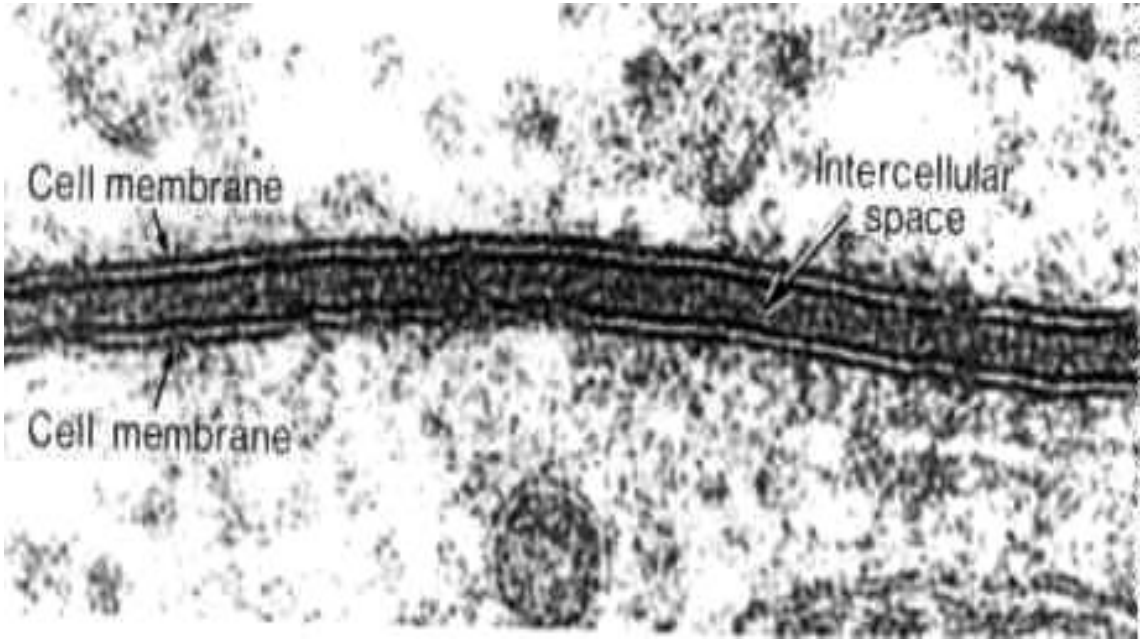
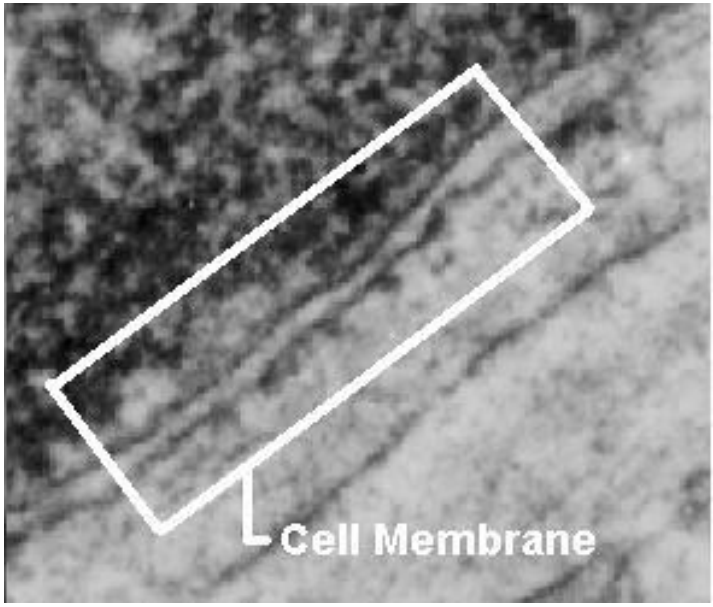
Cellular Membrane

Theory Lec. 3



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 (**Transmission electron microscopy)** picture of a real cell membrane.

About Cell Membranes (continued)

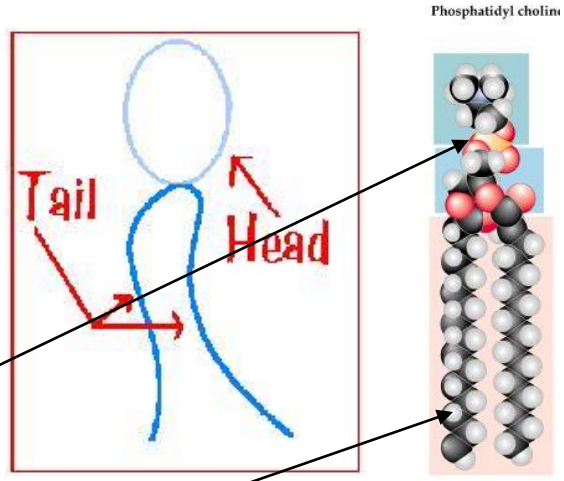
3.Structure of cell membrane

Lipid Bilayer -2 layers of phospholipids

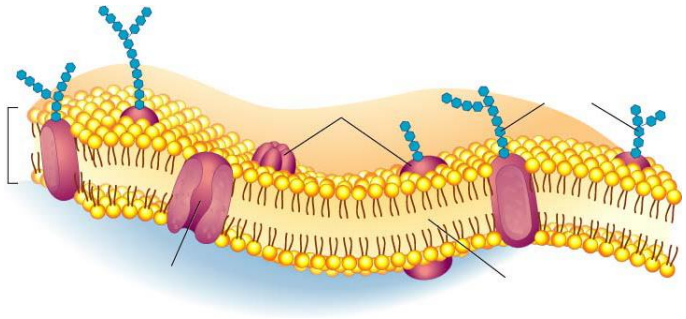
a. Phosphate <u>head</u> is *polar* (water loving-hydrophilic)

b. Fatty acid <u>tails</u> *non-polar* (water fearing-hydrophobic)

c. Proteins embedded in membrane

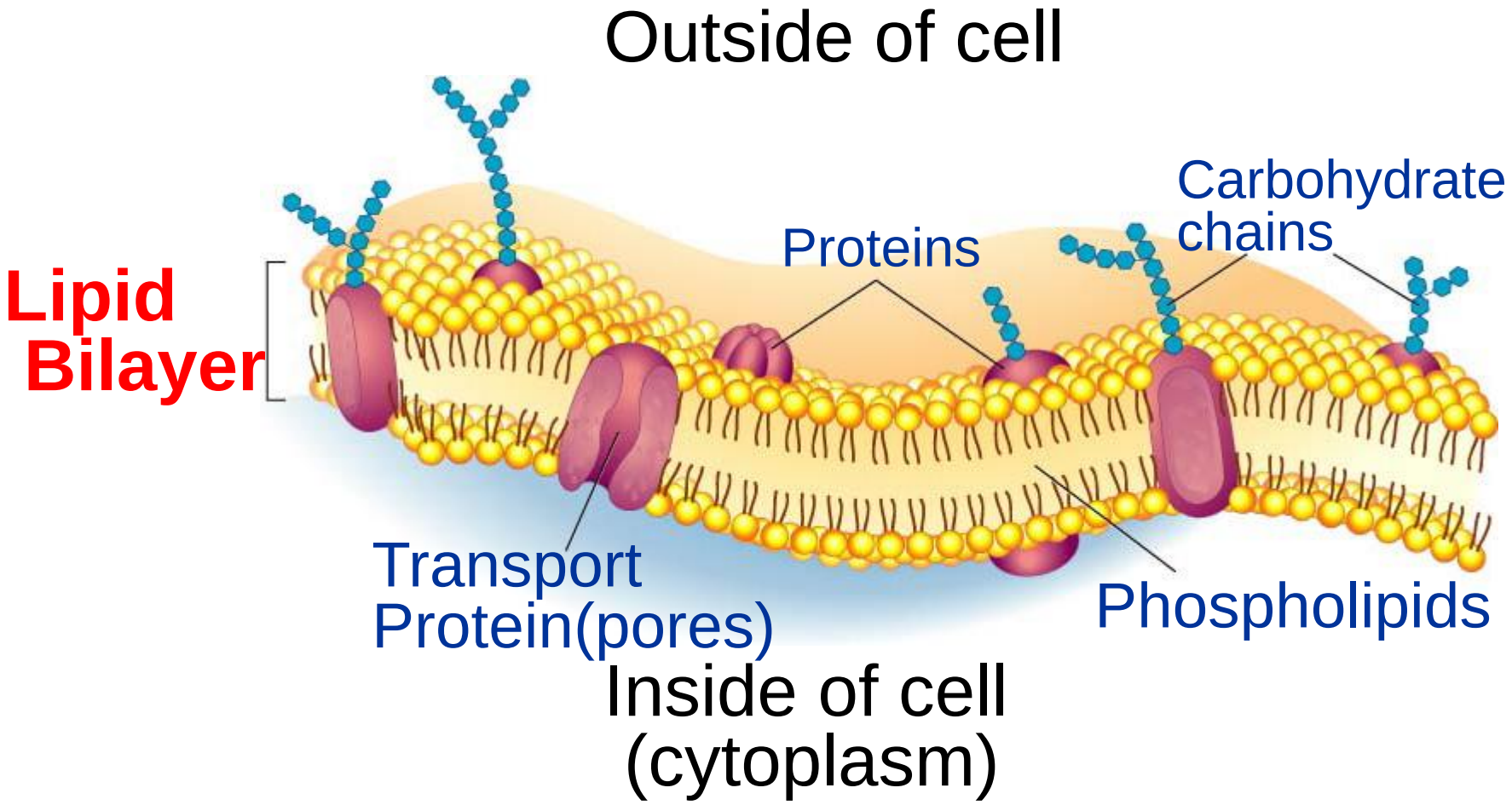


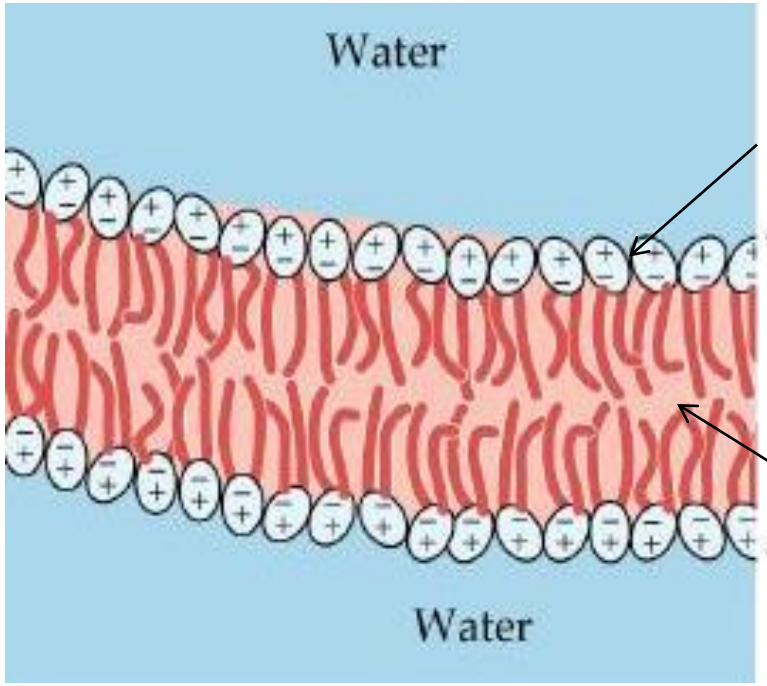
Phospholipid



Lipid Bilayer

Structure of the Cell Membrane



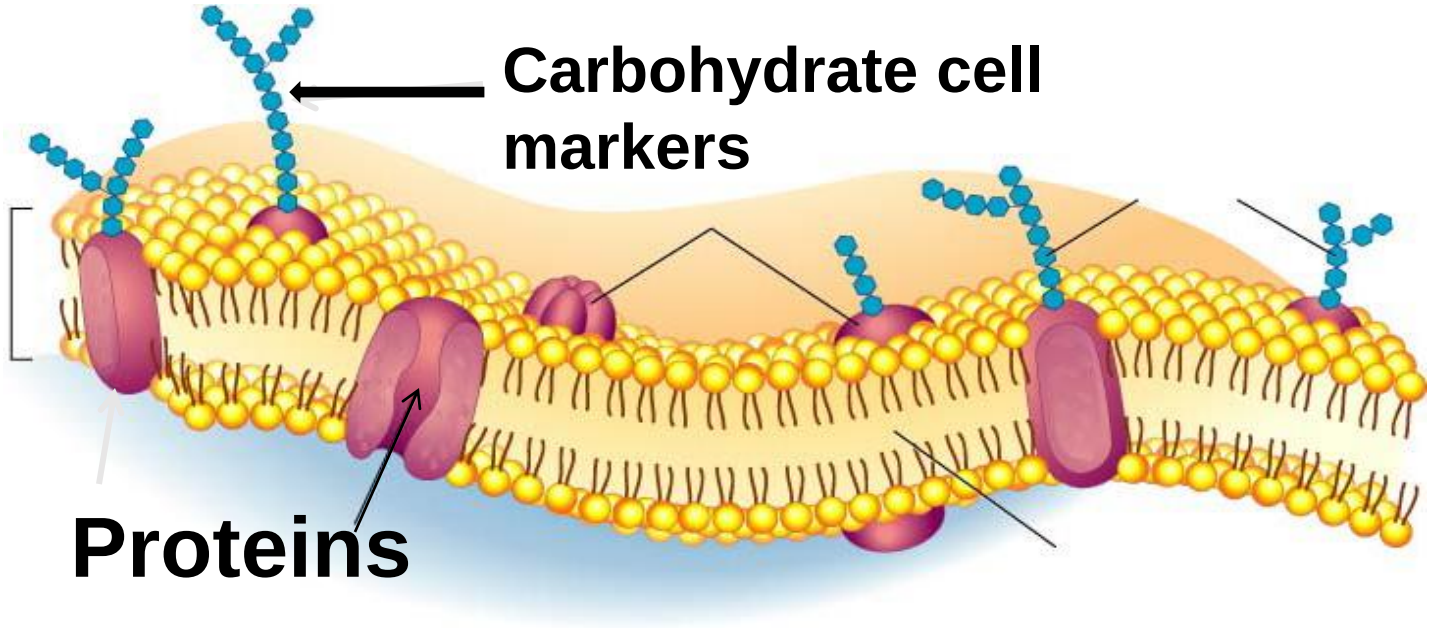


Polar heads

Non-polar tails

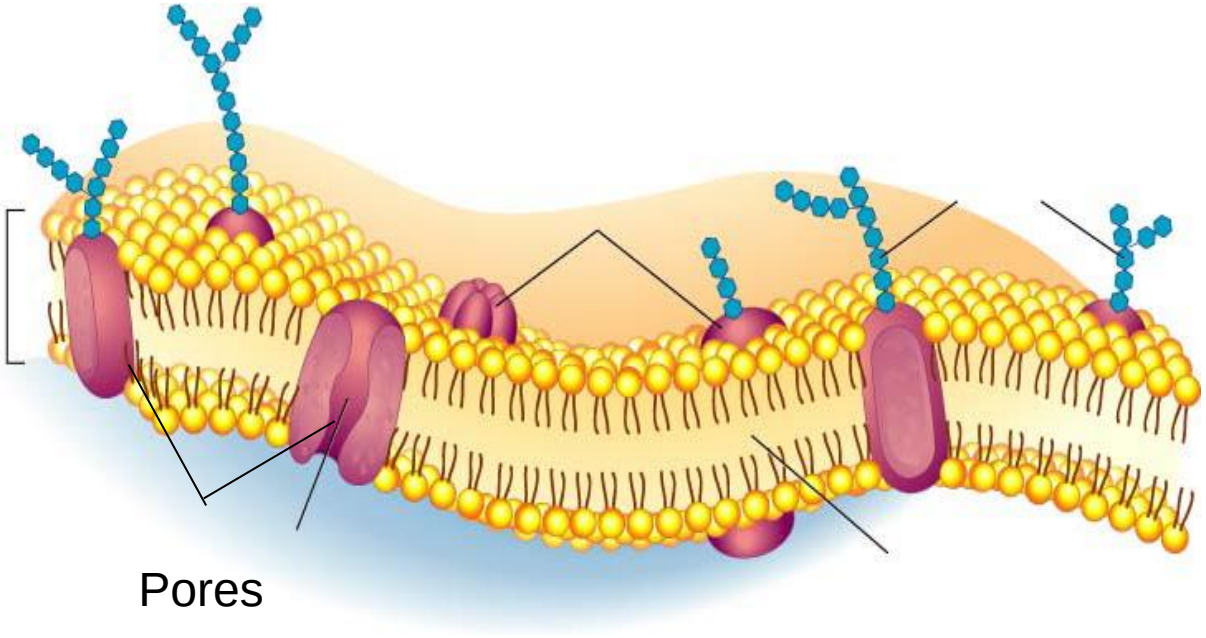
Fluid Mosaic Model of the cell membrane is the other name for the Cell Membrane

Membrane movement animation



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!



Cell Transport

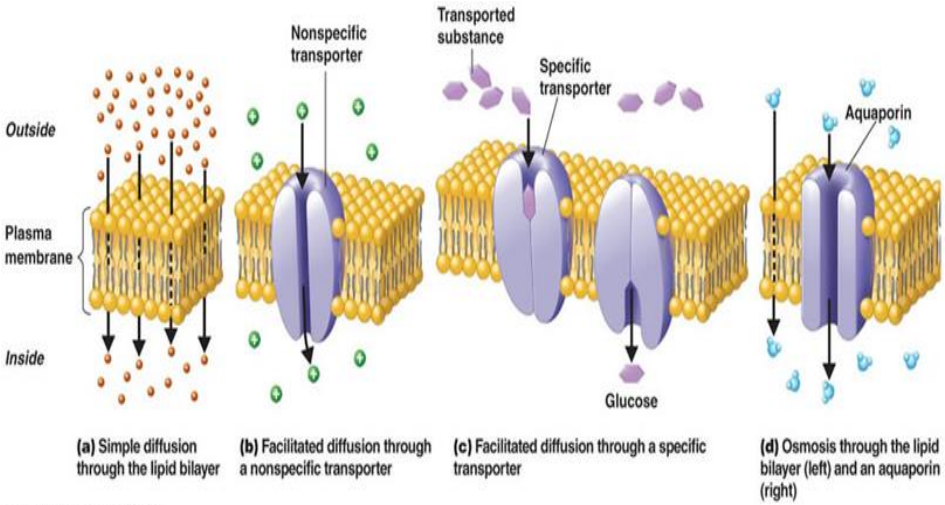
- Cells need to:
  - Take in things they need
  - Get rid of the things they don't need
  - Communicate with one another

- Two main types
  - Passive Transport
  - Active Transport

Passive Transport

- The movement of materials across the cell membrane **without** using energy
- Caused by concentration gradient
- Works in both directions

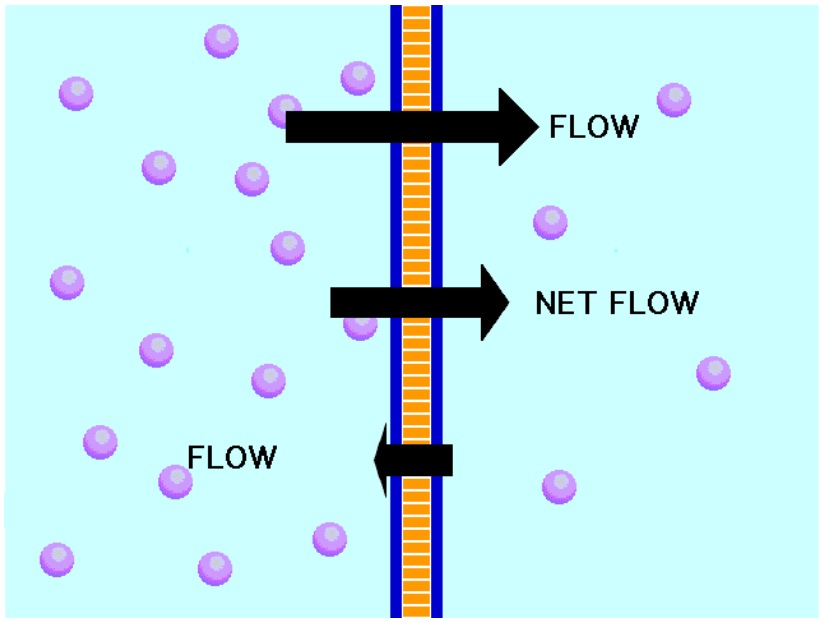
- Three types:
  - Diffusion
  - Facilitated diffusion
  - Osmosis



Diffusion

- The process by which molecules spread from areas of high concentration, to areas of low concentration (Moving across the concentration gradient)
- No energy is required
- When the molecules are even throughout a space - it is called **EQUILIBRIUM**

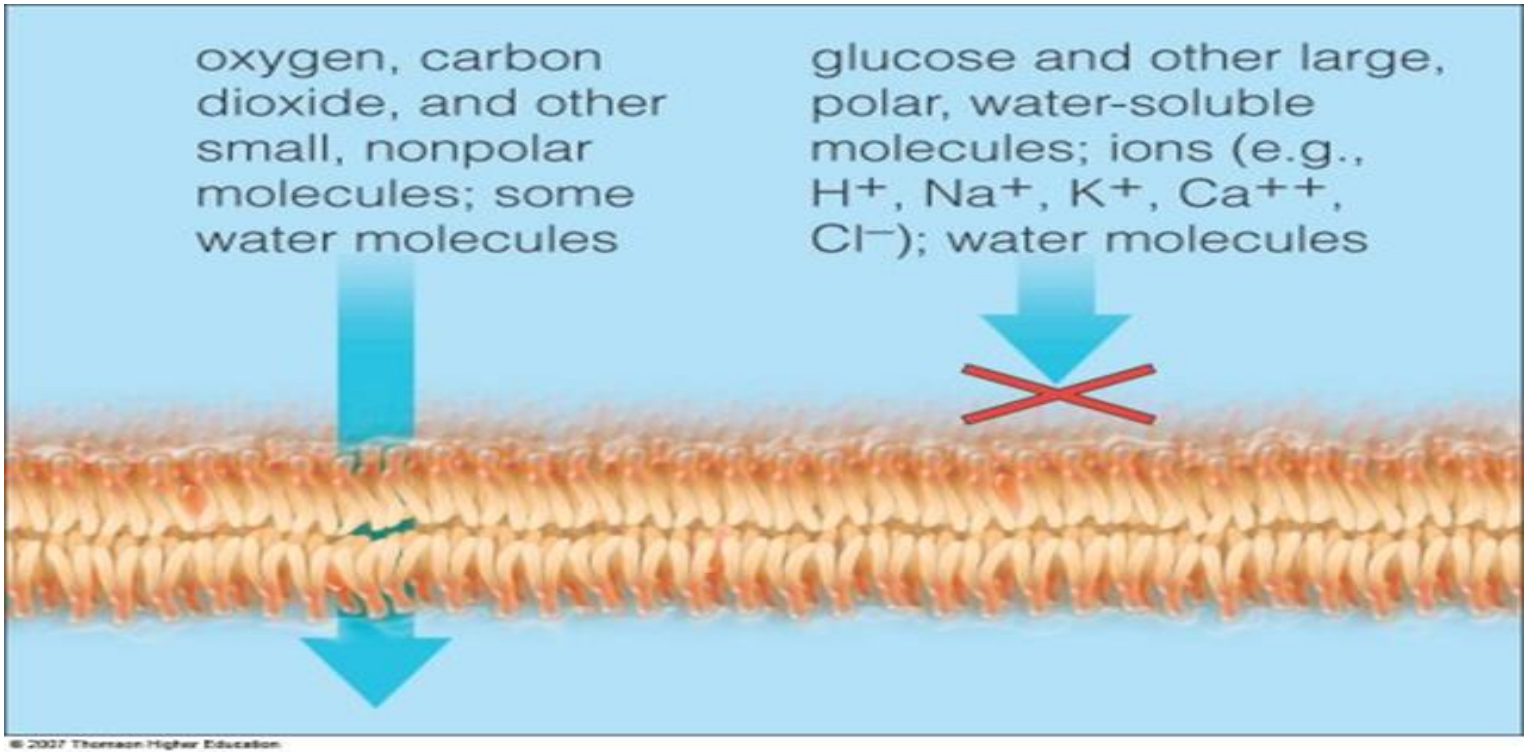
Diffusion across a membrane



- Permeable – membrane through which molecules can pass
- Move from high concentrations to low until equilibrium is reached
- Small, uncharged particles (oxygen, carbon dioxide, most lipids)
- No energy required

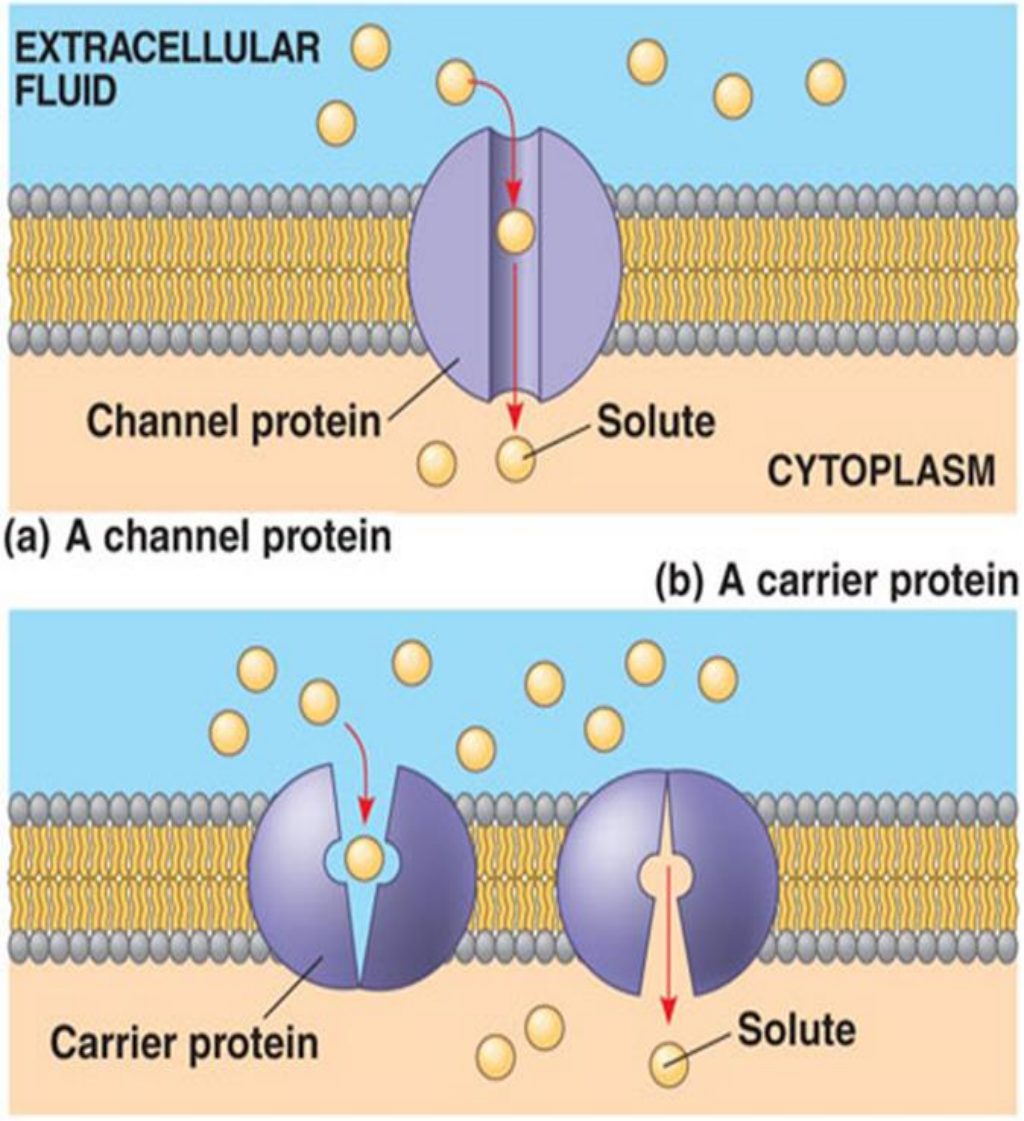
Facilitated Diffusion

- Molecules that cannot directly diffuse across the membrane pass through special protein channels
- NO ADDITIONAL ENERGY NEEDED



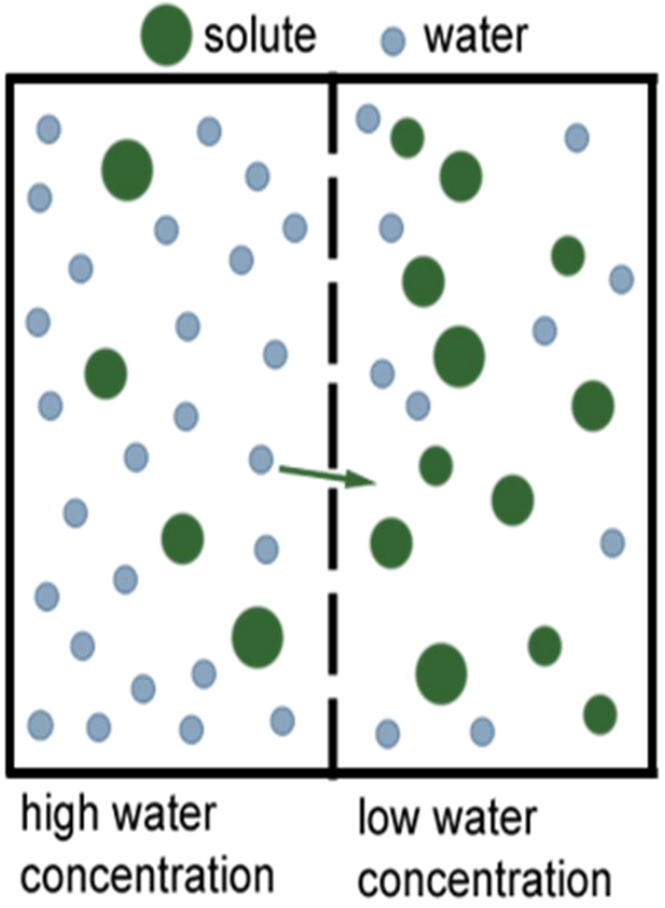
Facilitated Diffusion

- Ions & large molecules (Cl^- and glucose)
- Protein channels (“carriers”)
- Specific for each ion/molecule



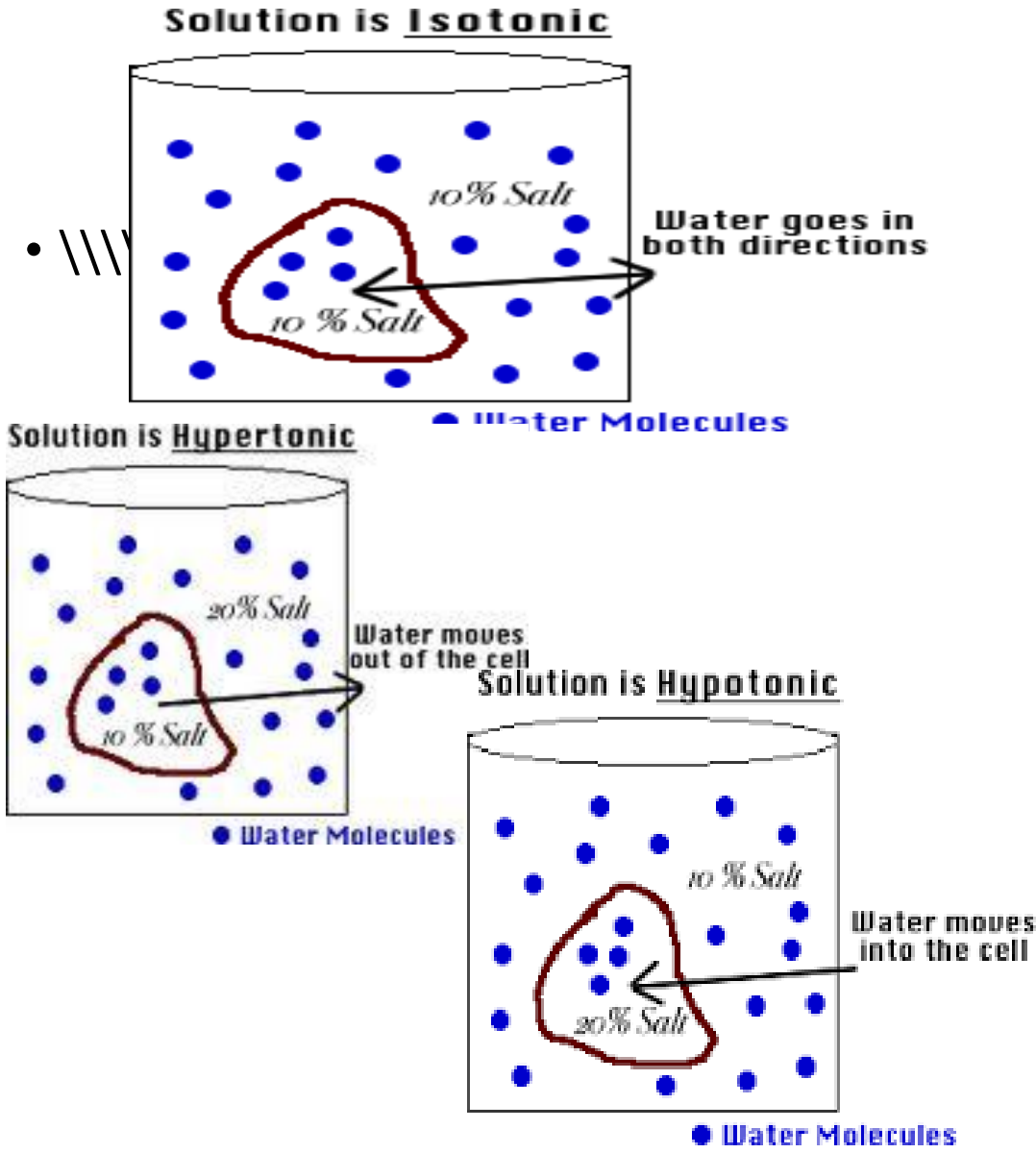
Osmosis

- Osmosis is the diffusion of water through a selectively permeable membrane down its concentration gradient
- From an area of high water concentration to an area of lower water concentration



Osmotic Solutions

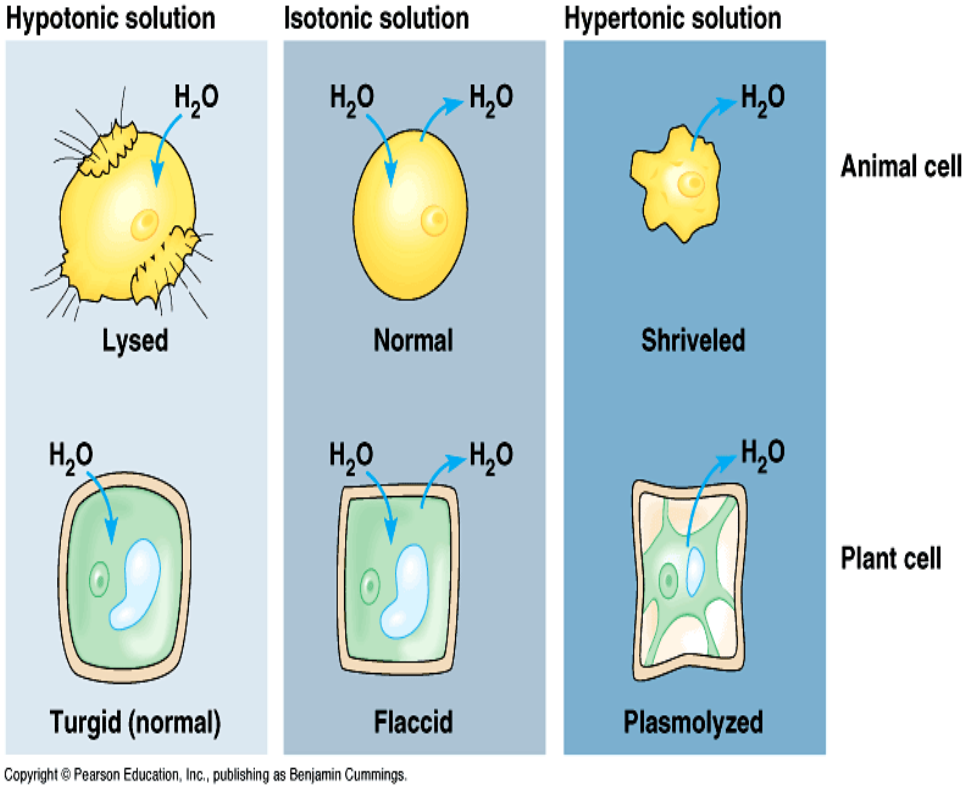
- Isotonic- concentrations of solute and solvent are equal
- Hypertonic- higher concentration of solutes
- Hypotonic- lower concentration of solutes



Osmotic Pressure

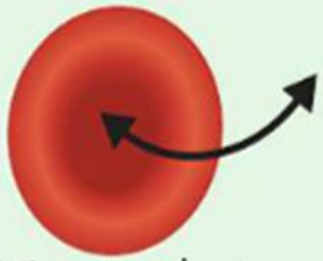
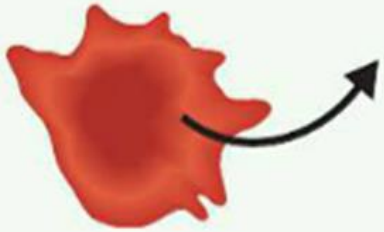
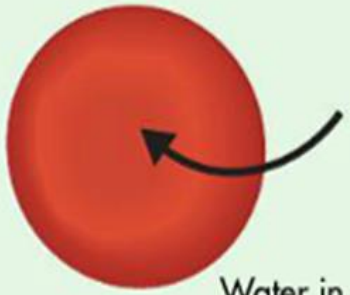
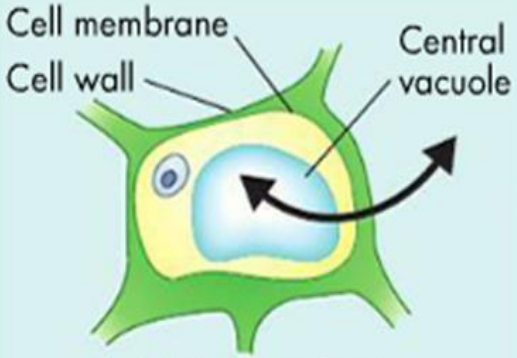
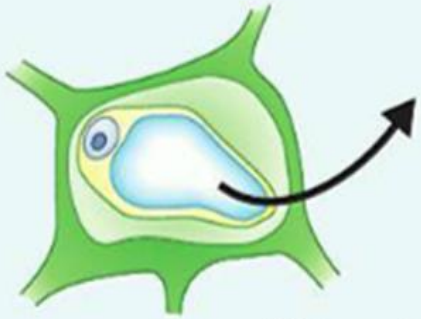
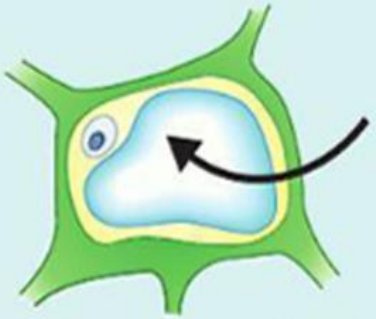
The pressure required to prevent the passage of water through a semi-permeable membrane from a region of low concentration of solutes to one of higher concentration, by osmosis.

Cell walls create this pressure this prevents plant cells from breaking



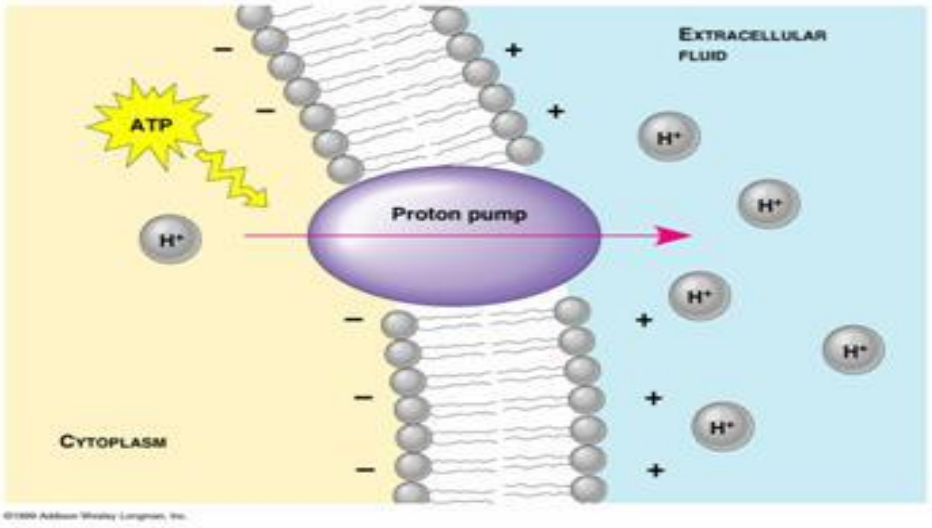
Osmotic pressure (again)

The Effects of Osmosis on Cells

Solution	**Isotonic:** The concentration of solutes is the same inside and outside the cell. Water molecules move equally in both directions.	**Hypertonic:** The solution has a higher solute concentration than the cell. A net movement of water molecules out of the cell causes it to shrink.	**Hypotonic:** The solution has a lower solute concentration than the cell. A net movement of water molecules into the cell causes it to swell.
Animal Cell	 Water in and out	 Water out	 Water in
Plant Cell	 Water in and out	 Water out	 Water in

Active Transport

- Movement **against** a concentration gradient
- **Requires Energy (ATP)**
- Allows for stockpiling
- One direction

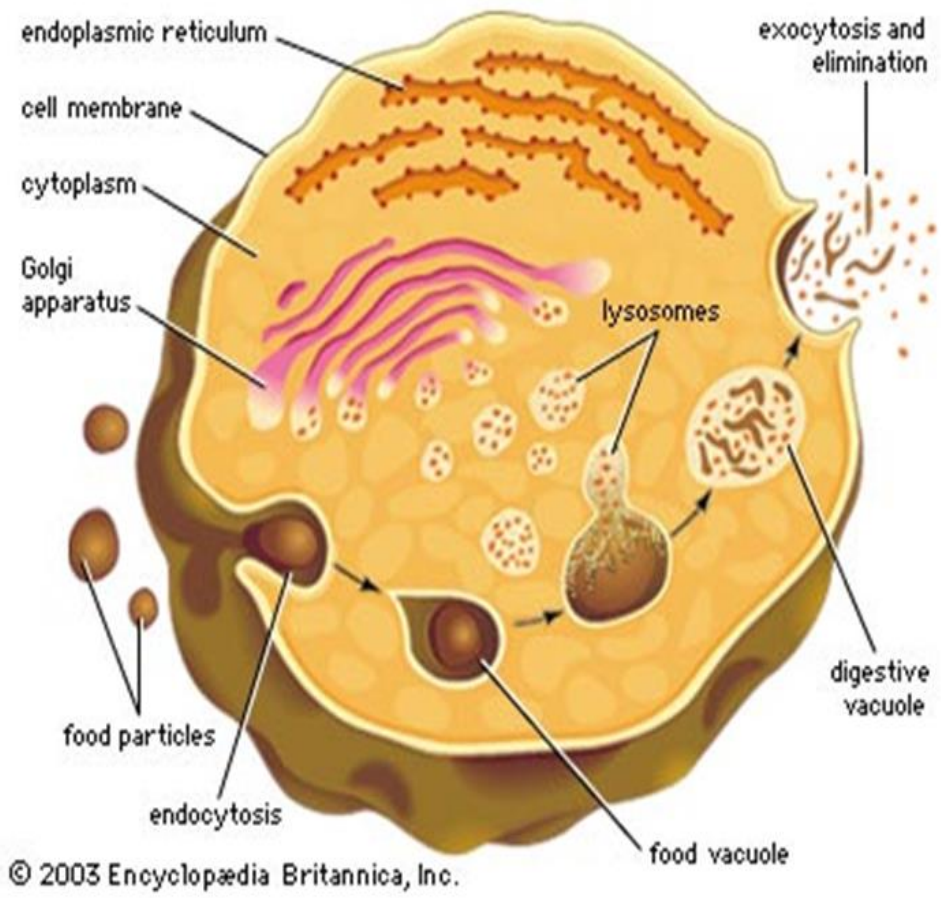


- **Types**:
  - Molecular Transport (Protein Pumps)
  - Bulk Transport (Endocytosis and Exocytosis)

Endocytosis

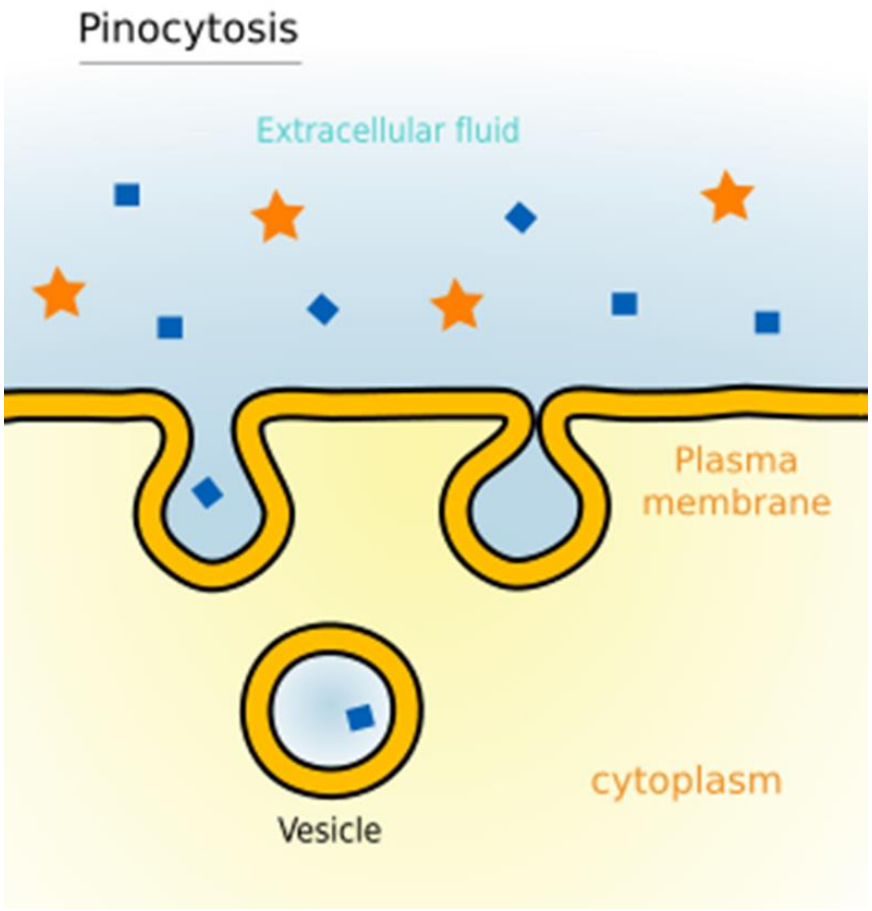
The process by which cells absorb material (molecules such as proteins) from outside the cell by engulfing it with their cell membrane

- Two Types
  - Pinocytosis
  - Phagocytosis



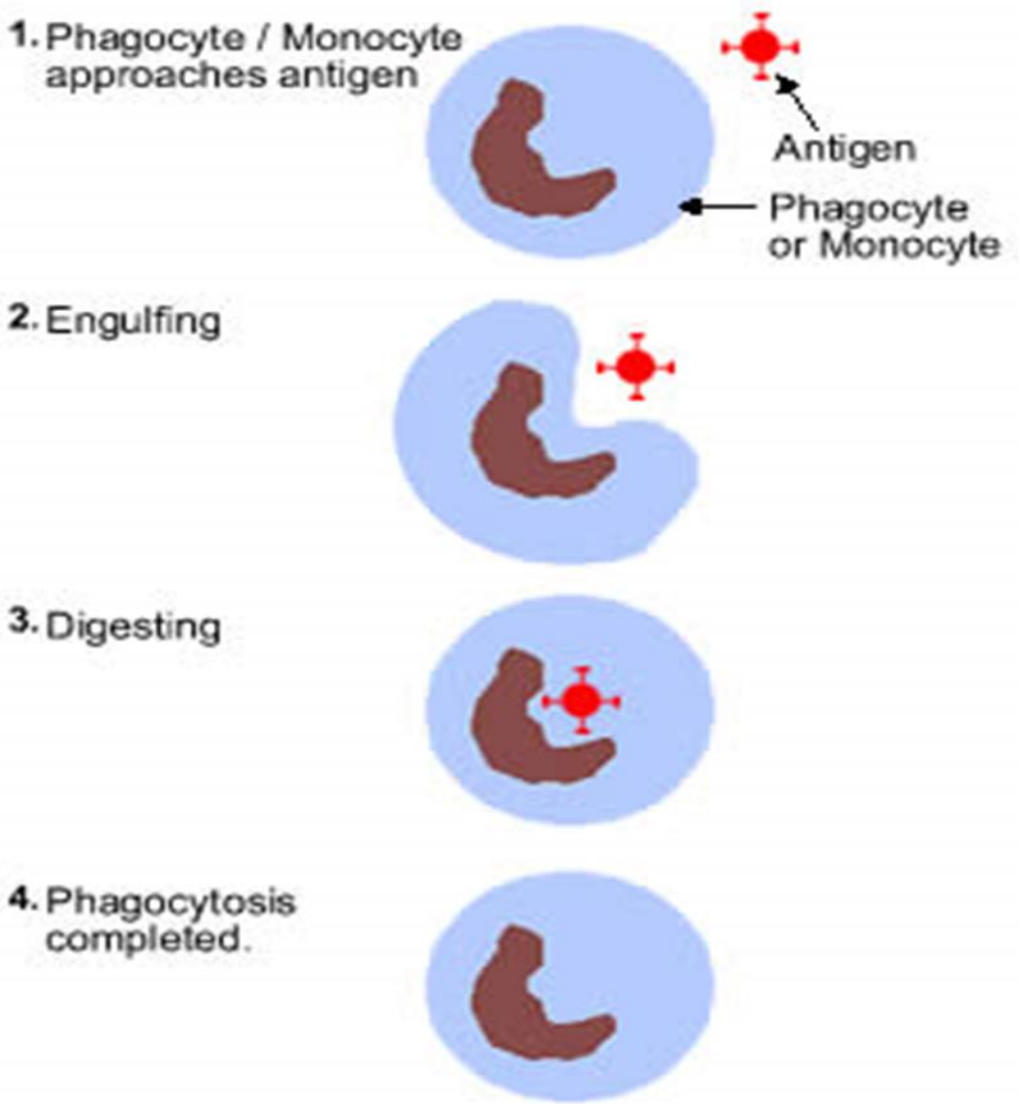
Pinocytosis

- Movement of liquids into the cell



Phagocytosis

- movement of solids into the cell.



Exocytosis

A cellular process where cells eject waste products or chemical transmitters (such as hormones) from the interior of the cell.

- Exocytosis is similar in function to Endocytosis but works in the opposite direction.