Honors Biology – Unit 2 – Chapter 5a
"THE WORKING CELL"

1. structure of the cell membrane
2. fluid-mosaic model: phospholipids, proteins, sugars, cholesterol
3. selective permeability: large, charged, polar vs. small, uncharged, non-polar
4. concentration gradients, passive transport, active transport
5. diffusion, facilitated diffusion: "down" the concentration gradient
6. active transport: "up" the concentration gradient
7. osmosis: "water moves to where there's more stuff"
8. examples of osmosis: animal cell, plant cell, U-tube
9. phagocytosis (cellular eating), pinocytosis (cellular drinking)
10. enzymes, activation energy, substrate, active site, "lock and key fit"
11. ways to stop enzymes: heat, pH, competitive and noncompetitive inhibitors

Honors Biology – Chapter 5a Word Roots
"THE WORKING CELL"

aqua- = water; **-pori** = a small opening (*aquaporin:* a transport protein in the plasma membrane of a plant or animal cell that facilitates the diffusion of water across the membrane)

co- = together (*cofactor:* a non-protein molecule or ion that is required for the proper functioning of an enzyme)

endo- = inner, within; **cyto-** = cell (*endocytosis:* cellular uptake of molecules or particles via formation of new vesicles from the plasma membrane)

exo- = outer; *exocytosis:* the movement of materials out of the cytoplasm of a cell by the fusion of vesicles with the plasma membrane)

hyper- = exceeding; **-tonus** = tension (*hypertonic:* a solution with a higher concentration of solutes)

hypo- = lower (*hypotonic:* a solution with a lower concentration of solutes)

iso- = same (*isotonic:* solutions with equal concentrations of solutes)

osmo- = pushing (*osmosis:* the diffusion of water across a selectively permeable membrane)

phago- = eat (*phagocytosis:* cellular "eating," a type of endocytosis in which a cell engulfs macromolecules, other cells, or particles into its cytoplasm)

pino- = drink (*pinocytosis:* cellular "drinking," a type of endocytosis in which the cell takes fluid and dissolved solutes into small membranous vesicles)

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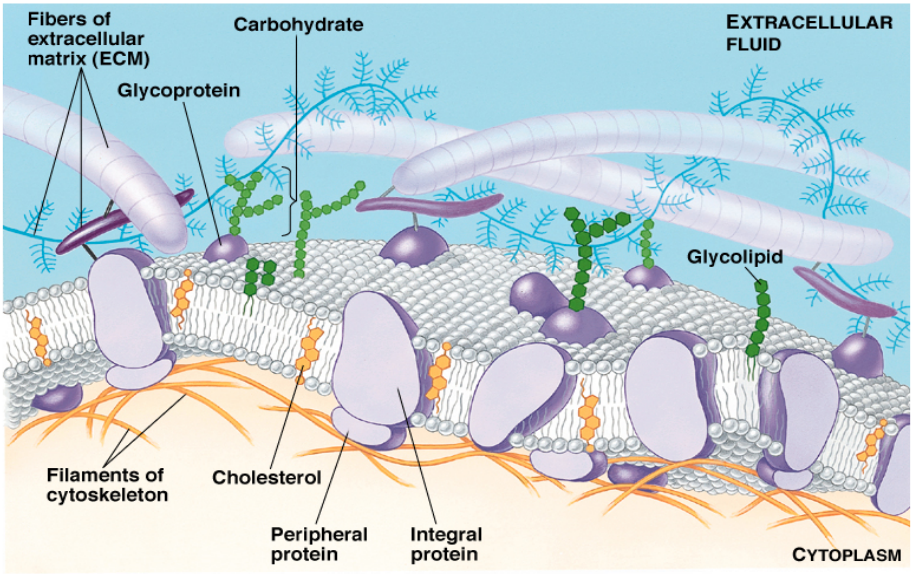
HONORS BIOLOGY – UNIT 2 – CHAPTER 5a NOTES

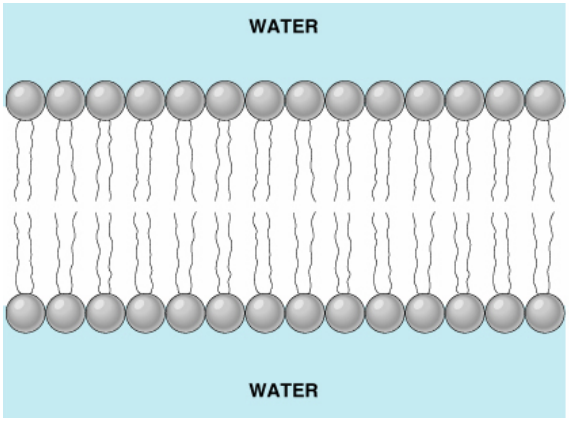
THE WORKING CELL

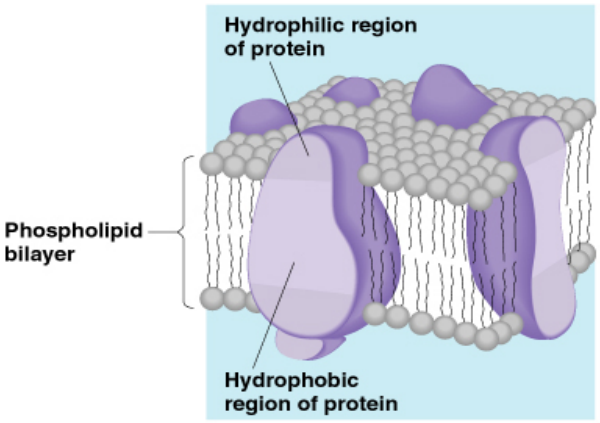
The Cell Membrane

The cell membrane creates a barrier around a cell that separates the liquid on the outside from the liquid on the inside. The water on the inside is called *cytoplasm*. The water on the outside is called *extracellular fluid*.



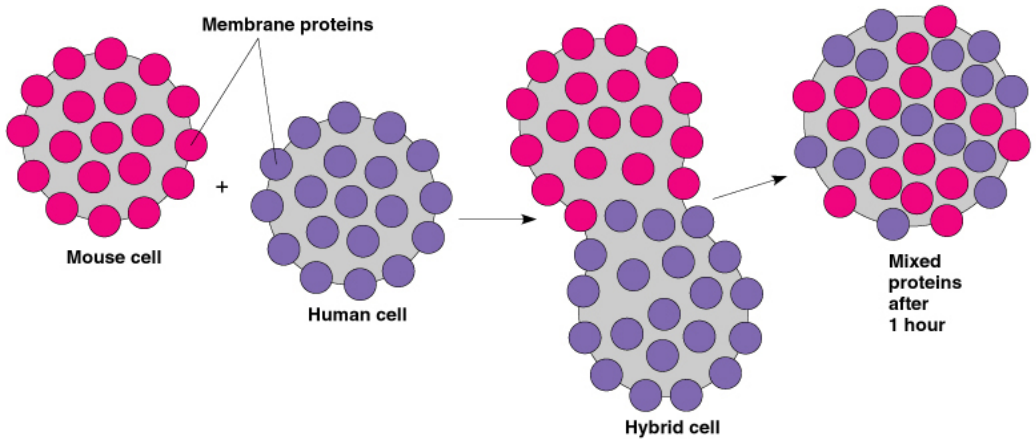
The phospholipids on the cell membrane arrange themselves into a bilayer so that the tails are all facing inward. The tails represent the actual barrier around the cell. The heads are polar, meaning that they like water. The tails are non-polar, meaning that they do not like water.





The cell membrane is called a *fluid-mosaic model*. Mosaic means that that there are a bunch of a different chemicals on the membrane, such as transport proteins, phospholipids, cholesterol, and sugars. Fluid means that these parts can move around and that the membrane is flexible.

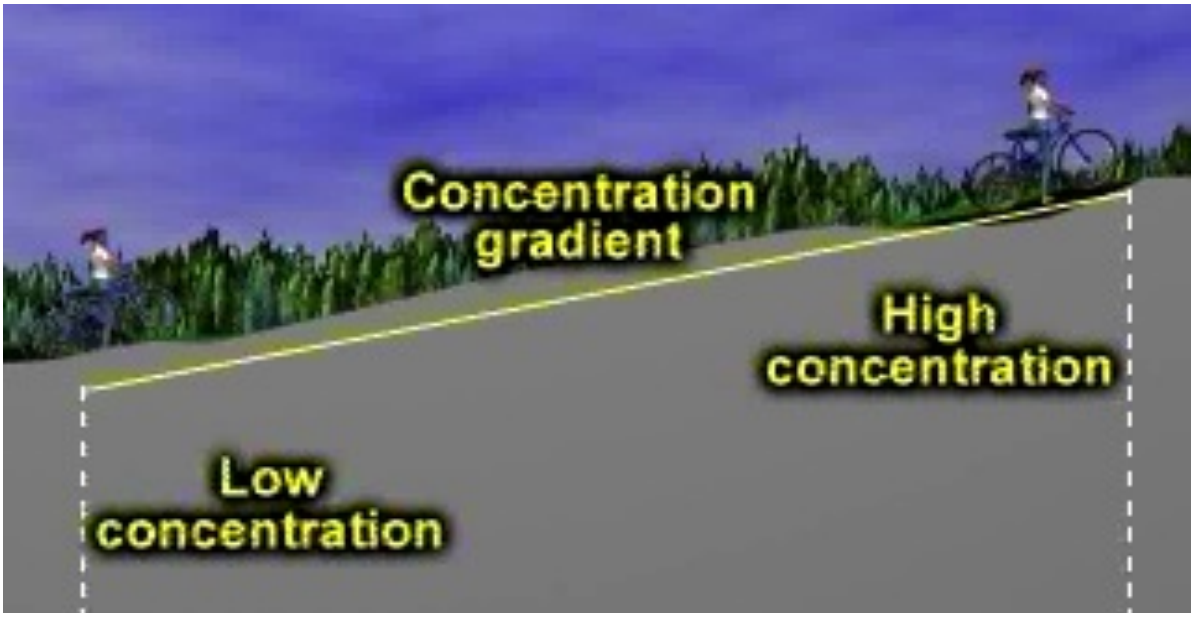
This experiment shows that the cell membrane is both fluid and mosaic:



There are 4 chemicals that are found on the cell membrane.

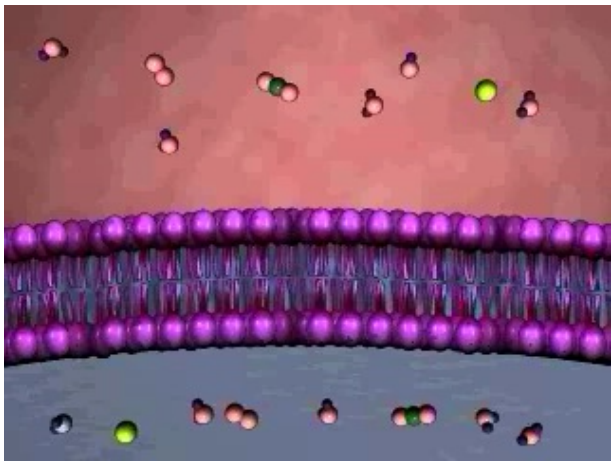
1. Phospholipids = create a barrier around the cell
2. Transport Proteins = helps move chemicals across the membrane during facilitated diffusion and active transport
3. Cholesterol = mixes in with the phospholipids tails and prevents them from getting tangled up
4. Sugars = give the cell an "identity" or "name-tag"

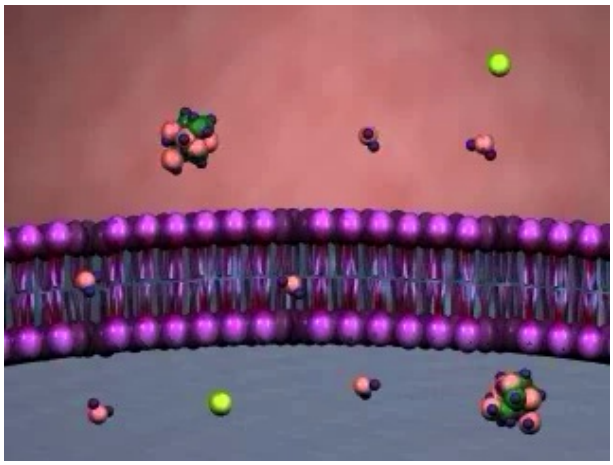
A *concentration gradient* is the difference in the number of particles on each side of the membrane. For example, if there are 30 particles outside the cell and 8 particles inside the cell, then gradient would be 22. The cell does NOT need energy to move particles *down* the gradient (from where there is more to where there is less). However, the cell DOES need energy to move particles *up* the gradient (from where there is less to where there is more).



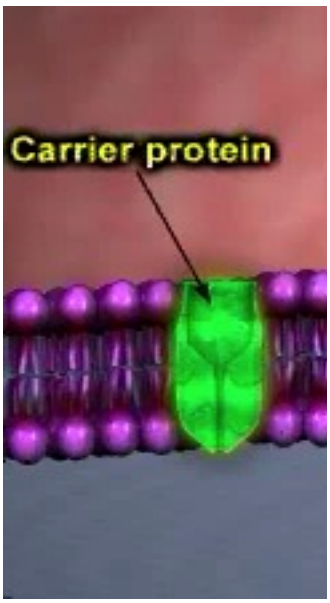
Passive transport is a type of transport that does NOT require energy. The 2 types of passive transport are diffusion and facilitated diffusion. Diffusion is when particles move across the membrane *down* the gradient *without* the use of a transport protein. Facilitated diffusion is when particles move across the membrane *down* the gradient *with* the use of a transport protein. Transport proteins can be *channel proteins* or *carrier proteins*. Channel proteins are like hollow tubes that allow particles to move through. Carrier proteins require that the particle goes through the protein using a *lock and key* fit.

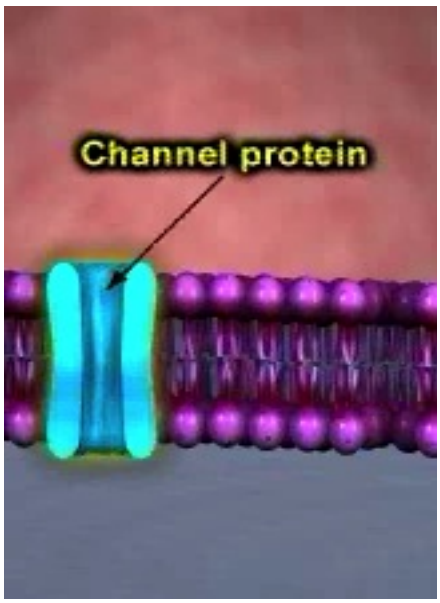
These pictures show diffusion (NOT facilitated diffusion) because there are no transport proteins.





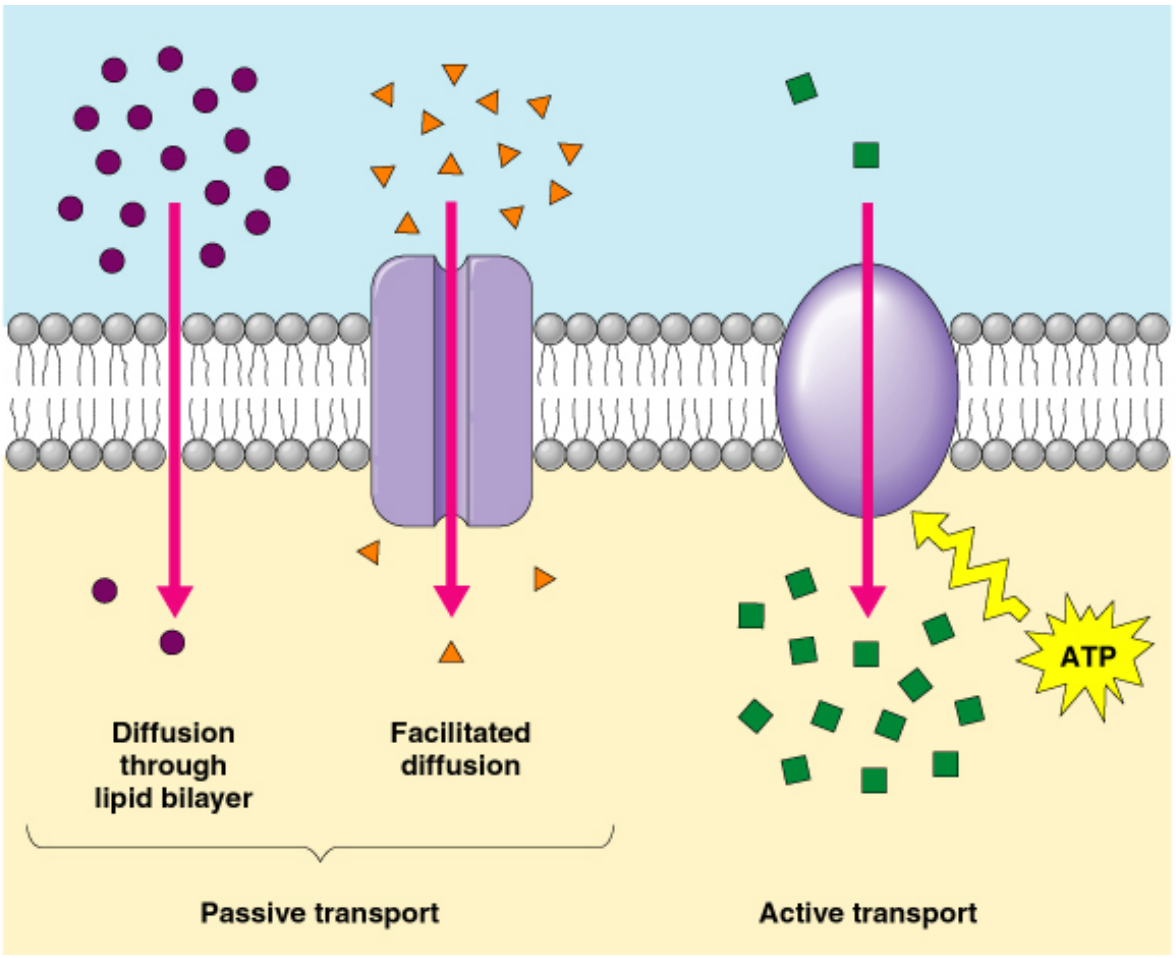
Three types of chemicals can go across the membrane by diffusion: SMALL particles, UNCHARGED particles, and NON-POLAR particles. Three types of chemicals can only go across the membrane using facilitated diffusion: LARGE particles, CHARGED particles, and POLAR particles.





Active transport is a type of transport that DOES require energy. Active transport is when particles move across the membrane *up* the concentration gradient *with* the use of a transport protein. This is called active transport because it requires a burst of *energy* in the form of *ATP*.

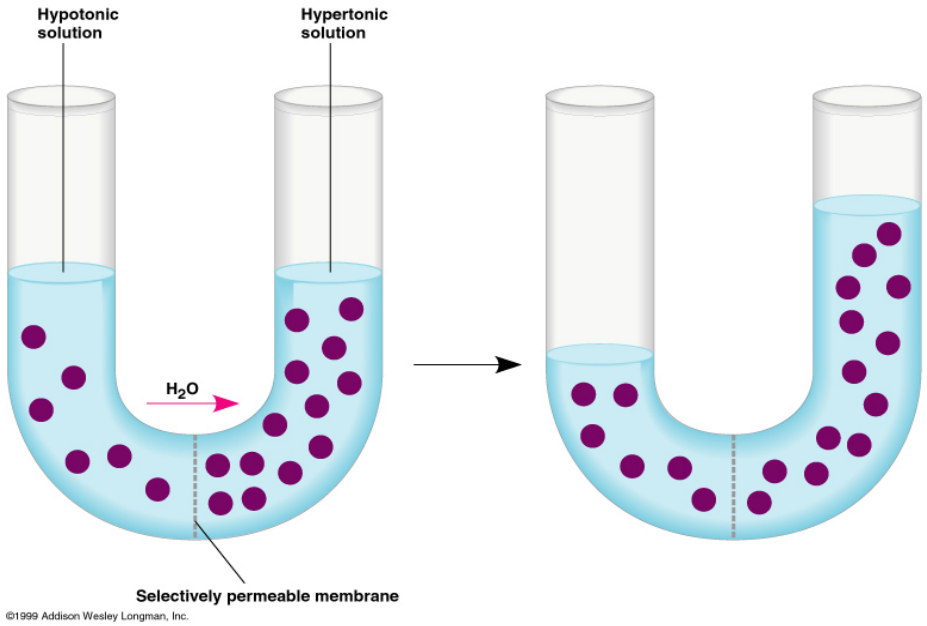
This diagram reviews the 3 types of transport across the cell membrane.

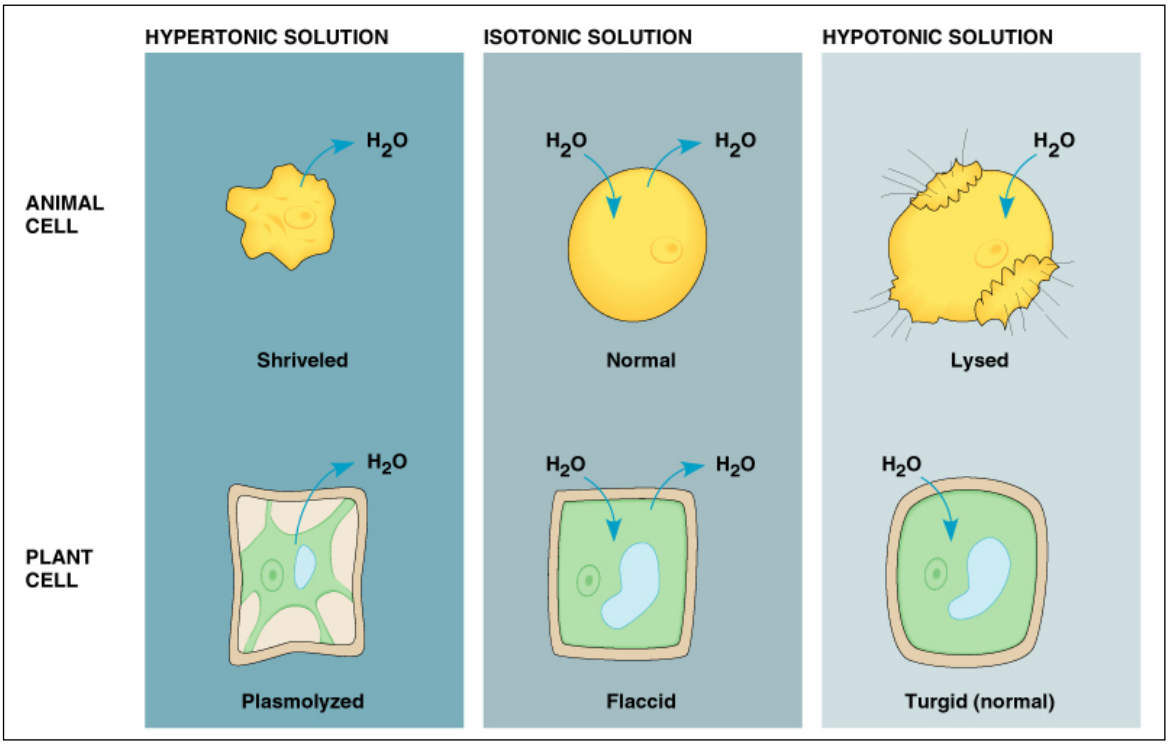


Osmosis is the diffusion of water across the cell membrane. There are three terms that are helpful to understanding osmosis:

1. hypotonic = a solution with less "stuff" (particles, ions, glucose, salt, etc.)
2. hypertonic = a solution with more "stuff" (particles, ions, glucose, salt, etc.)
3. isotonic = a solution with the same amount of "stuff" (particles, ions, glucose, salt, etc.)

For osmosis, remember that WATER ALWAYS GOES TO WHERE THERE'S MORE STUFF!





Enzymes

- enzyme = a protein that speeds up a chemical reaction by lowering the activation energy needed to "jump-start" the reaction
- activation energy = the energy needed to start a chemical reaction
  ALL reactions need activation energy – even the ones that produce a lot of energy
  Activation energy is like a "spark" that "jump-starts" a reaction
- substrate = the chemical that goes into an enzyme to get changed
- active site = the part of the enzyme that receives the substrate
- "lock and key fit" = the substrate fits into the enzyme like a key fits into a lock
- 2 enzyme conditions:
  1. pH (enzymes only work at a certain pH)
     EX: stomach enzymes only work in an acidic pH (pH = 1 or 2)
     EX: intestinal enzymes only work in a slightly basic pH (pH = 8)
     Therefore, your stomach and your intestines contain different enzymes.
     Changing the pH can DENATURE the enzyme!
  2. Heat (enzymes only work at a certain temperature)
     EX: heat usually destroys an enzyme so that it doesn't work
     High heat can DENATURE the enzyme!
- Inhibitors physically prevent the substrate from joining with an enzyme:
  1. competitive inhibitor = A chemical that looks like the substrate and fits into the active site. The real substrate is physically blocked from entering the active site.
  2. non-competitive inhibitor = A chemical fits into a site away from the active site, causeing a change in the 3-dimensional structure of the enzyme. This changes the shape of the active site. The substrate can no longer fit into the active site.
- Many types of medicines are enzyme inhibitors.