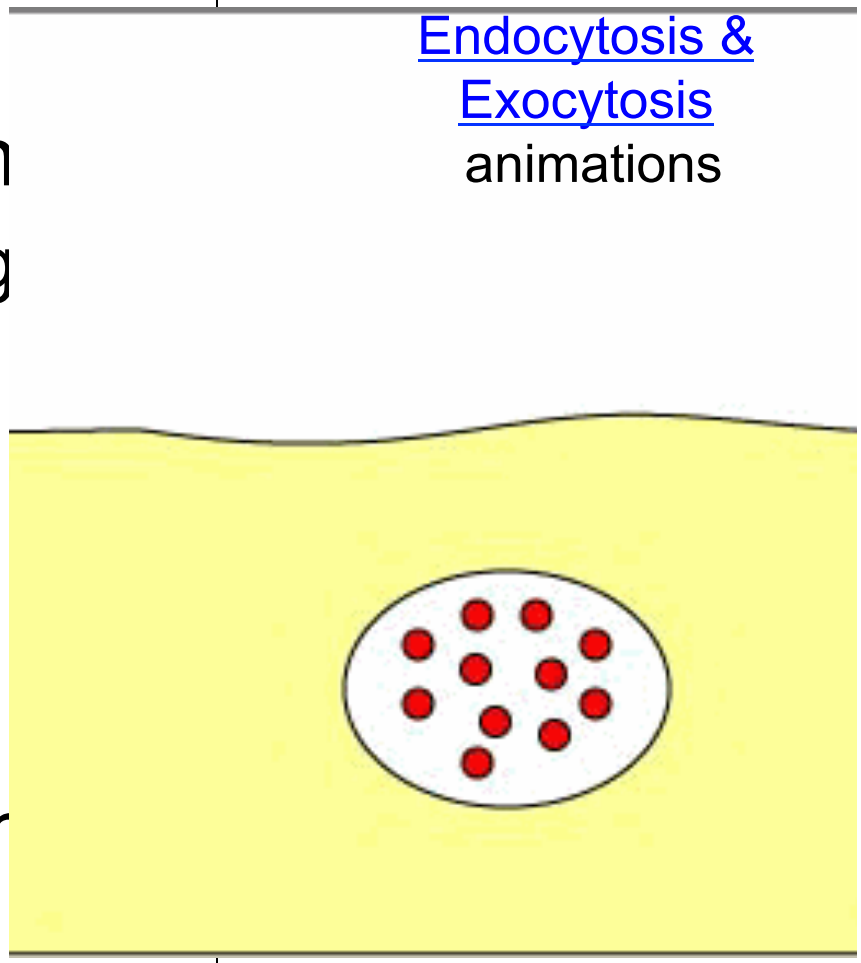


Types of Active Transport

3. **Exocytosis**: Forces material out of cell in

- membrane surrounding material fuses with cell membrane
- Cell changes shape requires energy
- EX: Hormones or wastes released fror cell

Endocytosis & Exocytosis animations



Transportation of Molecules

- Passive Transport
- Diffusion & Osmosis
- Movement of molecules across a semi-permeable membrane

  - no energy required

- Facilitated Diffusion

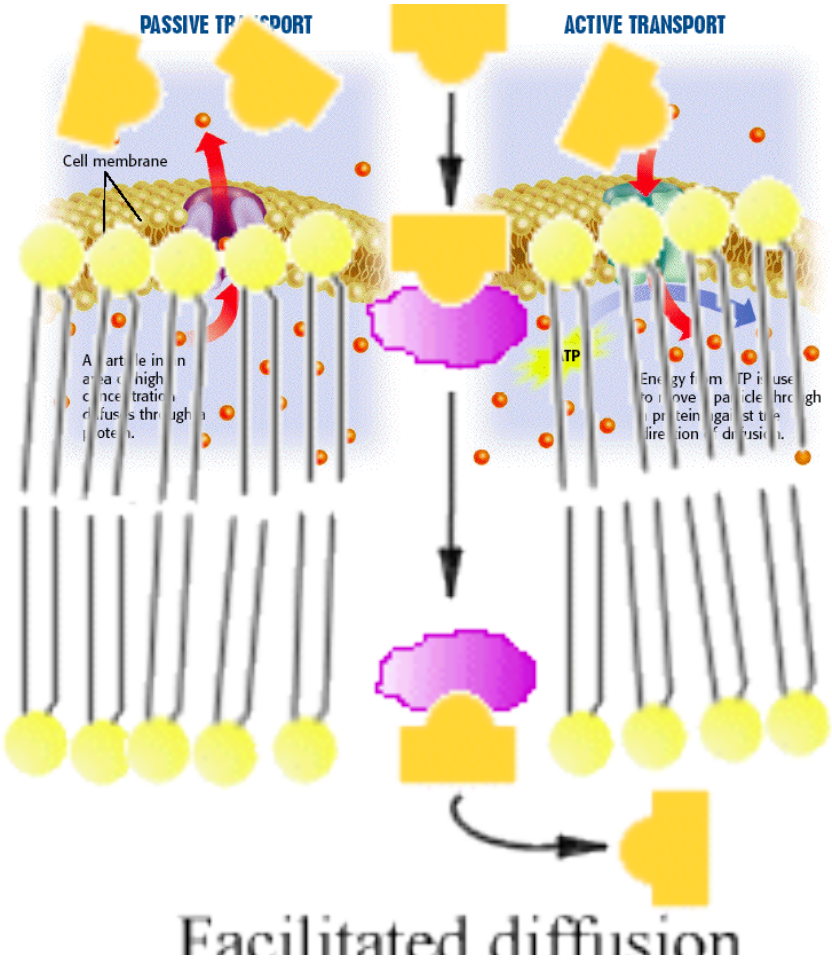
  -Movement of molecules across a semi-permeable membrane with a protein

  - no energy required

- Active Transport

  -Movement of molecules across a semi-permeable membrane against a concentration gradient with a protein, endocytosis or exocytosis

  - ENERGY – ATP



Facilitated diffusion