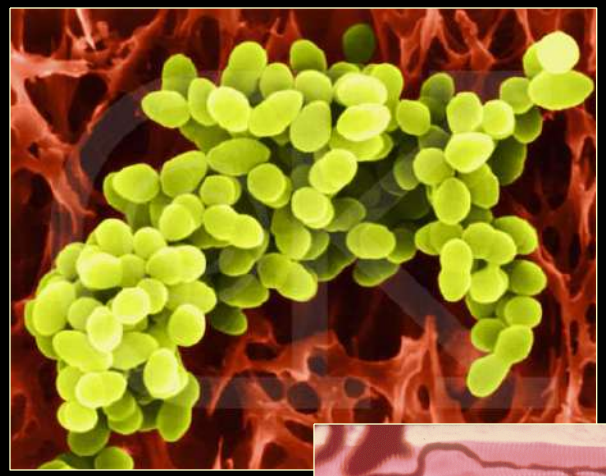
The Cell Theory and Membrane Transport

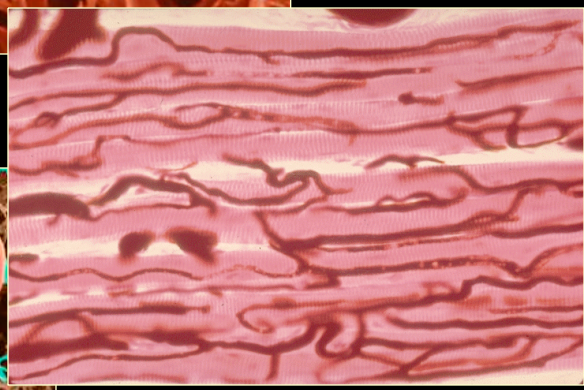
IN 61 & 63

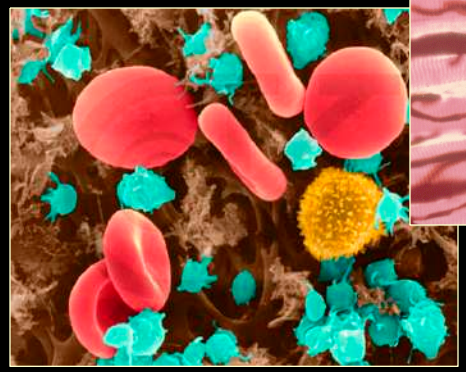
HEADINGS
IMPORTANT WORDS
VOCABULARY

THE CELL

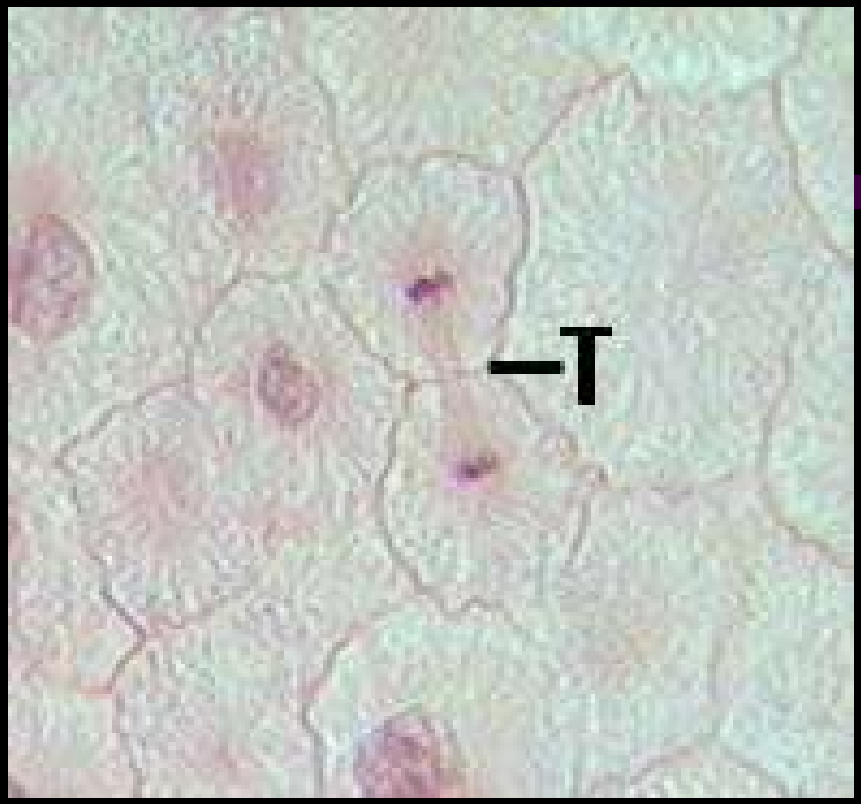
- **A CELL IS A MEMBRANE BOUND STRUCTURE THAT IS THE BASIC UNIT OF LIFE**
- **THE FIRST PERSON TO OBSERVE LIVING CELLS WAS A DUTCH MICROSCOPE MAKER, ANTON VAN LEEUWENHOEK (1632-1723)**

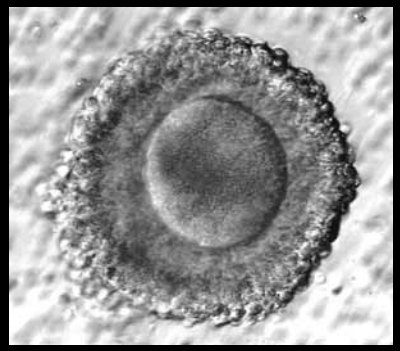


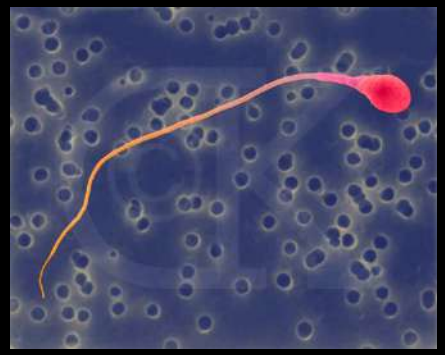




THE CELL THEORY



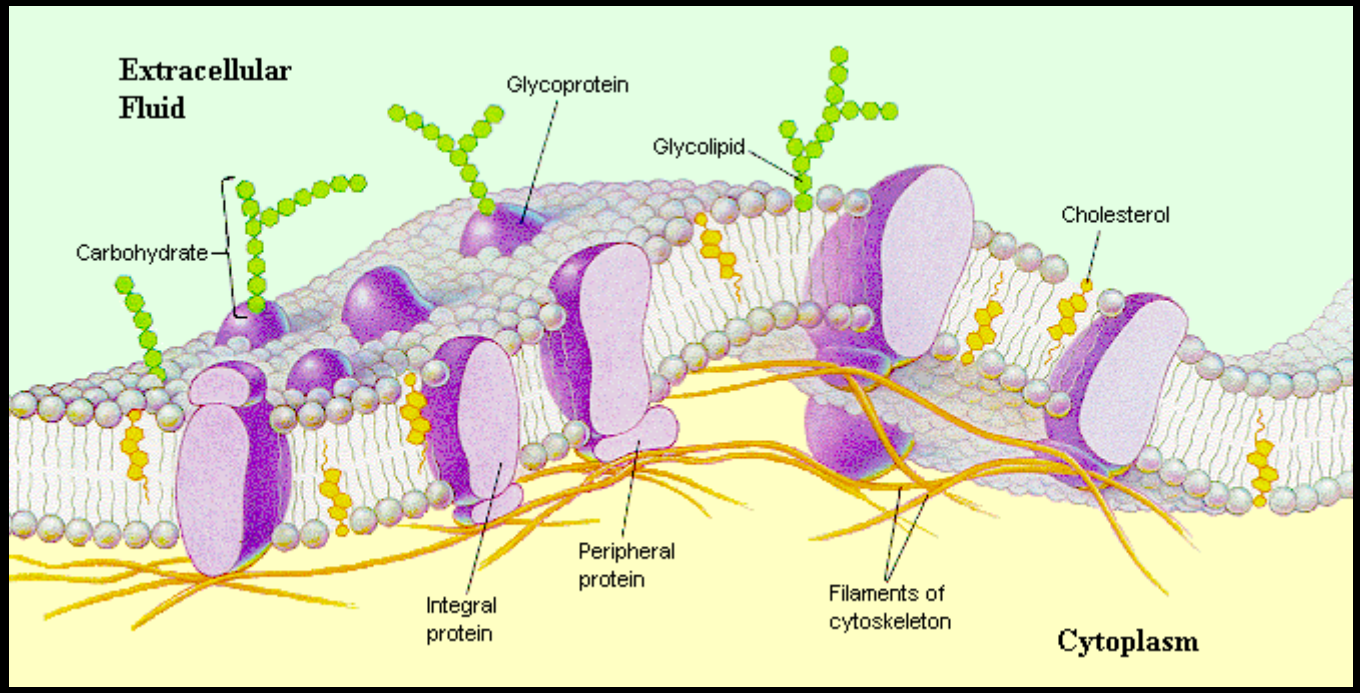




1. ALL LIVING THINGS ARE COMPOSED OF ONE OR MORE CELLS
2. CELLS ARE THE BASIC UNITS OF STRUCTURE AND FUNCTION IN AN ORGANISM
3. CELLS COME ONLY FROM THE REPRODUCTION OF EXISTING CELLS

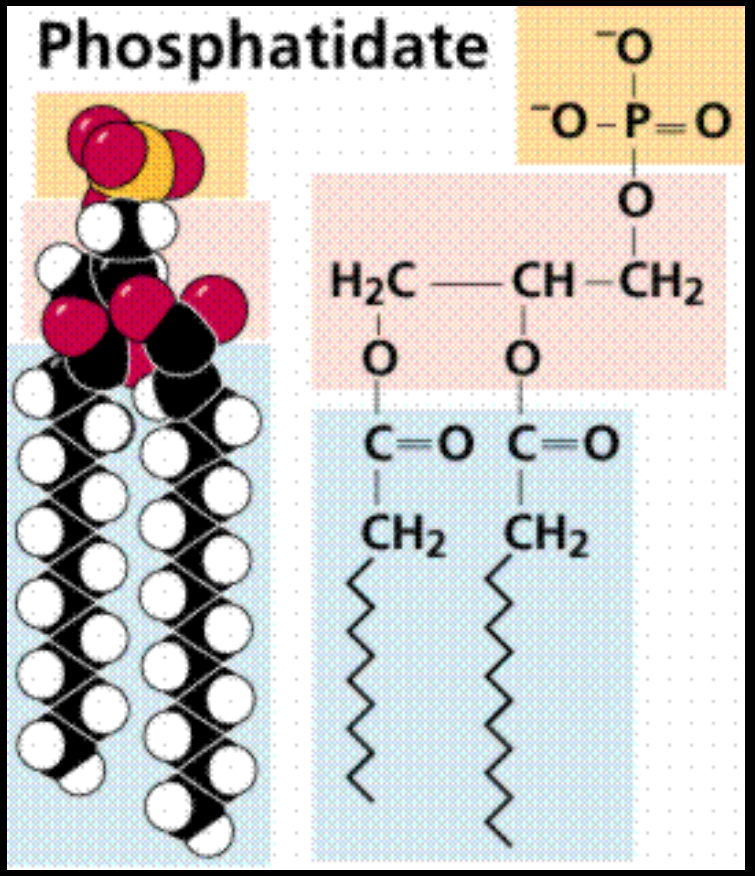
FLUID MOSAIC MODEL

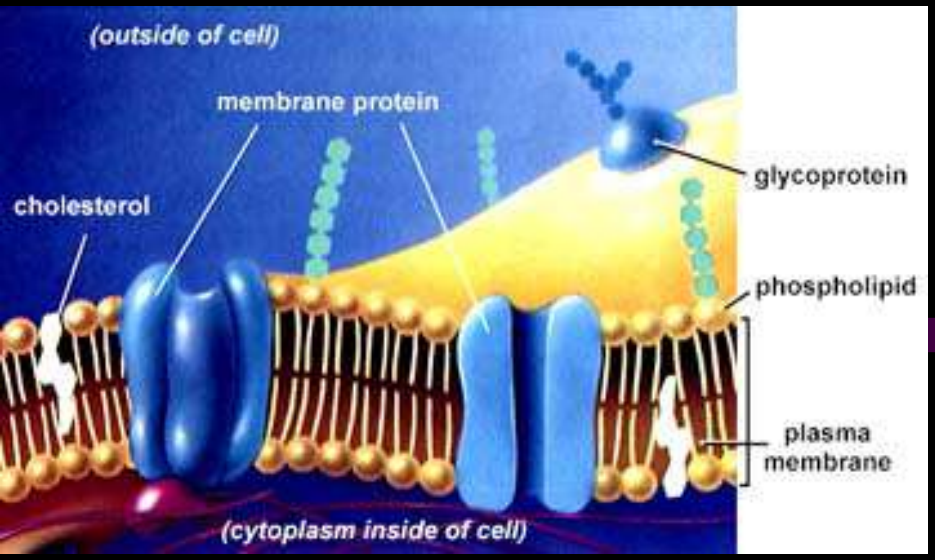
- USED TO DESCRIBE THE CELL MEMBRANE
- THE LIPID BILAYER (aka: Cell Membrane) BEHAVES MORE LIKE A FLUID THAN A SOLID
- THIS ALLOWS FOR A LATERAL MOVEMENT PROTEINS W/I THE LIPID BILAYER
- PATTERN IS CONSTANTLY CHANGING!



MEMBRANE LIPIDS

- **PHOSPHOLIPID:**
  - HAS A POLAR HEAD
  - 2 NON-POLAR TAILS
  - HYDROPHILIC Head= CLOSE TO WATER AS POSSIBLE
  - HYDROPHOBIC Tail = FAR AWAY FROM WATER AS POSSIBLE



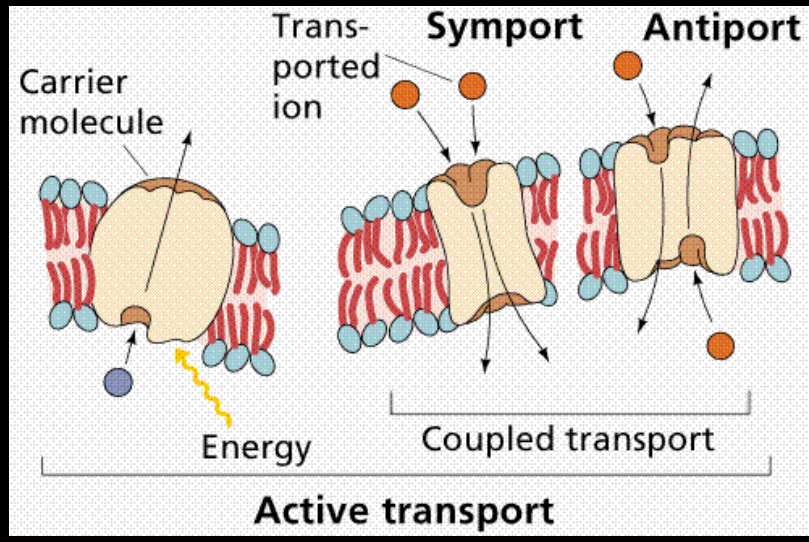


LIPID BILAYER

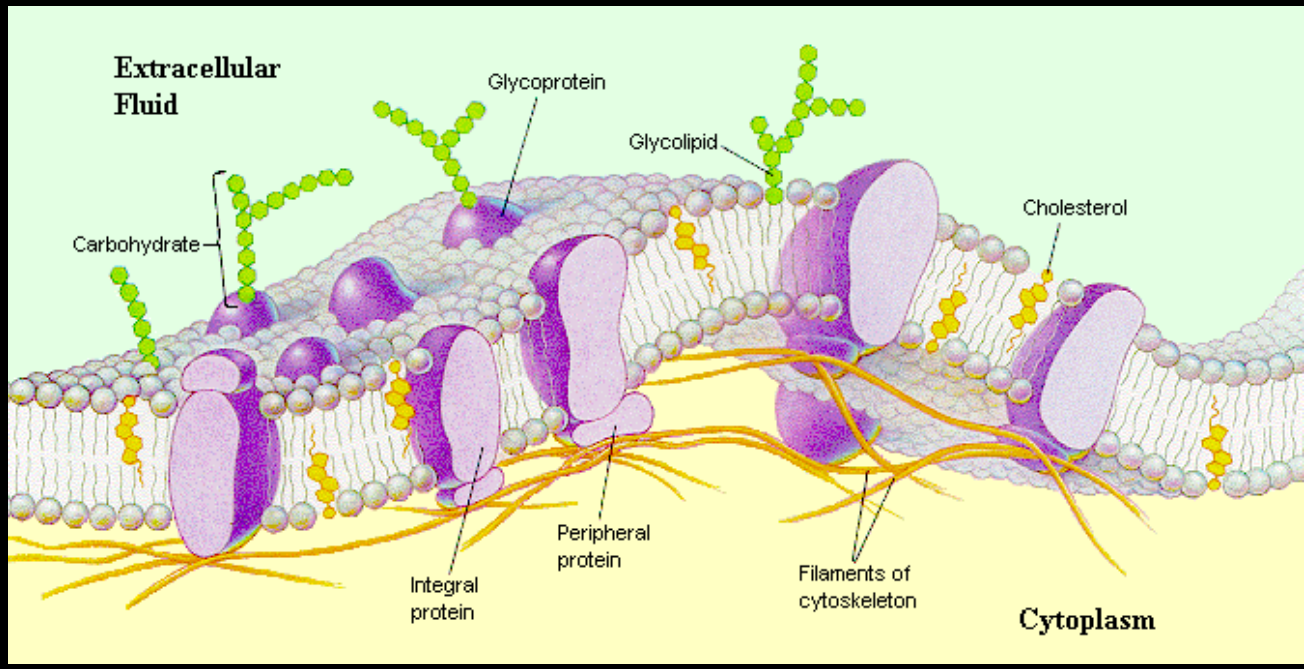
- THE CELL IS SURROUNDED BY WATER
- MOLECULES ON BOTH SIDES OF THE CELL MEMBRANE
- H20 MOLECULES CAUSE THE PHOSPHOLIPIDS TO FORM 2 LAYERS…*LIPID BILAYER!*
- PHOSPHOLIPID HEAD FACE OUTWARD & TAILS INWARD

INTEGRAL PROTEINS

- PROTEINS THAT ARE EMBEDDED INTO THE LIPID BILAYER
  - CAN BE EXPOSED TO THE INSIDE AND OUTSIDE OF THE CELL

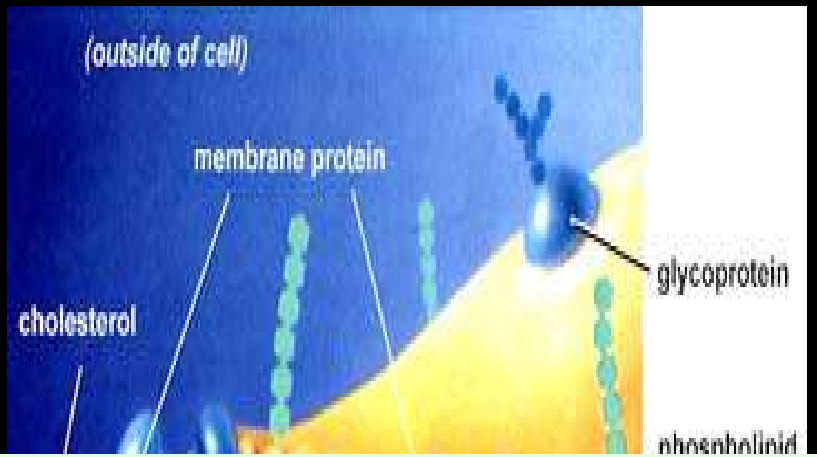


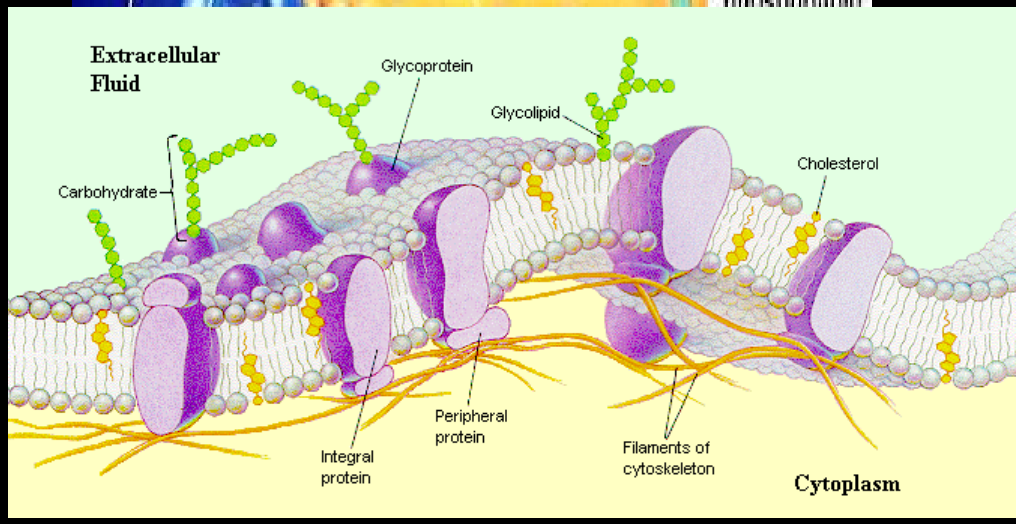
- OFTEN CARBS ATTACHED TO I.P.
- EXPOSED TO THE EXTERNAL ENVIRONMENT
- THE CARBOHYDRATES CAN:
  - HOLD ADJOINING CELLS TOGETHER
  - ACT AS SITES WHERE VIRUSES OR CHEMICAL MESSAGES CAN ATTACH (EX. HORMONES)
- CAN FORM CHANNELS OR PORES
- TRANSPORT



PERIPHERAL PROTEINS:

- LOCATED ON BOTH INTERIOR & EXTERIOR SURFACES OF THE CELL MEMBRANE





Movement Across the Membrane

Passive Transport:

1. Diffusion
2. Osmosis
   - Requires No Energy
   - Movement of like species from area of high concentration to low

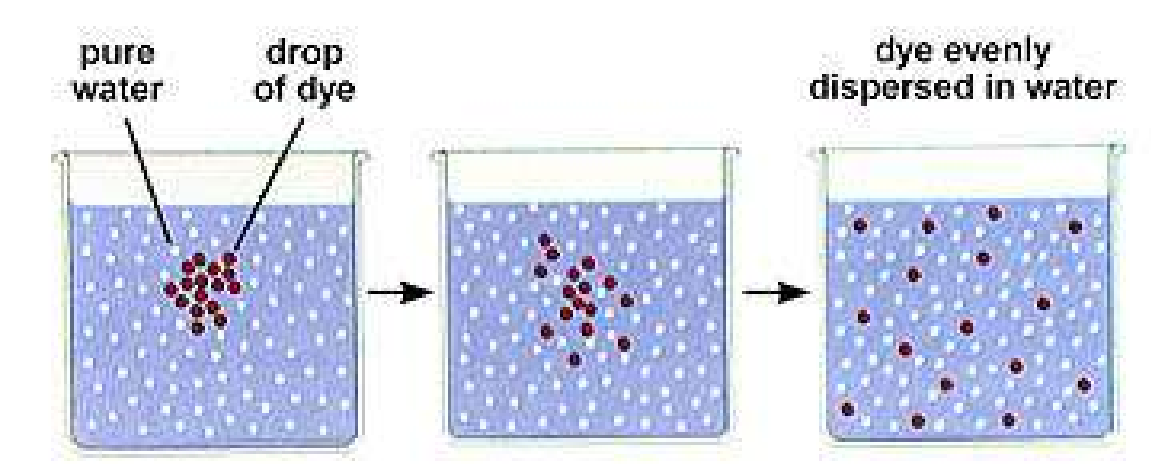
Active Transport:

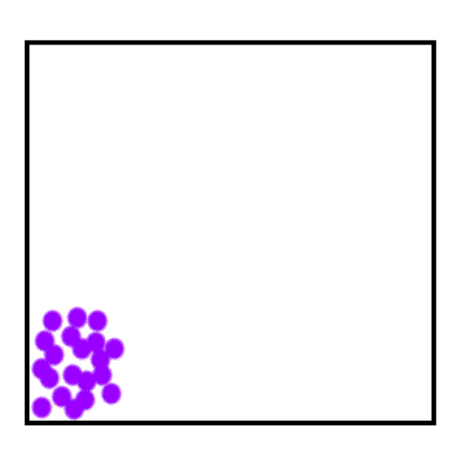
3. Na+/K+ Pump
4. Endocytosis/Exocytosis

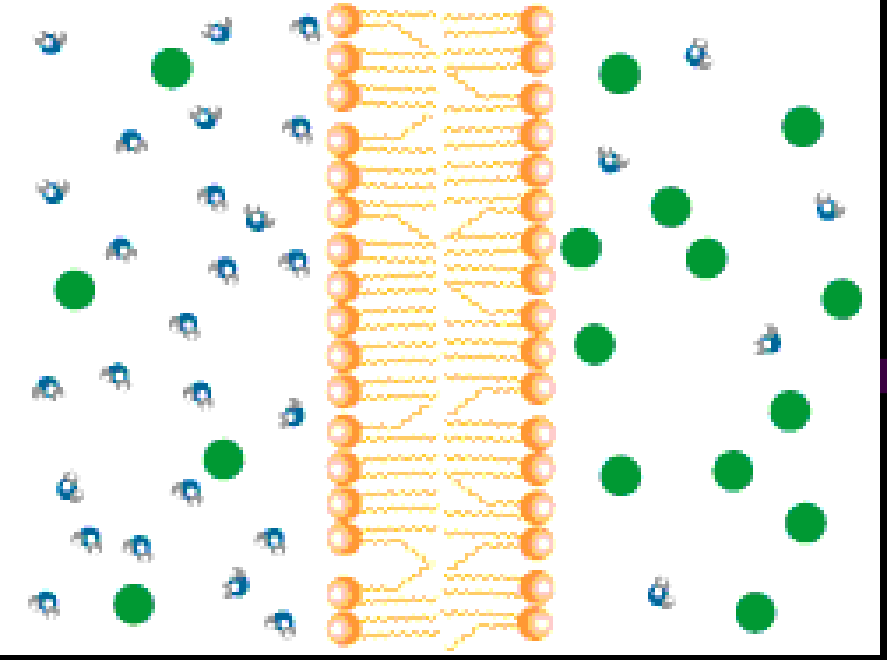
– Requires Energy

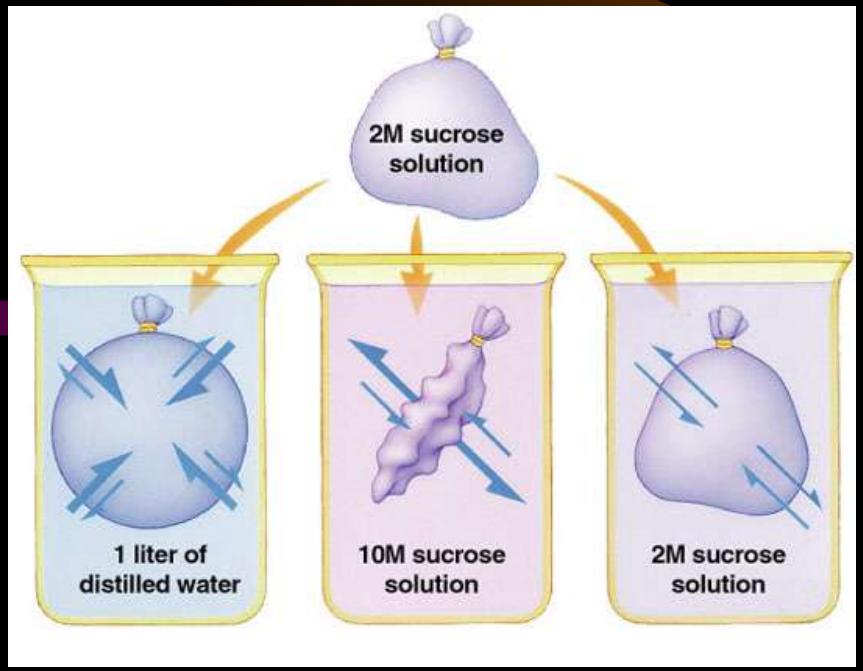
Passive Transport

- Diffusion = movement of like species from high [ ] to low [ ].

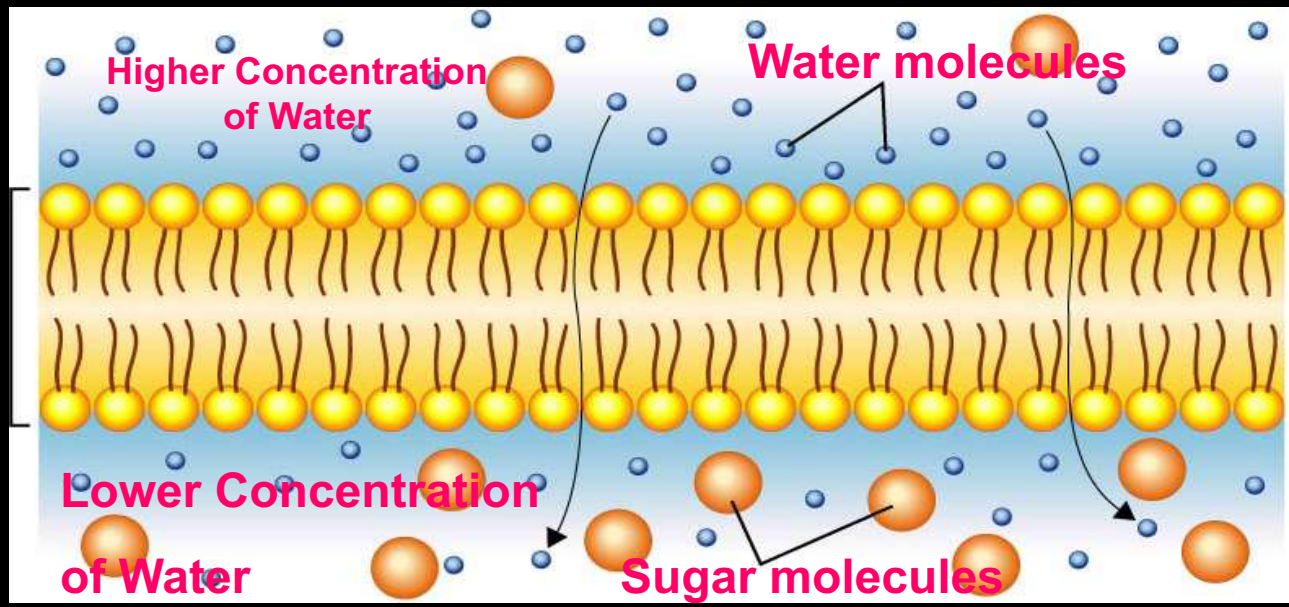




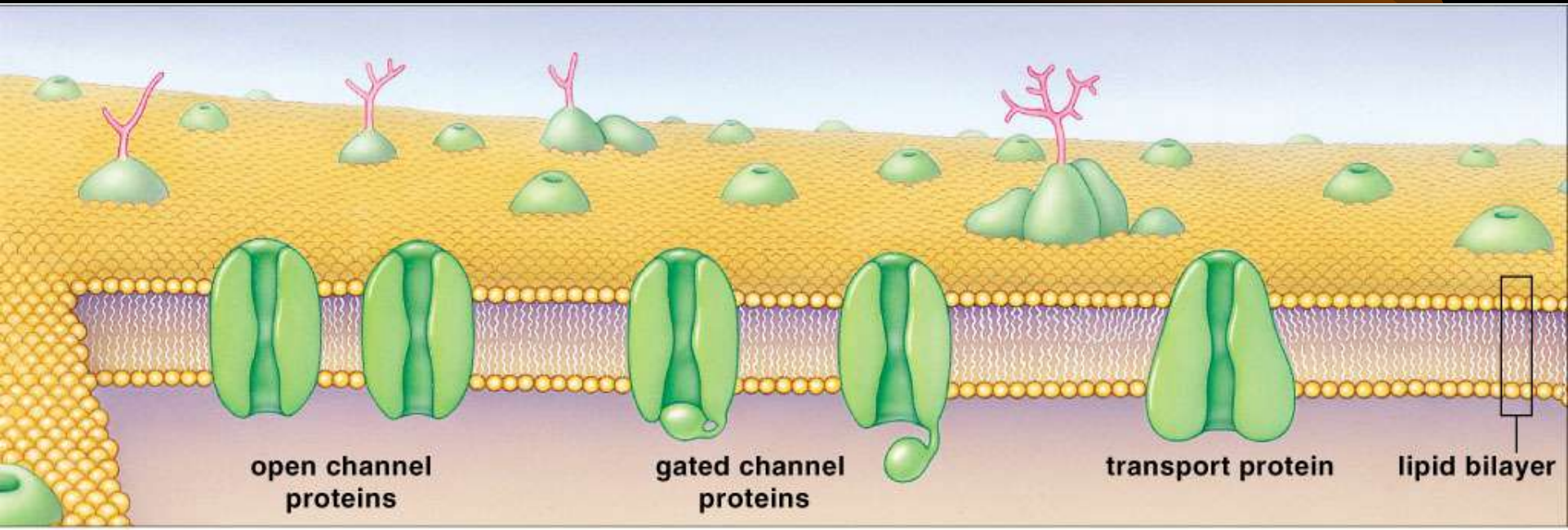




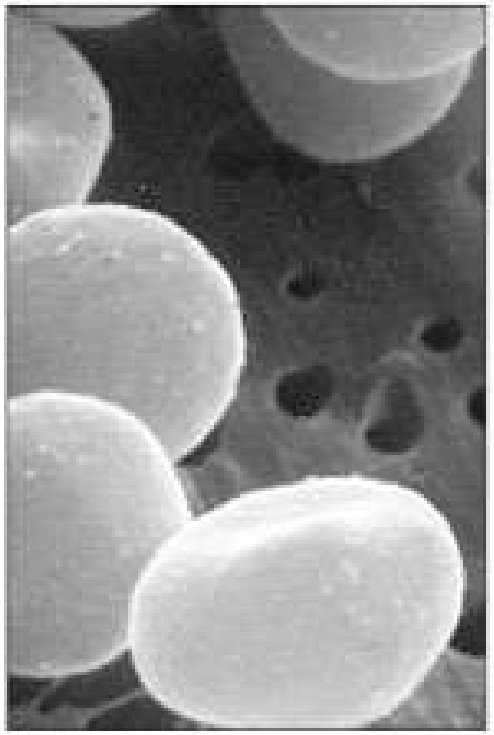
- **Osmosis** = movement of a solvent from area of high[] to low [] across selectively permeable membrane



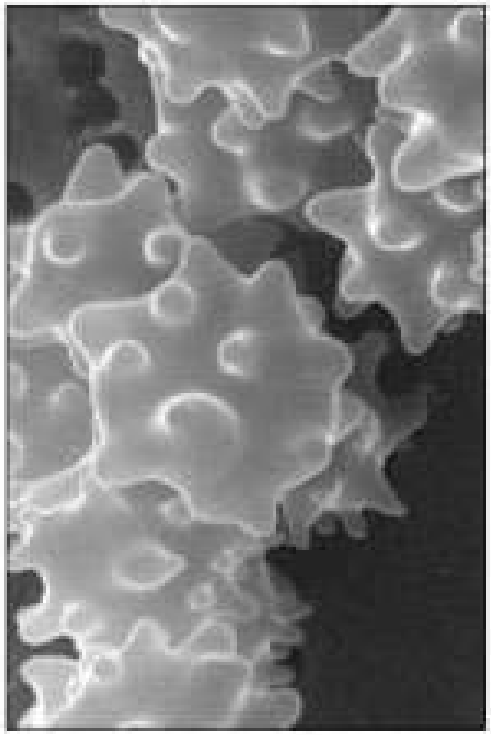
Passive Transport



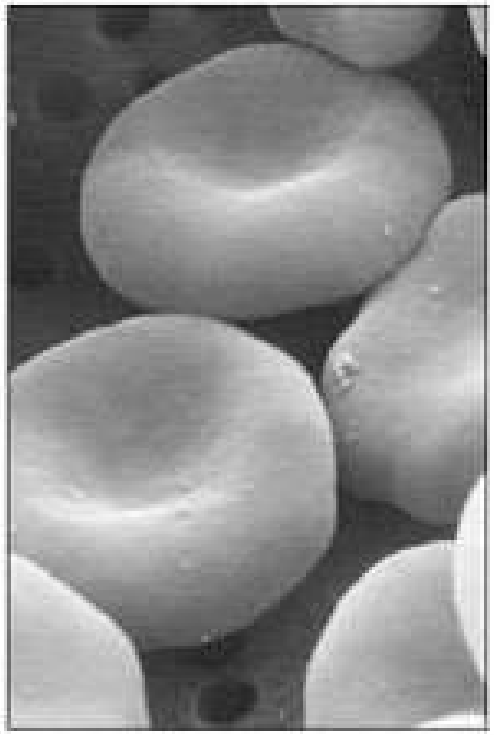
- **Ion Channels** = a specialized membrane movement of K^+, Ca^{2+}, Cl^-, and Na^+ ions.
- **Facilitated Diffusion** = process is used for molecules that cannot diffuse rapidly through the cell membrane.



HYPOTONIC CONDITIONS



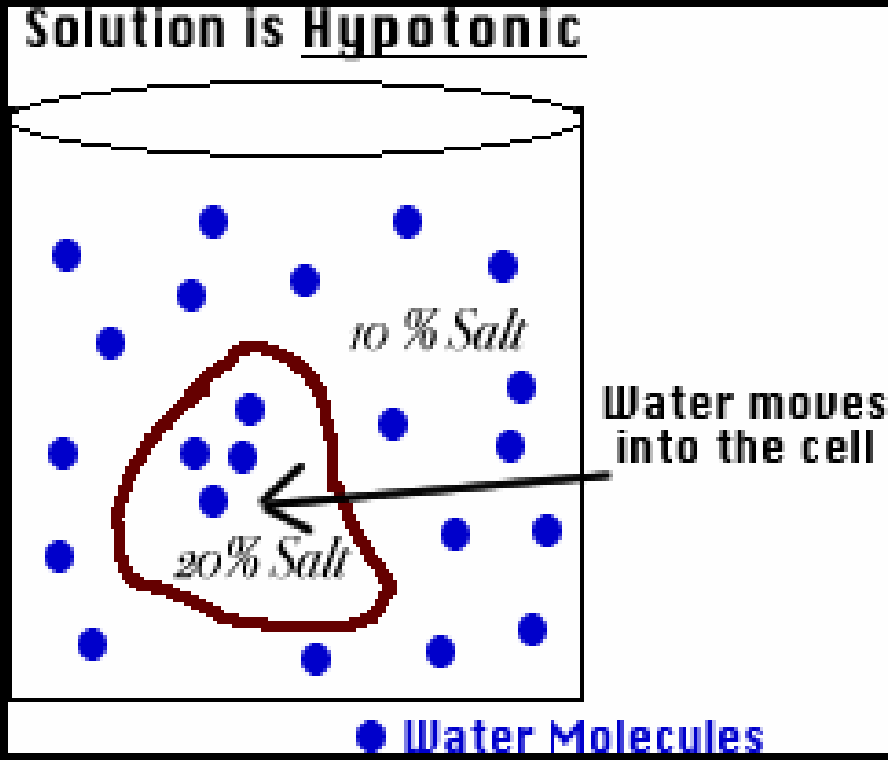
HYPERTONIC CONDITIONS



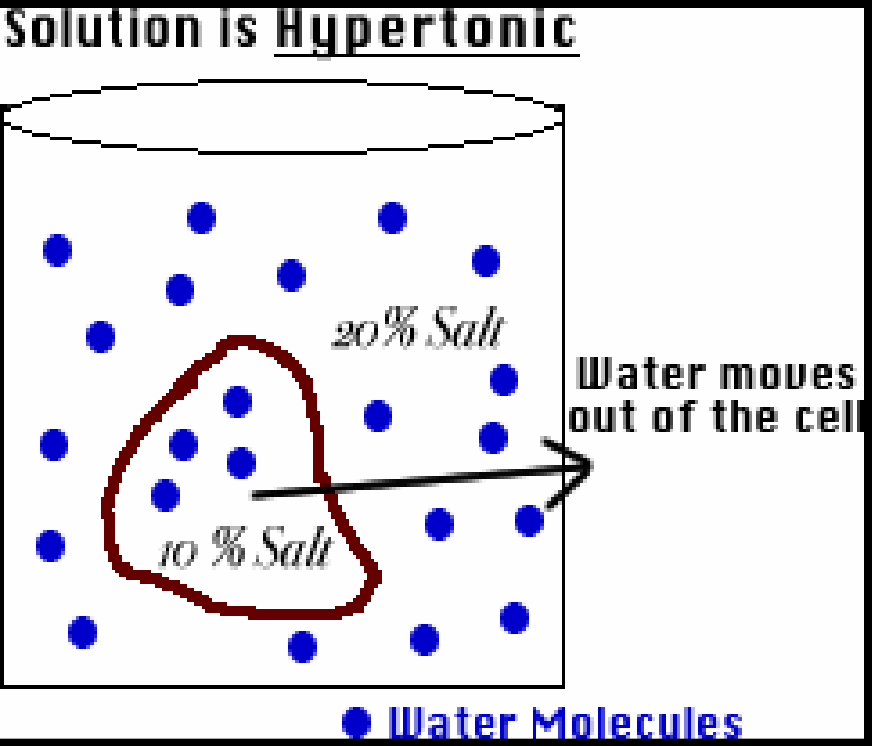
ISOTONIC CONDITIONS

HYPOTONIC:

- [ ] of dissolved substances is ***lower*** outside cell than inside cell
- HYPO means "below strength"
- Water will move ***INTO*** cell causing it to **SWELL**
- Cells could rupture if the cell takes in too much water
- This increases pressure inside of cell (**TURGOR PRESSURE**)



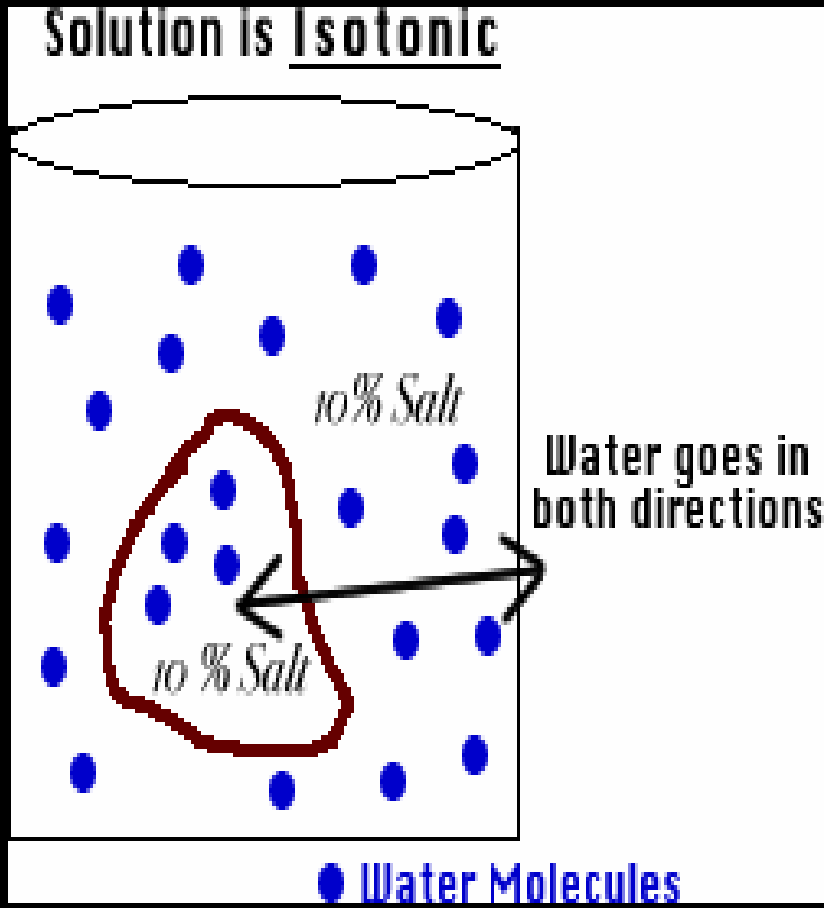
HYPERTONIC:



- [ ]of dissolved substances is higher outside the cell, lower inside cell
- HYPER means "above strength"
- H2O rushes ***OUT*** of cell causing it to ***shrivel***
- Can result in PLASMOLYSIS in plants which causes wilting
- HYPER KIDS GO OUT TO PLAY!!!

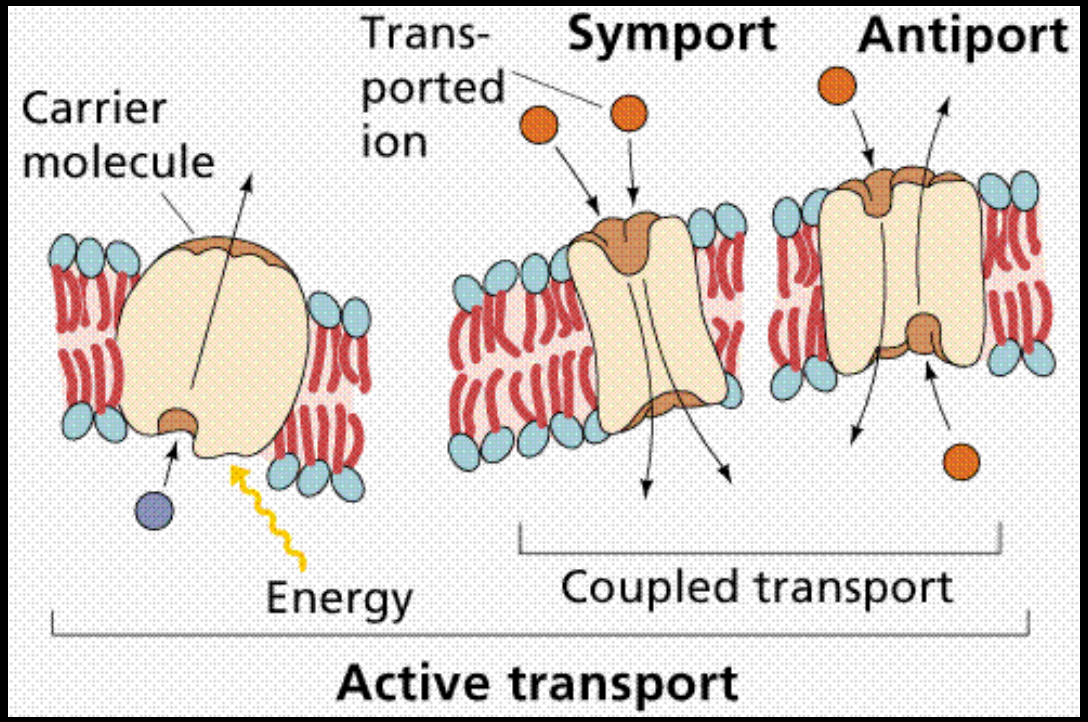
*ISO*TONIC:

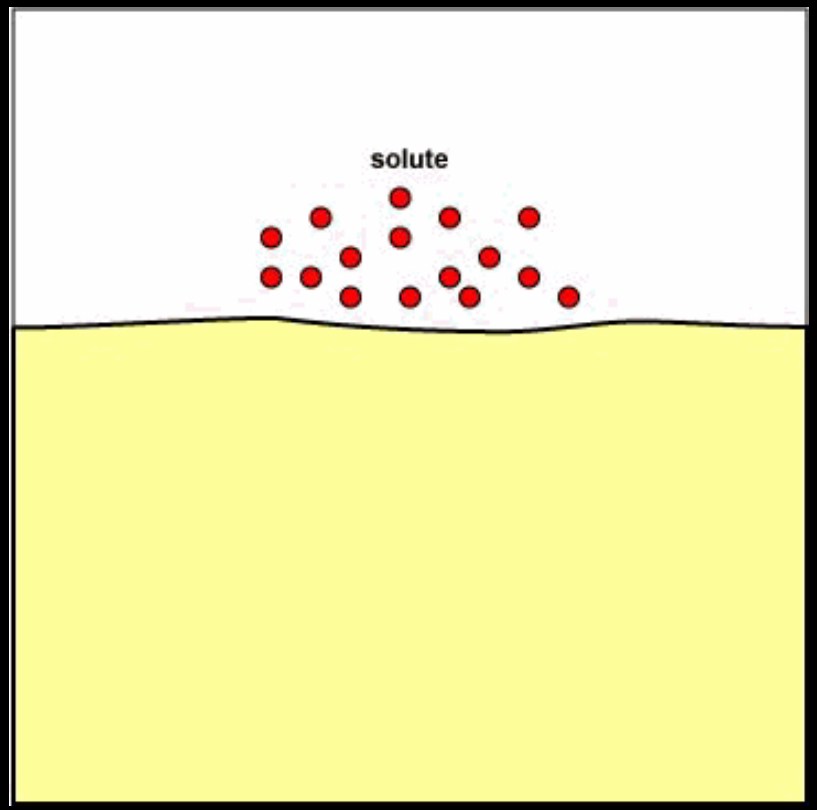
- [ ] of dissolved substances outside the cell is the ***same*** as the inside of the cell
- ISO- means "equal to"
- Movement into cell = movement out of cell



Active Transport

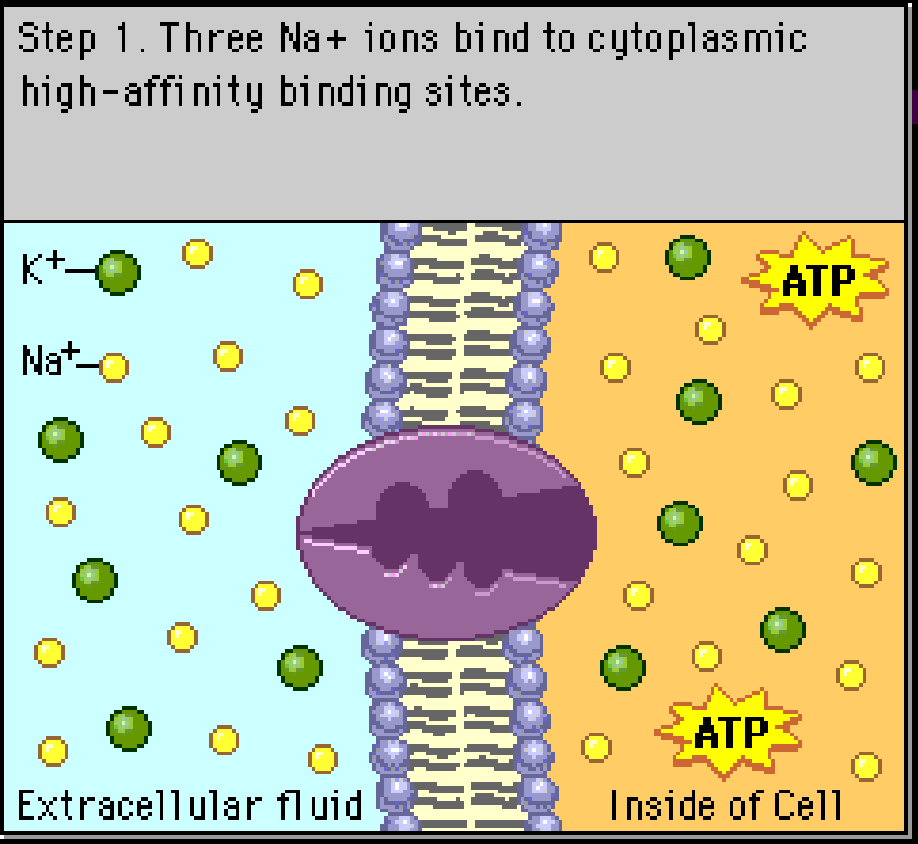
- Requires energy in the form of ATP (Adenosine Triphosphate) and protein pumps





- Endocytosis = the process by which cells ingest external fluid, macromolecules, and large particles.
  - Pinocytosis = water
  - Phagocytosis = particles (solids)
- Exocytosis = the process by which cells remove fluids, macromolecules, and large particles.

Na/ K^+ pumps



Step 1: 3 Na+ ions attach to high level binding site

Step 2: ATP is hydrolyzed, transferring a Phosphate to the pump

Step 3: The pump changes shape—moving Na+ outside!

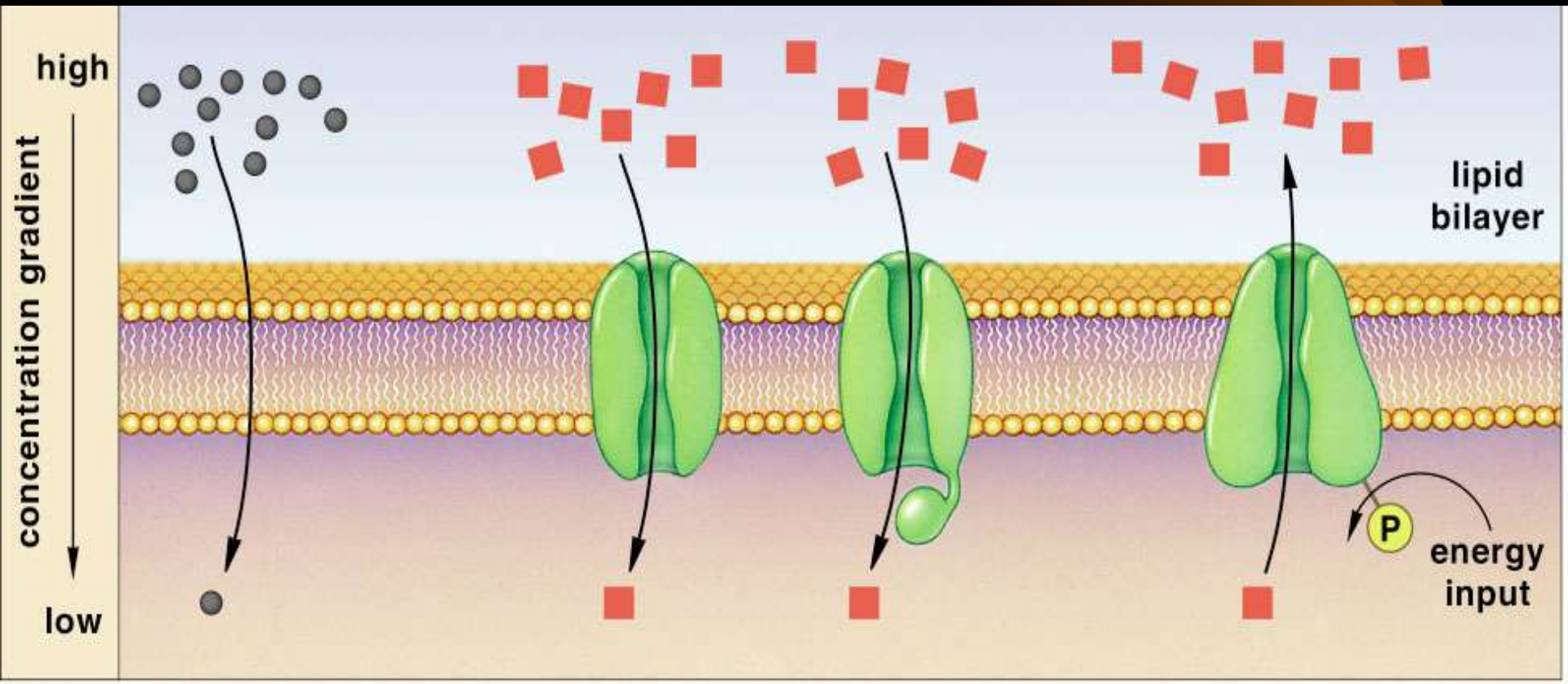
Step 4: Na+ break off & 2 K+ bind to site

Step 5: Phosphate (P) is hydrolyzed, changing the ATP to ADP

Step 6: Pump changes shape and K+ attach to low level binding site

Step 7: K+ leave and cycle starts again!!!

Transport Summary



DIFFUSION ACROSS LIPID BILAYER	PASSIVE TRANSPORT	ACTIVE TRANSPORT
Lipid-soluble substances as well as water diffuse across.	*Water-soluble substances, and water, diffuse through interior of transport proteins. No energy boost required. Also called facilitated diffusion.*	*Specific solutes are pumped through interior of transport proteins. Requires energy boost.*