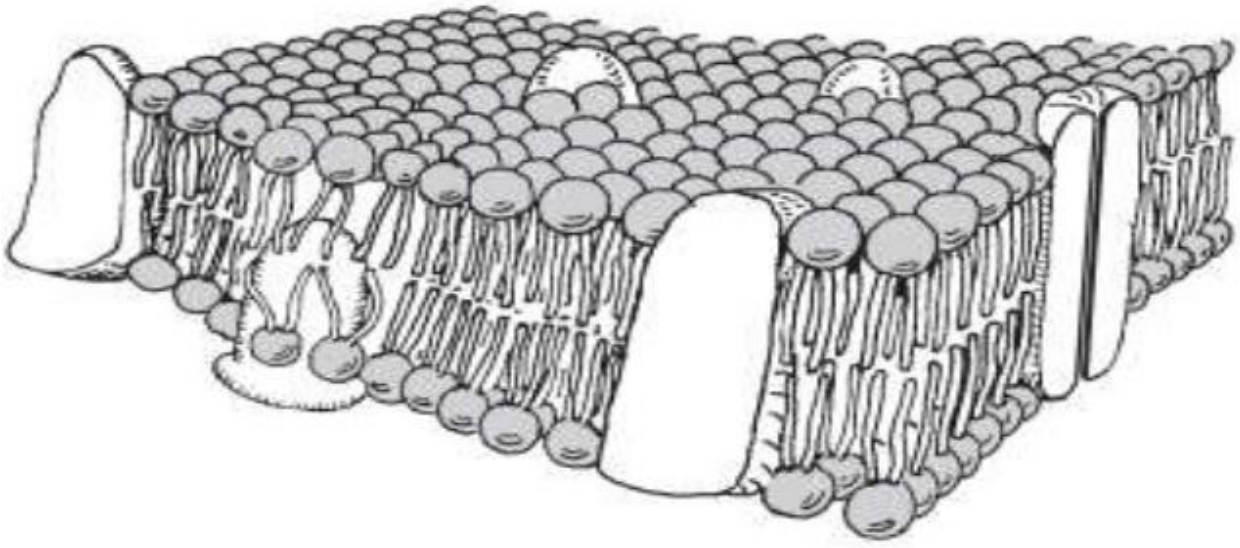
CELL MEMBRANE



Structure

- Phospholipids bilayer (1 glycerol molecule, 2 fatty acids and phosphate group)
- Different proteins, lipids, and carbohydrates

The Fluid Mosaic Model

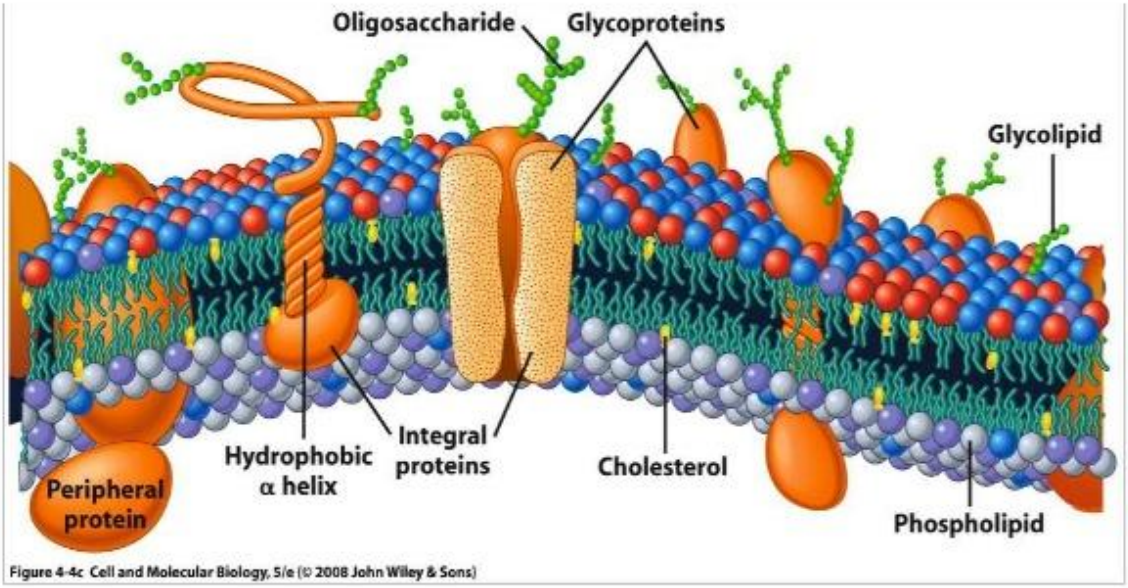
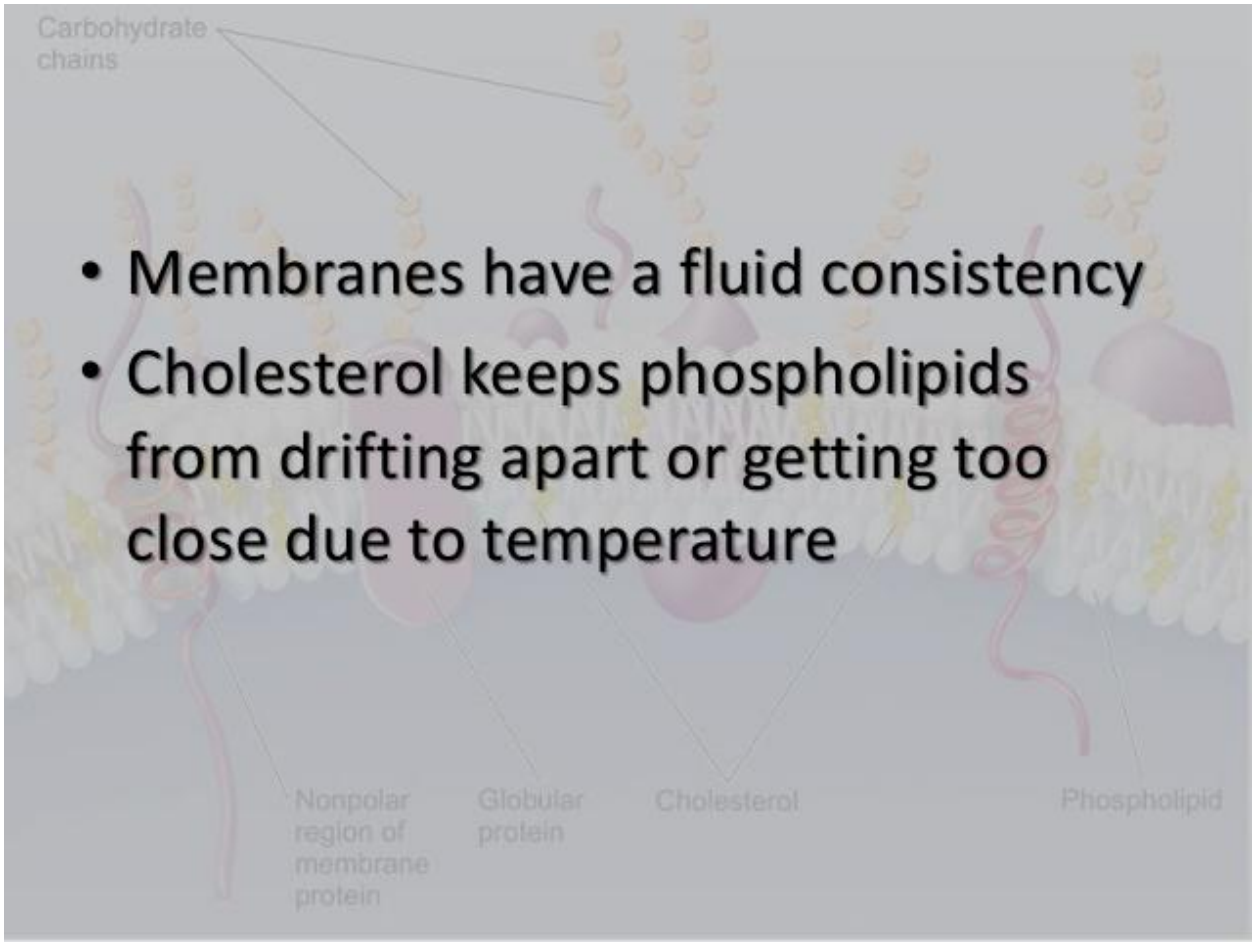
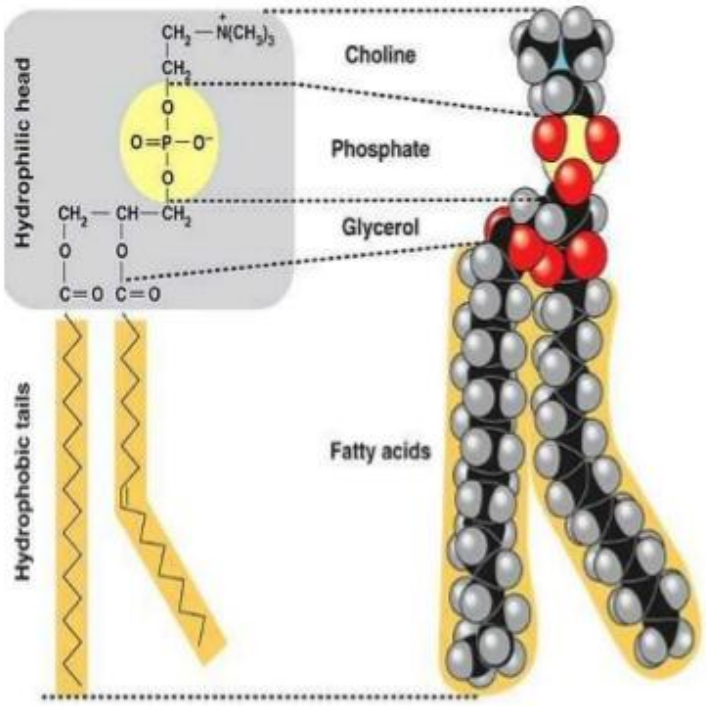


Figure 4-4c Cell and Molecular Biology, 5/e (© 2008 John Wiley & Sons)



- Membranes have a fluid consistency
- Cholesterol keeps phospholipids from drifting apart or getting too close due to temperature



Phospholipids have a “head” with a charge, which is the result of the phosphate group.

The “tail” is a fatty acid that is hydrophobic.

Membrane Proteins

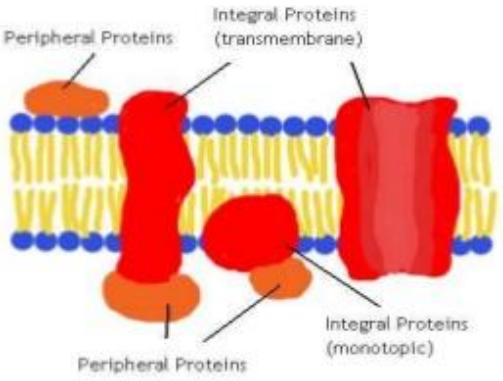
<u>Function:</u>

- Transportation
- Enzymes
- Receptor sites
- Cell adhesion
- Attachment to the cytoskeleton

Membrane Proteins

Types:

- Integral: Proteins that insert into the membrane
- Peripheral: Proteins that are attached loosely to inner or outer surface



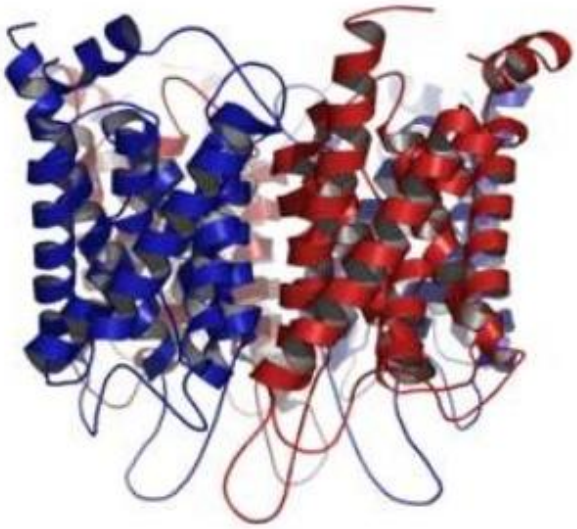
Carbohydrates

- Usually branched molecules of 15 or less sugar units
- Some are bounded to lipids (glycolipids)
- Most are bounded to proteins (glycoproteins)
- Function is cell to cell recognition

Cell Function

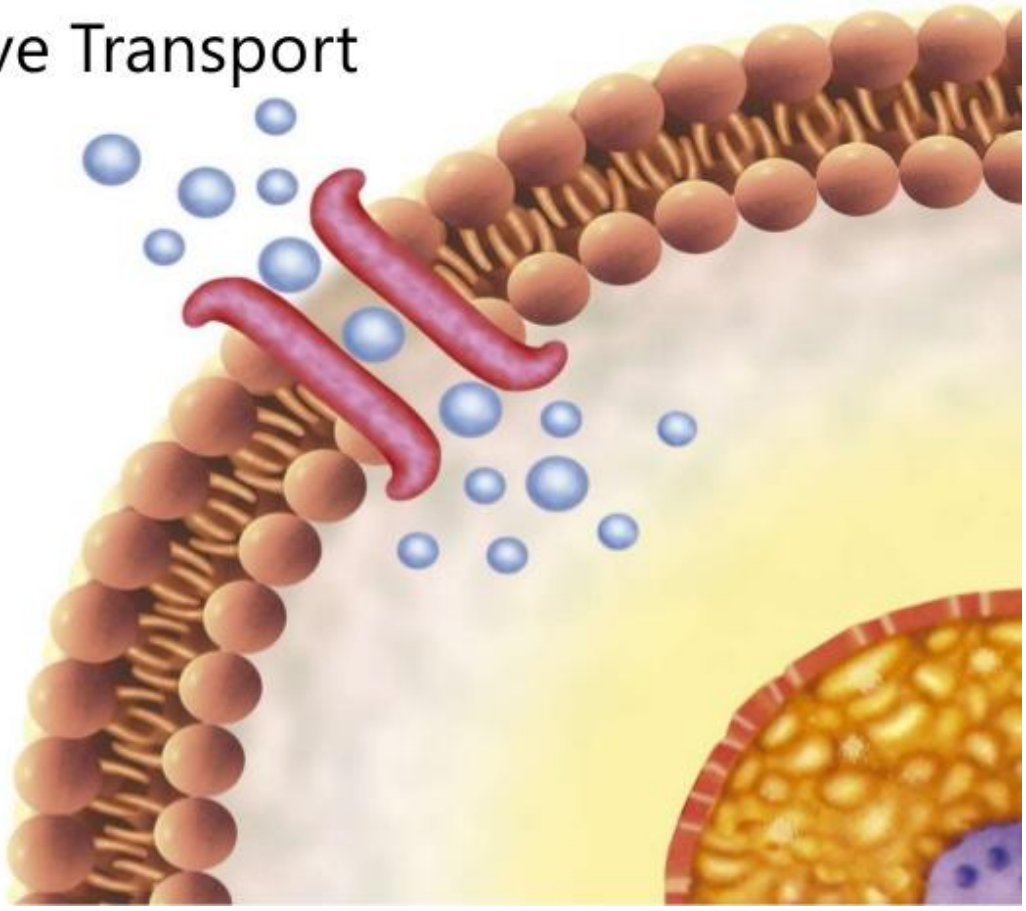
- Separates internal metabolic events from the external environment
- Controls movement of materials into and out of cell
- Selective permeability

Aquaporin



Aquaporin are integral membrane proteins that lets water flow more rapidly inside the cell than by diffusing through the phospholipid bilayer.

Passive Transport

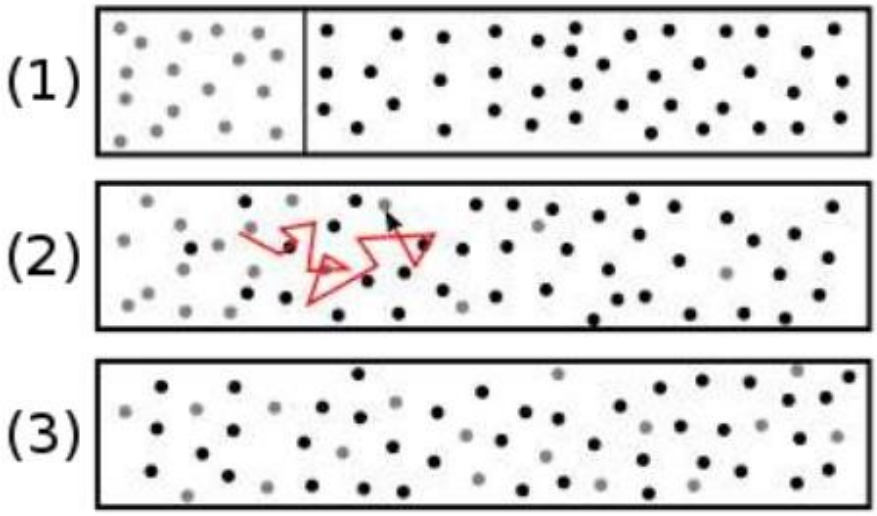


Passive Transport

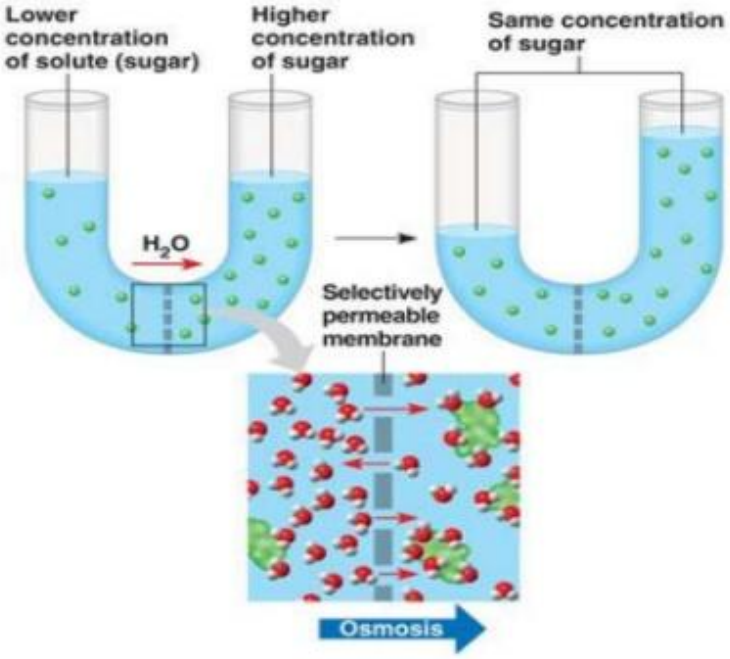
It is the movement of substances down a concentration gradient and does not require energy use.

- Diffusion
- Osmosis
- Dialysis
- Facilitated diffusion
- Simple diffusion

Diffusion



OSMOSIS

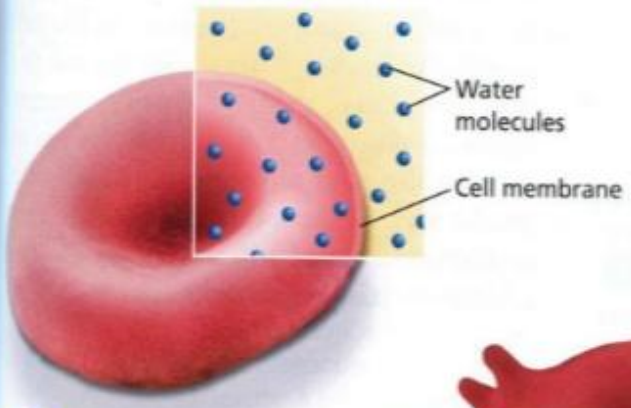

Lower concentration of solute (sugar)
Higher concentration of sugar
Same concentration of sugar
H_2O
Selectively permeable membrane
Osmosis

Facilitated diffusion

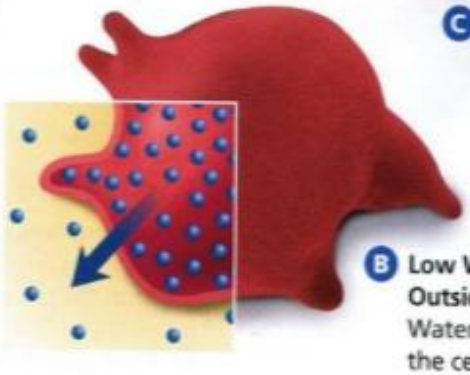
- Movement of large molecules
- High to low regions of concentration
- Channel proteins: tunnel shape transporting small charged molecules
- Carrier proteins: transports non charged molecules with a specific shape

Effects of Osmosis on Cells

In osmosis, water diffuses through a selectively permeable membrane.



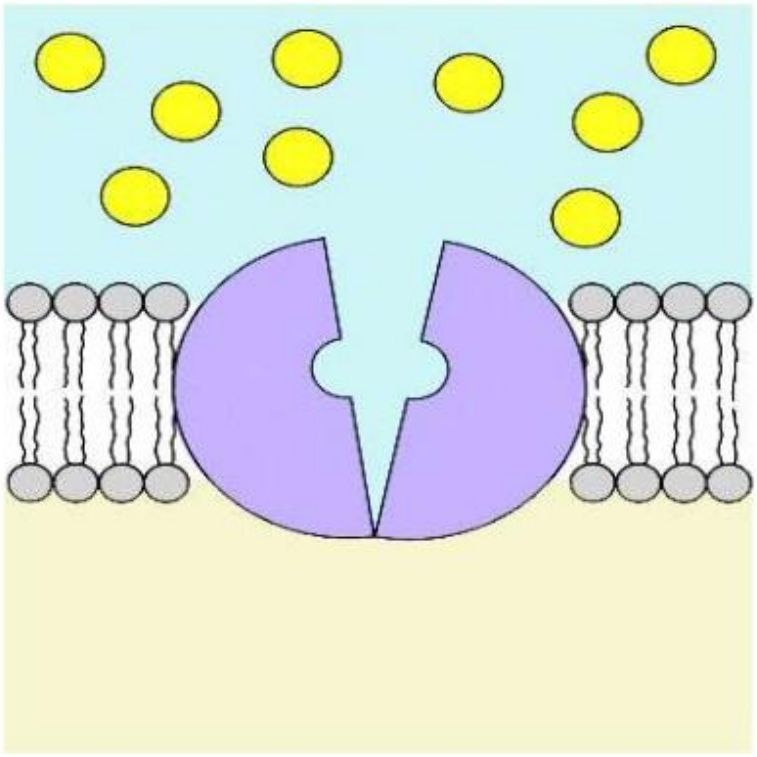
A Normal Red Blood Cell
Concentration of water inside the cell is the same as outside.

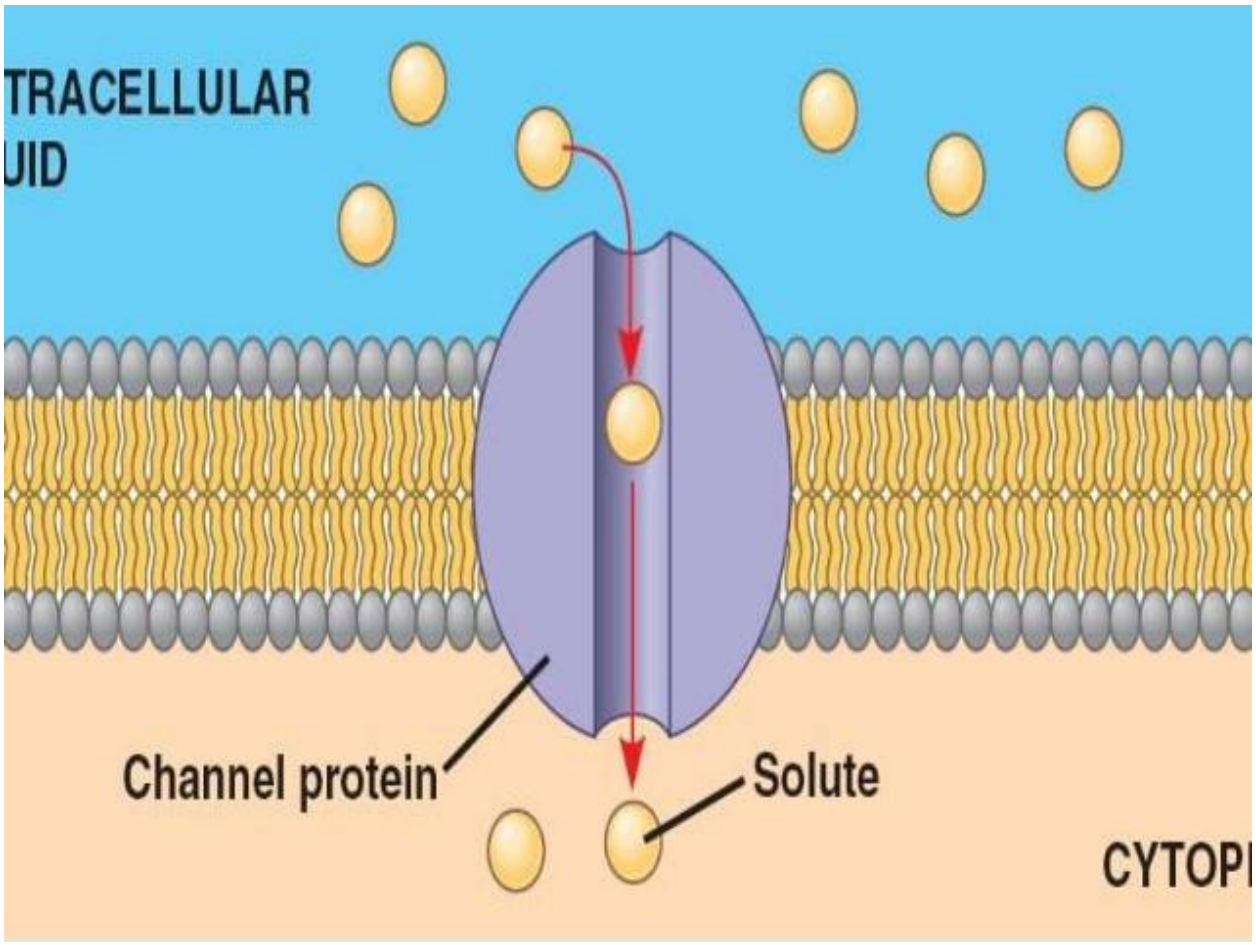


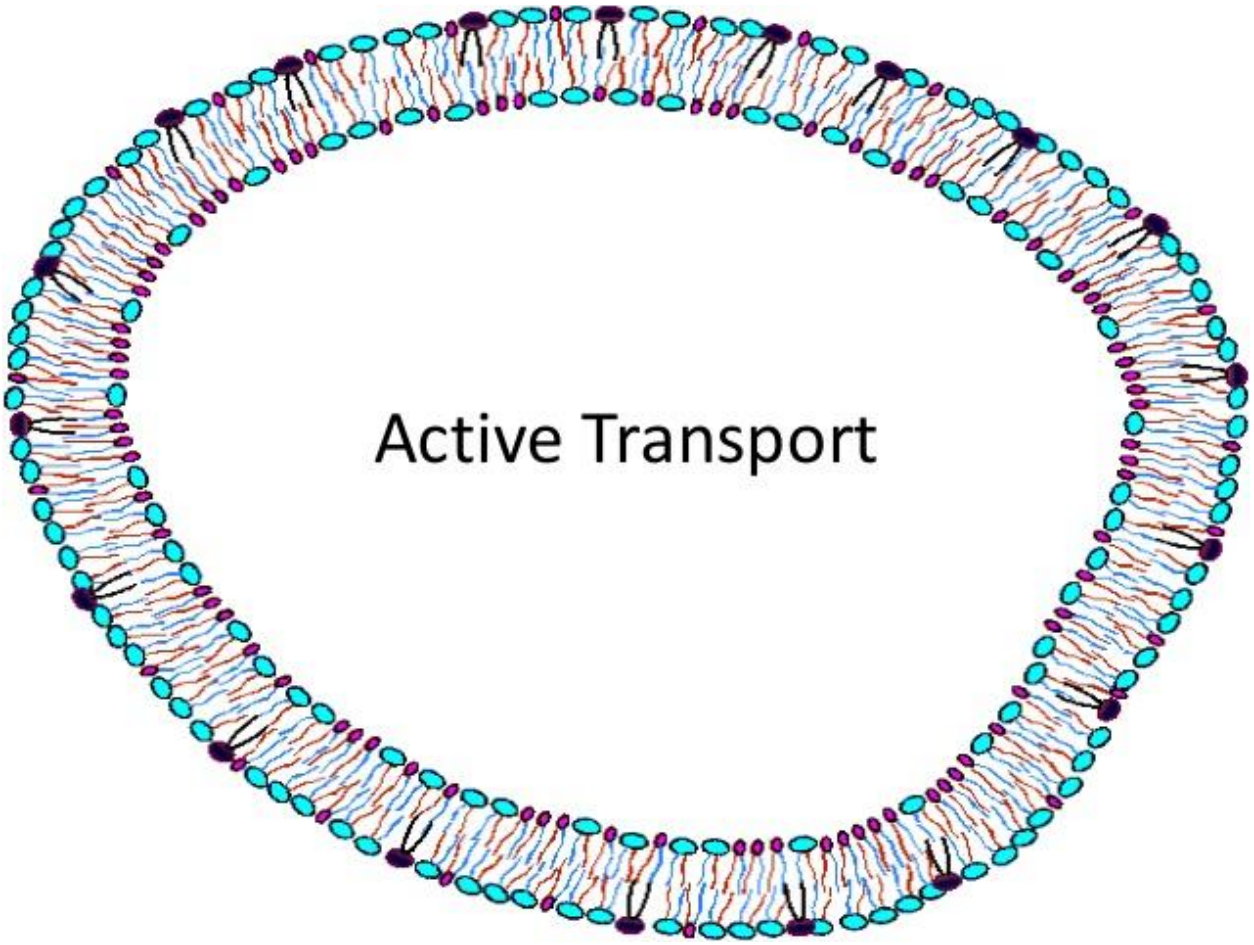
B Low Water Concentration Outside Cell
Water moves out of the cell during osmosis.

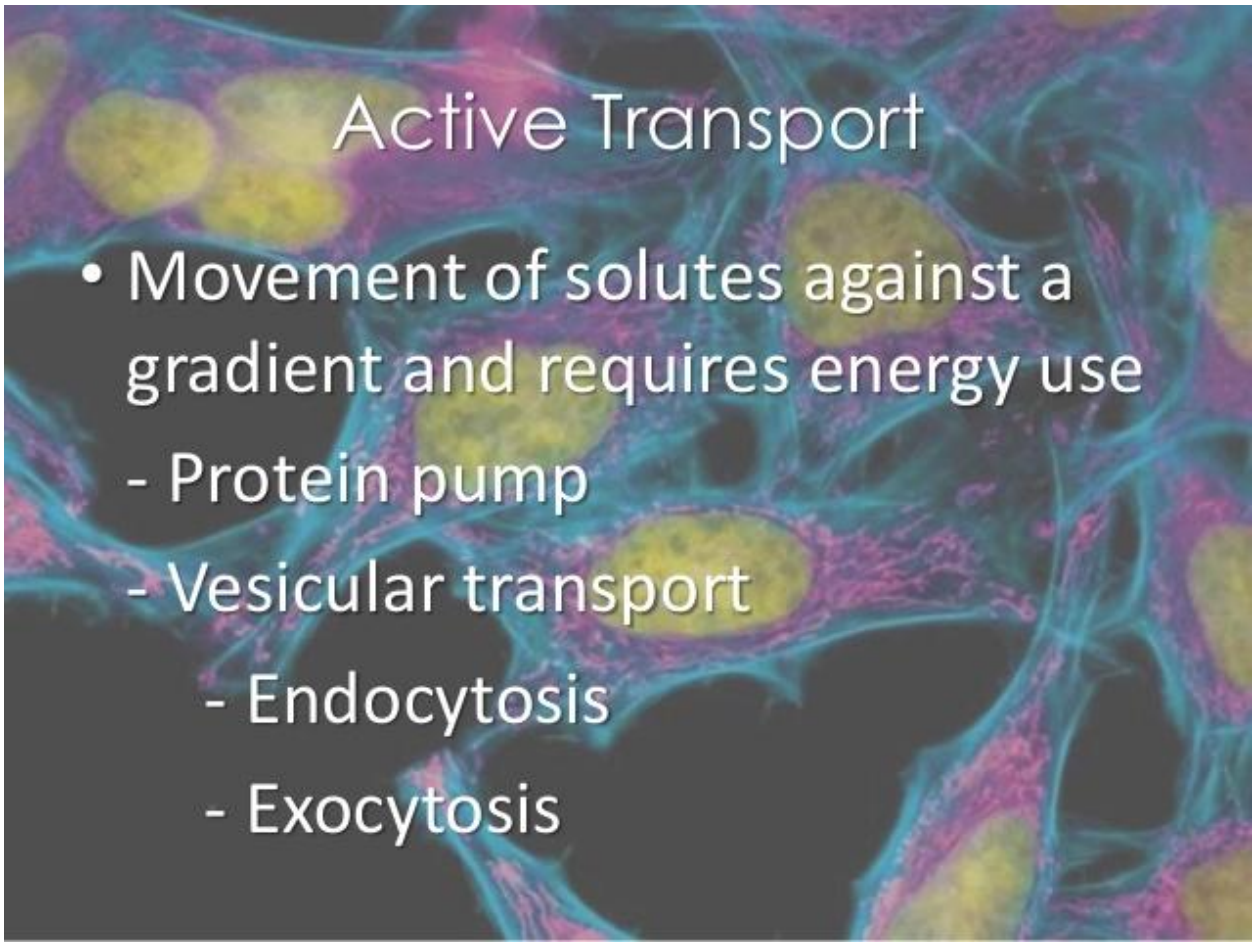
C High Water Concentration Outside Cell
During osmosis, water moves into the cell.

Facilitated Diffusion

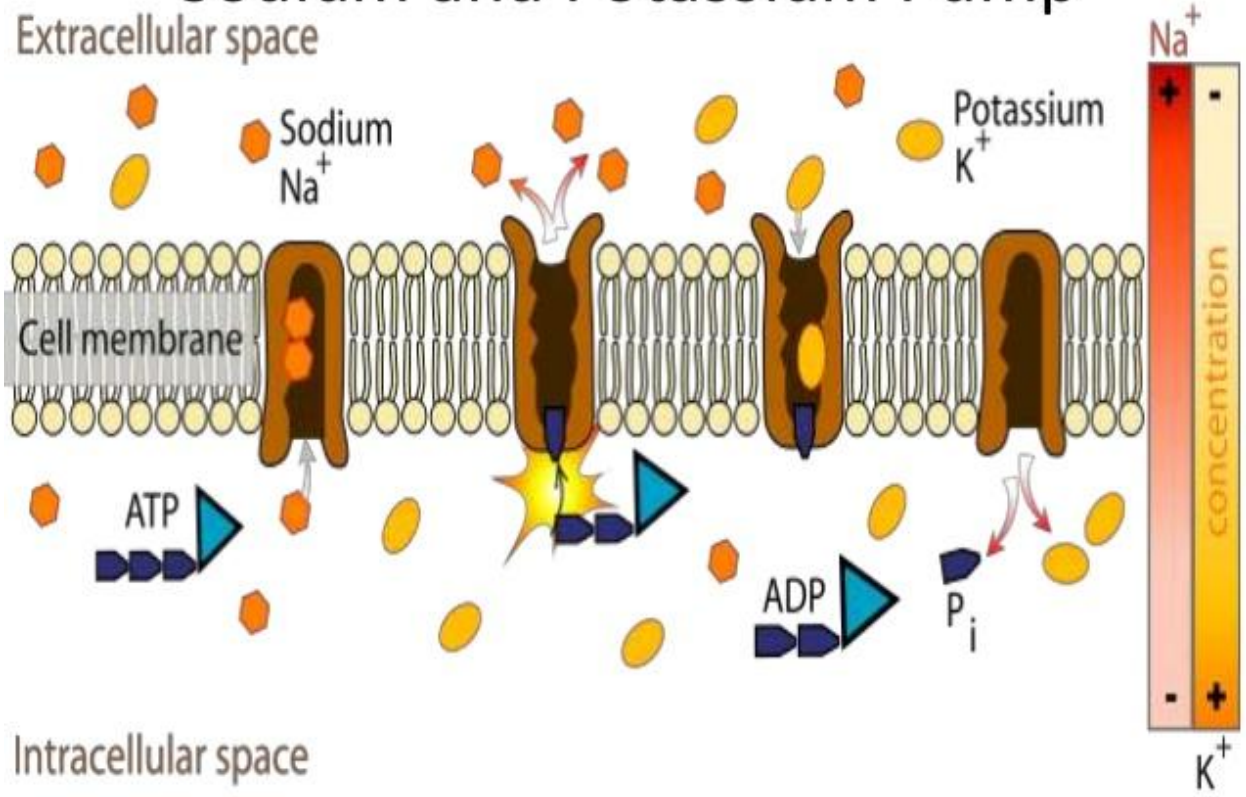


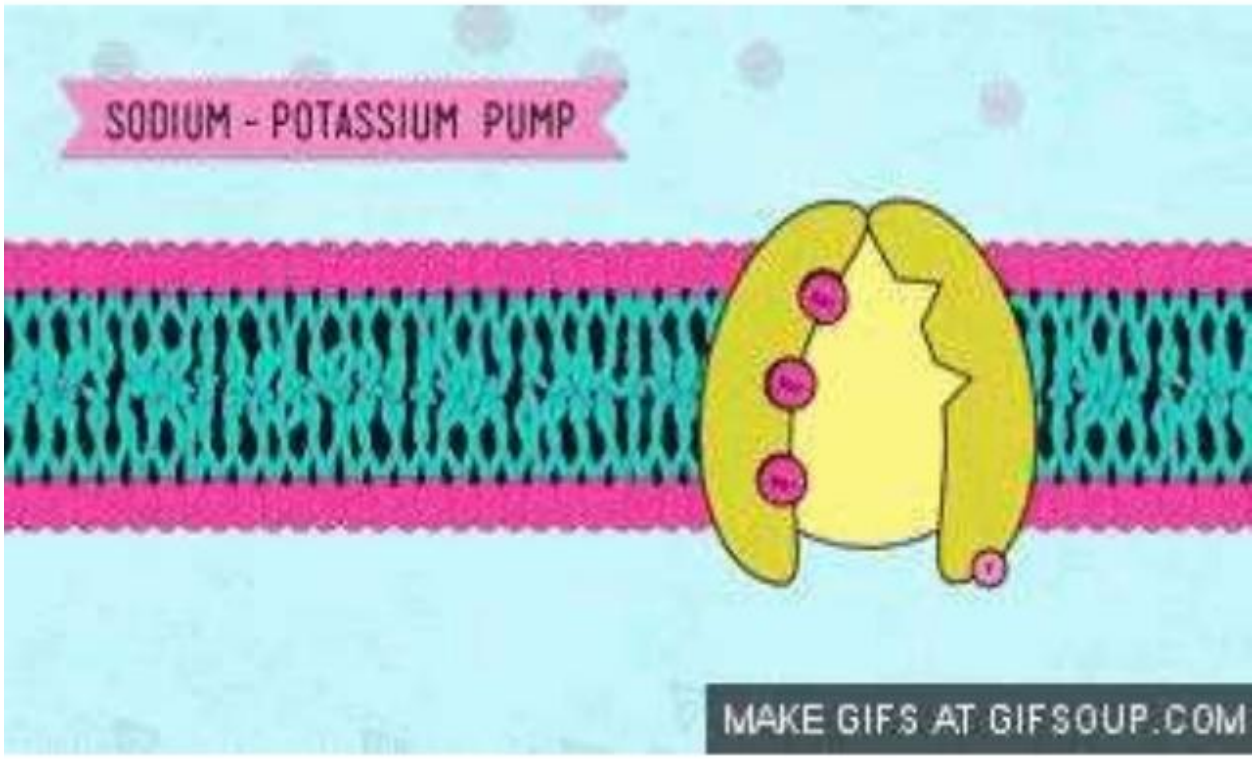

TRACELLULAR
UID
Channel protein
Solute
CYTOPI


Active Transport


Active Transport
• Movement of solutes against a gradient and requires energy use
- Protein pump
- Vesicular transport
- Endocytosis
- Exocytosis

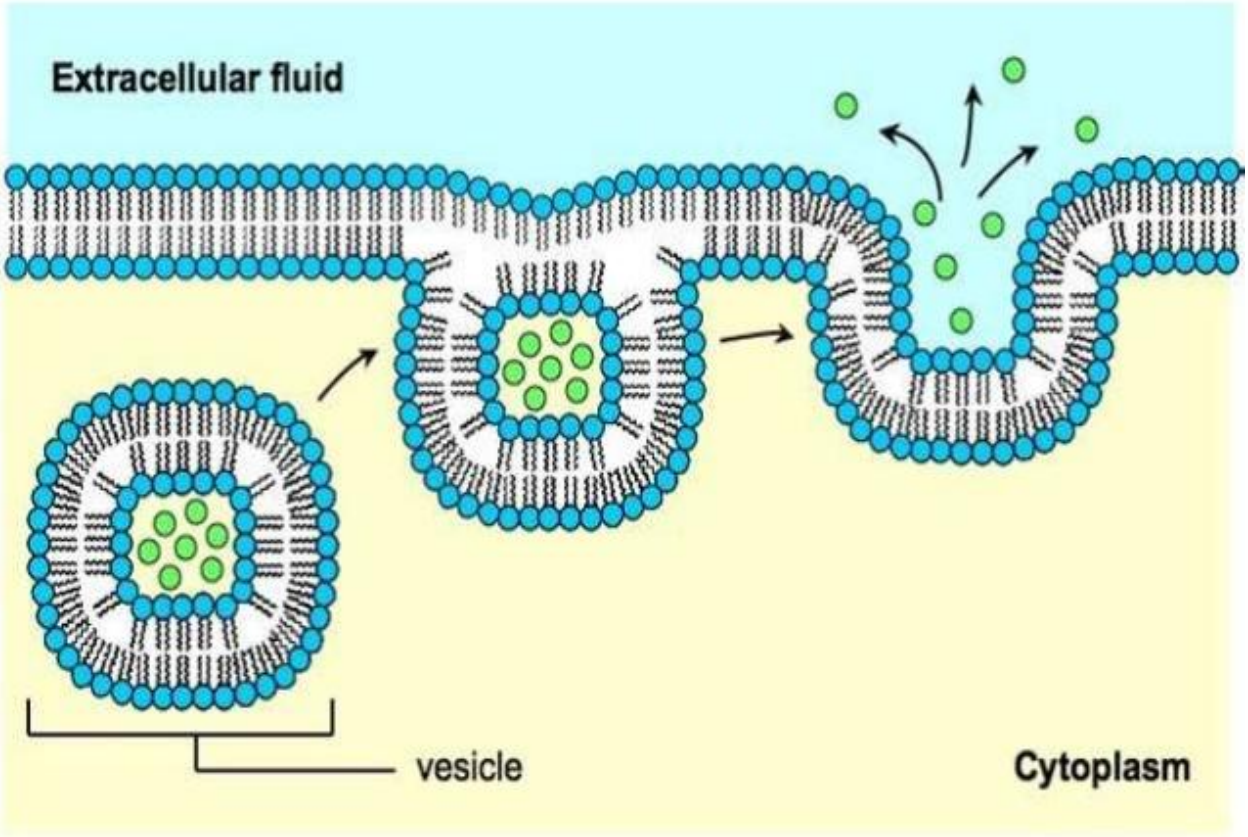
Sodium and Potassium Pump




SODIUM - POTASSIUM PUMP
MAKE GIFS AT GIFSOUP.COM

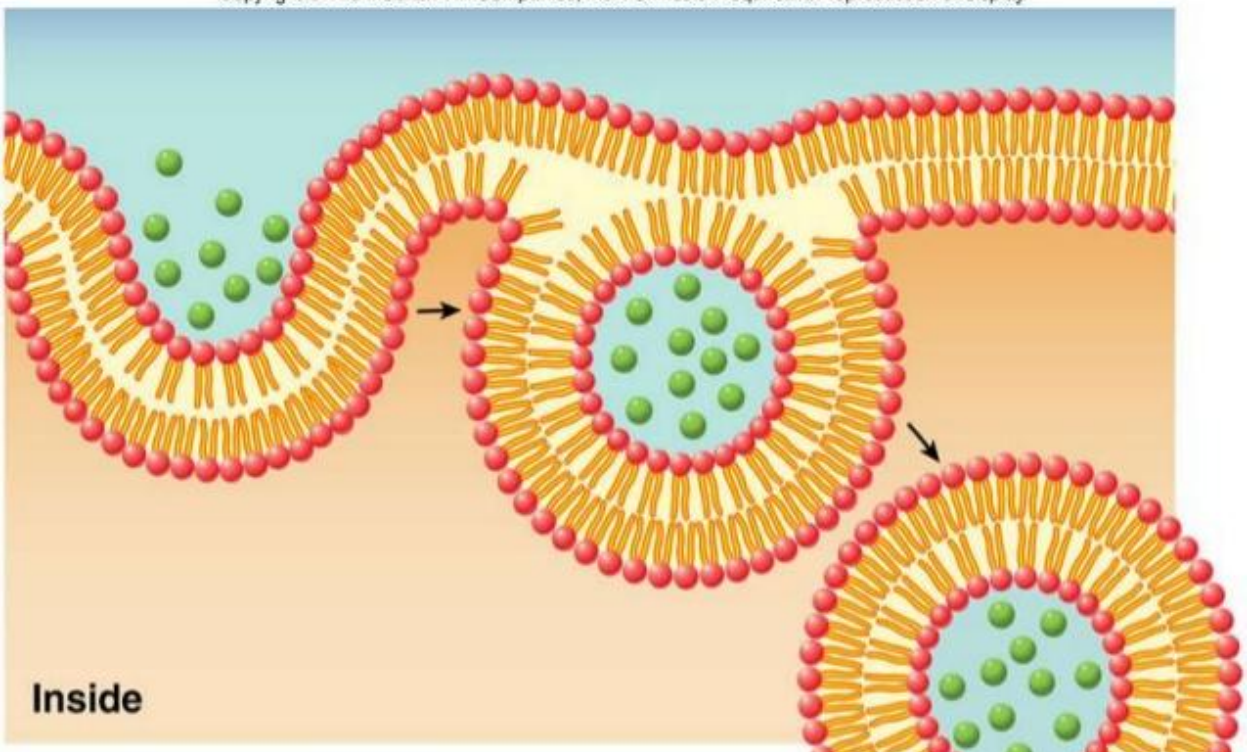
Exocytosis

A vesicle from inside the cell moves to the cell membrane. The vesicle fuses to the membrane and the contents are secreted.


Extracellular fluid
vesicle
Cytoplasm

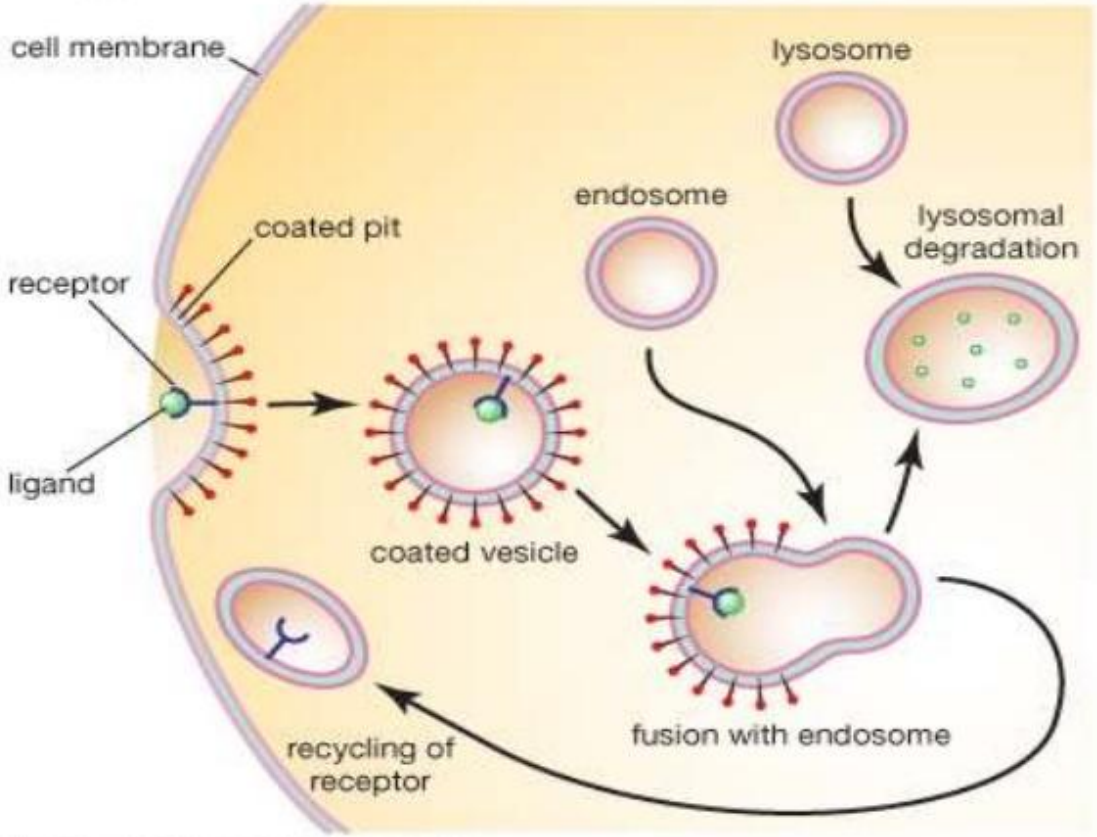
Endocytosis

- **Pinocytosis:** plasma membrane folds inward, forming a pinocytic vesicle
- **Phagocytosis:** plasma membrane engulfs the solid material
- **Receptor mediated endocytosis:** specific molecules bind to specialized receptors



b. Endocytosis

Receptor-mediated endocytosis

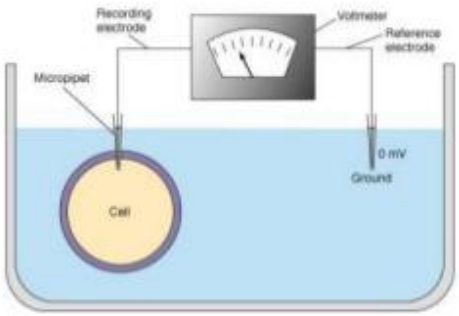


- All eukaryotic cells maintain a non-zero transmembrane potential.
- Negative voltage inside, positive voltage outside (-40mV to -80mV)
- Membrane potential provides power
- Used for transmitting signals

- The resting membrane potential is the electrical gradient across the cell membrane.
- Resting: the membrane potential has reached a steady state and is not changing.
- Potential: the electrical gradient created by the active transport of ions is a source of stored or potential energy.

Measuring Resting Membrane Potential

- Micropipets filled with solutions conduct charge. It is inserted into cell
- The voltmeter measures the potential difference (mV)
- The reference electrode is placed in the extracellular fluid. The extracellular fluid is designated as the ground and assigned a charge of 0 mV.



Resting Membrane Potential in Real Cells

- Most cells are 40x more permeable to K+ than Na+.
- The resting membrane potential is closer to -70 mV because a small amount of Na^+ leaks into the cell.
- The Na^+ is pumped out and the K^+ pumped in by the Na^+/K^+-ATPase.

Goldman Equation

- **Used to calculate the membrane potential resulting from all the participating ions when V_m is not changing:**

$$V_m = \frac{RT}{zF} \ln \frac{P_K[K^+]_{out} + P_{Na}[Na^+]_{out} + P_{Cl}[Cl^-]_{in}}{P_K[K^+]_{in} + P_{Na}[Na^+]_{in} + P_{Cl}[Cl^-]_{out}}$$