Diffusion

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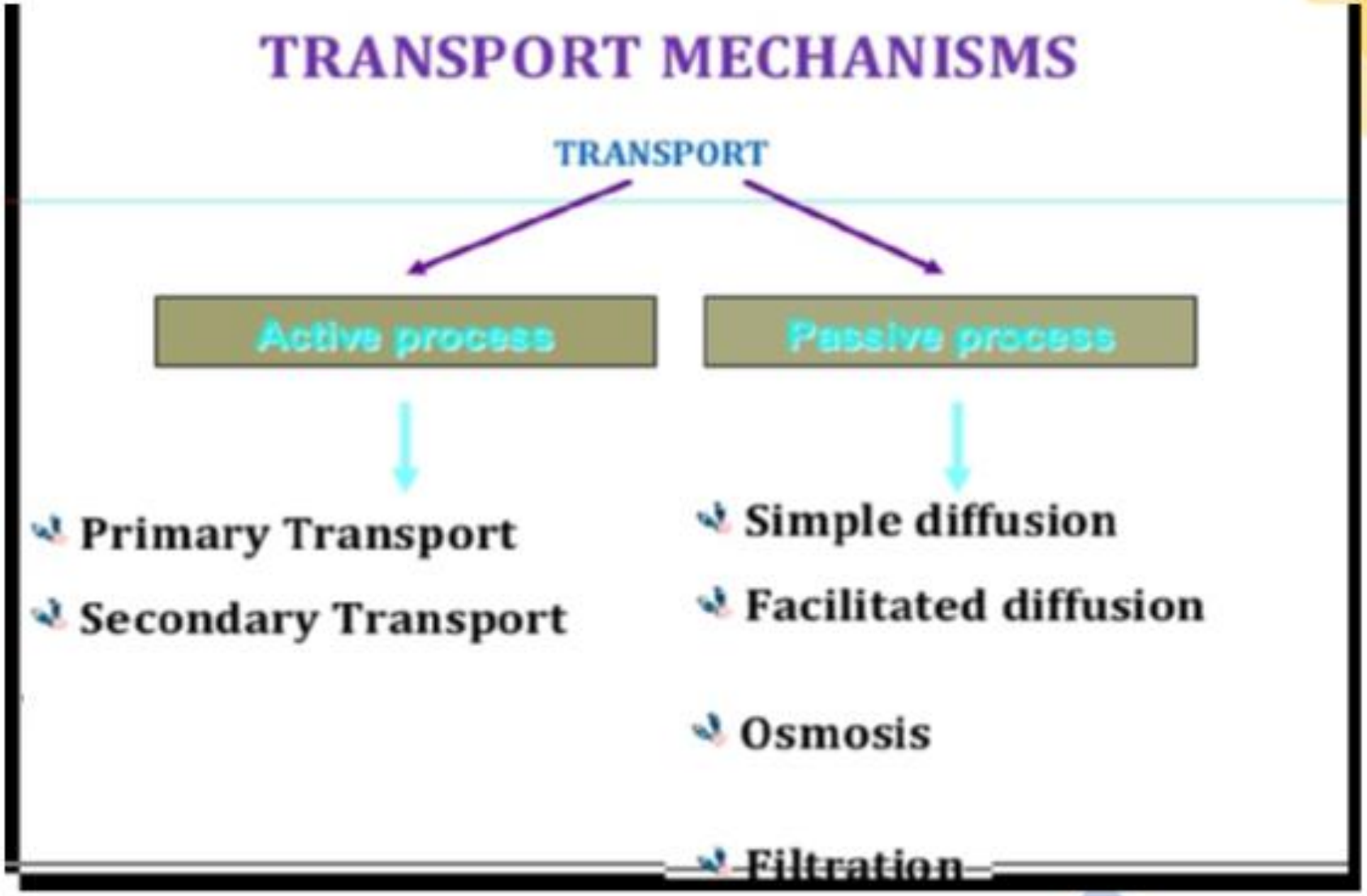
Objectives

- Identify type of transport the cell membrane
- Identify passive transport
- Identify diffusion
- The difference between diffusion and osmosis

TRANSPORT MECHANISMS



Passive Transport

Cytoplasm, extracellular fluid and cell membrane vary in concentrations and pressure gradients.

Concentration refers to the overall POPULATION of molecules as well as the RATIO in that location compared to another.

Net Movement

DYNAMIC EQUILIBRIUM

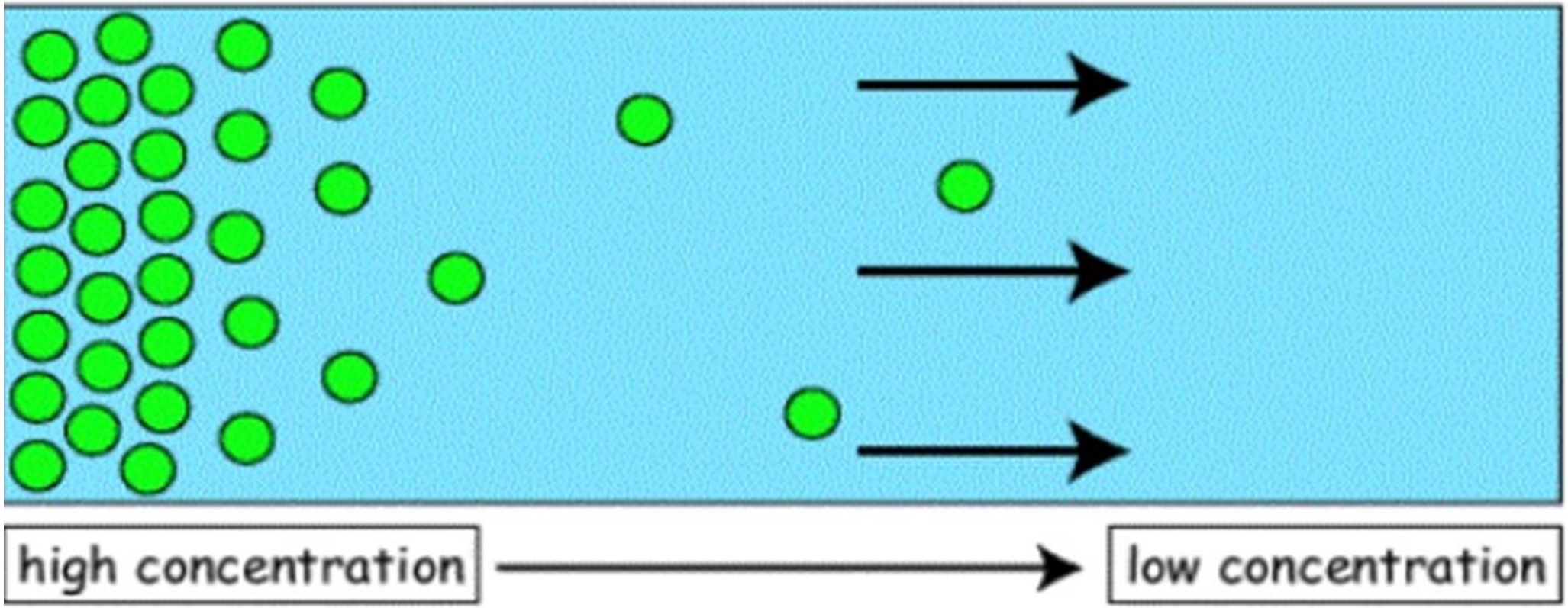
Passive transport includes

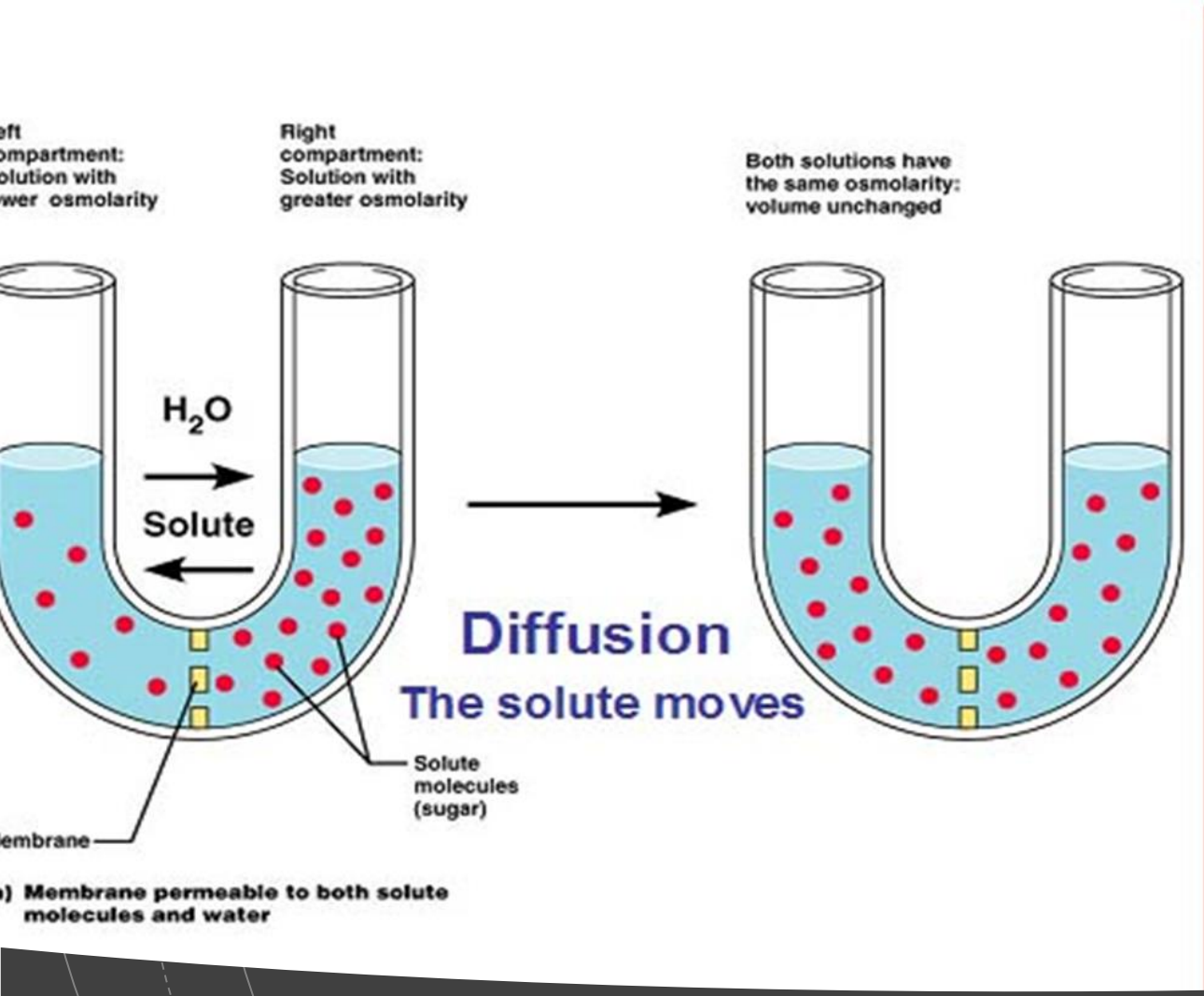
- **Simple Diffusion**
  - **Tendency of molecules of any substance to spread out into the available space. Substances will diffuse down their concentration gradient.**
- **Osmosis**
  - **The diffusion of water molecules across a selectively permeable membrane.**
  - **Hypertonic = solution with higher [conc.] of solutes**
  - **Hypotonic = solution with lower [conc.] of solutes**
  - **Isotonic = solutions are equal in solute concentration**
- **Facilitative Diffusion**

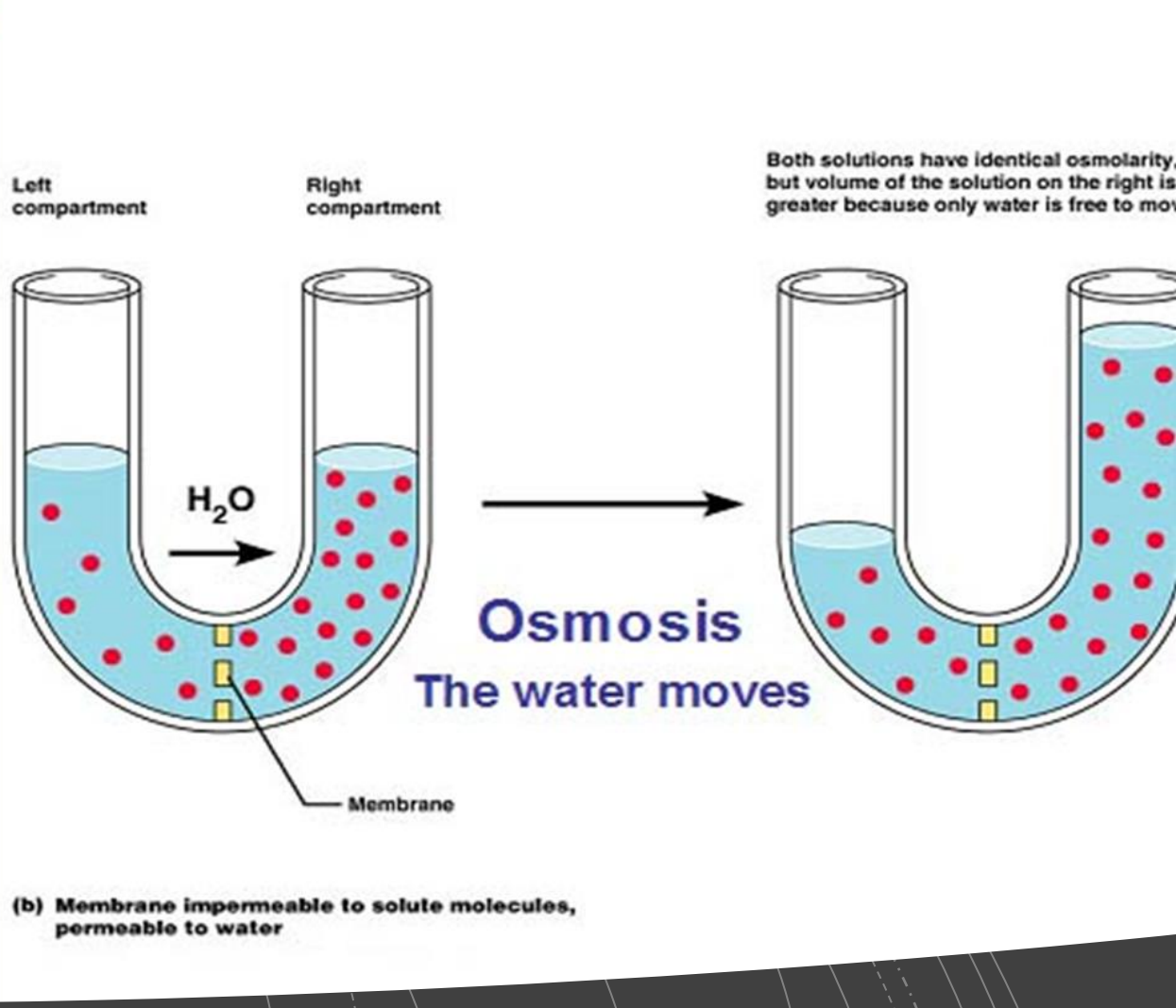
-Transport proteins are helping molecules to cross membrane, but still diffusion (lowering overall free energy) thus doesn't require energy from cell.

- **Filtration**

Diffusion







Diffusion Vs. Osmosis

FACTORS AFFECTING NET RATE OF DIFFUSION

FICK'S LAW OF DIFFUSION:

$$J = -\frac{DA \times (C1-C2)}{T}$$ at particular temperature.

D = Diffusion coefficient.
A = Surface area.
C1&C2 = Concentrations on either sides.

Factors that Influence Diffusion Rates

- Distance -
  - The shorter the distance, the more quickly [ ] gradients are eliminated
  - Few cells are father than 125 microns from a blood vessel
- Molecular Size
  - Ions and small molecules diffuse more rapidly
- Temperature -
  - ↑ temp., ↑ motion of particles
- Steepness of concentrated gradient -
  - The larger the [ ] gradient, the faster diffusion proceeds
- Membrane surface area -
  - The larger the area, the faster diffusion proceed

Diffusion Across Membranes

- **Simple Diffusion**
  - Lipophilic substances can enter cells easily because they diffuse through the lipid portion of the membrane
    - Examples are fatty acids, steroids, alcohol, oxygen, carbon dioxide, and urea,
- **Channel-Mediated Diffusion**
  - Membrane channels are transmembrane proteins
  - Used by ions, very small water-soluble compounds
  - Much more complex than simple diffusion

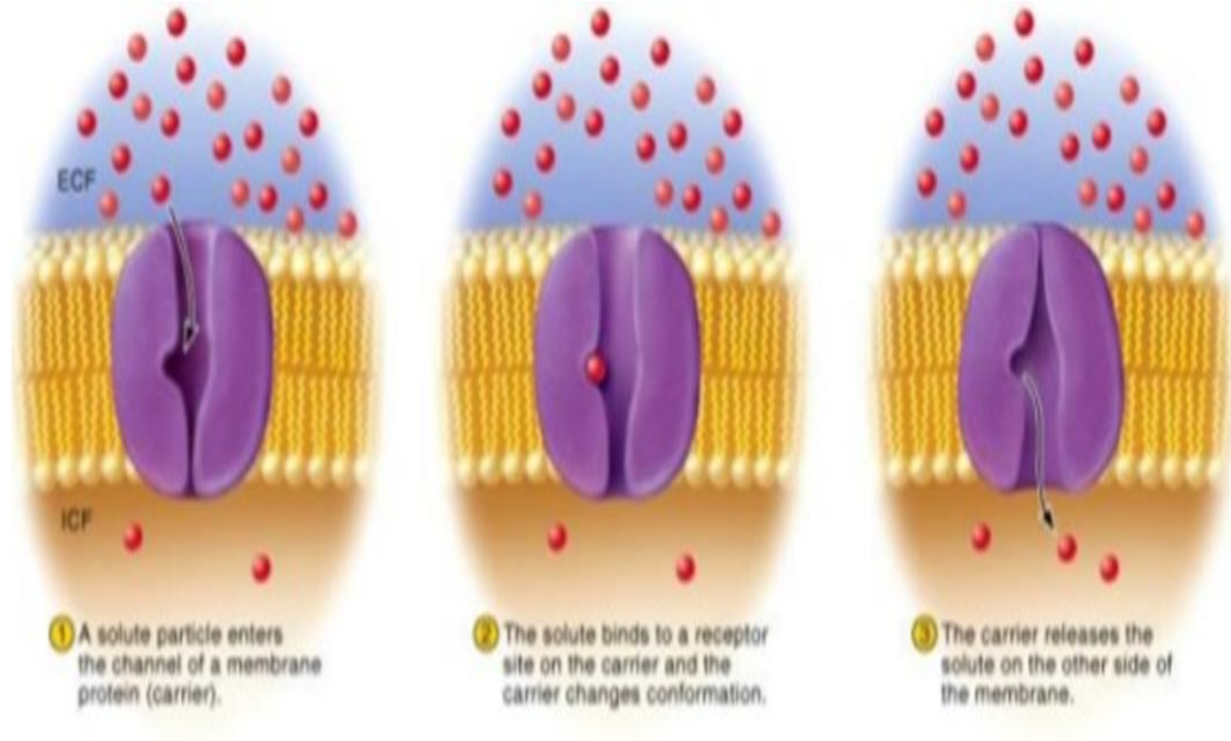
Facilitated Diffusion

Glucose and amino acids are insoluble in lipids and too large to fit through membrane channels

Passive process, i.e. no ATP used

Solute binds to receptor on carrier protein

- Latter changes shape then releases solute on other side of membrane
- Substance moved *down* its concentration gradient



Diffusion through the cell membrane