

## Transport Across the Cell Membrane

### How Molecules Cross the Plasma Membrane

1. What type of molecules can pass through the plasma membrane?  
small, non-charged, lipid soluble
2. What type of molecules cannot pass through the plasma membrane?  
macromolecules, non-charged
3. Since some molecules and not others can cross a membrane, it is said to be differentially or selectively permeable.
4. Passive transport ways do not use ATP and involve passive or facilitated transport. Active transport ways do use cellular energy and include active transport, endocytosis and exocytosis.

### Diffusion and Osmosis

1. What happens during diffusion? molecules move from an area of high concentration to low concentration (down  $\Delta$  gradient) until equilibrium is established
2. If dye molecules are placed in water, the solute is the dye and the solvent is the water molecules.
3. Define osmosis. The diffusion of water across a selectively permeable membrane from an area of high [water] to low [water]
4. As water enters the thistle tube, hydrostatic pressure builds up and the net movement of water ceases. The hydrostatic pressure is equivalent to the osmotic pressure inside the tube.
5. In isotonic solutions, the solute concentration is the same on both sides of the membrane, and there is no net gain or loss of water. If a cell is placed in a hypotonic solution, water enters the cell and may cause the cell to burst. Hemolysis refers to disrupted red blood cells.
6. Turgor pressure occurs when a plant cell is placed in hypotonic solution and the cytoplasm expands because the large vacuole gains water. The plant cell does not burst due to the cell wall of the plant.  
central
7. In a hypertonic solution, water leaves the cell and the cell shrinks. If red blood cells are placed in a crenation solution greater than 0.9% sodium chloride, they shrink and the process is called plasmolysis. Plasmolysis occurs when the plasma membrane pulls away from the cell wall and the cytoplasm shrinks in a hypertonic solution.
8. Define the following terms:
  - a. turgor pressure: refers to the interior pressure that adds to the strength of a cell and builds up when  $H_2O$  moves through osmosis
  - b. crenation: Red Blood Cell shrinks in a hypertonic solution
  - c. plasmolysis: plasma membrane pulls away, cell contents shrink, due to loss of water
9. Red blood cells will not gain or lose water if they are put into 0.9% NaCl. such a solution is said to be isotonic. If the red blood cells were placed in 0.75% NaCl, such a solution would be considered hypotonic and water would enter (enter/leave) the cell and cause the cells to undergo hemolysis. On the other hand, if the red blood cells were placed in 1.5% NaCl, such a solution would be considered hypertonic. In this case, water would leave (enter/leave) the cell and the red blood cells would shrink (swell/shrink). Such a condition is termed crenation.

### Transport by Carrier Proteins

1. What accounts for the ability of useful molecules to enter and exit the cell at a rapid rate?  
**carrier proteins**
2. Are carrier proteins specific for a particular molecule? **YES**  
**facilitated**
3. In **passive** transport, glucose and amino acids bind to specific carrier proteins, transport the molecules to the other side of the membrane down their **concentration** gradient without the expenditure of **ATP/energy**
4. In **active** transport, carrier proteins and an expenditure of **ATP/energy** are needed to transport molecules **against** their concentration gradient. If the carrier protein transports sodium and potassium, it is called a sodium-potassium **pump**.

### Endocytosis and Exocytosis

1. Define endocytosis: **cells take in substances by vesicle formation**
2. Define exocytosis: **vesicles fuse with plasma membrane as secretion occurs.**  
**↳ plasma membrane enlarges.**
3. **Phagocytosis** occurs when the material taken in by endocytosis is large, such as a food particle. **Pinocytosis** occurs when vesicles form around a liquid or very small particles.

### Summary

1. Label each of the situations listed below as to whether diffusion (D), osmosis (O), facilitated transport (F), active transport (A), exocytosis (E), phagocytosis (P) or pinocytosis (Pi) has taken place.
  - F** Glucose enters liver cells very quickly by binding to a receptor in the plasma membrane.
  - D** An onion is detected by smell at the end of the kitchen table.
  - O** A red blood cell shrinks in a solution containing 1% salt.
  - D** Red dye crystals are equally distributed in a beaker of water.
  - Pi** Fluid, containing minerals, enters a cell by forming a vesicle at the plasma membrane.
  - E** Thyroid hormone exits the cell after the Golgi vesicle containing it fused with the plasma membrane.
  - P** A bacterial cell is engulfed by a white blood cell.
  - A** Sodium ions are pumped out of a cell against a concentration gradient.

2. Complete the table below to distinguish how molecules pass into and out of cell by writing Yes or No.

Process	Uses Energy	Uses Carrier Protein	Goes with Conc. Gradient	Goes against Conc. Gradient	Plasma Membrane Forms Vesicles	Molecules Enter Cell	Molecules Leave Cell	Fluid Uptake in Vesicle	Solid uptake in Vesicle
Diffusion	X	X	✓	X	X	✓	✓	X	X
Osmosis	X	X	✓	X	X	✓	✓	X	X
Facilitate transport	X	✓	✓	X	X	✓	✓	X	X
Active Transport	✓	✓	X	✓	X	✓	✓	X	X
Exocytosis	✓	X	both	both	<del>both</del> X	X	✓	X	X
Pinocytosis	✓	X	both	both	✓	✓	X	✓	X
Phagocytosis	✓	X	both	both	✓	✓	X	X	✓

3. How does each of the following molecules enter a cell?
  - a. oxygen **DIFFUSION**
  - b. glucose **FACILITATED DIFFUSION**
  - c. potassium ions **ACTIVE TRANSPORT**
  - d. water **OSMOSIS**