Plasma Membrane

By:
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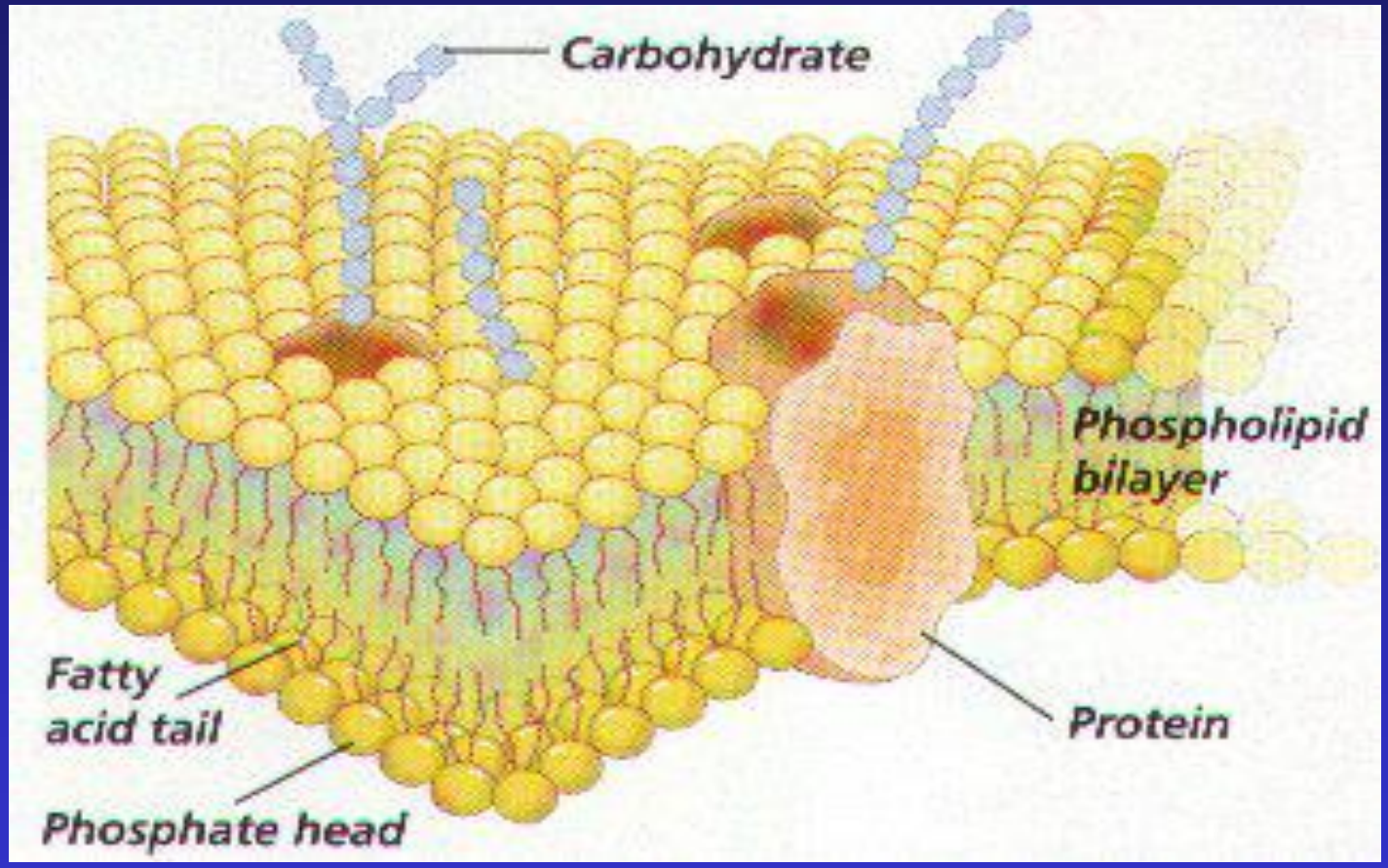
Cell or Plasma Membrane



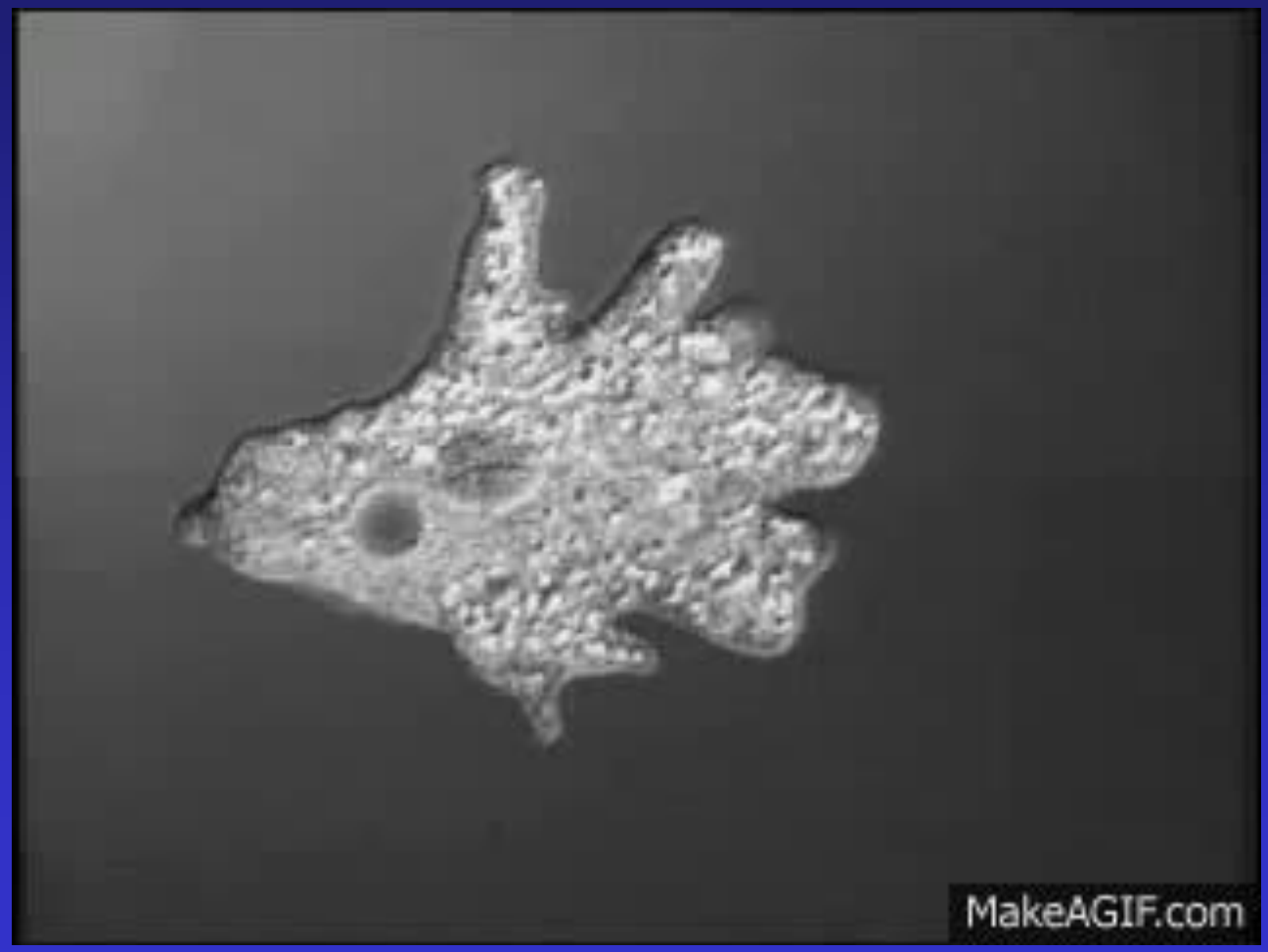
Gateway to the Cell

Cell Membrane

- The outer most boundary in Animal cells.
- In Plants, Fungi and Bacteria it is covered by Cell wall.
- Chemically composed of Proteins, Lipids and Carbohydrates.

Cell Membrane

The cell membrane is **flexible** and allows a **unicellular** organism to **move**



Homeostasis

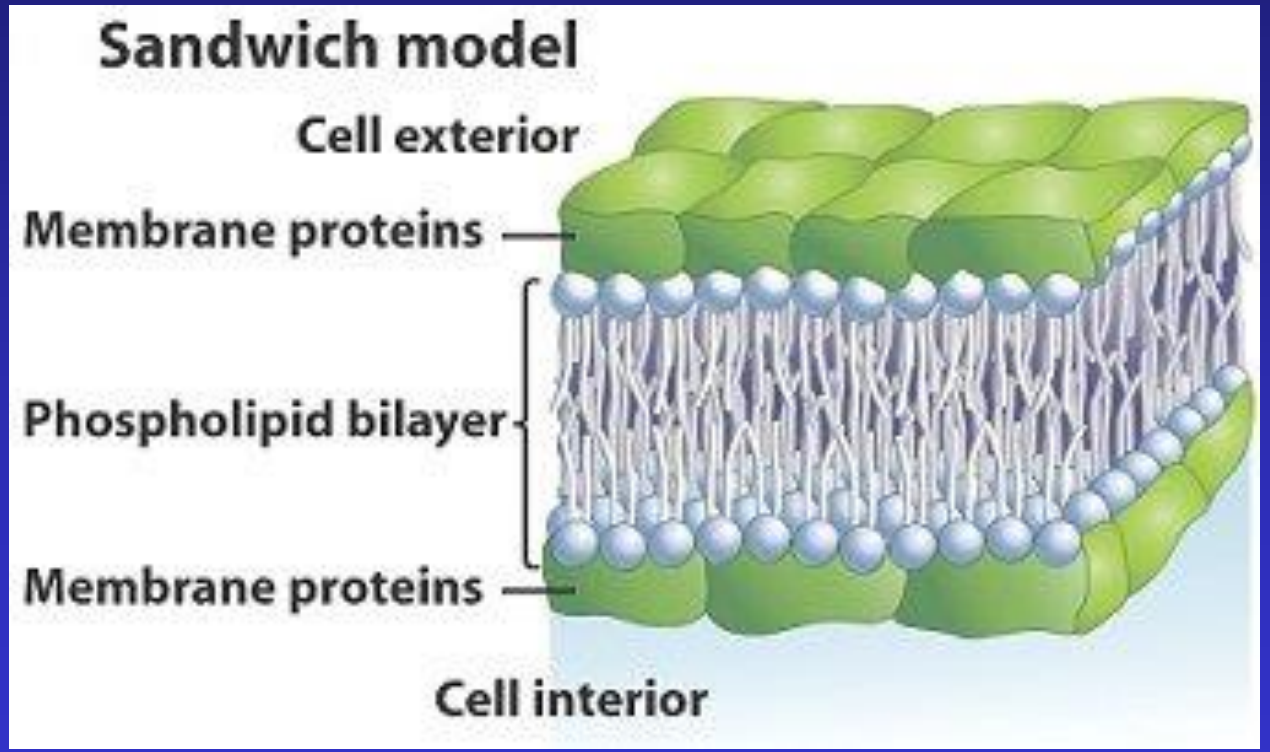
- **Balanced** internal condition of cells
- Also called **equilibrium**
- **Maintained by plasma membrane** controlling what enters & leaves the cell

Functions of Plasma Membrane

- Protective barrier
- Regulate transport in & out of cell (selectively permeable)
- Allow cell recognition
- Provide anchoring sites for filaments of cytoskeleton
- In neurons (nerve cells) the cell membrane transmits nerve impulses

Structure of the Cell Membrane

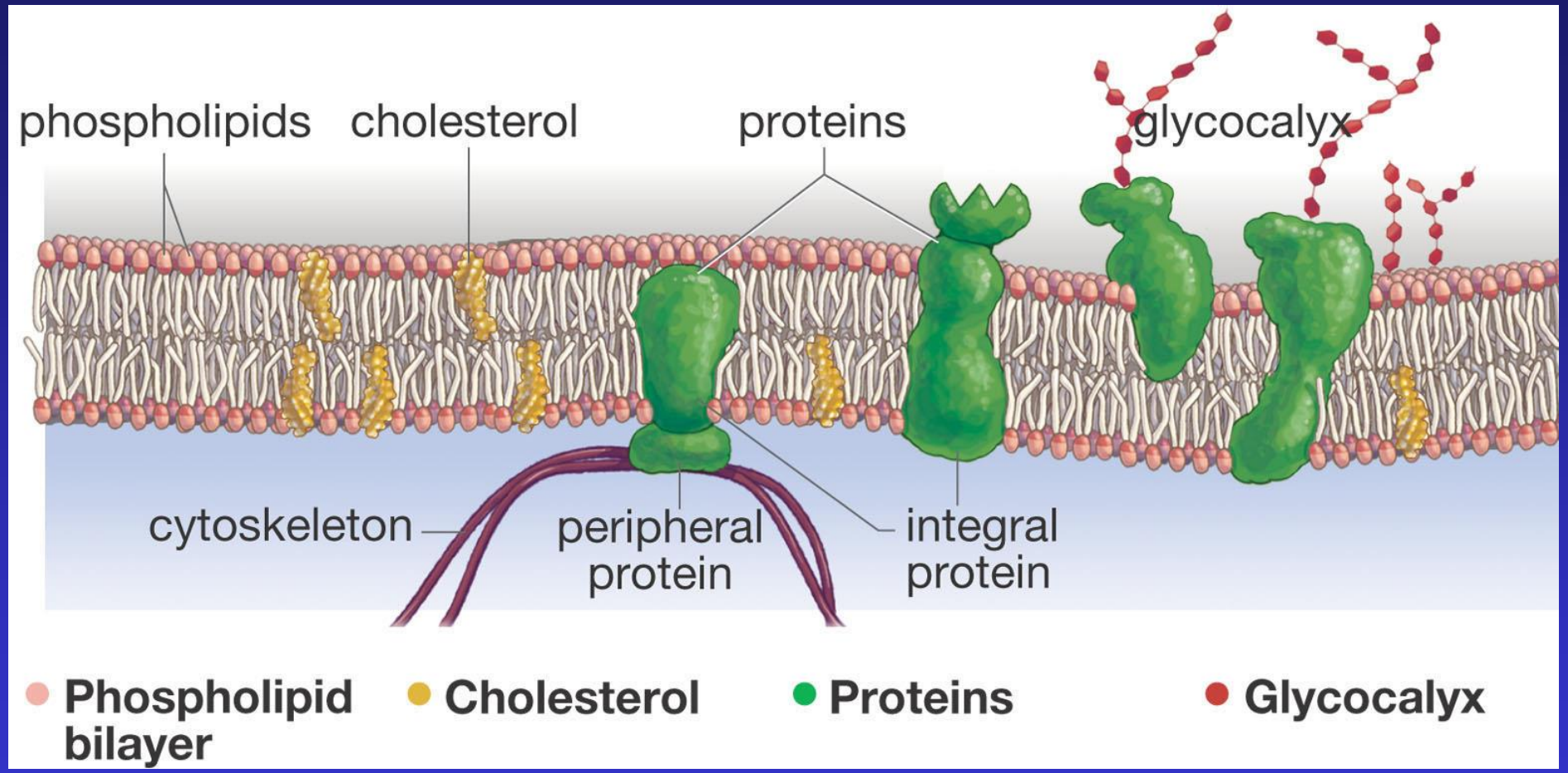
- Unit Membrane Model
- 1950s by J. David Robertson
- Lipid bilayer sandwiched between inner and outer layers of protein



Structure of the Cell Membrane

- **Fluid Mosaic Model**
- Singer and Nicolson in 1972
- The **Fluid Mosaic Model** describes the plasma membrane as a **dynamic and flexible structure**, where a mosaic of proteins is embedded in a fluid phospholipid bilayer, with **carbohydrates** on the outside and **cholesterol** regulating fluidity.

Fluid Mosaic Model



Phospholipids

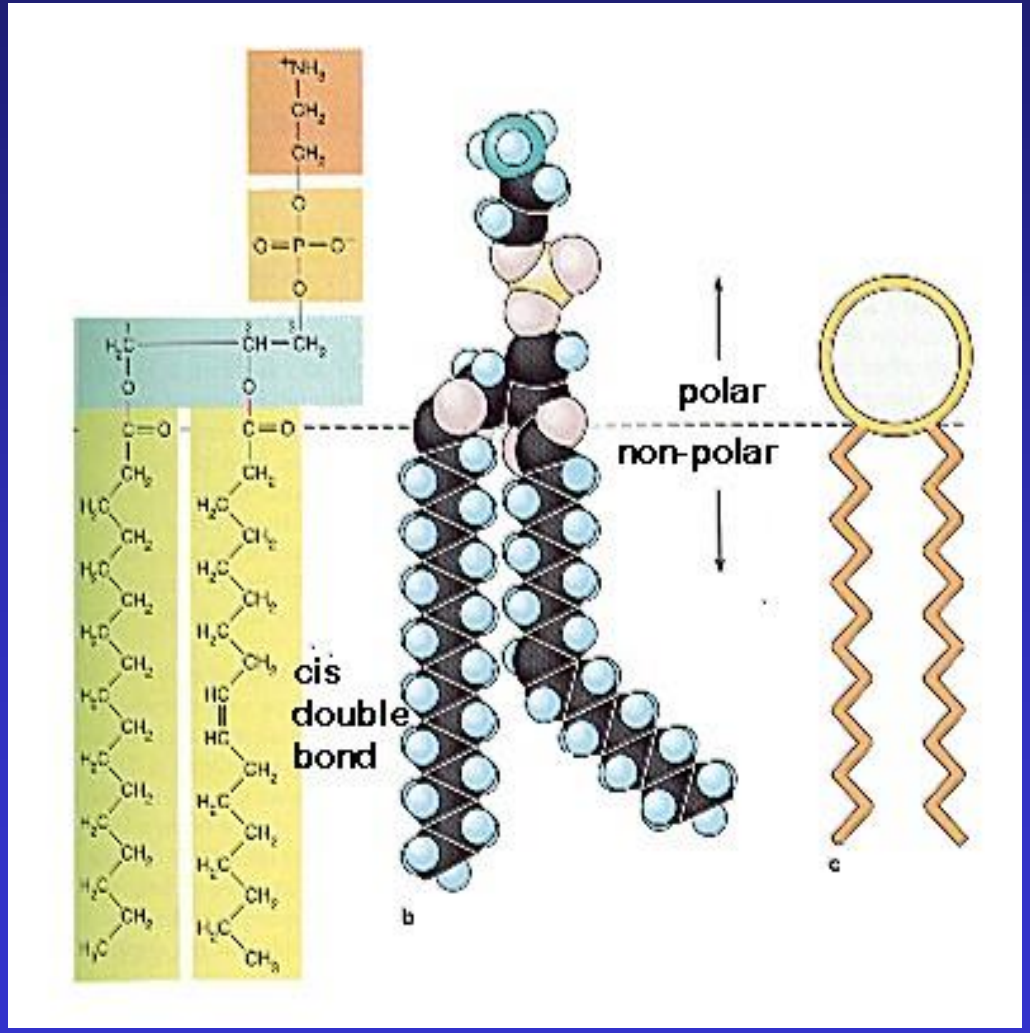
Proteins

Phospholipids

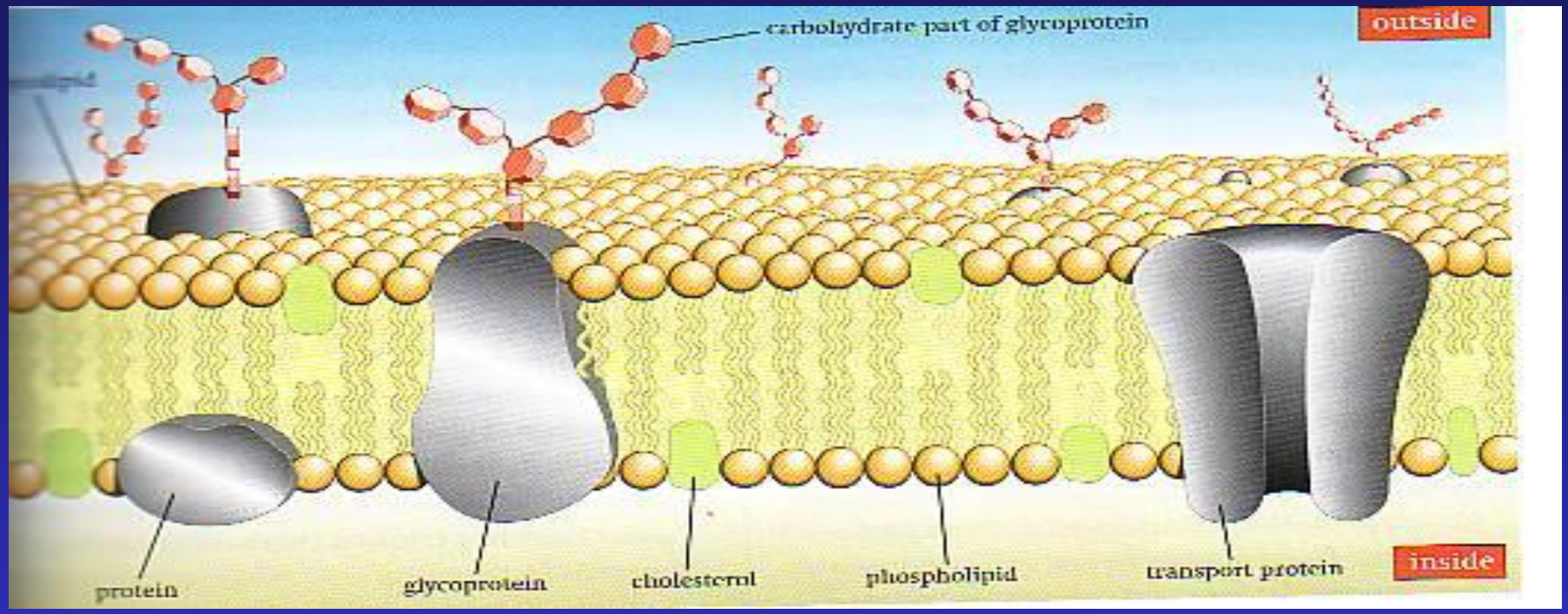
Make up the cell membrane

Contains 2 fatty acid chains that are nonpolar

Head is polar & contains a Phosphate group



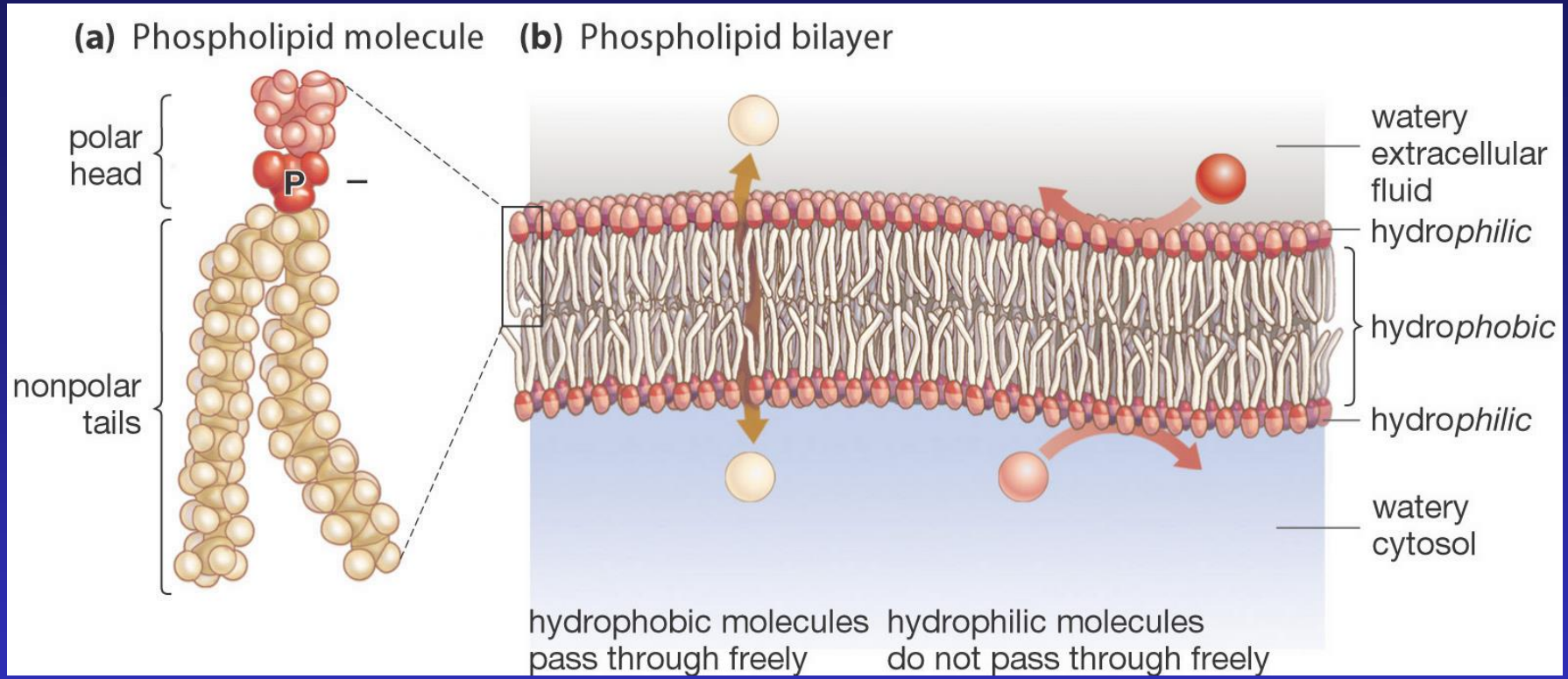
FLUID MOSAIC MODEL



FLUID- because individual phospholipids and proteins can move around freely within the layer, like it's a liquid.

MOSAIC- because of the pattern produced by the scattered protein molecules when the membrane is viewed from above.

Cell Membrane

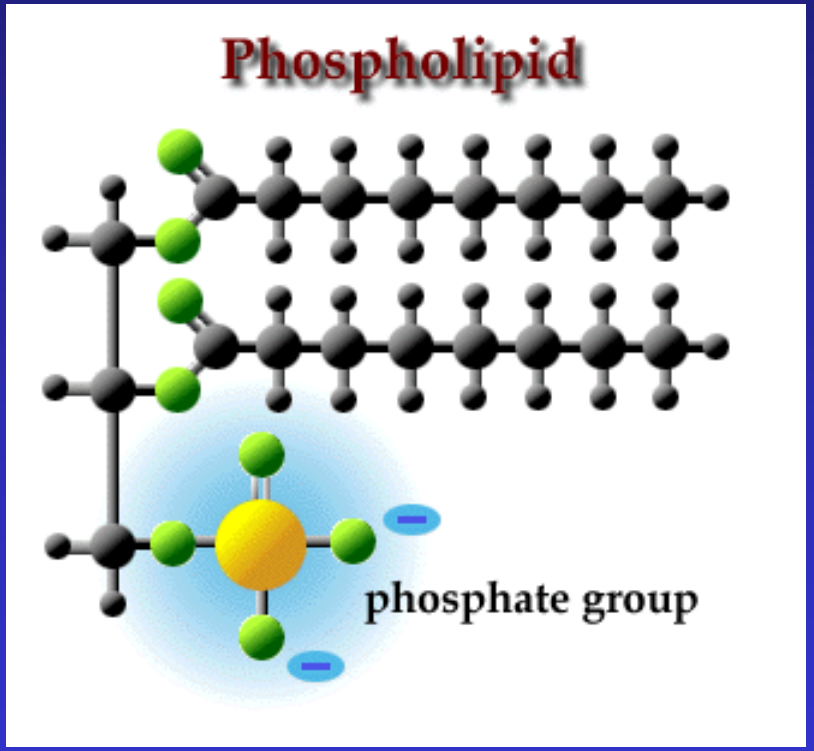


The cell membrane is made of 2 layers of **phospholipids** called the lipid **bilayer**

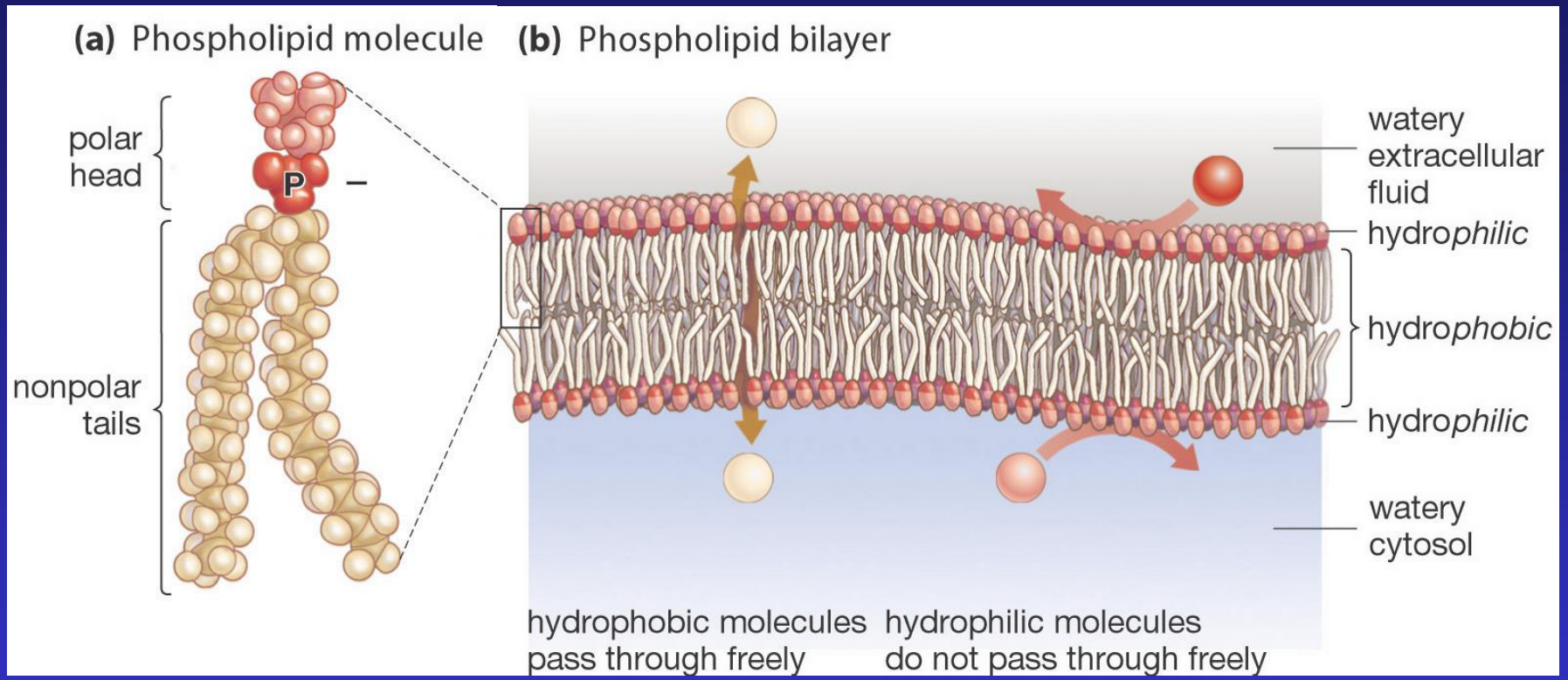
Hydrophobic molecules pass **easily**; hydrophillic **DO NOT**

Solubility

- Materials that are soluble in lipids can pass through the cell membrane easily



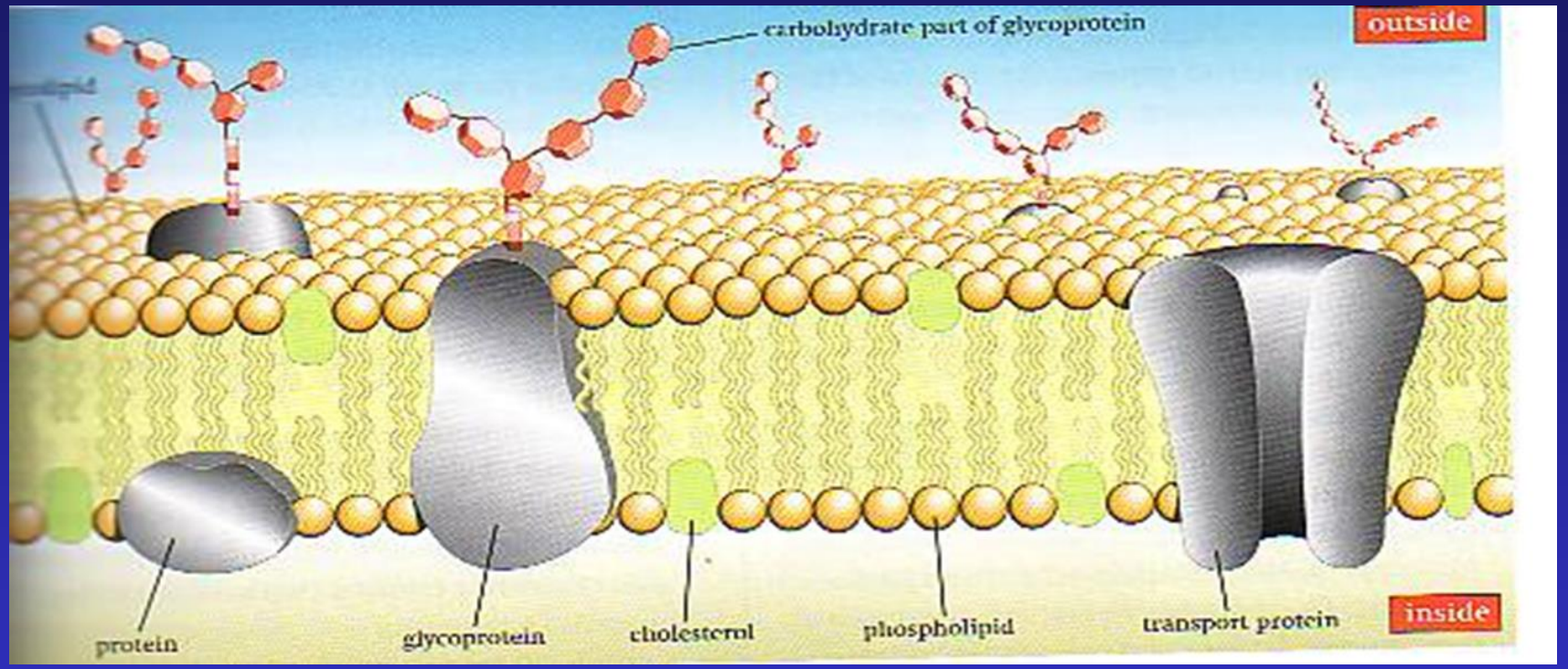
Semipermeable Membrane



Small non-charged molecules move through easily.

Examples: O_2, and CO_2

Semipermeable Membrane

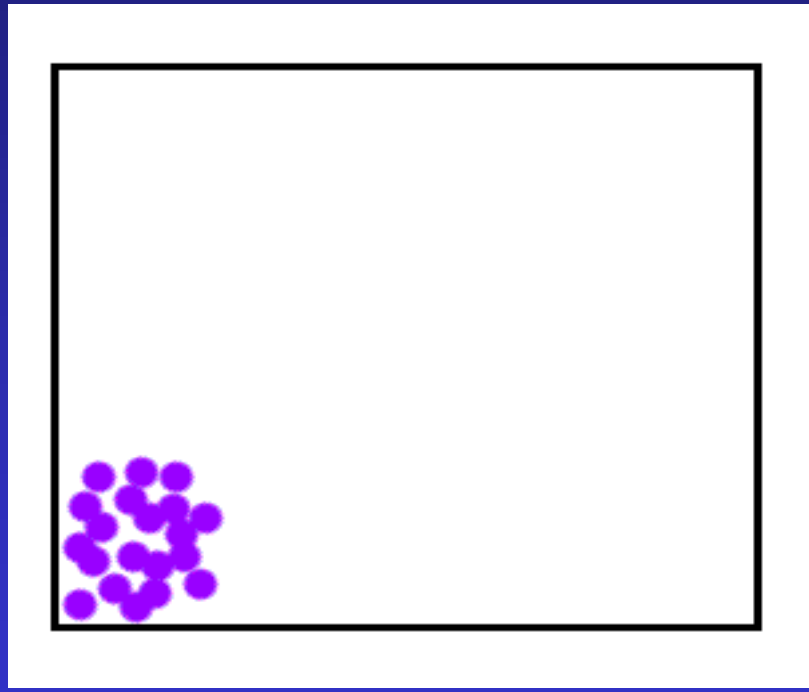


Ions, and large molecules such as glucose and amino acids do not move through the membrane on their own. They must use transport proteins

Types of Transport Across Cell Membranes

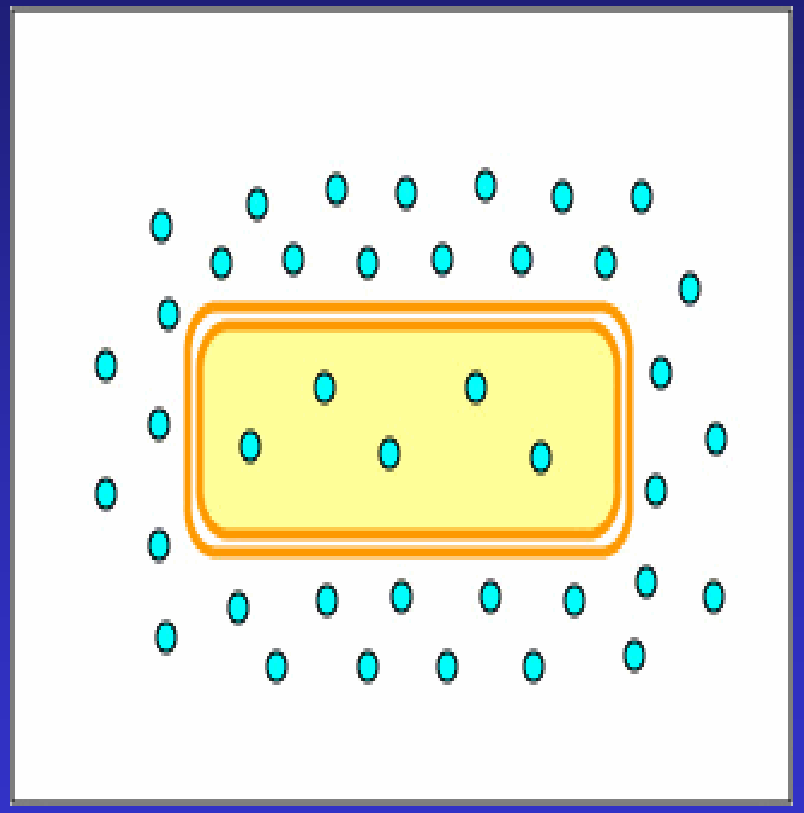
Simple Diffusion

- Requires NO energy
- Molecules move from area of HIGH to LOW concentration

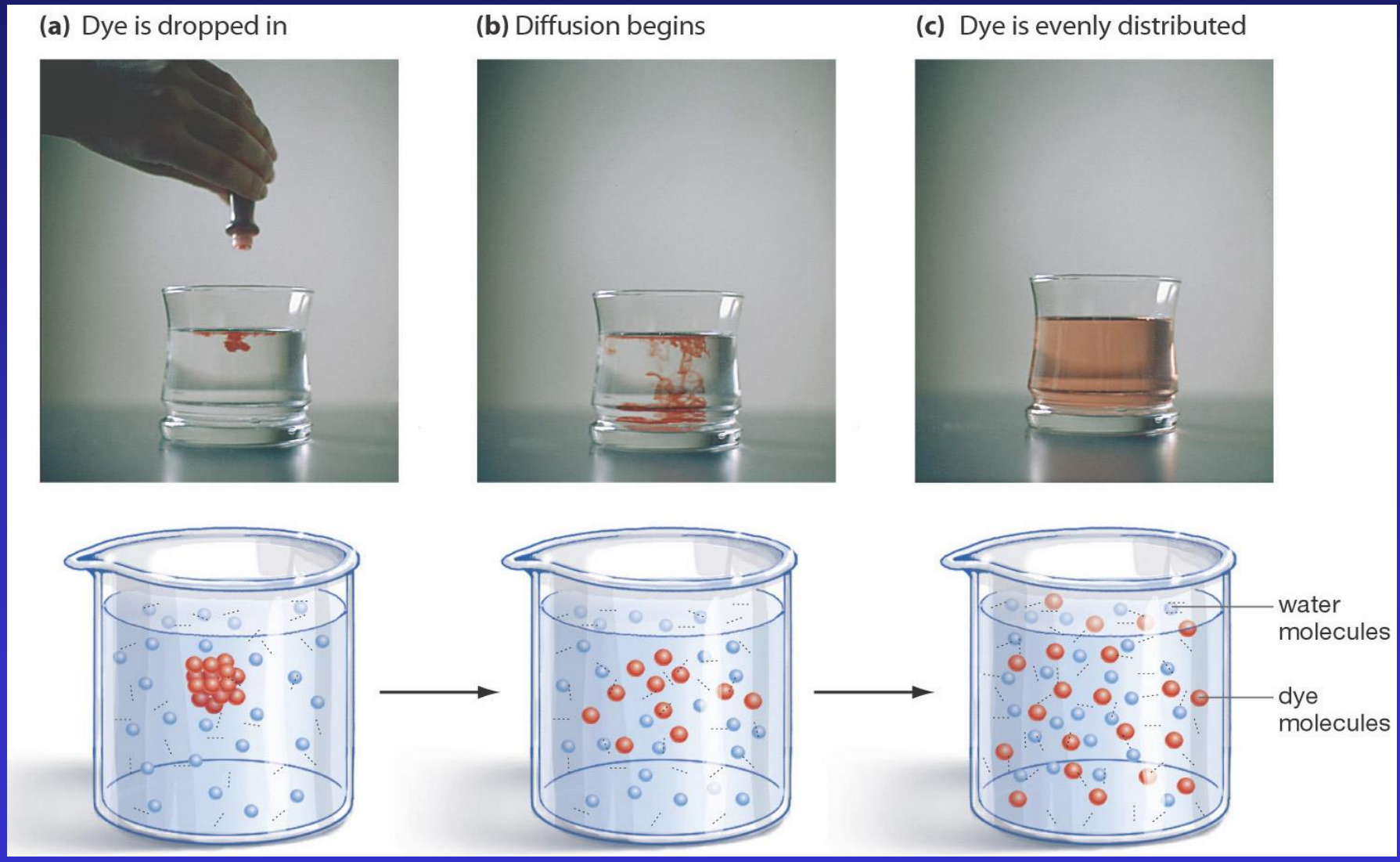


DIFFUSION

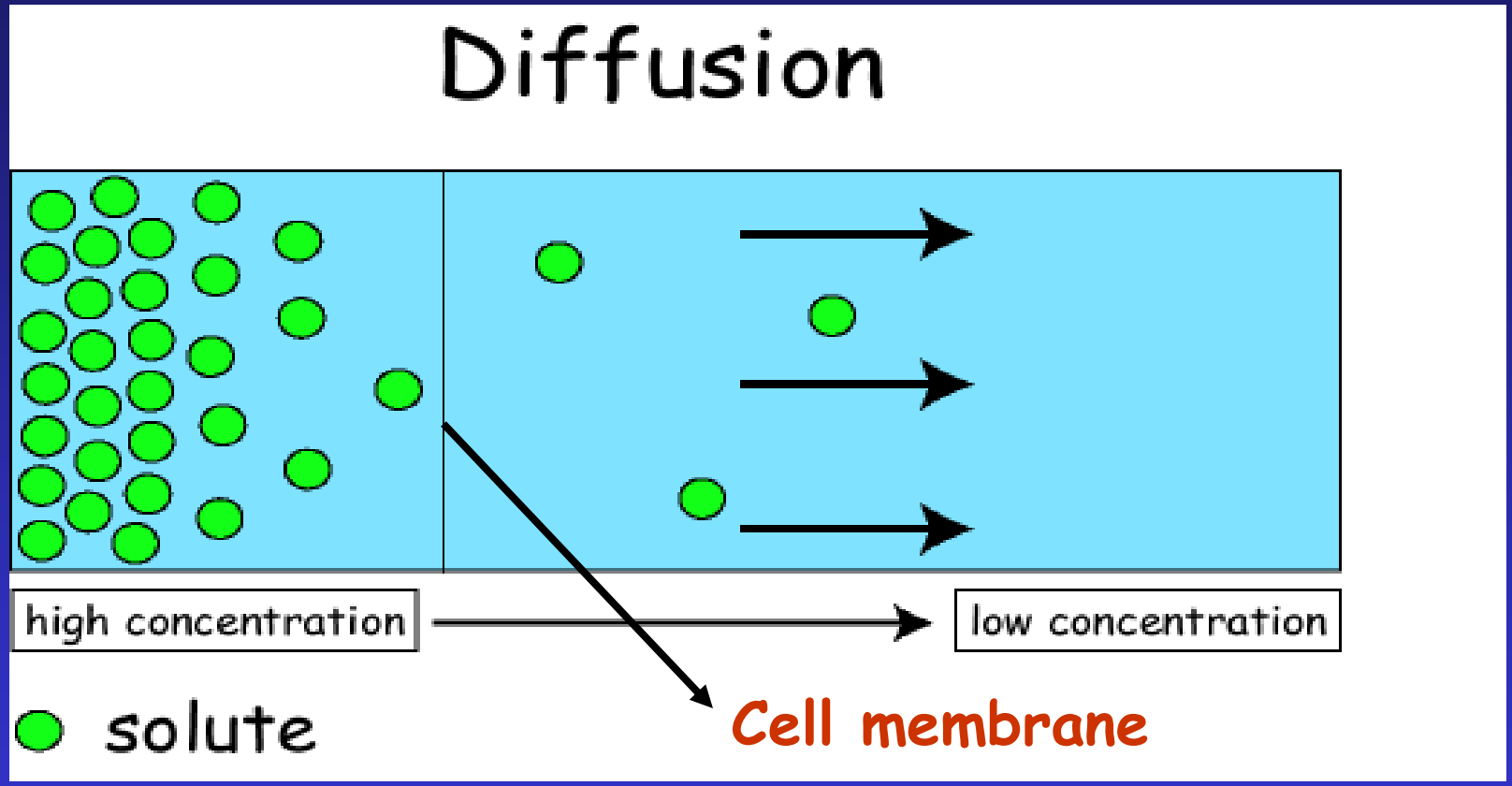
Diffusion is a PASSIVE process which means no energy is used to make the molecules move.



Diffusion of Liquids



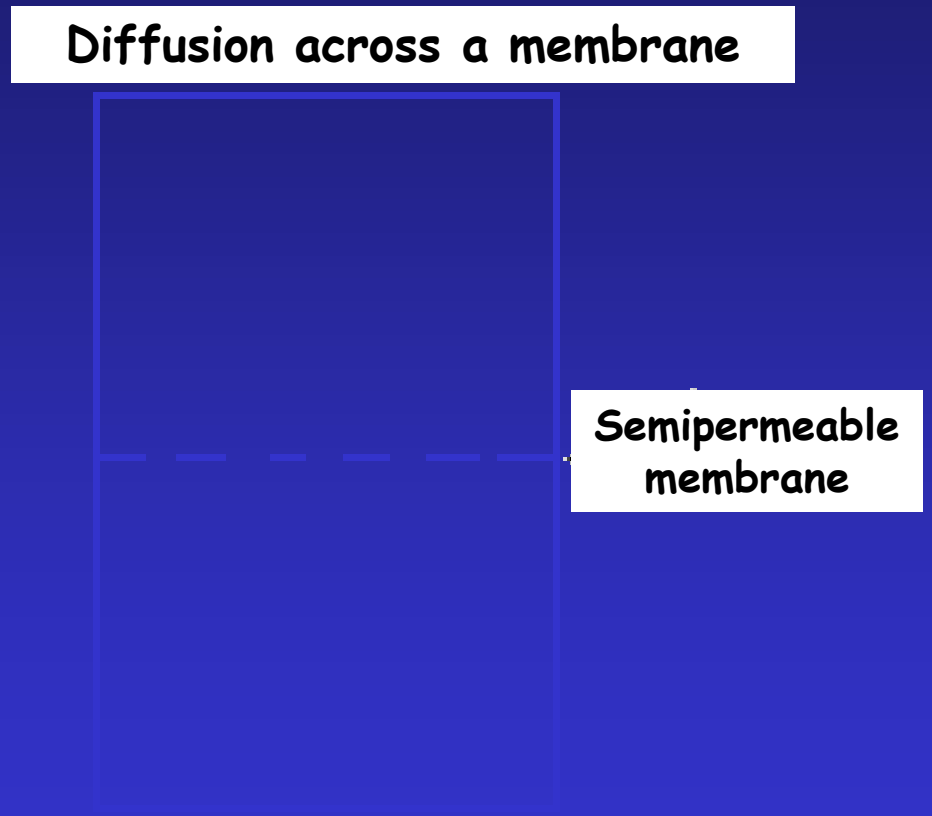
Diffusion through a Membrane



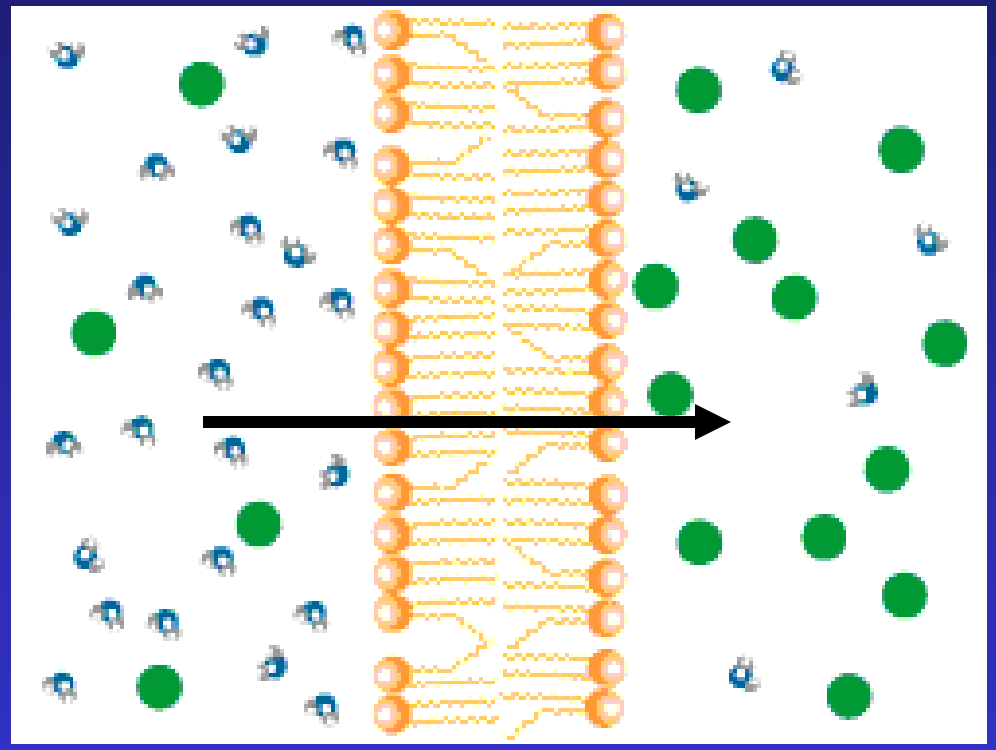
Solute moves DOWN concentration gradient (HIGH to LOW)

Osmosis

- Diffusion of water across a membrane
- Moves from HIGH Concentration to a LOW concentration



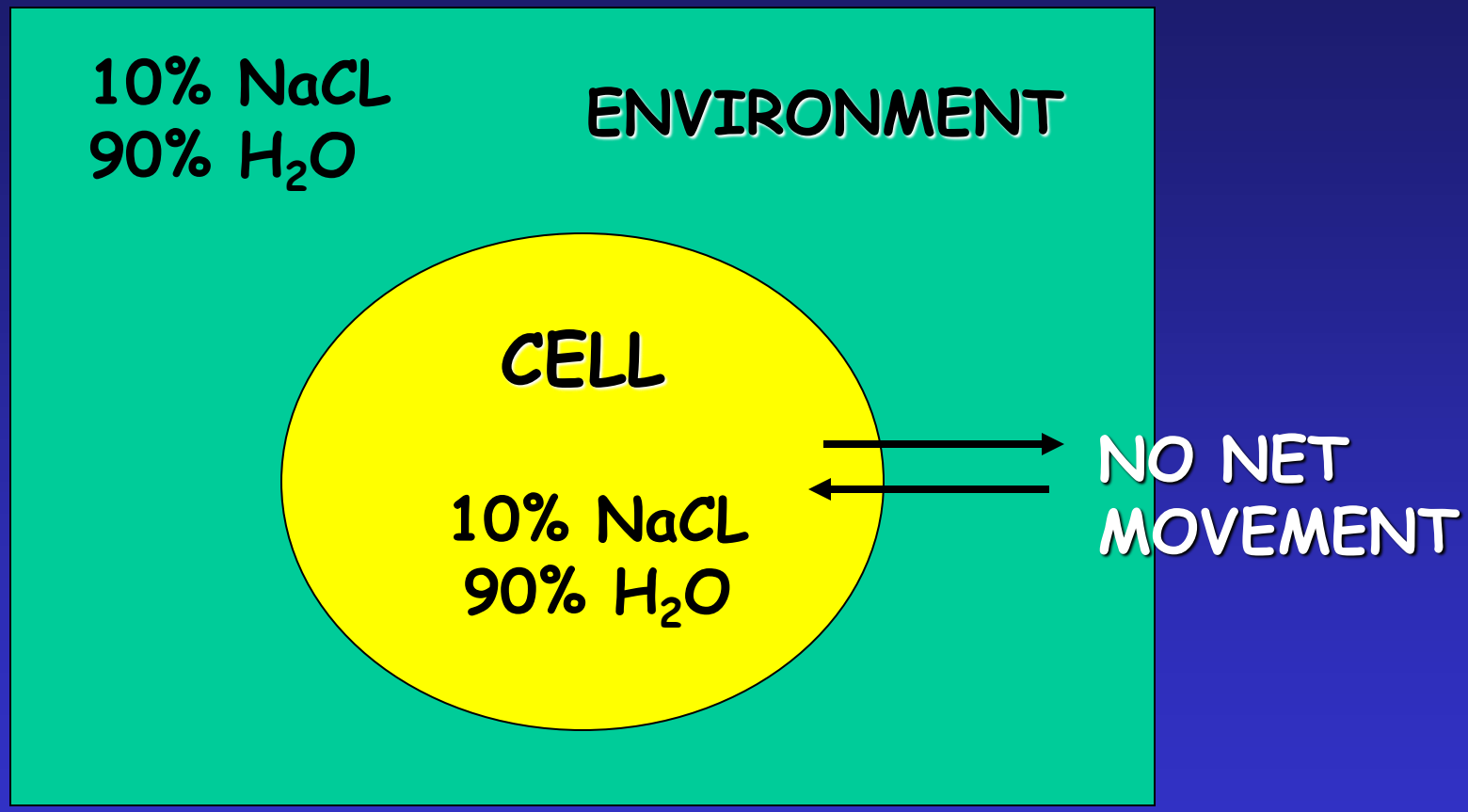
Diffusion of H_2O Across A Membrane



High H_2O potential
Low solute concentration

Low H_2O potential
High solute concentration

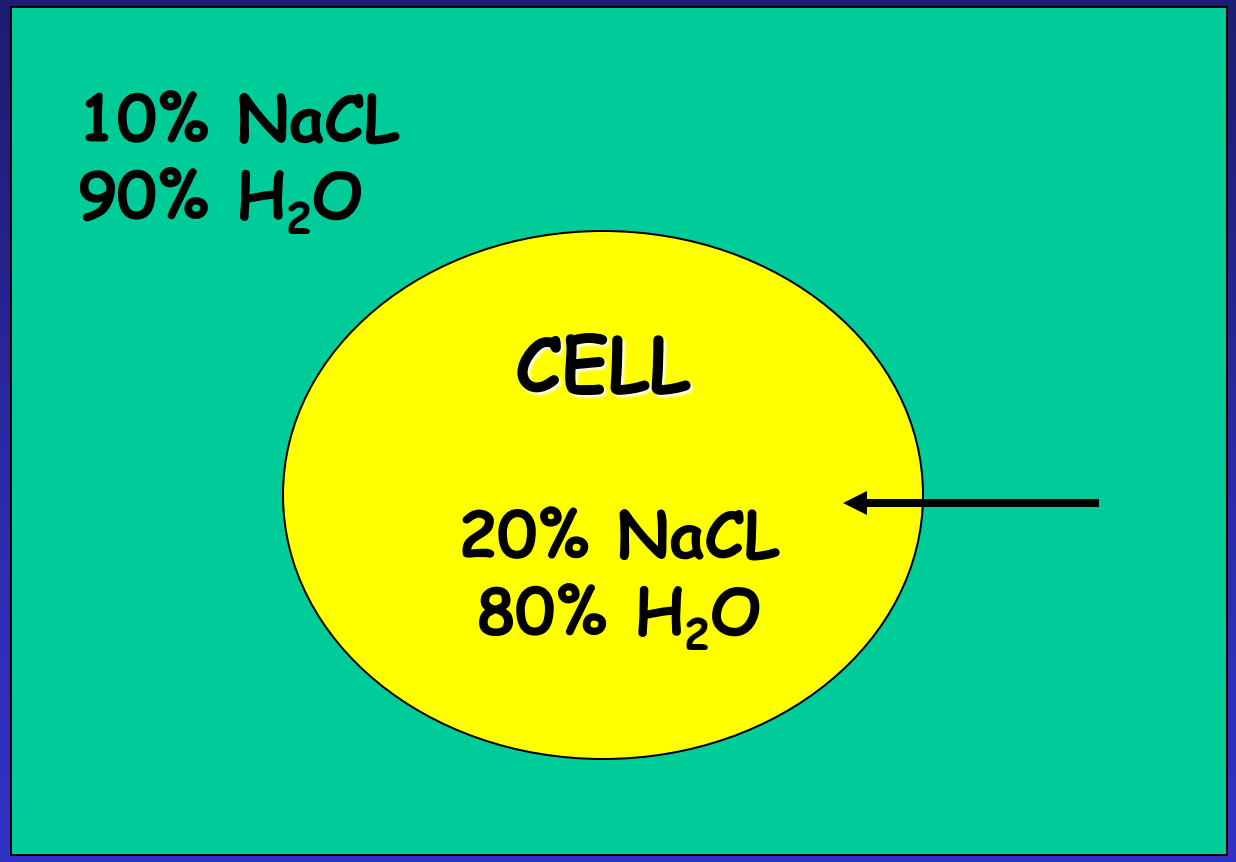
Cell in Isotonic Solution



What is the direction of water movement?

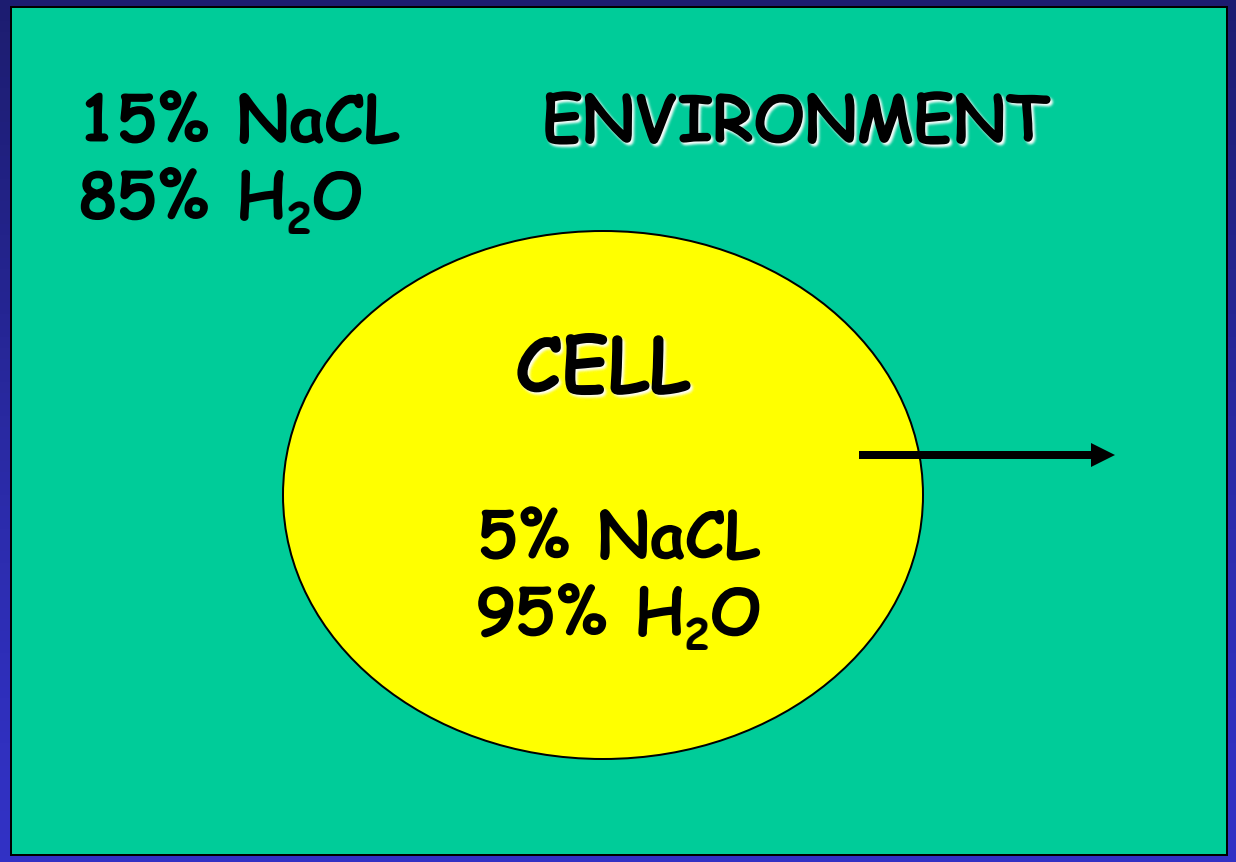
The cell is at equilibrium.

Cell in Hypotonic Solution



What is the direction of water movement?

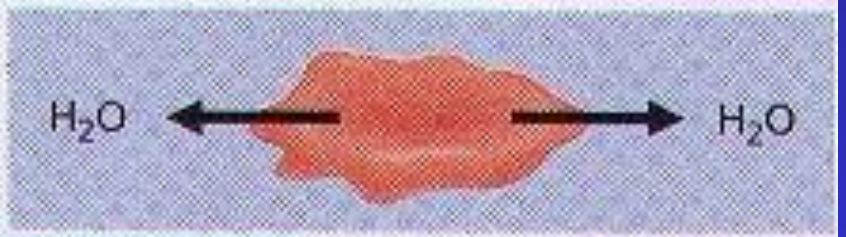
Cell in Hypertonic Solution

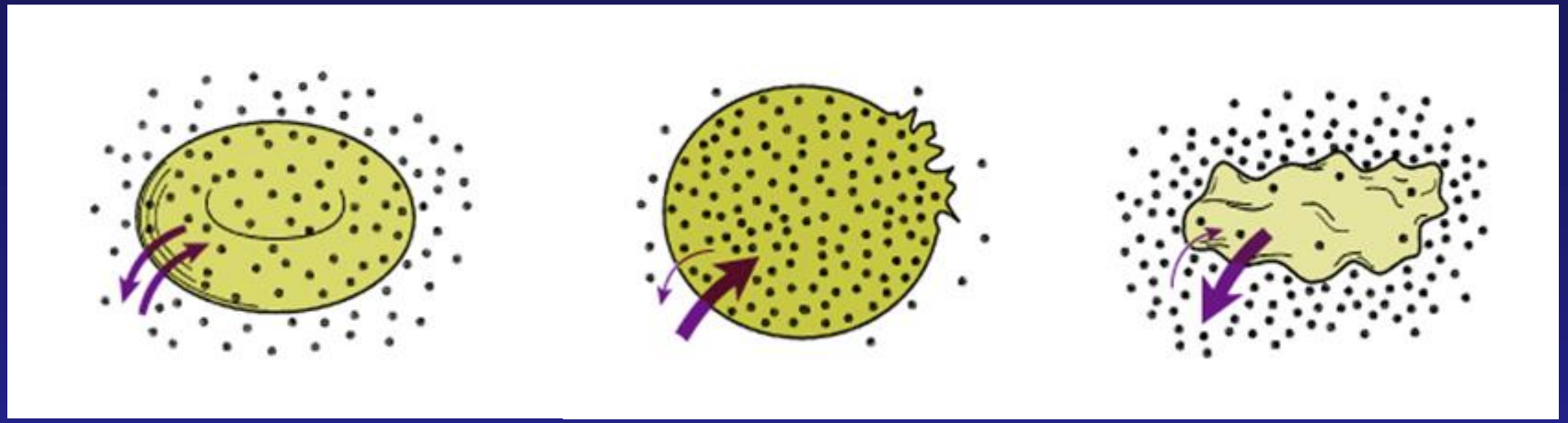


What is the direction of water movement?

Cells in Solutions

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	



Isotonic Solution

↓

NO NET MOVEMENT OF H_2O (equal amounts entering & leaving)

Hypotonic Solution

↓

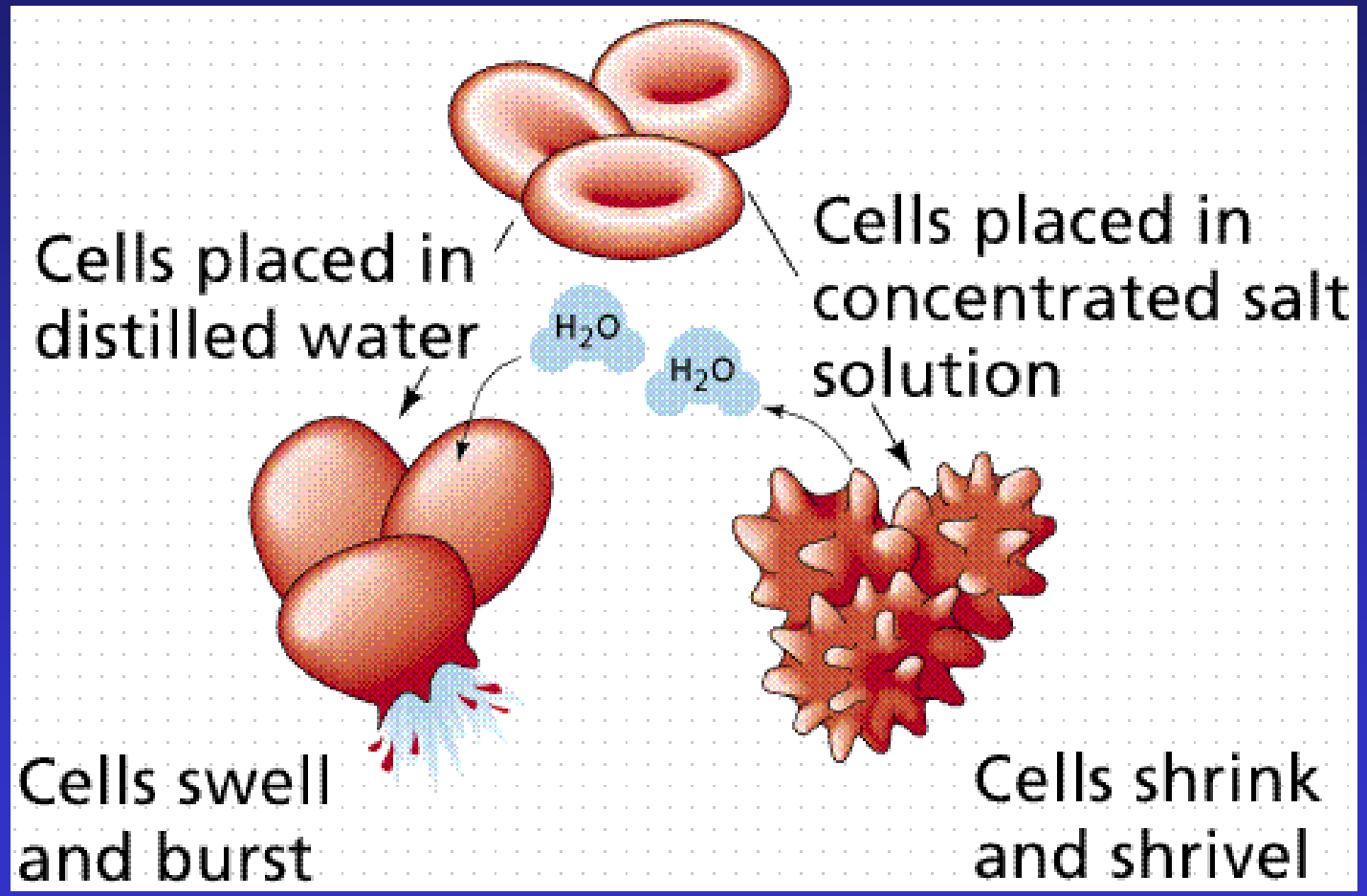
CYTOLYSIS

Hypertonic Solution

↓

PLASMOLYSIS

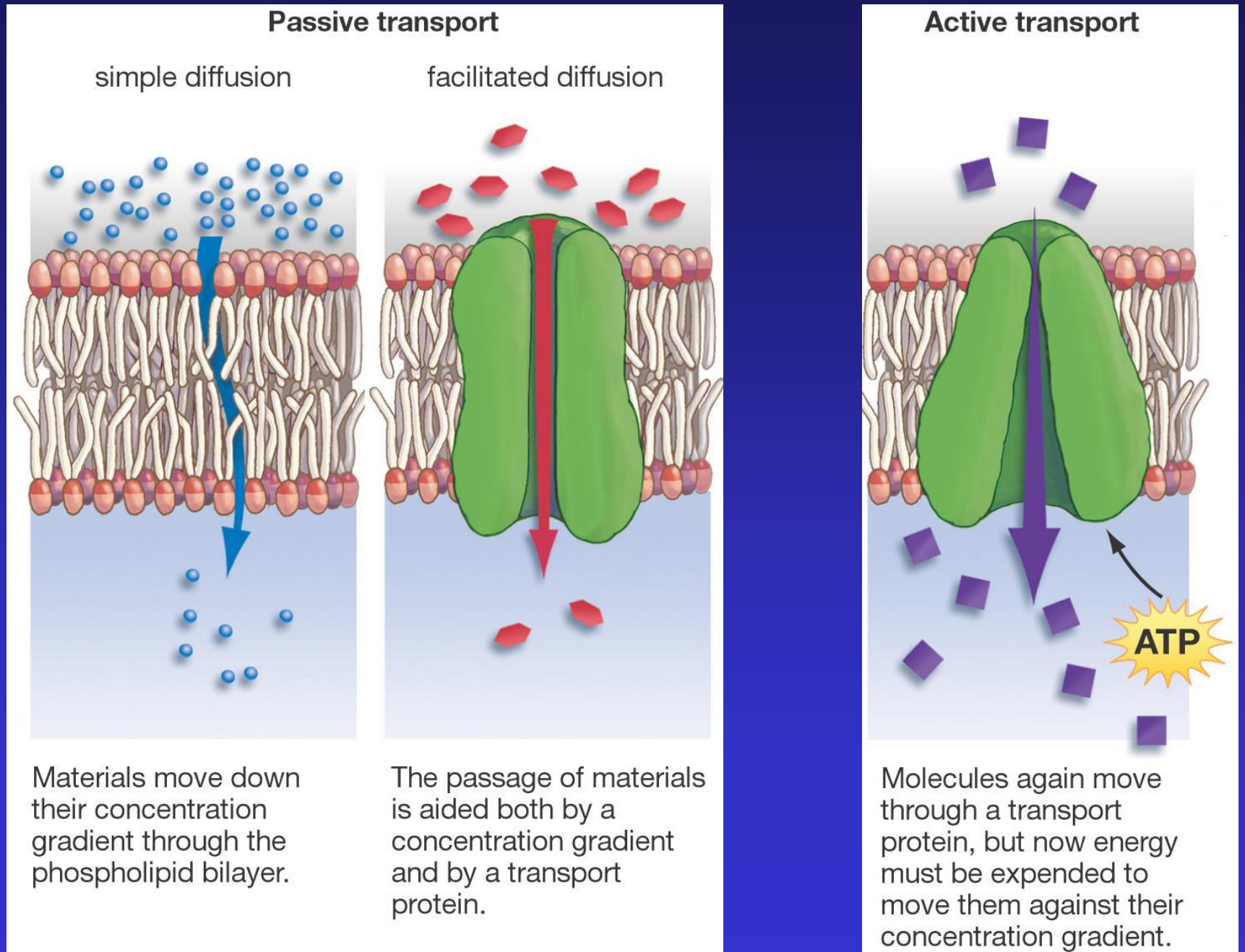
Cytolysis & Plasmolysis

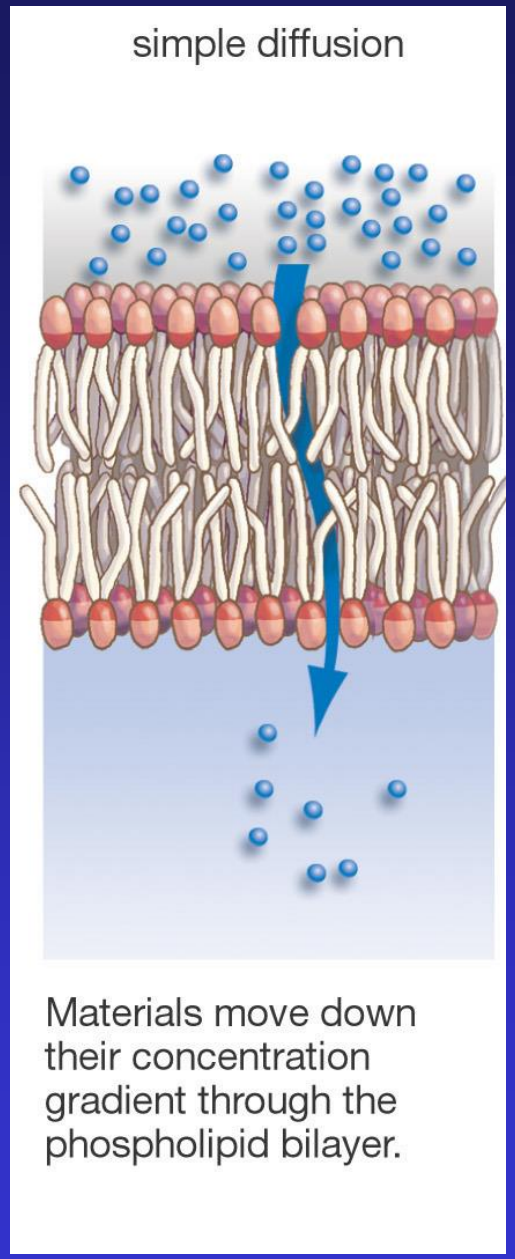


Cytolysis

Plasmolysis

Three Forms of Transport Across the Membrane

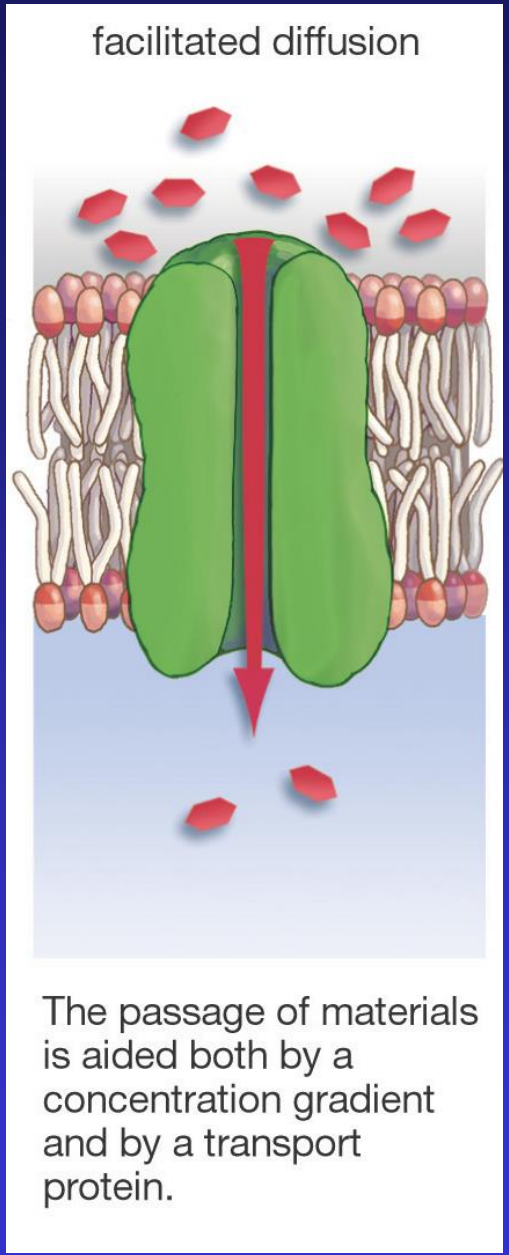




Passive Transport

Simple Diffusion

- Doesn't require energy
- Moves high to low concentration
- Example: Oxygen diffusing in or carbon dioxide diffusing out.



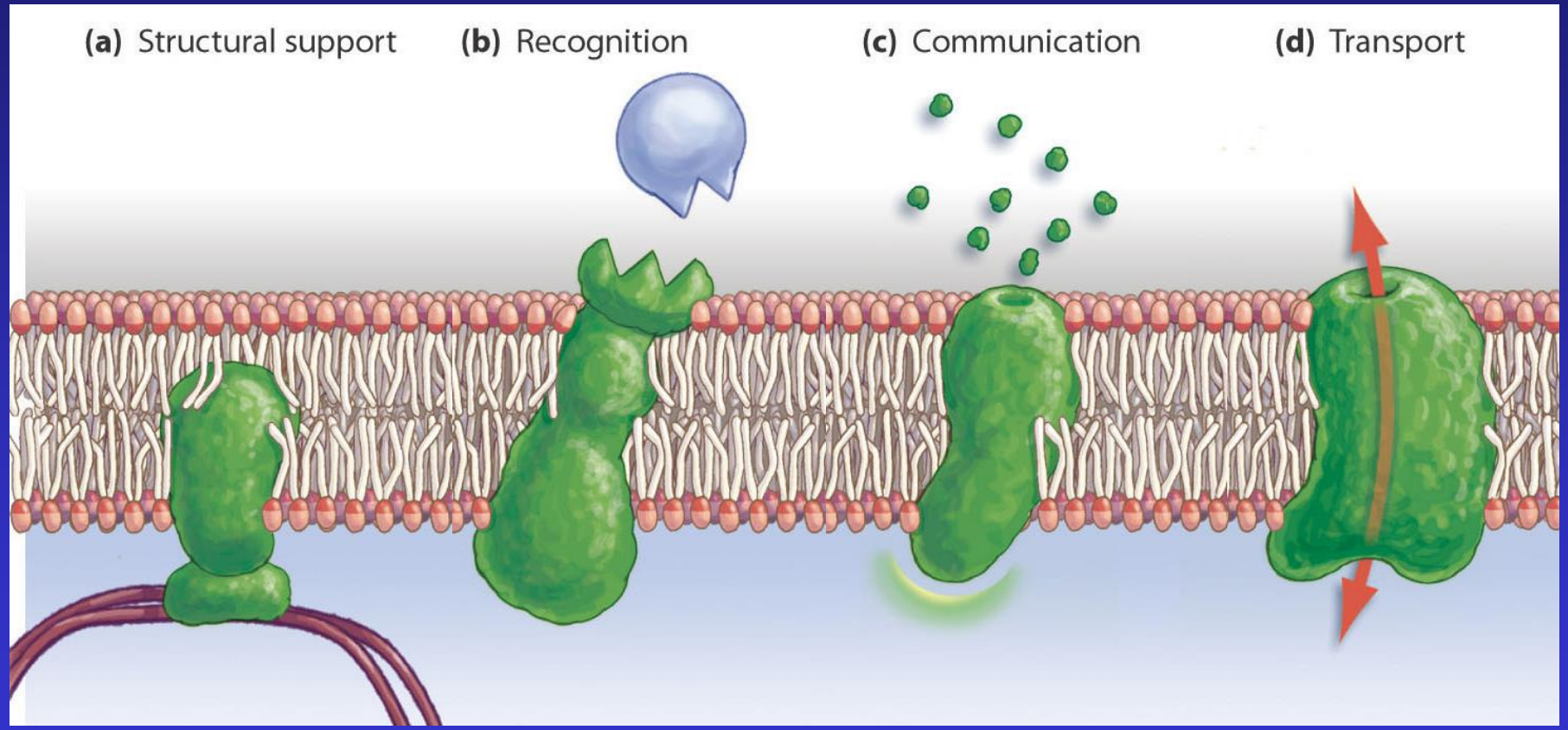
Passive Transport

Facilitated diffusion

- Doesn't require energy
- Uses transport proteins to move high to low concentration

Examples: Glucose or amino acids moving from blood into a cell.

Proteins Are Critical to Membrane Function

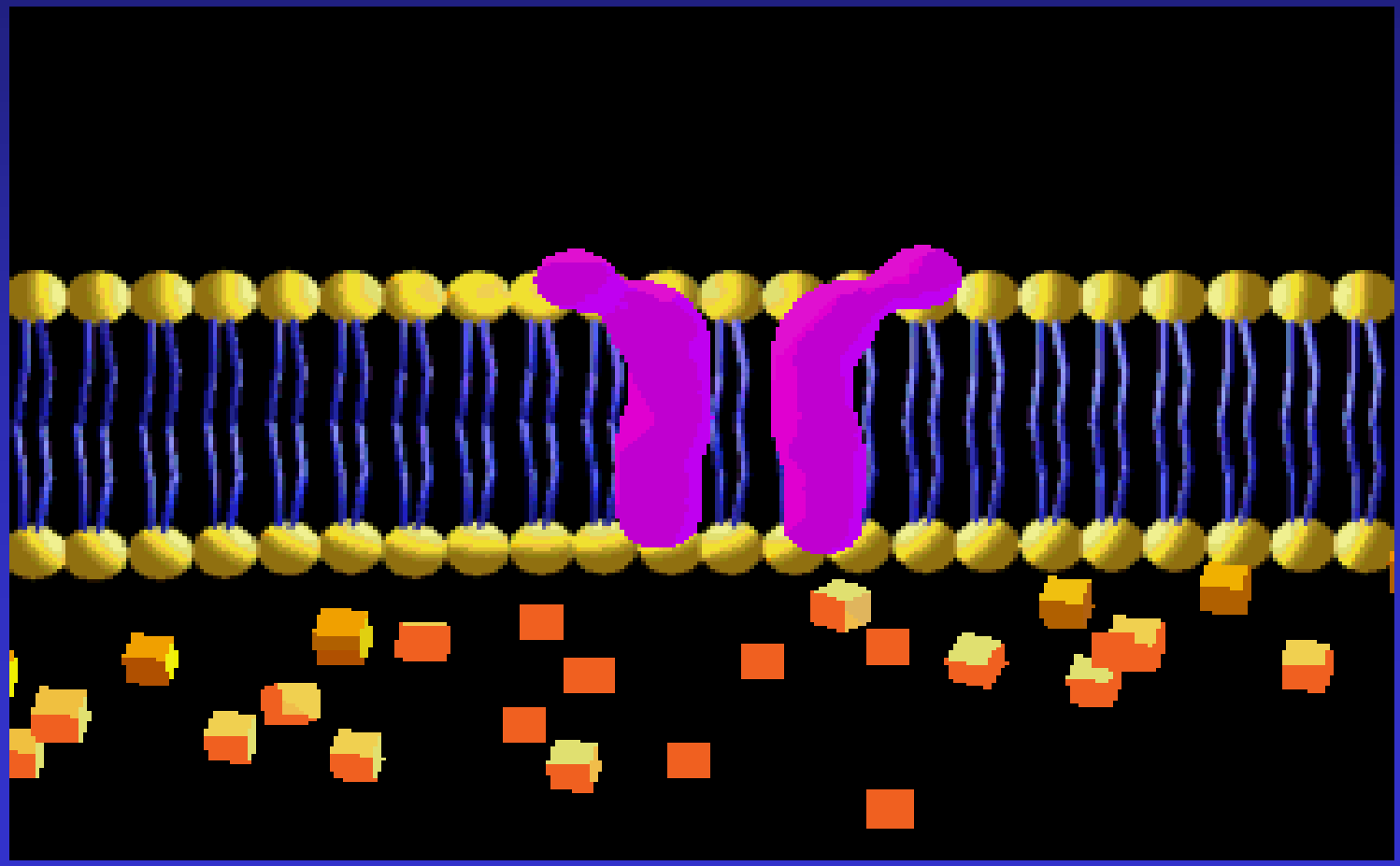


Types of Transport Proteins

- Channel proteins are embedded in the cell membrane & have a pore for materials to cross
- Carrier proteins can change shape to move material from one side of the membrane to the other

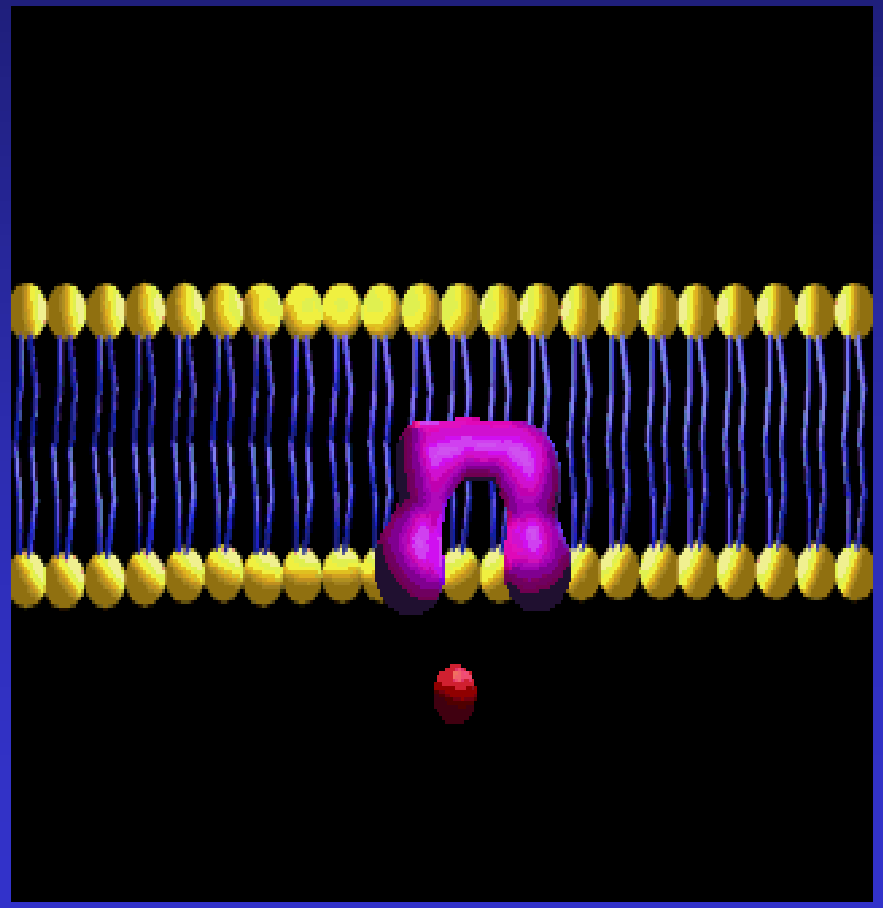
Facilitated Diffusion

Molecules will randomly move through the pores in Channel Proteins.



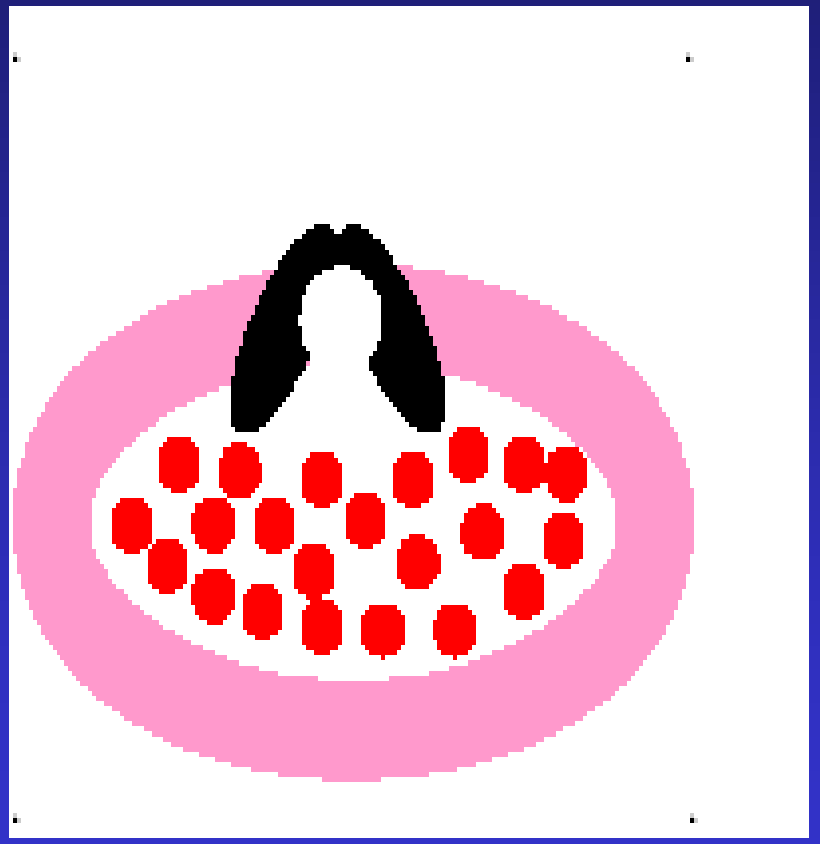
Facilitated Diffusion

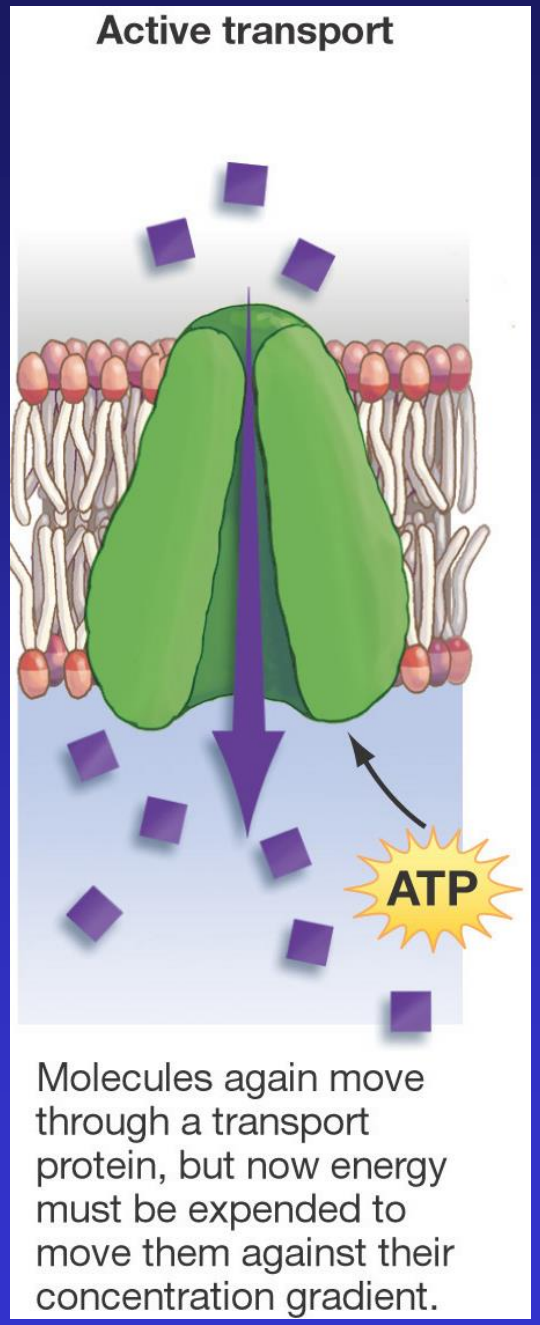
- Some Carrier proteins do not extend through the membrane.
- They bond and drag molecules through the lipid bilayer and release them on the opposite side.



Carrier Proteins

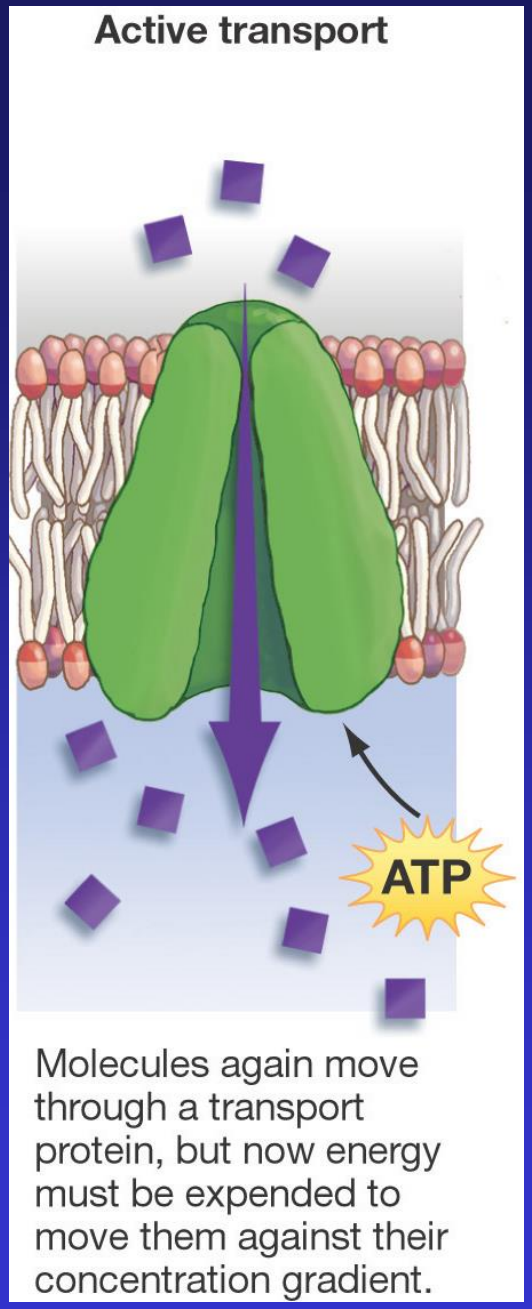
- Other carrier proteins change shape to move materials across the cell membrane





Active Transport

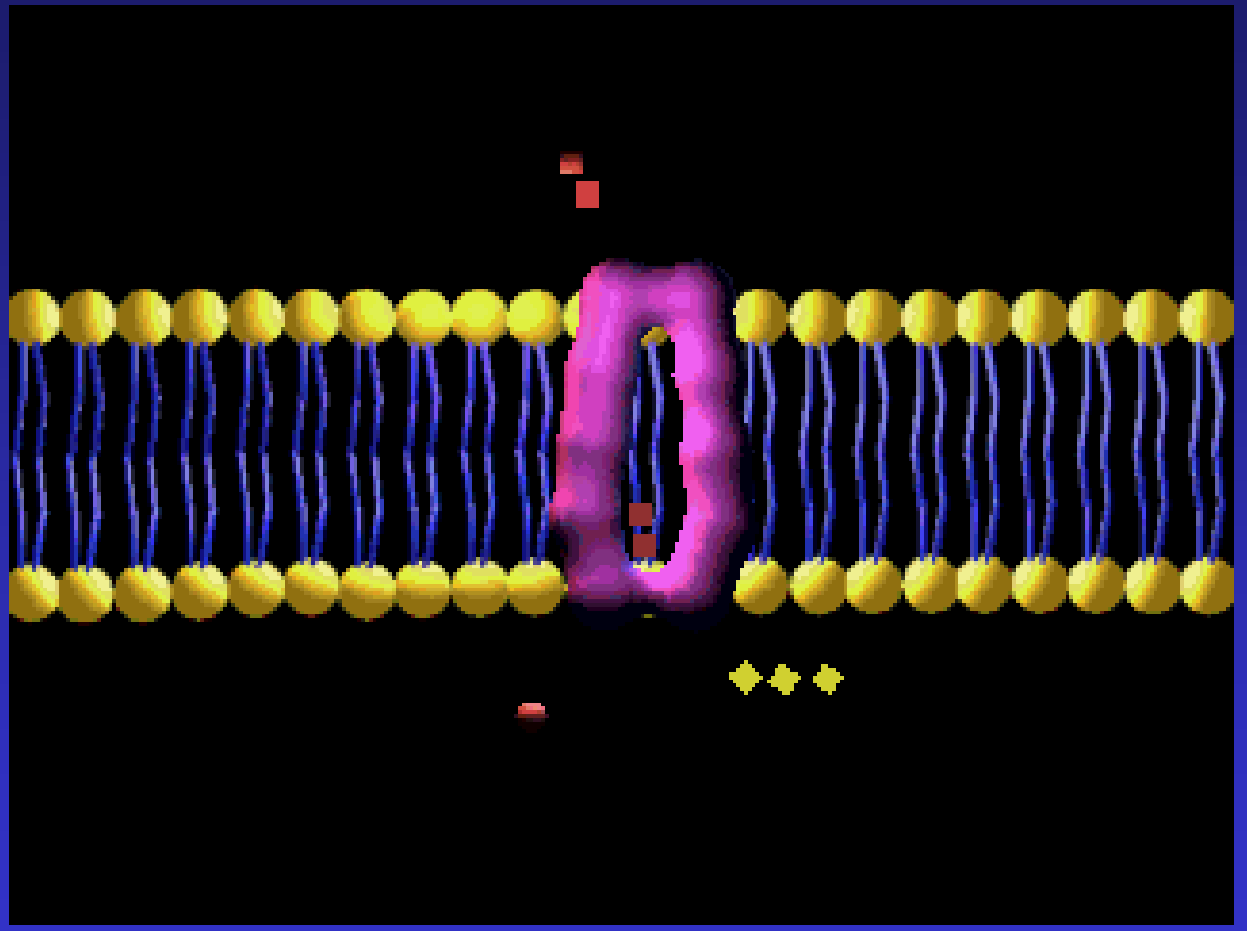
- Requires energy or ATP
- Moves materials from LOW to HIGH concentration
- AGAINST concentration gradient



Active transport Sodium-Potassium Pump

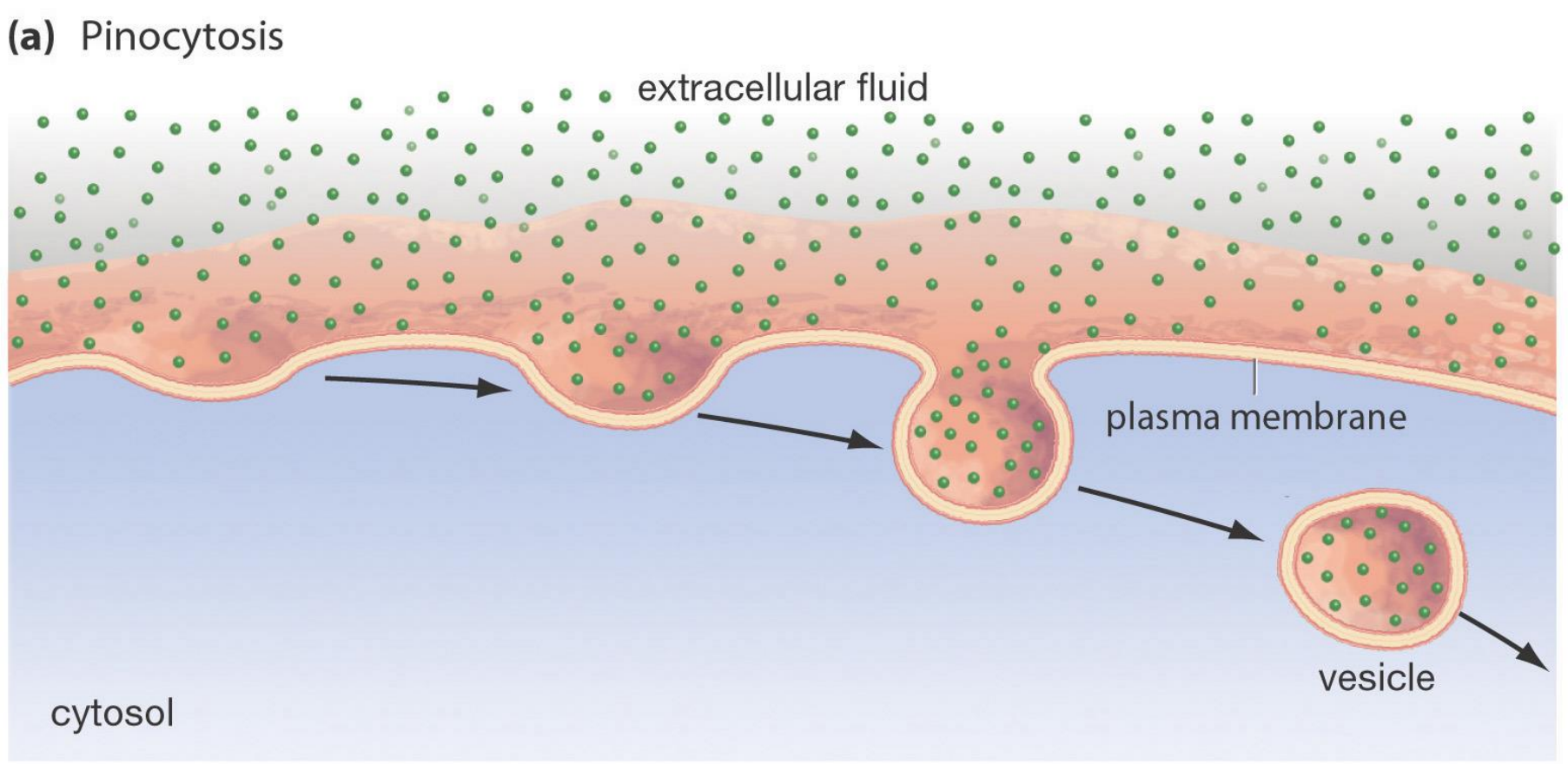
- Examples: Pumping Na^+ (sodium ions) out and K^+ (potassium ions) in against strong concentration gradients.
- Called Na+-K+ Pump

Sodium-Potassium Pump



3 Na+ pumped in for every 2 K+ pumped out; creates a membrane potential

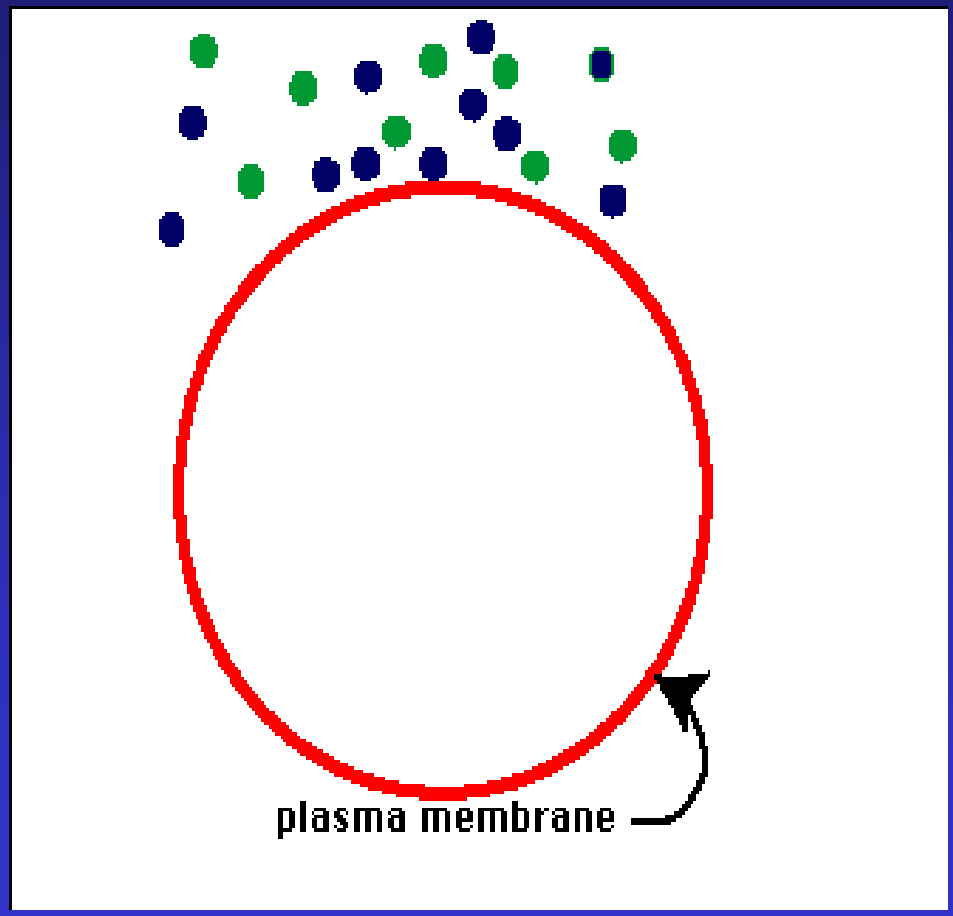
Endocytosis: Pinocytosis



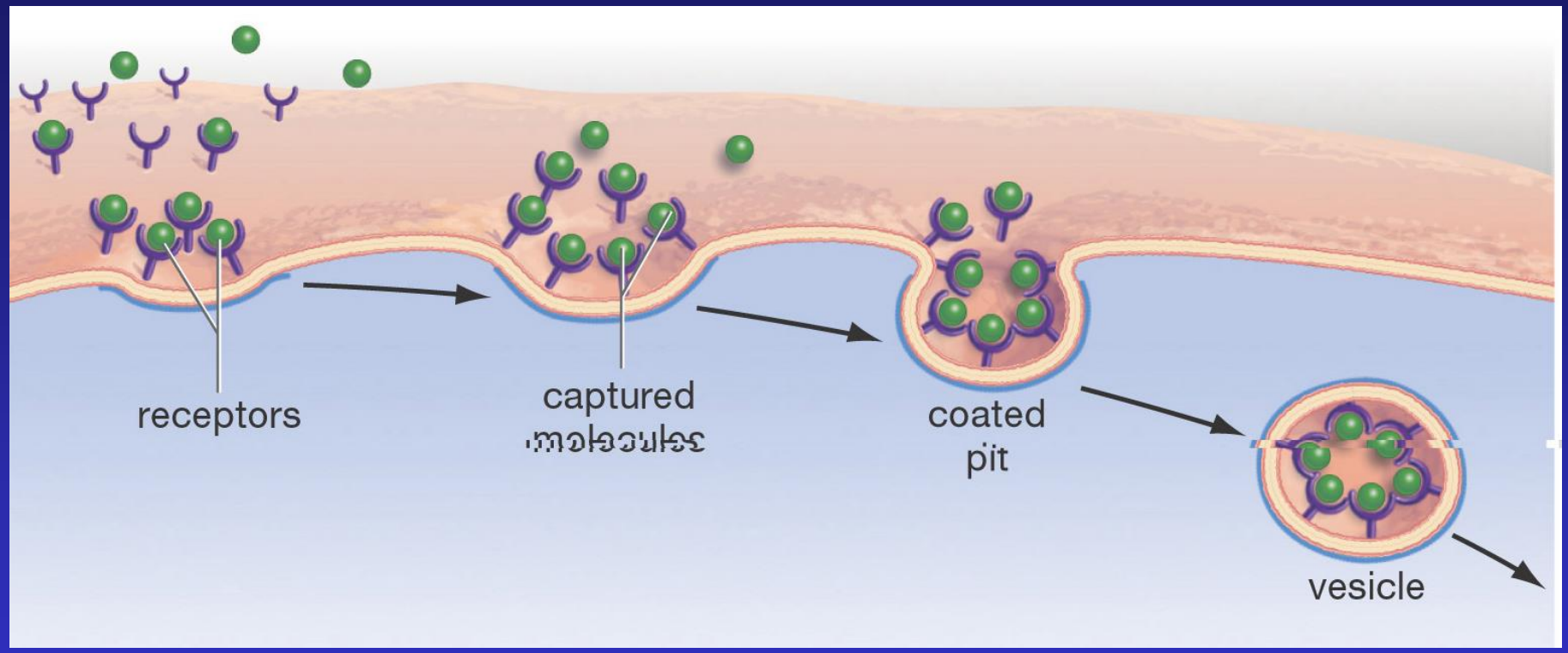
Most common form of endocytosis.
Takes in dissolved molecules as a vesicle.

Pinocytosis

- Cell forms an **invagination**
- Materials **dissolve in water** to be brought into cell
- Called **"Cell Drinking"**

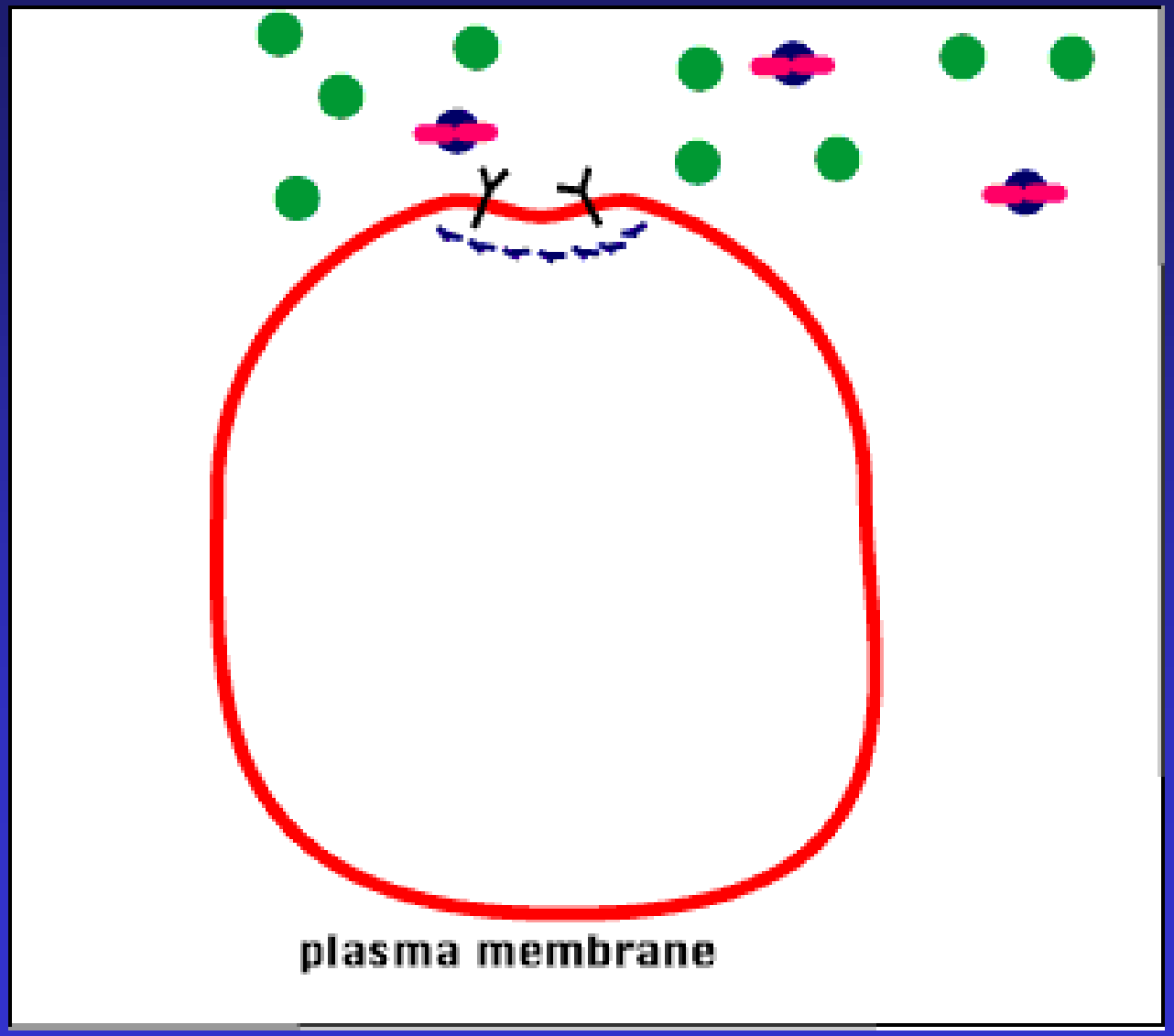


Receptor-Mediated Endocytosis

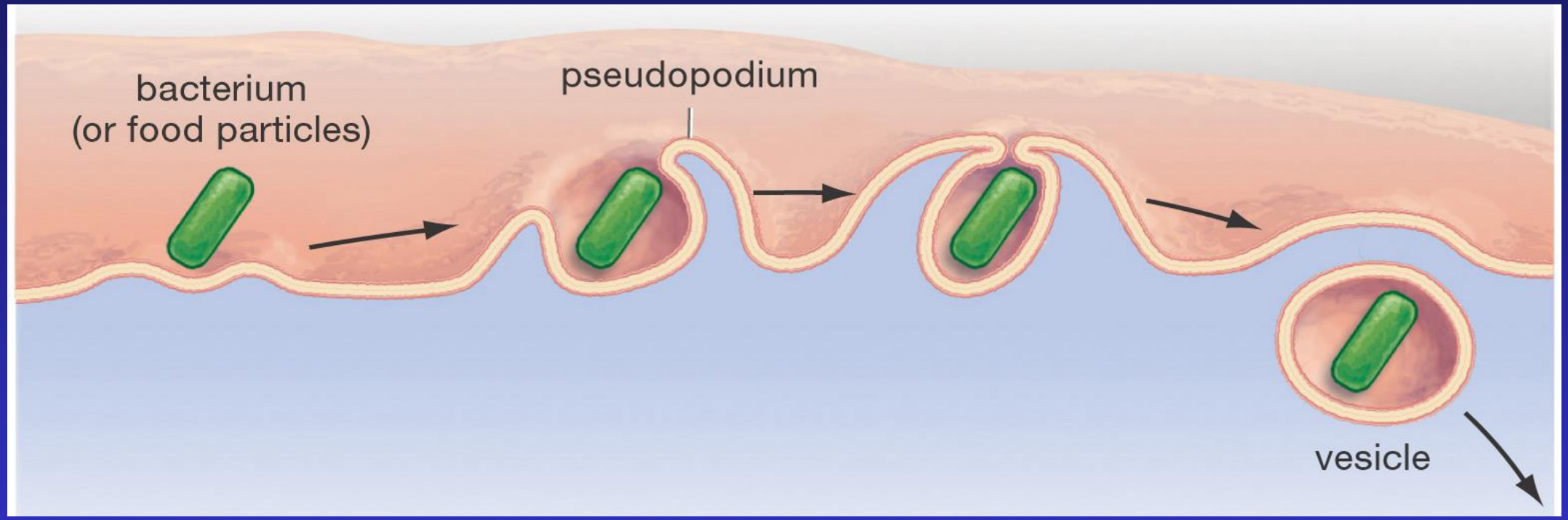


Some integral proteins have receptors on their surface to recognize & take in hormones, cholesterol, etc.

Receptor-Mediated Endocytosis



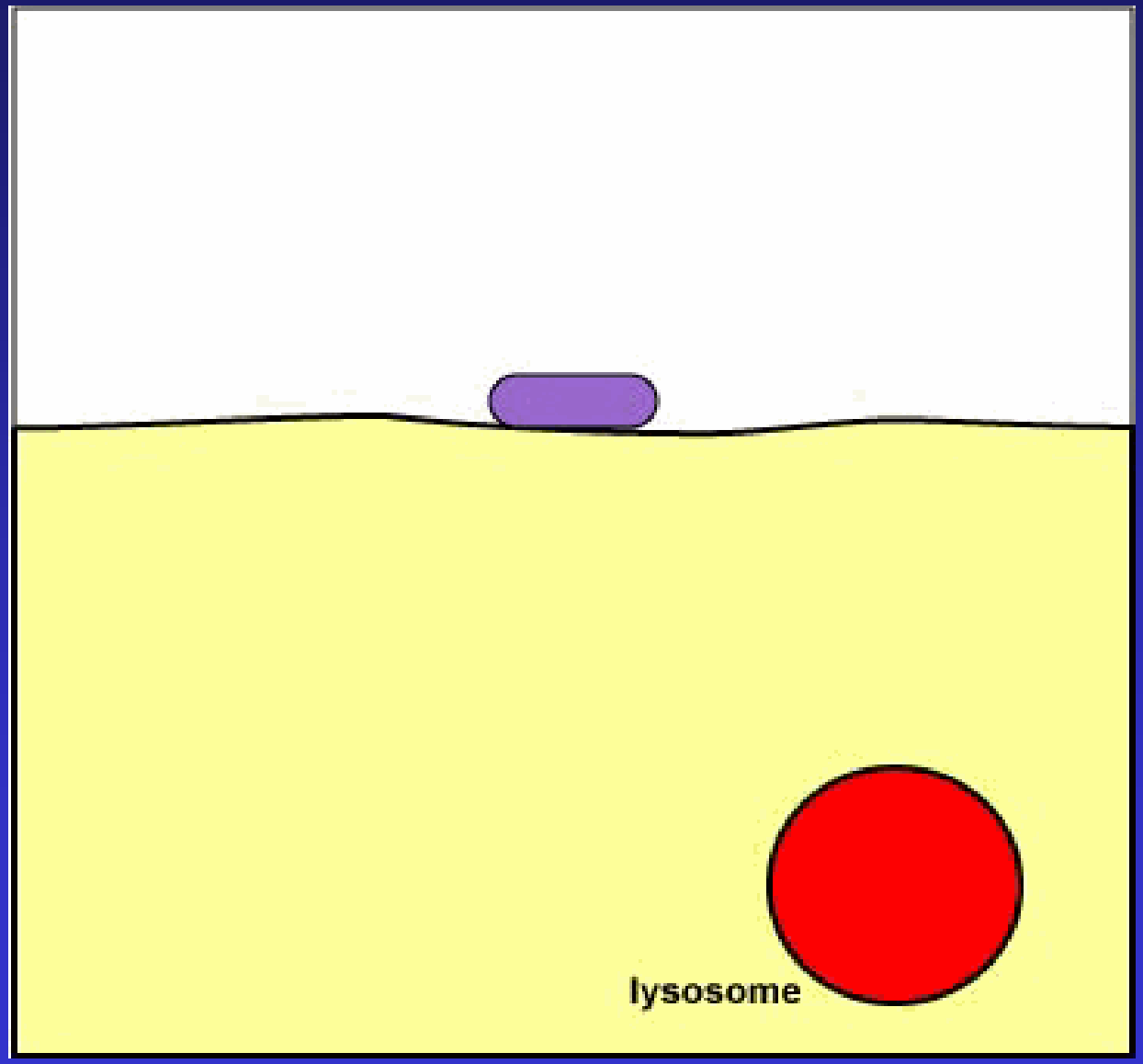
Endocytosis - Phagocytosis



Used to engulf large particles such as food, bacteria, etc. into vesicles

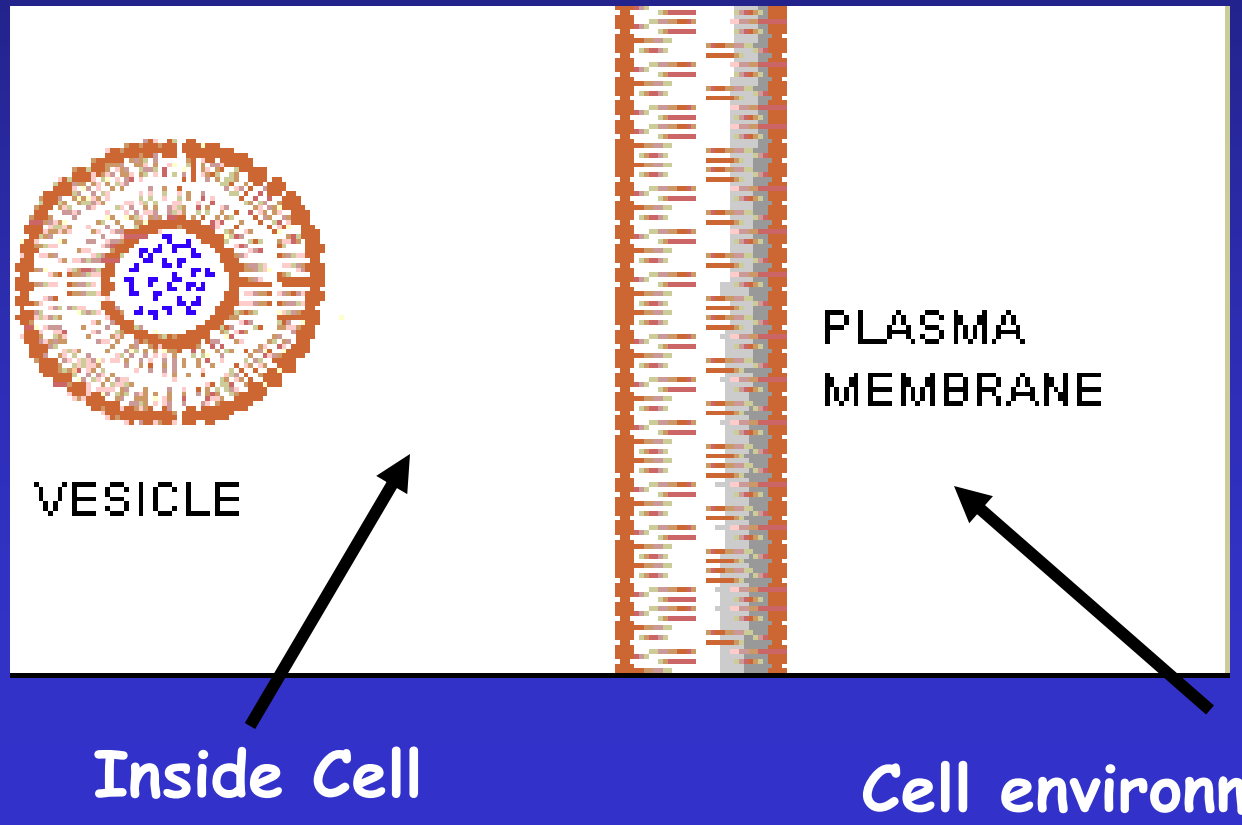
Called "Cell Eating"

Endocytosis - Phagocytosis



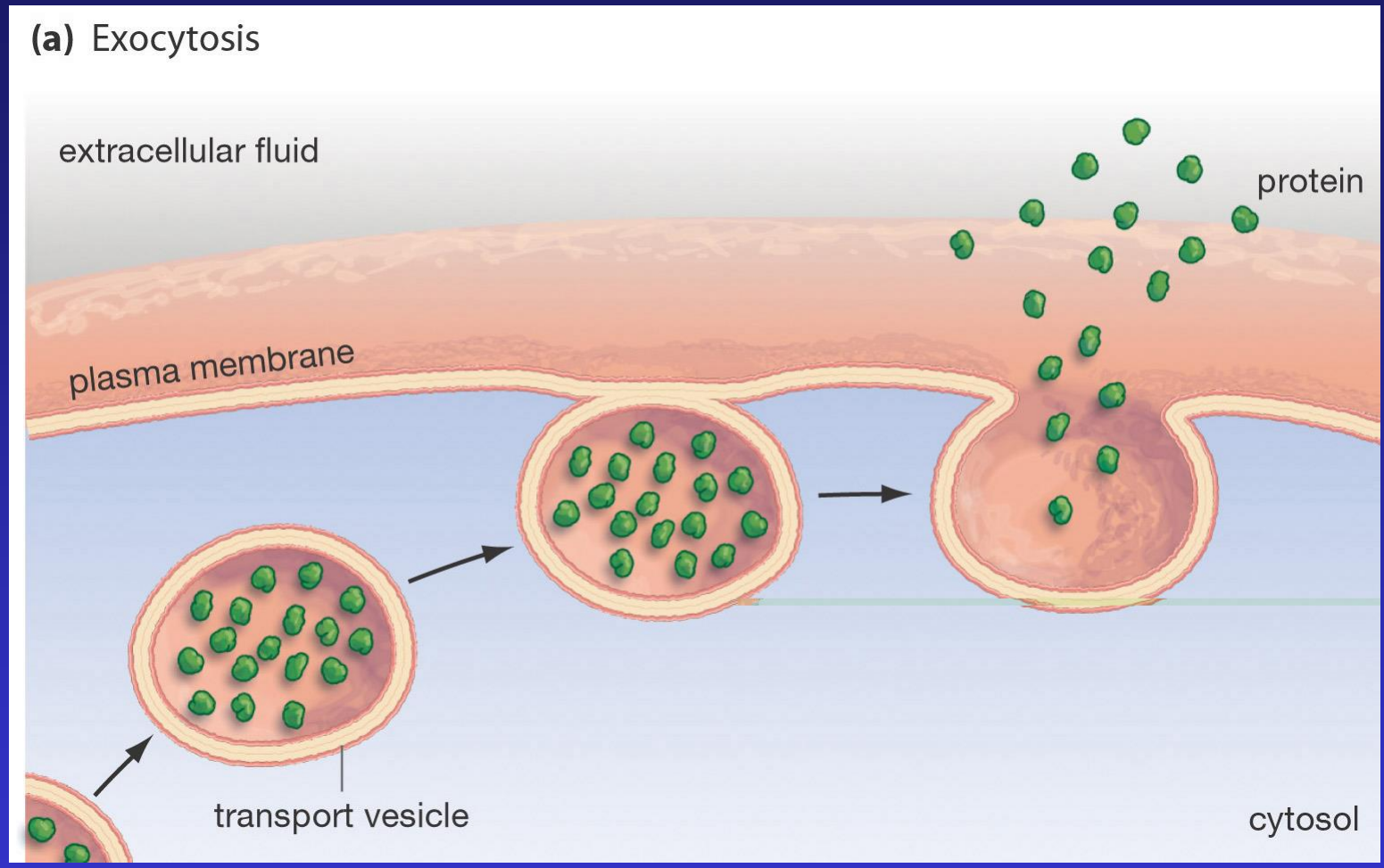
Exocytosis

The opposite of endocytosis is exocytosis. Large molecules that are manufactured in the cell are released through the cell membrane.



Moving the "Big Stuff"

Exocytosis - moving things out.



Molecules are **moved out** of the cell by **vesicles** that **fuse** with the plasma membrane.

Thank You