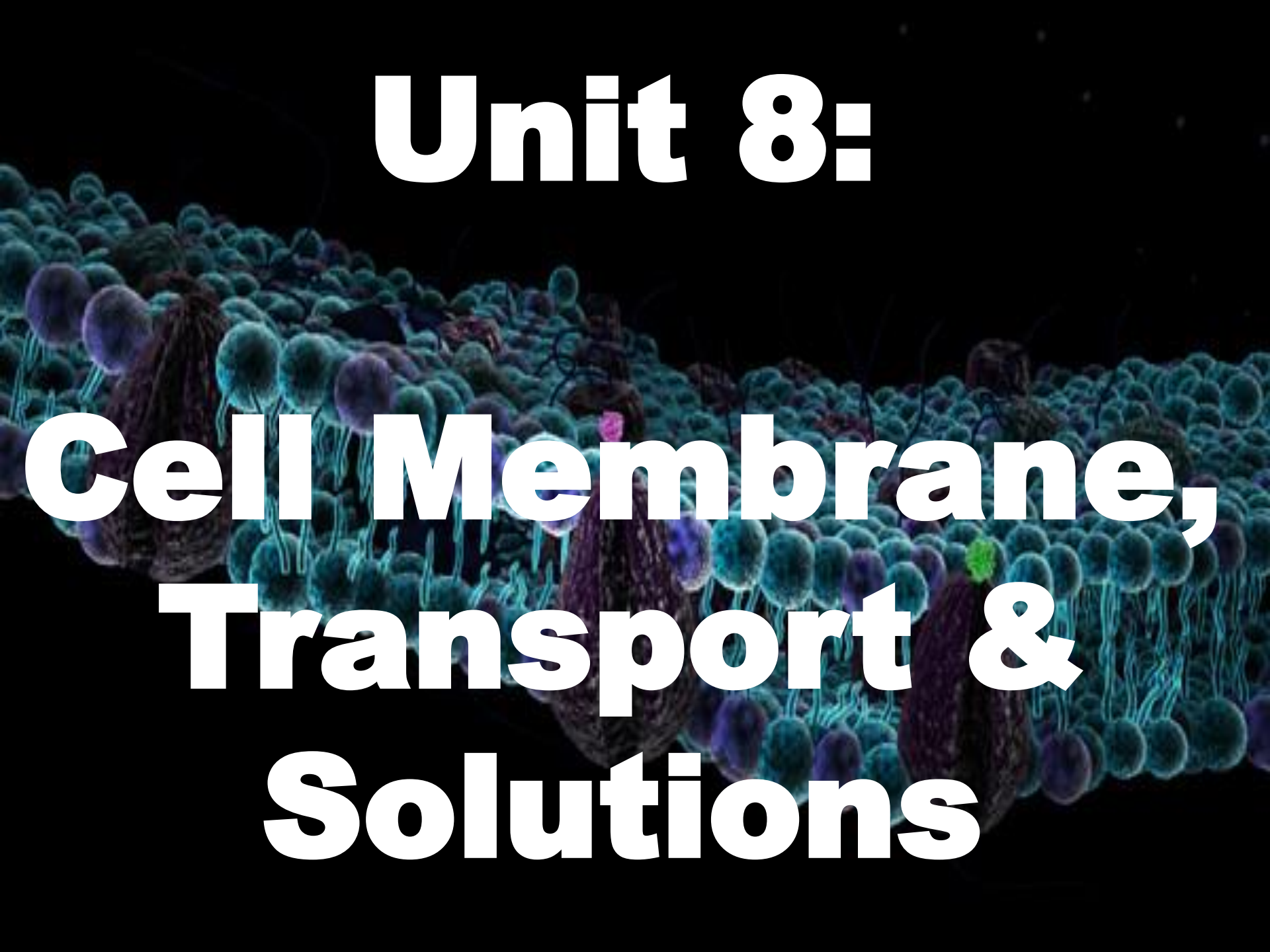
Unit 8:

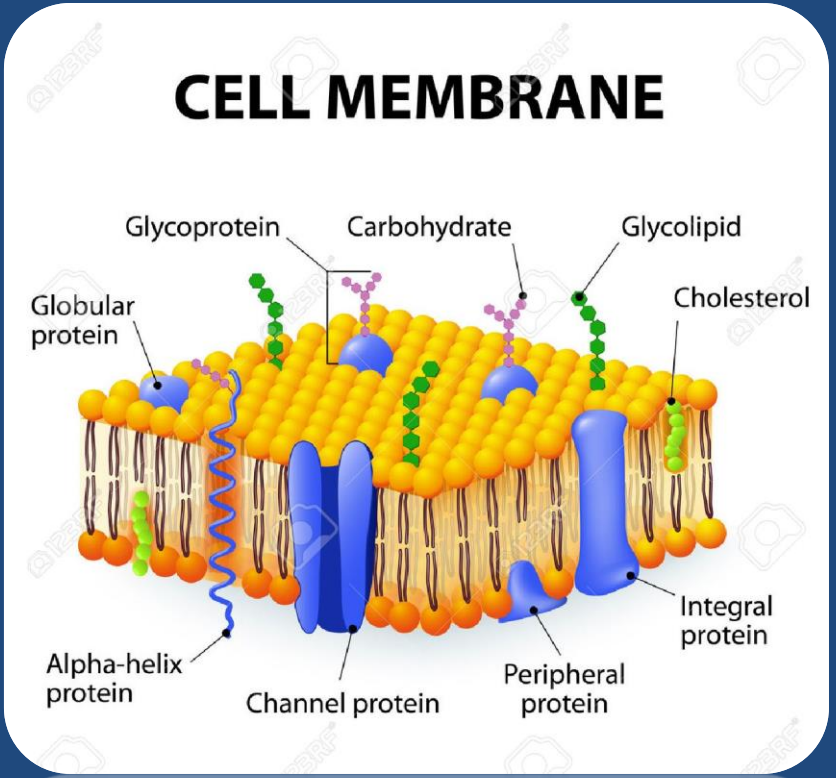


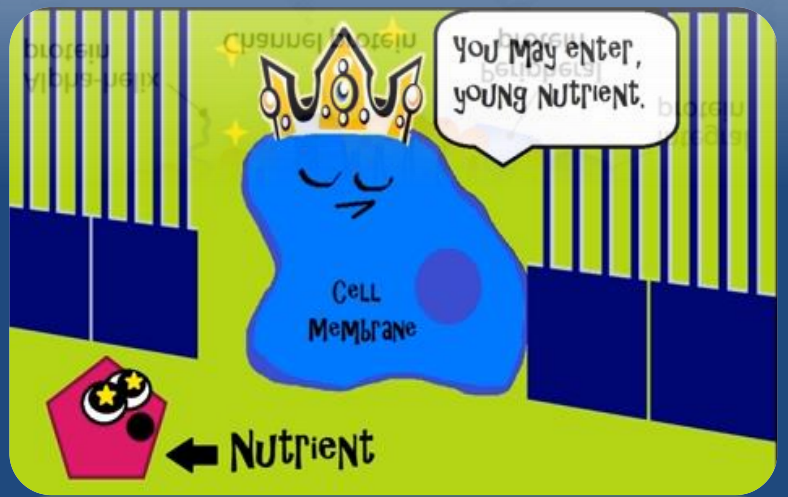
Cell Membrane, Transport & Solutions

Functions of Cell Membrane:

- Provides **protection & support**

- Regulates:
  - What **enters** & **leaves** the cell
  - Takes in **food** & **water**
  - Holds **cytoplasm** within the cell
  - Eliminates wastes to maintain **homeostasis**

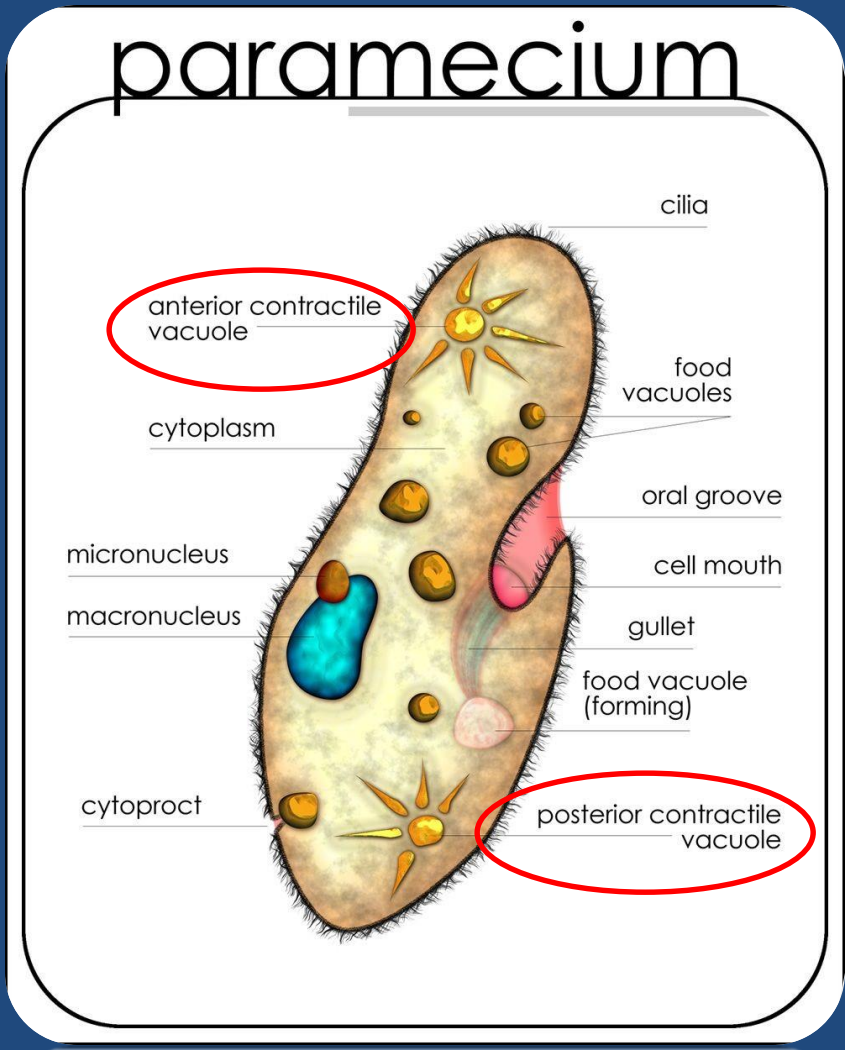




What is *Homeostasis*?

- An organism's ability to keep a **constant (or balanced)**, internal environment

- Ex: Paramecium have contractile vacuoles that collect and remove excess water



Structure of Cell Membrane/Lipid Bilayer

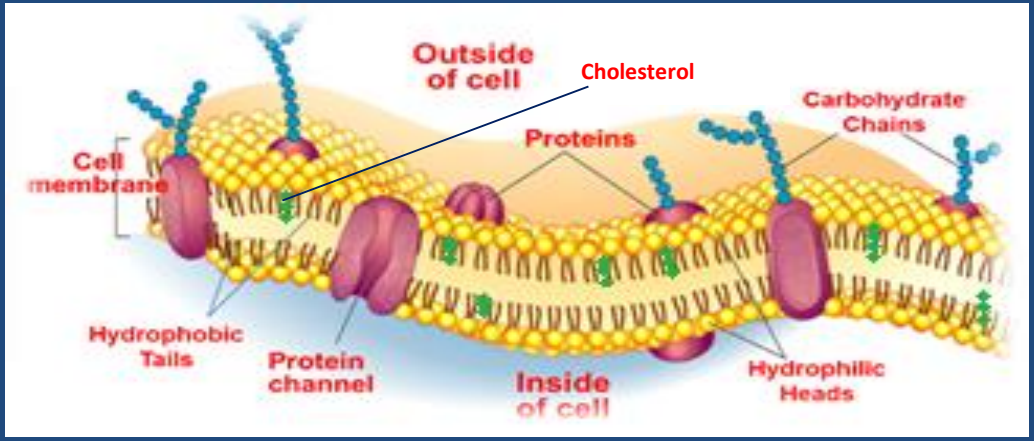
- **Protein molecules** embedded in lipid bilayer

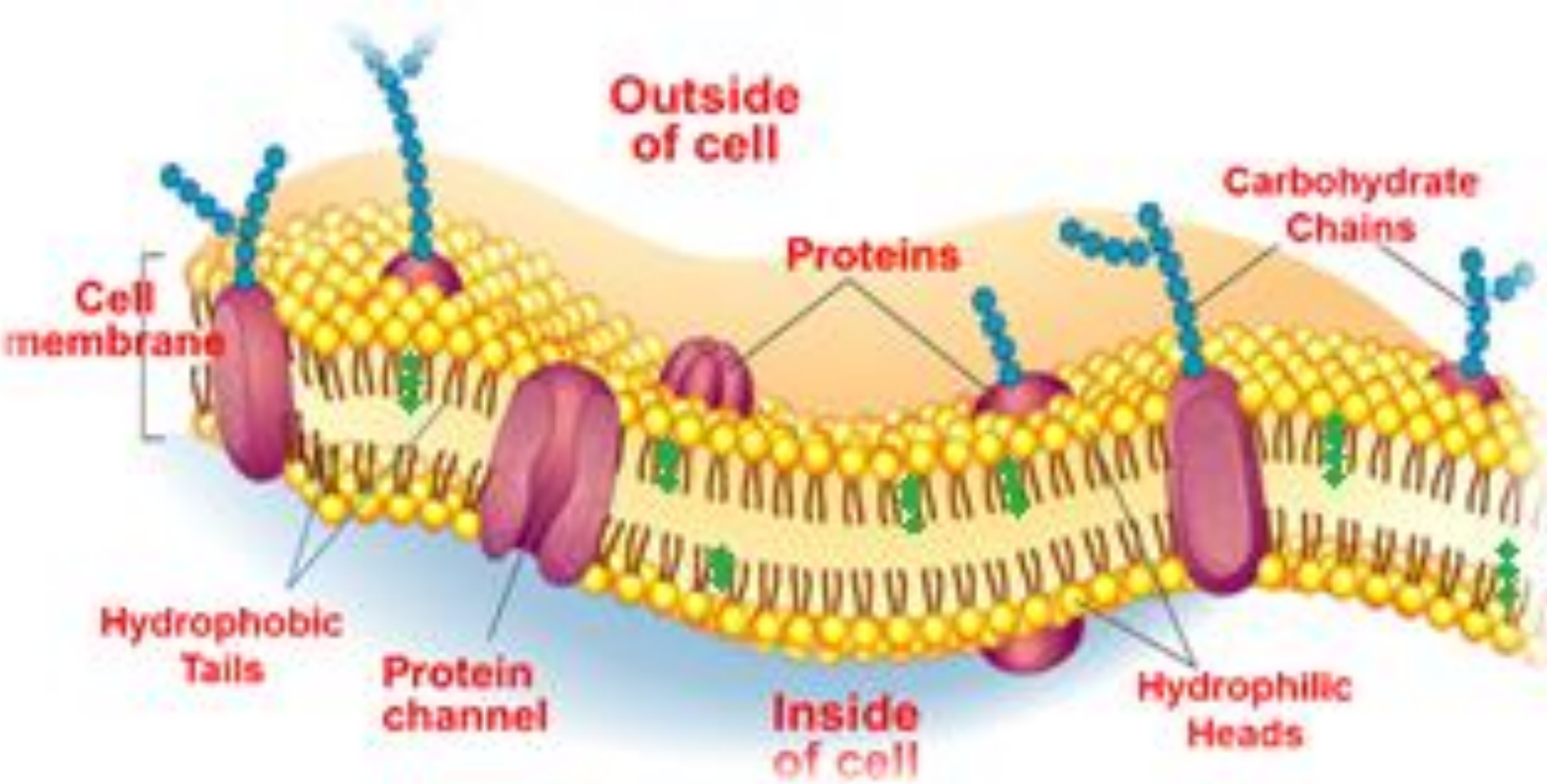
  -Forms **channels** and **pumps** to move **materials** (large molecules) **across cell membrane**

- Carbohydrate chains for **recognizing** other cells, determining self from non-self.

  *Can be a problem for organ transplants

- **Cholesterol** in-between hydrophobic tails gives cell membrane more support and prevents water-soluble molecules from moving across the cell membrane




Outside
of cell
Carbohydrate
Chains
Proteins
Cell
membrane
Hydrophobic
Tails
Protein
channel
Inside
of cell
Hydrophilic
Heads

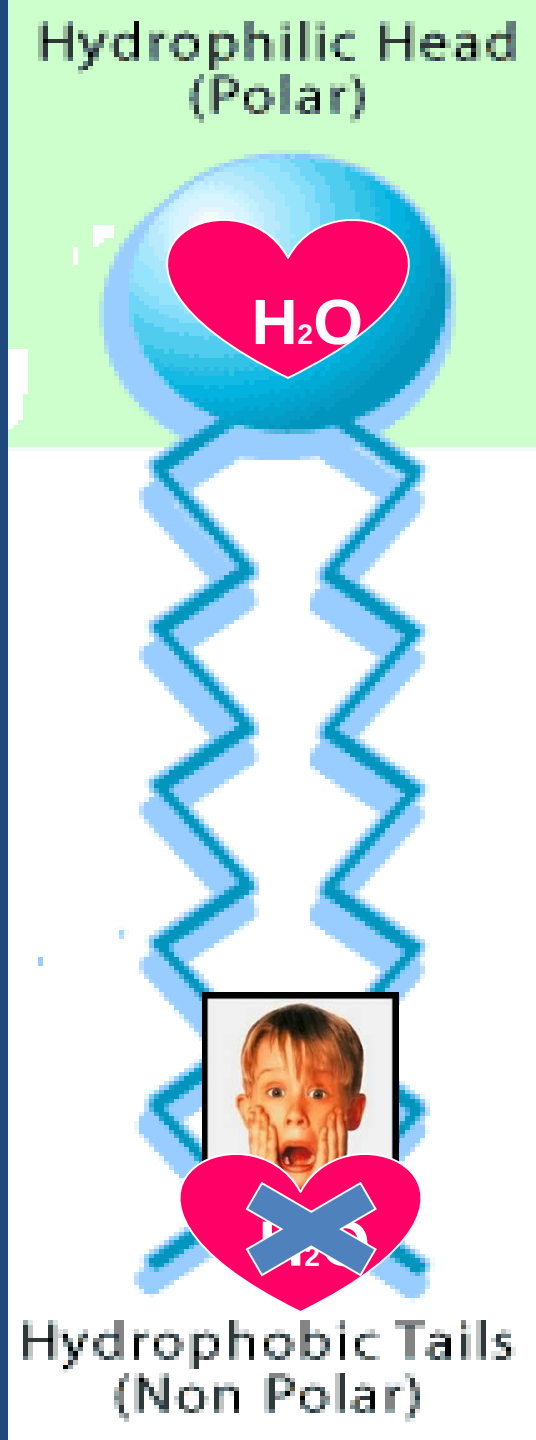
Hydrophilic Heads/Hydrophobic Tails

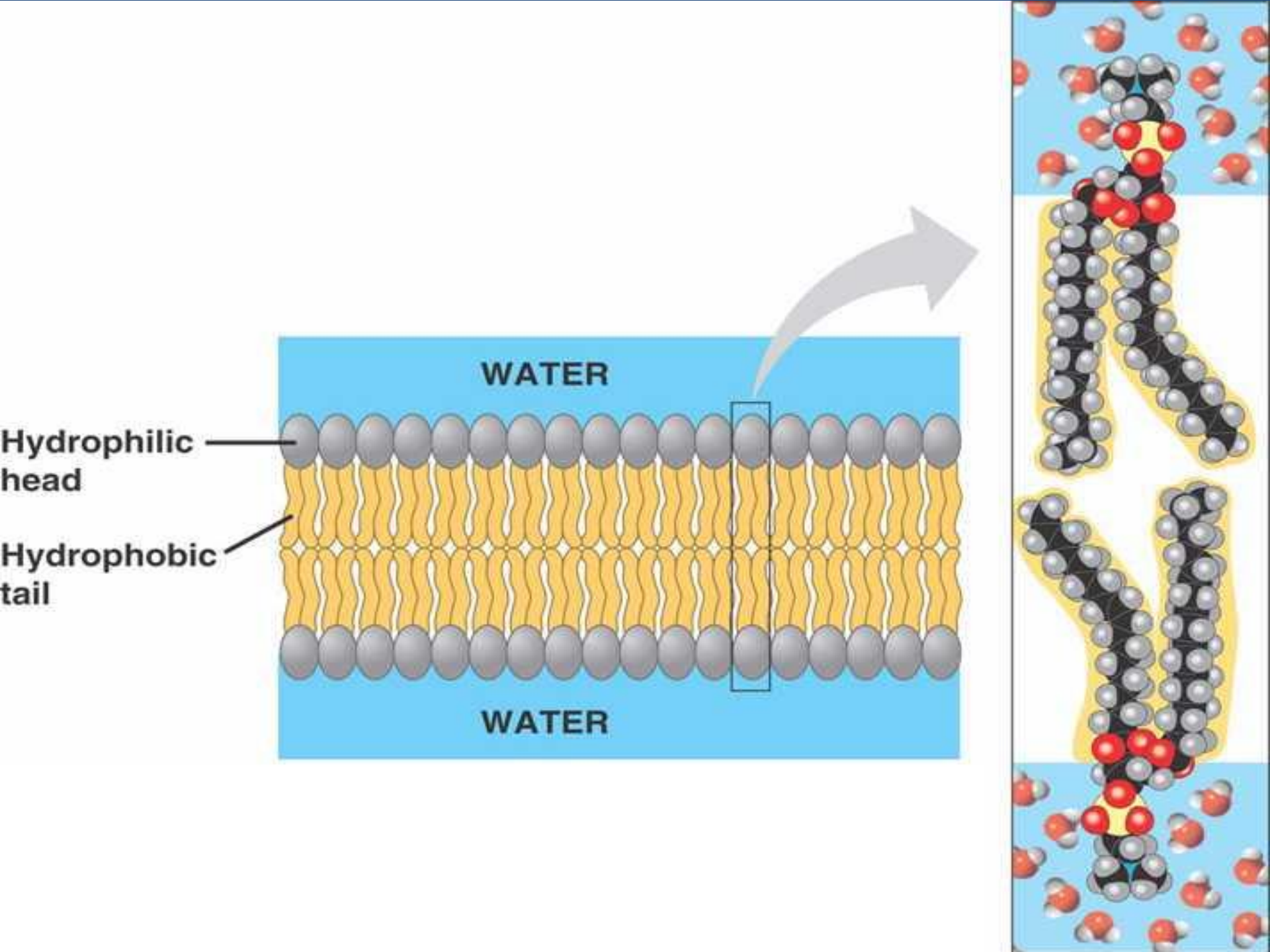
Composed of **LIPID bilayers** (also called a phospholipid)

- Top & bottom of layer has **phosphate** – Has a charge & can attract water **(Hydrophilic)**
- Middle has a **lipid tail**

– Has no charge, and does not mix with water **(Hydrophobic)**

- **Head and Tail are important in forming the LIPID Bilayer**



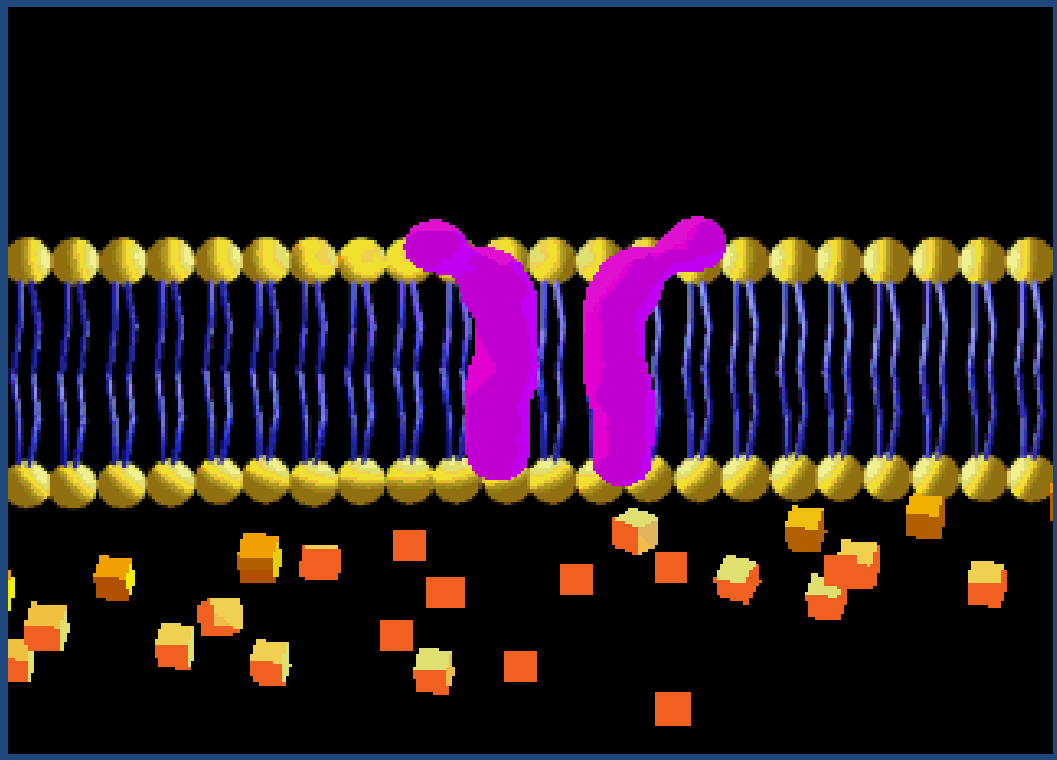

WATER
Hydrophilic head
Hydrophobic tail
WATER

Purpose of Cell Transport

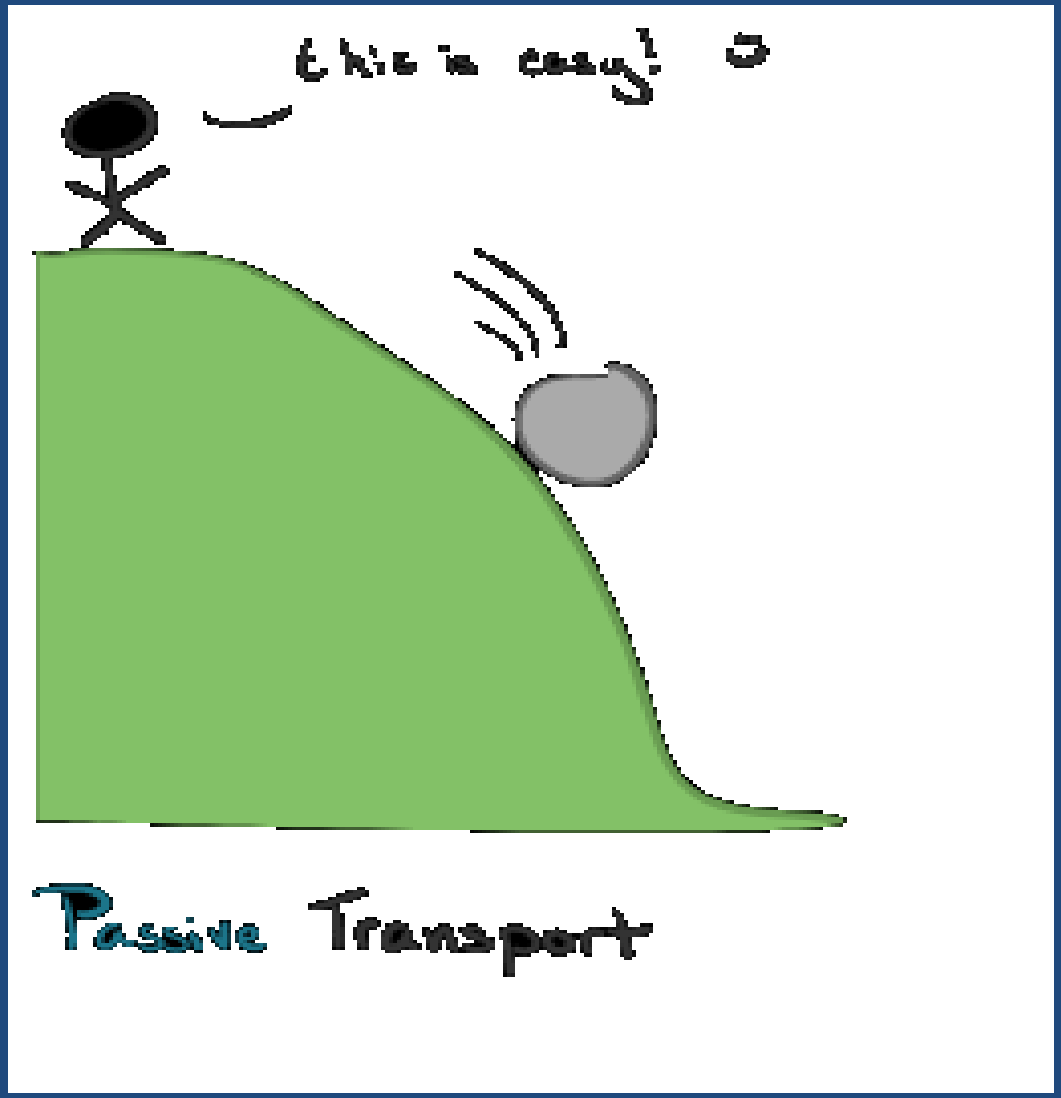
- Cells must move materials across the membrane in order to maintain homeostasis

– Nutrients/ Oxygen must be able to move ***into*** the cell

– Wastes must be able to move ***out*** of the cell



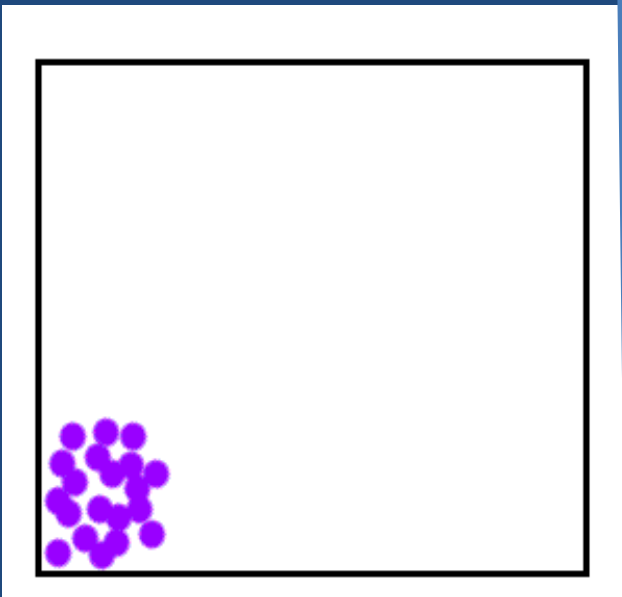
Passive Transport – NO Energy!



Passive Transport – requires NO Energy!

1. Diffusion

- Movement of molecules through the cell membrane from high to low concentrations

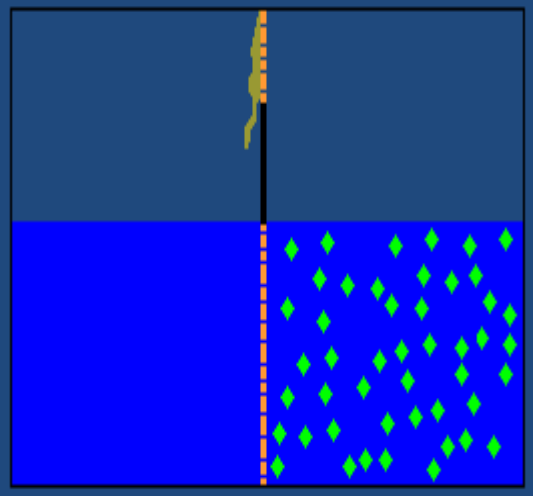


2. Facilitated Diffusion

- Movement of molecules through the cell membrane using transport proteins from high to low concentrations

3. Osmosis

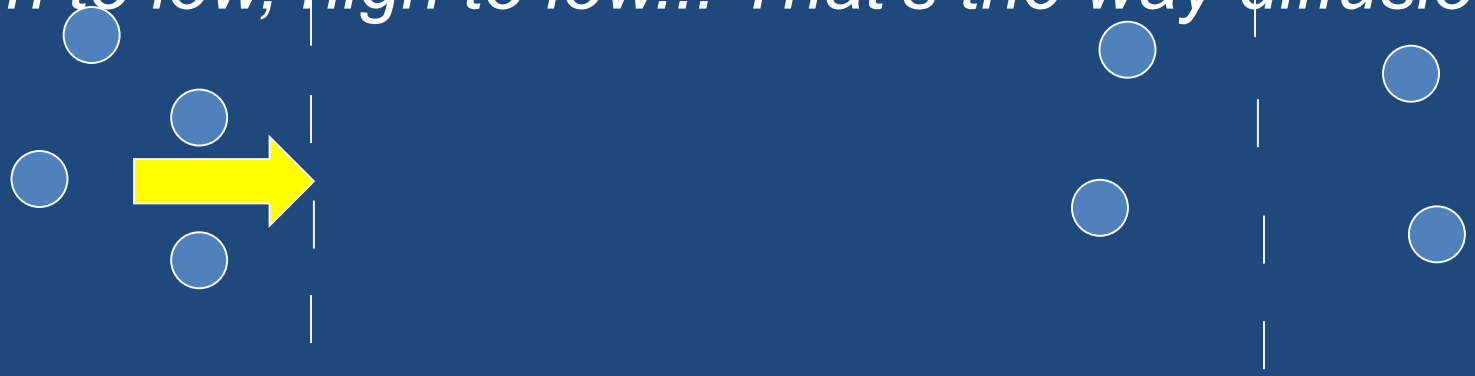
- Movement of water molecules through the cell membrane from high to low concentration



Diffusion

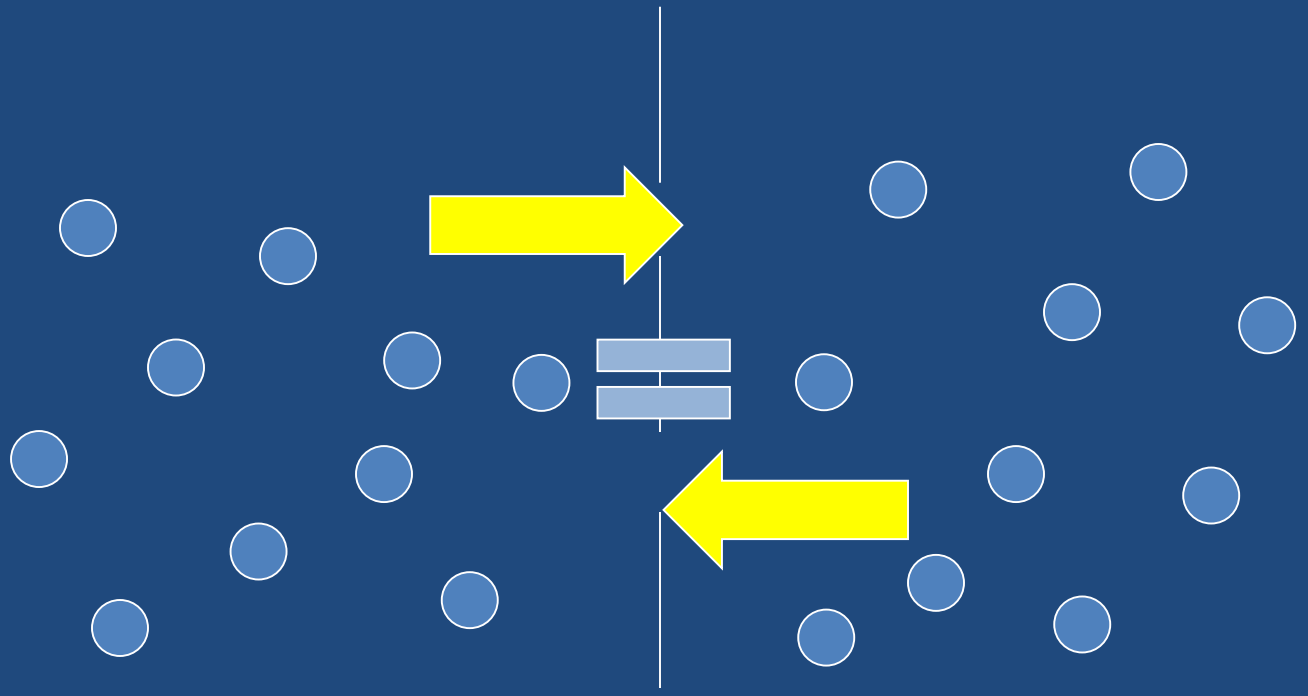
- Molecules move from areas of higher concentration to areas of lower concentration
- Molecules constantly collide back and forth to maintain homeostasis
  - NO Energy required!

"High to low, high to low... That's the way diffusion goes!"



- Molecules still move across cell membrane in both directions, but NO CHANGE in concentration

Homeostasis (or equilibrium)

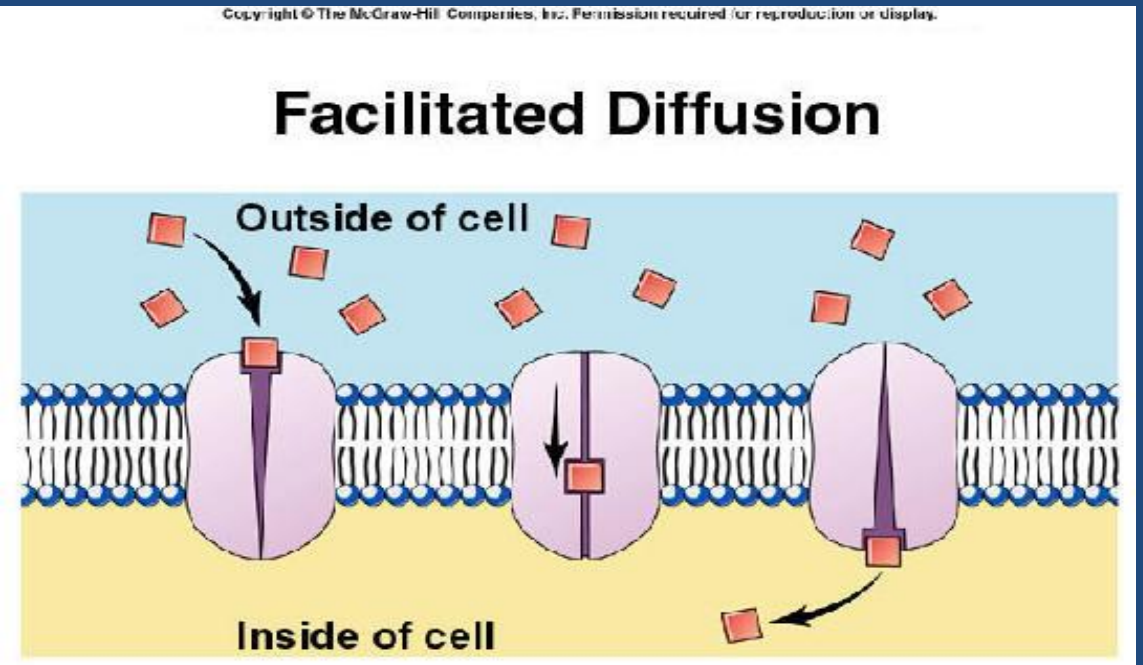


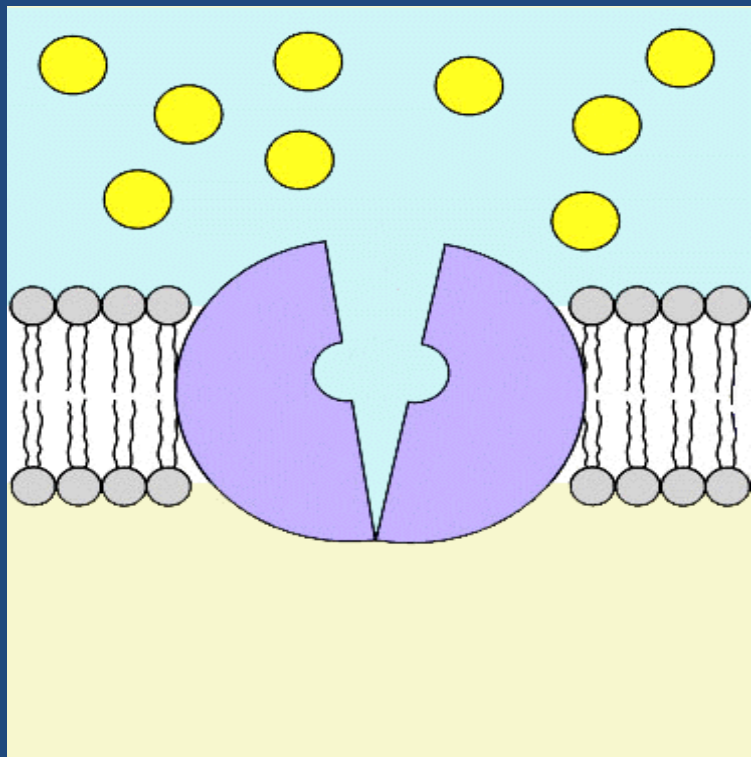
Diffusion Video

Facilitated Diffusion

Diffusion of large molecules across the cell membrane through protein channels

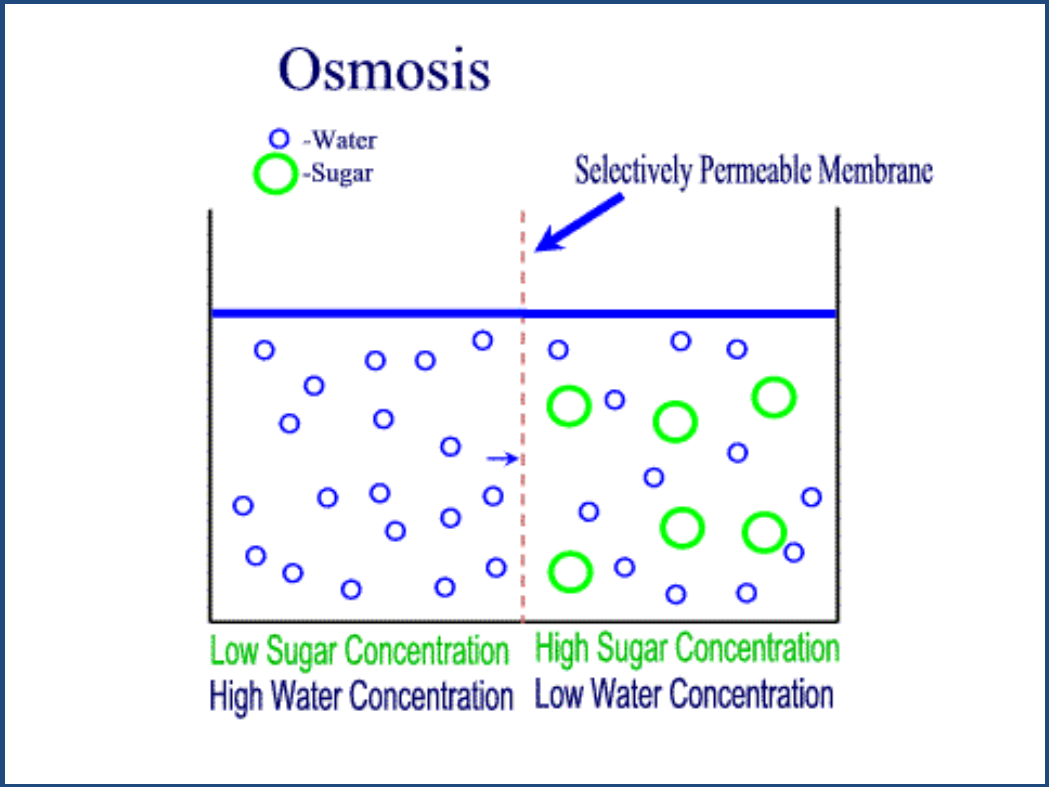
- **NO energy required!**
- Ex: Glucose



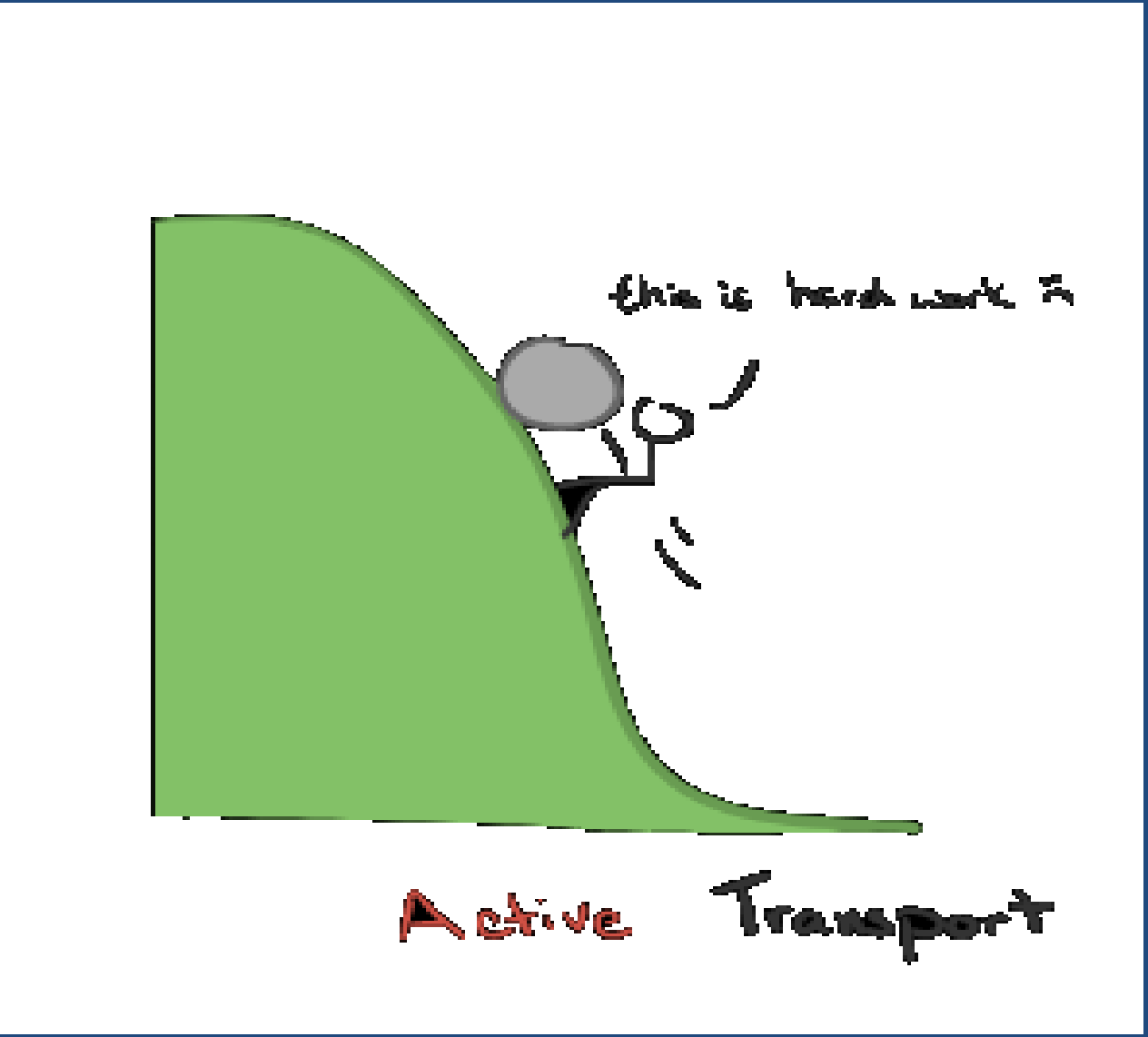


Osmosis

- Diffusion of **WATER** from areas of higher concentration to areas of lower concentration - No energy required!!!

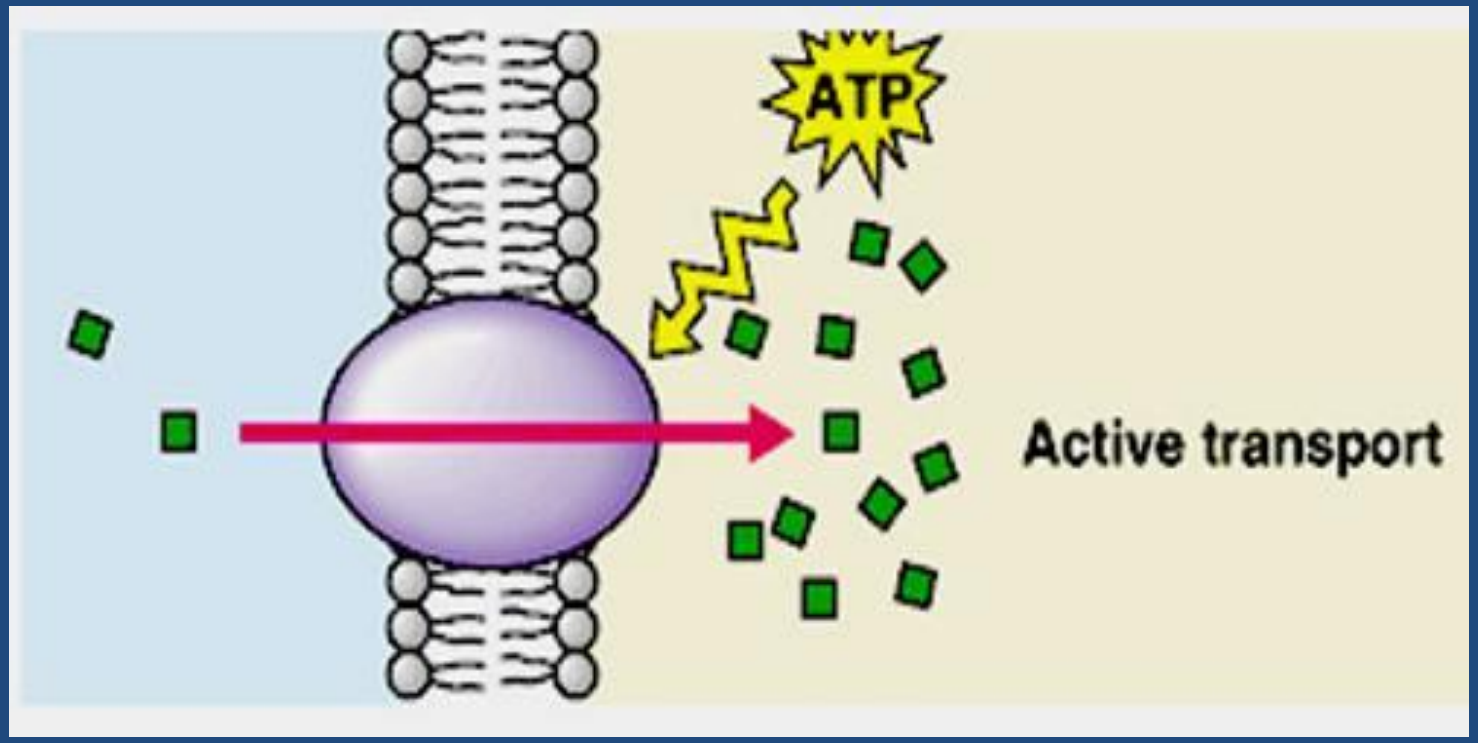


Active Transport – REQUIRES Energy!



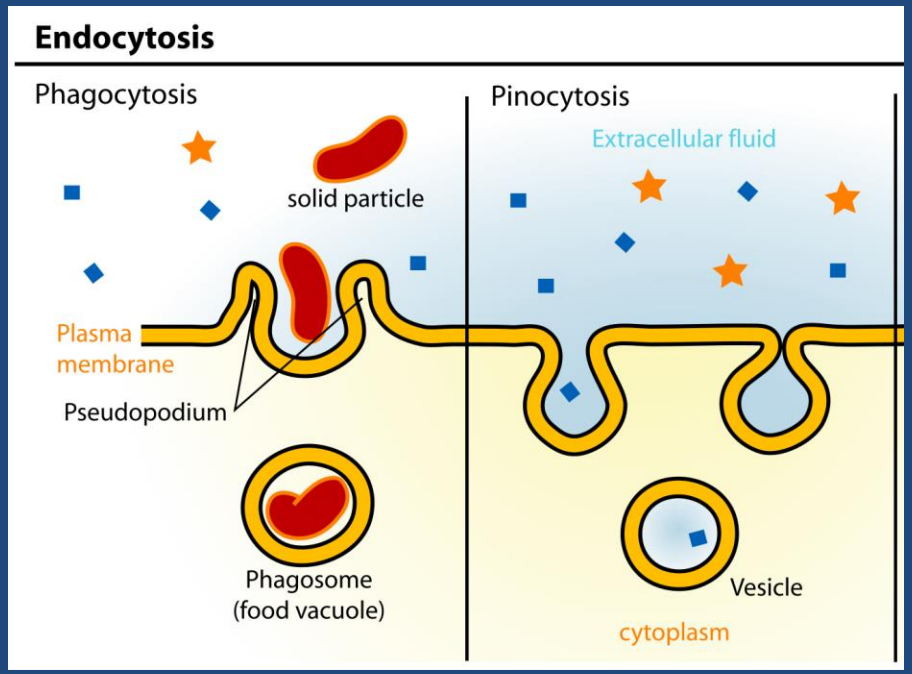
Active Transport – Requires Energy!

- Movement of materials across cell membrane from an area of **lower** concentration to **higher** concentration with help of transport protein



Endocytosis –Requires ATP!

- Endocytosis- process of taking material into the cell by means of infoldings, or pockets, of the cell membrane

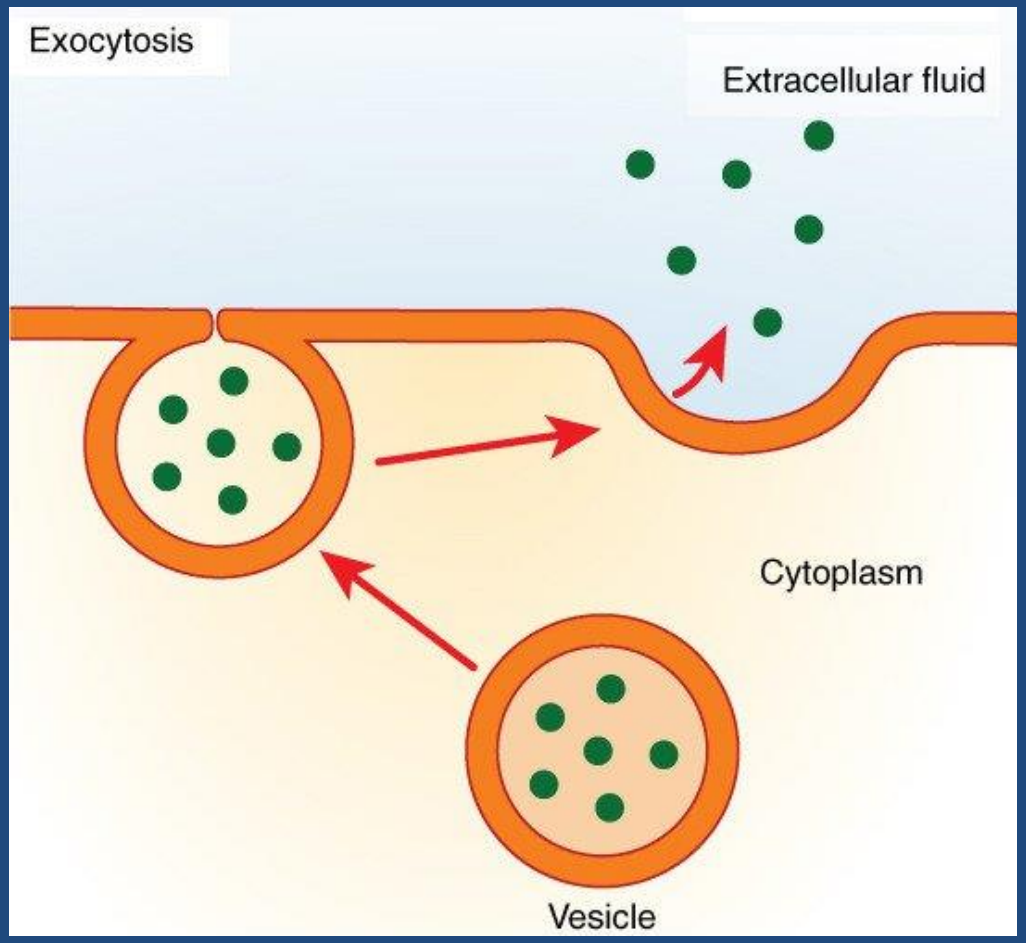


  - Phagocytosis
    - Cytoplasm surrounds a solid particle and packages it into a vacuole – cell engulfs it
  - Pinocytosis
    - Tiny pockets form along the cell membrane, fill with liquid, & pinch off to form vesicle

Exocytosis –Requires ATP!

- Exocytosis- process of releasing materials out of the cell

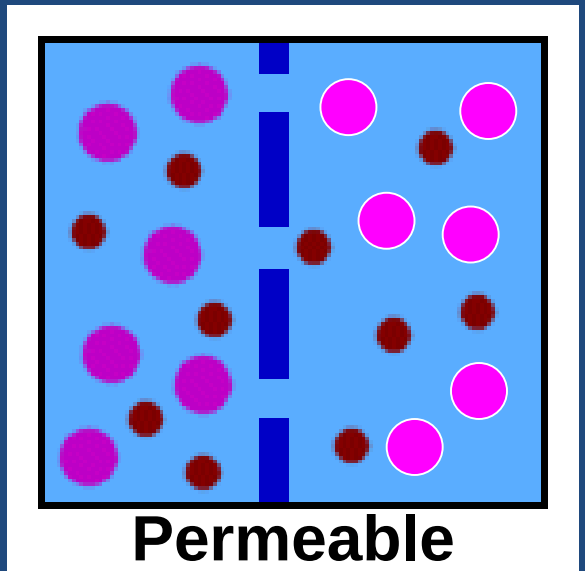
  – The membrane of the vesicle surrounding the material fuses with the cell membrane forcing the contents out of the cell



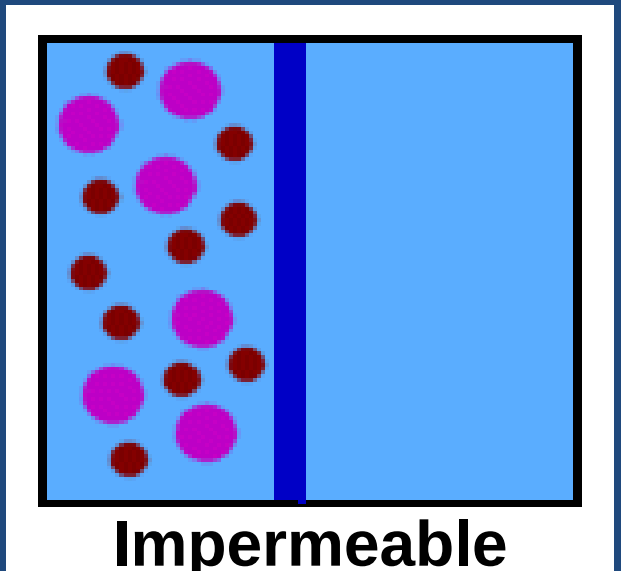
Types of Membranes

A. **Permeable Membrane** -Any substance can move across.

B. **Impermeable Membrane** –NO substance can move across.



Permeable

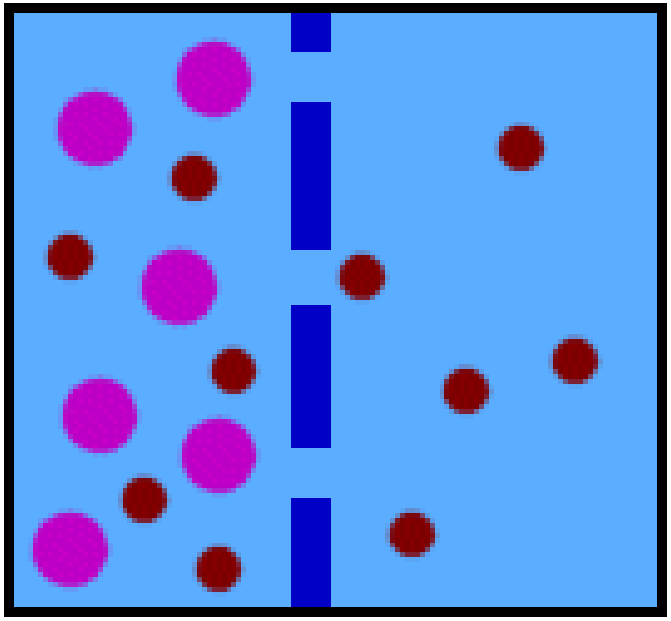


Impermeable

Types of Membranes

C. Selectively Permeable Membrane

- Some substances can & some cannot move across, possibly due to size of molecule



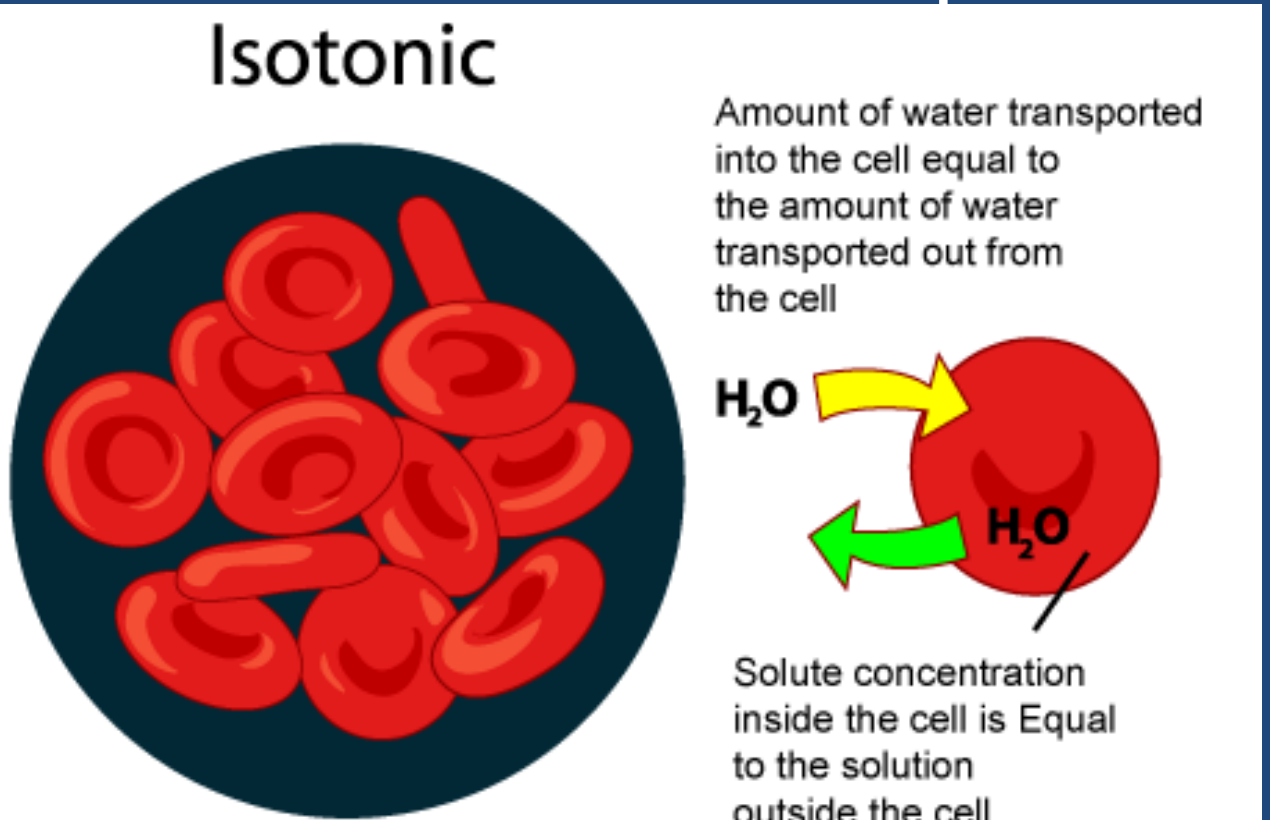
Selectively Permeable

Types of Solutions

A. **<u>Isotonic</u> Solution** - concentration of ***solutes*** same inside & outside cell

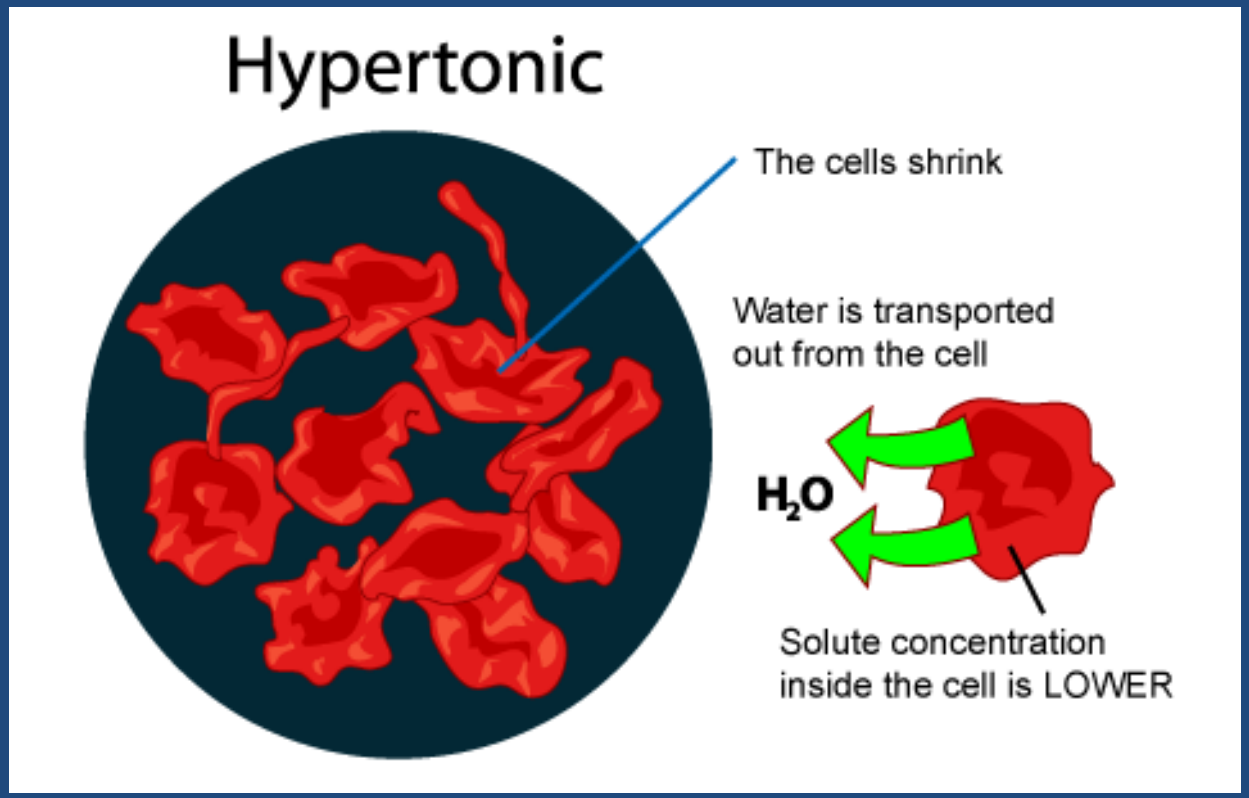
- <u>Won't gain or lose water</u>

Ex: blood & tap water



B. <u>Hypertonic</u> Solution- higher ***solute*** concentration outside than in the cell --- Water moves out, cell <u>shrinks</u>

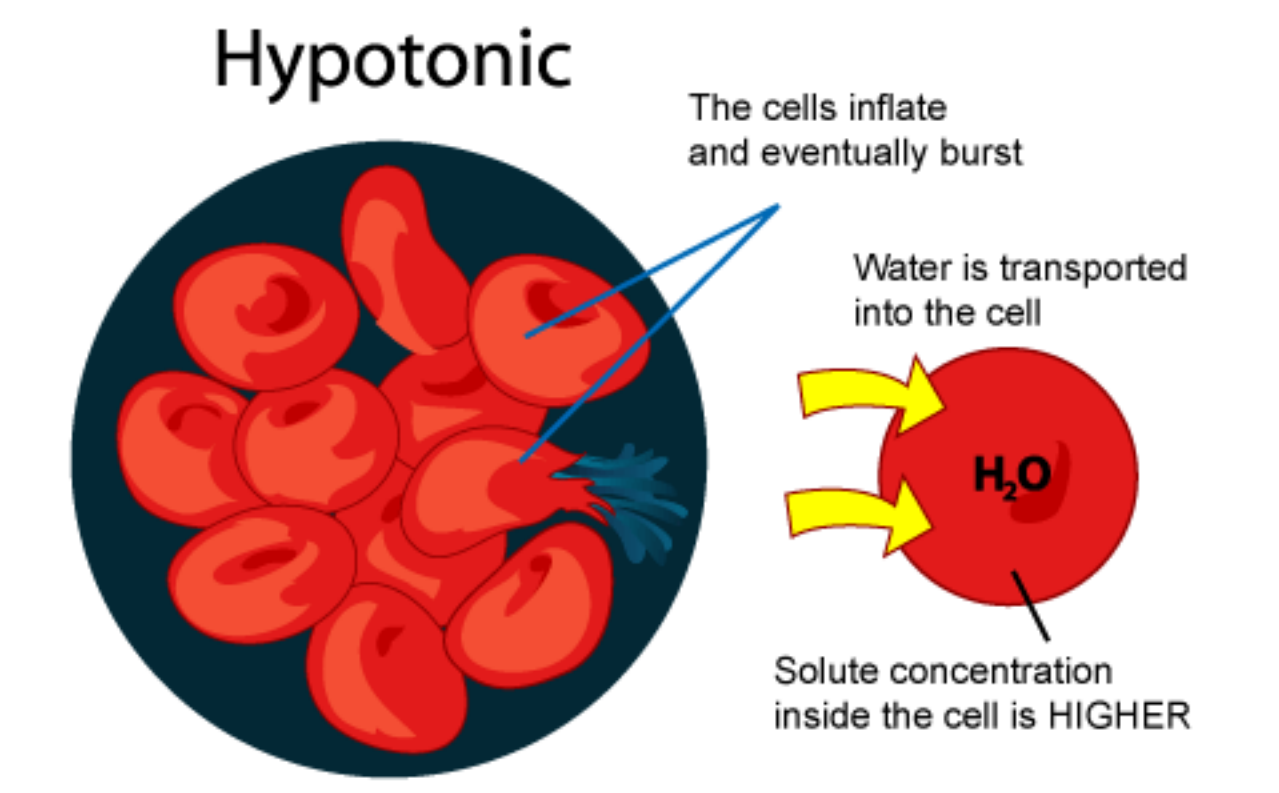
Ex: Salt water

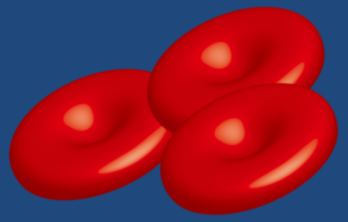


C. **<u>Hypotonic</u> Solution** – lower ***solute*** concentration outside than inside the cell

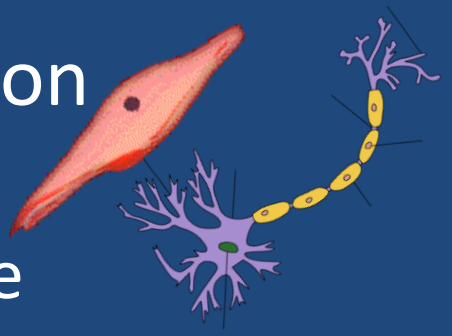
- Water moves in, cells <u>swell & burst</u>

Ex: Distilled or fresh water



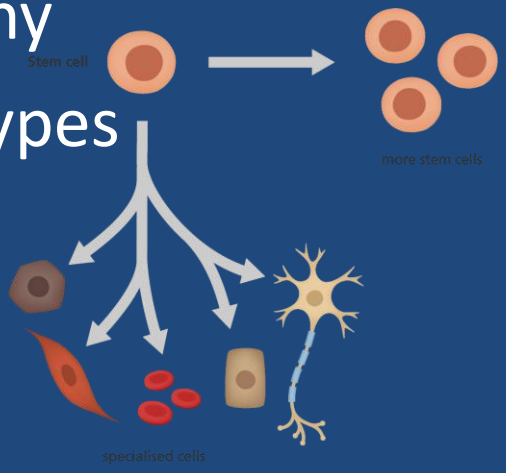


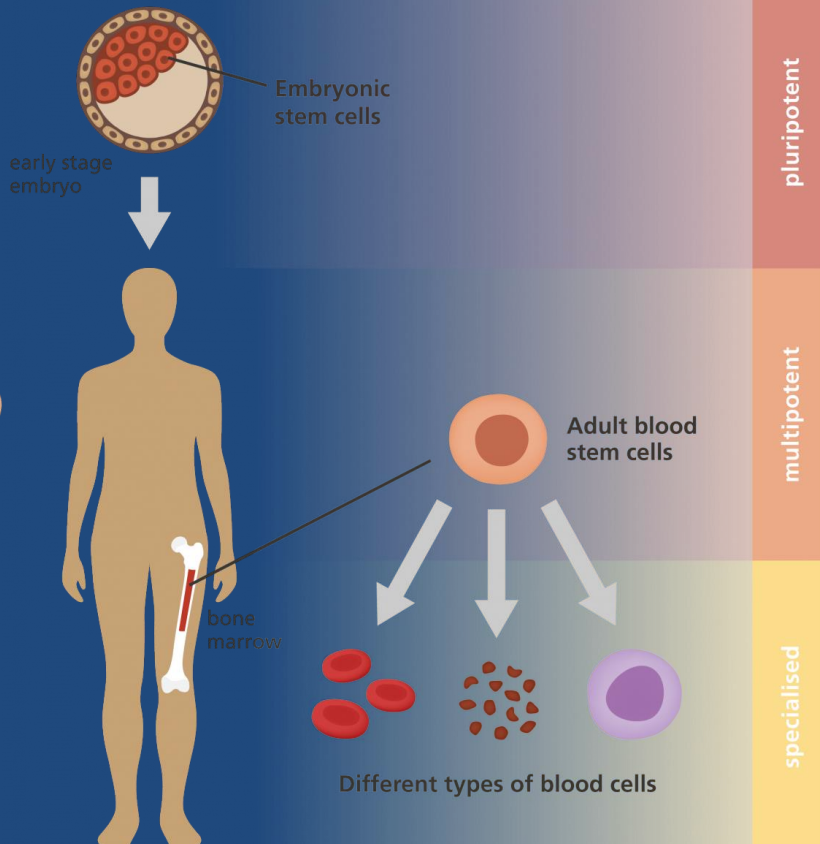
Cell Specialization/Differentiation



– Cells become efficient at one process and are <u>dependent</u> on other cells for the necessities of life
  - Ex: Neuron (Nerve) cells specialize in processing and transmitting information

– Stem cells are <u>unspecialized</u> cells that have the ability to develop into many specialized cell types

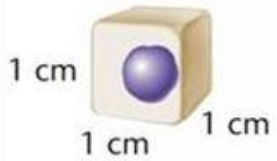
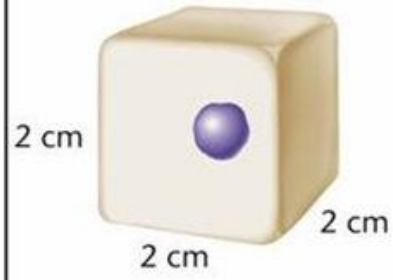
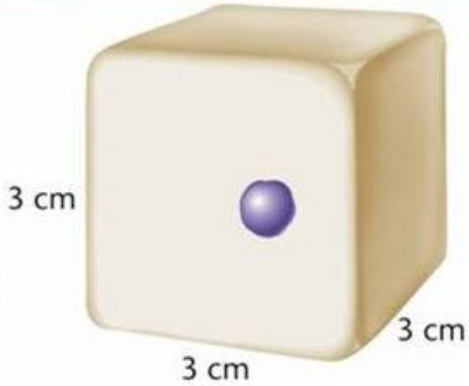




Limits to Cellular Growth

- Remember that ALL cells have limits for cell growth!
- A cell's surface area can NOT increase fast enough to meet the demands of the internal volume of the cell
  - *The cell is not able to bring in nutrients & get rid of wastes fast enough to survive.*

Ratio of Surface Area to Volume in Cells

Cell Size			
Surface Area (length x width x 6)	1 cm x 1 cm x 6 = 6 cm^2	2 cm x 2 cm x 6 = 24 cm^2	3 cm x 3 cm x 6 = 54 cm^2
Volume (length x width x height)	1 cm x 1 cm x 1 cm = 1 cm^3	2 cm x 2 cm x 2 cm = 8 cm^3	3 cm x 3 cm x 3 cm = 27 cm^3
Ratio of Surface Area to Volume	6 / 1 = 6 : 1	24 / 8 = 3 : 1	54 / 27 = 2 : 1