

AP Biology Insta-Review

Unit 1: Chemistry of Life



Tiffany Jones
@apbiopenguins



AP Biology students are
penguins because they are
Dressed for Success!
You are now an AP Bio
Penguin!



Today's Plan:

Macromolecules

Water Properties

Practice Questions

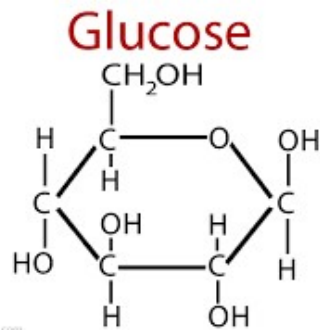
Unit 1 Q&A



Carbohydrates

Composed of C, H, & O – Ratio: 1:2:1

Monomer: Monosaccharide



Examples: Glucose, Fructose, Galactose

Disaccharides: Two monosaccharides

Bond: Glycosidic Linkage

Examples: Sucrose, Lactose, Maltose

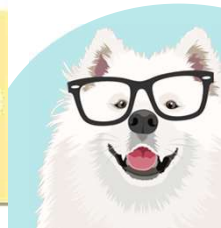
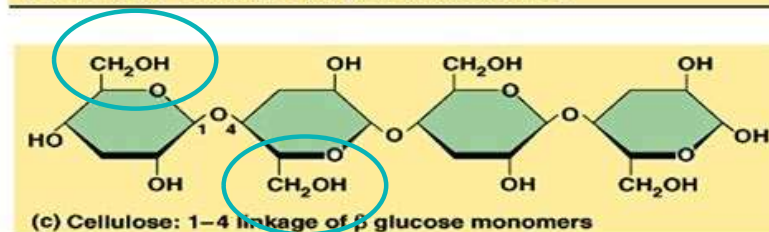
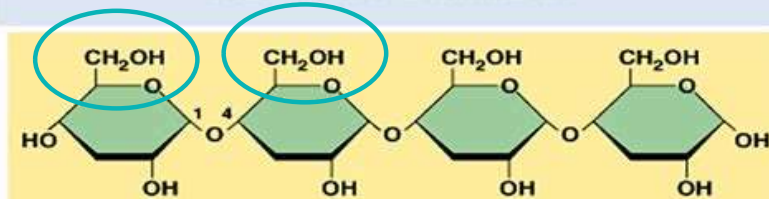
Structural:

- Cellulose: found in plant cell walls
- Chitin: found in fungi cell walls & exoskeleton of arthropods

Storage:

- Starch: found in plants
- Glycogen: found in animals

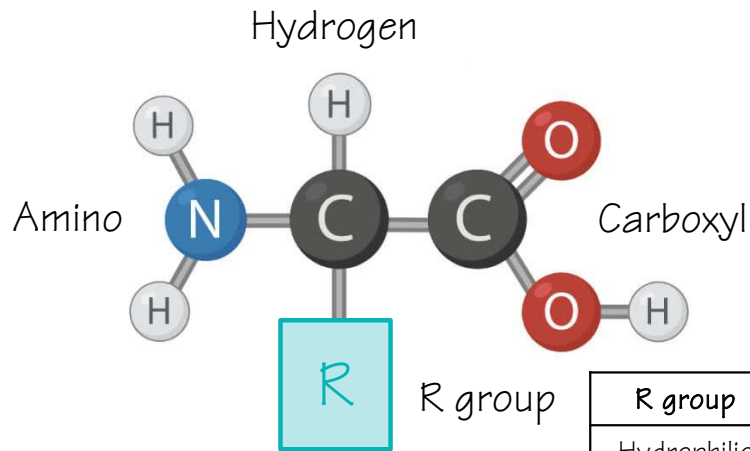
Starch vs. Cellulose



Proteins

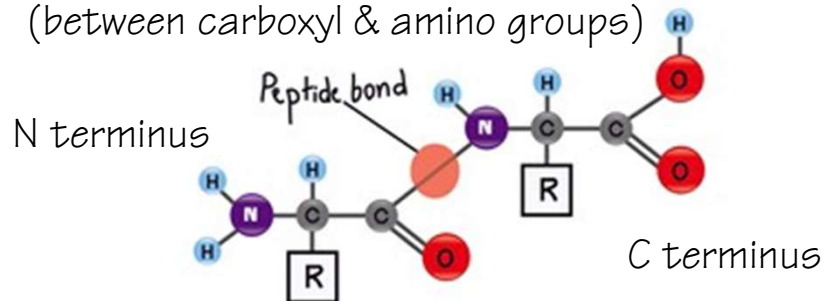
Composed of C, H, O, N, & S

Monomer: Amino Acid



Bond: Peptide bond

(between carboxyl & amino groups)



Levels of Protein Structure:

Primary:

- Bond: peptide bonds between amino acids
- Structure: string of amino acids

Secondary:

- Bond: hydrogen bonds between backbone
- Structure: alpha helix or beta pleated sheet

Tertiary:

- Bond: ANY (hydrogen, covalent, ionic, ...)
between R groups
- Structure: final 3D structure

Quaternary:

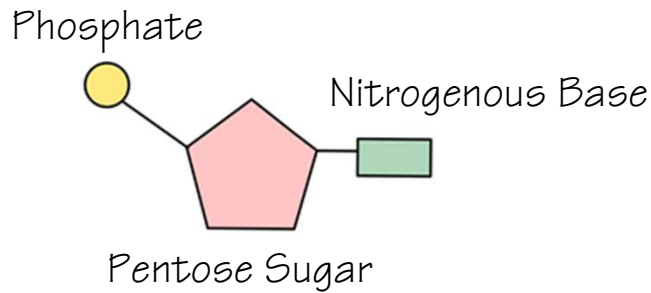
- Bond: ANY (hydrogen, covalent, ionic, ...) between R groups of different polypeptides



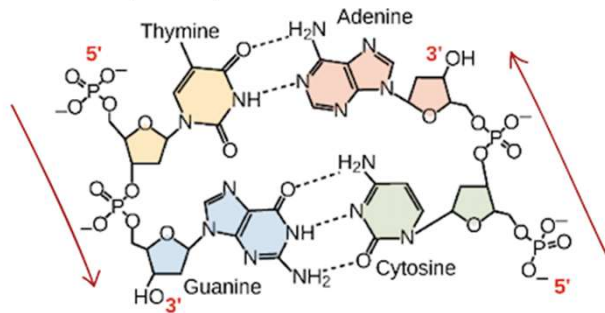
Nucleic Acids

Composed of C, H, O, N, & P

Monomer: Nucleotide

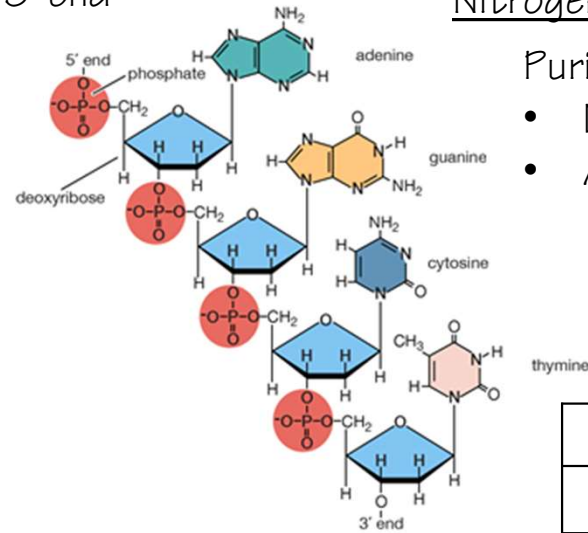


Bond: Phosphodiester linkage
(between phosphate and hydroxyl)



Directionality: 5' → 3'; antiparallel

5' end



Nitrogenous Bases

Purine:

- Double Ring
- A & G

Pyrimidine:

- Single Ring
- C, U, T

Base Pairing	H bonds
A & T	2
C & G	3

	DNA	RNA
Nitrogenous Bases	A, T, C, G	A, U, C, G
Sugar	Deoxyribose	Ribose
Strandedness	"double"	"single"



Lipids

Composed of C, H, O, & P (in phospholipids)

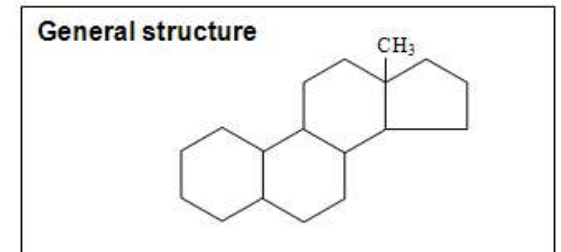
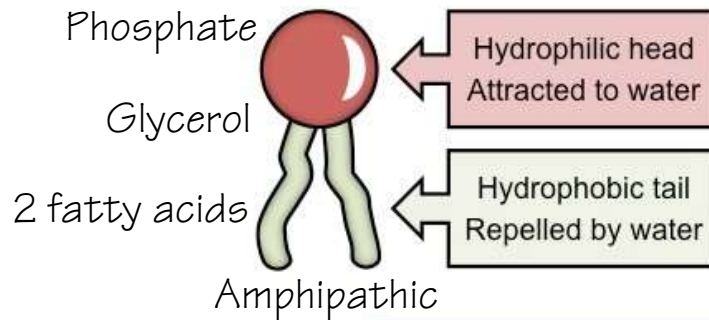
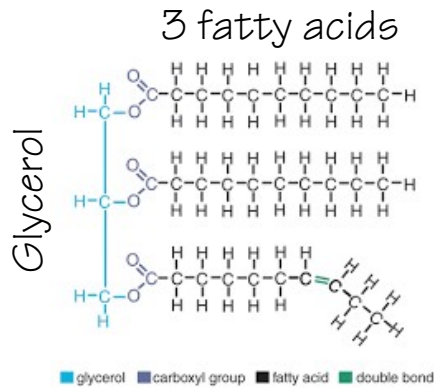
All of the lipids are NONPOLAR!!

Monomer: N/A

Fats

Phospholipids

Steroids



Four fused rings

Ligand:

- Intracellular Reception

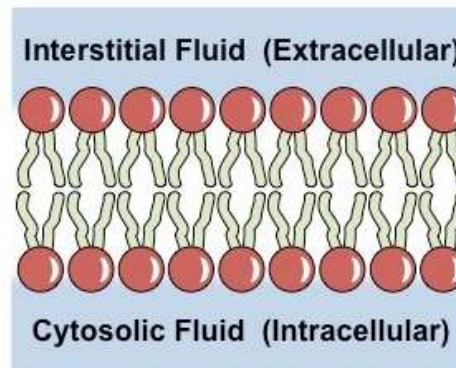


Saturated fatty acid

- ALL single bonds
- Each carbon is SATURATED by hydrogen

Unsaturated fatty acid

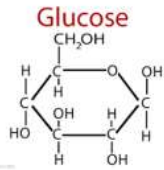
- At least one double bond
- NOT all carbons are SATURATED by hydrogen



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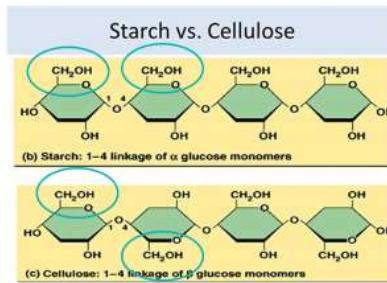
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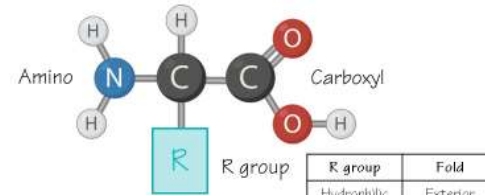
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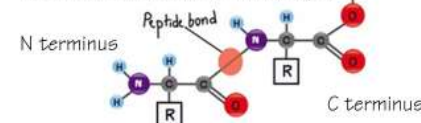
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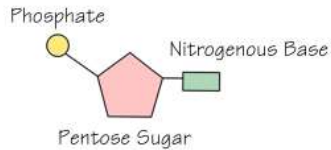
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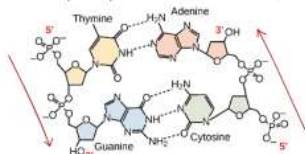
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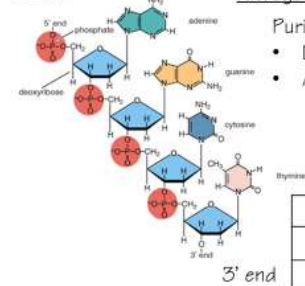


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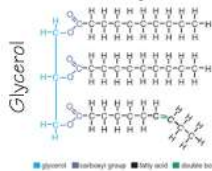
Composed of C, H, O, & P (in phospholipids)

Monomer: N/A

All of the lipids are NONPOLAR!!

Fats

3 fatty acids



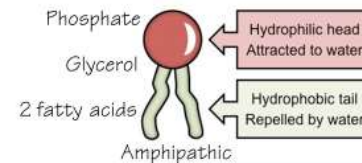
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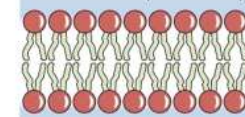
Unsaturated fatty acid

- At least one double bond
- Not all carbons are SATURATED by hydrogen

Phospholipids

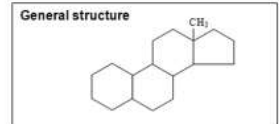


Interstitial Fluid (Extracellular)



Cytosolic Fluid (Intracellular)

Steroids



Four fused rings

Ligand:

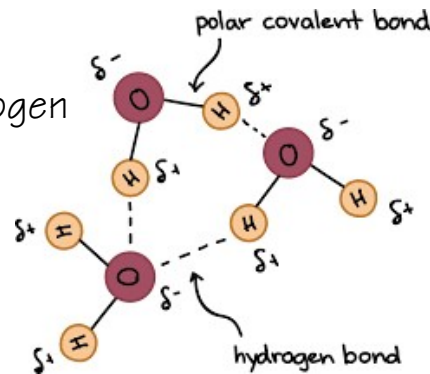
- Intracellular Reception



Polar

Polar covalent bonds between oxygen & hydrogen
IN the water molecule

Hydrogen bonds between oxygen & hydrogen
BETWEEN water molecules

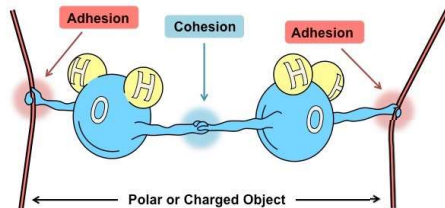


Universal Solvent

Partial negative oxygen binds with other polar molecules (partial positive end) & to positively charged ions (cations)

Partial positive hydrogen binds with other polar molecules (partial negative end) & to negatively charged ions (anions)

Cohesion/Adhesion



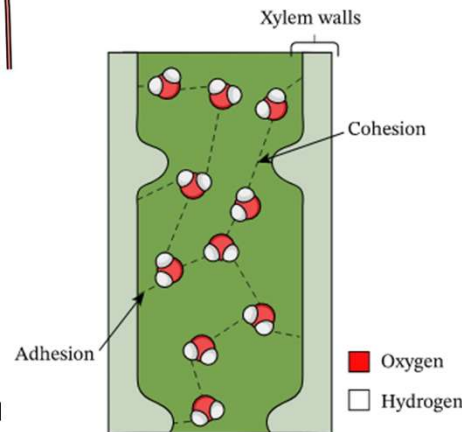
Cohesion:

- Water molecules attracted to other **WATER** molecules

Adhesion:

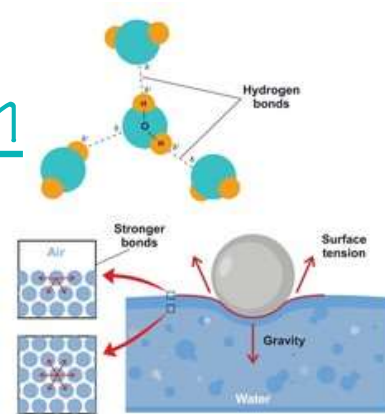
- Water molecules attracted to other **POLAR** substances

Together leads to Capillary Action



Surface Tension

Cohesion develops a "surface" based on the interaction of hydrogen bonds



Allows you to skip rocks or water striders to walk on water



Less Dense when Solid

Hydrogen bonds inhibit compaction
Ice floats; temperature buffer

High Specific Heat

Water must absorb or release A LARGE amount of energy to change 1 gram of water by 1°C.

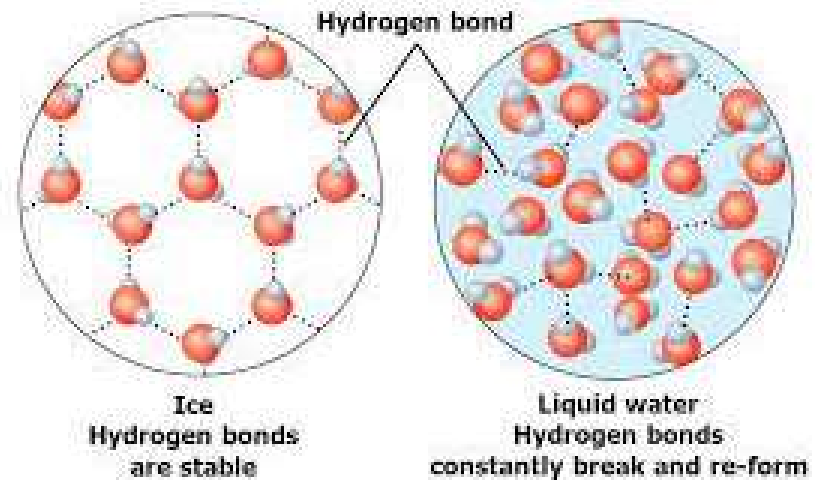
Evaporative Cooling

Release water on surface of organism to absorb heat energy from body (and break the bonds cooling down the organism)

pH

$$\text{pH} = -\log [\text{H}^+]$$

As the concentration of hydronium/hydrogen ion increases, the pH decreases



Temperature Buffer

- Coastal Regions
- Body Temperature



Multiple Choice Practice:

Scientists examined the folded structure of a purified protein resuspended in water and found that amino acids with nonpolar R groups were primarily buried in the middle of the protein, whereas amino acids with polar R groups were primarily on the surface of the protein. Which of the following best explains the location of the amino acids in the folded protein?

- a. Polar R groups on the surface of the protein can form ~~ionic~~ ^{hydrogen} bonds with the charged ends of the water molecules.
- b. Polar R groups are too bulky to fit in the middle of the protein and are pushed toward the protein's surface.
- c. Nonpolar R groups that cannot form hydrogen bonds with water are pushed into the middle of the protein.
- d. Nonpolar R groups from different parts of the protein form covalent bonds with each other to maintain the protein's structure. Hydrophobic interaction due to attractive forces



Multiple Choice Practice:

Rosalind Franklin's x-ray diffraction images taken in the 1950s most directly support which of the following claims about DNA?

- a. The ratios of base pairs are constant.
- b. The nucleotide sequence determines genetic information.
- c. The two strands of DNA are antiparallel.
- d. The basic molecular structure is a helix.



Free Response Practice:

Geneticists investigated the mode of inheritance of a rare disorder that alters glucose metabolism and first shows symptoms in adulthood. The geneticists studied a family in which some individuals of generations II and III are known to have the disorder. Based on the pedigree (Figure 1), the geneticists concluded that the disorder arose in individuals II-2 and was caused by a mutation in mitochondrial DNA.

(a) The disorder alters glucose metabolism. **Describe** the atoms AND types of bonds in a glucose molecule.

The disorder alters glucose metabolism. **Describe** the atoms AND types of bonds in a glucose molecule.

- The atoms are carbon, hydrogen, and oxygen (C, H, and O) and are held together by covalent bonds.



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