

Organic Chemistry

- ▣ Branch of science dealing with the element carbon and its many properties.
- ▣ It is usually associated with *all* living organisms.
 - About 30% of an organism's *dry weight* (called **Biomass**) is Carbon in organic molecules.
 - Helps to make the organic molecules: *Carbohydrates, Lipids, Proteins, and Nucleic Acids.*
 - The *original source* for Carbon in *all life forms* is Carbon Dioxide. (CO₂)(Photosynthesis)
 - Also supported by the Stanley Miller experiment, as discussed earlier.

Carbon

- ▣ Carbon has versatility in four directions because of its **Tetravalence**. (**Tetra** means "four")
- ▣ The tetravalence allows carbon to act like an *intersection* in the building of an organic molecule.
 - This allows cells to build an almost infinite number of *different* molecules.



CARBON

- ▣ **Covalent** bonding *capabilities* of Carbon
 - Single Bond between Carbon atoms.(shown as: C-C)
 - Double Bond between Carbon atoms. (shown as: C=C)
 - Triple Bond between Carbon atoms. (shown as: C≡C)
- ▣ **Most common partners are hydrogen, oxygen, and nitrogen.**



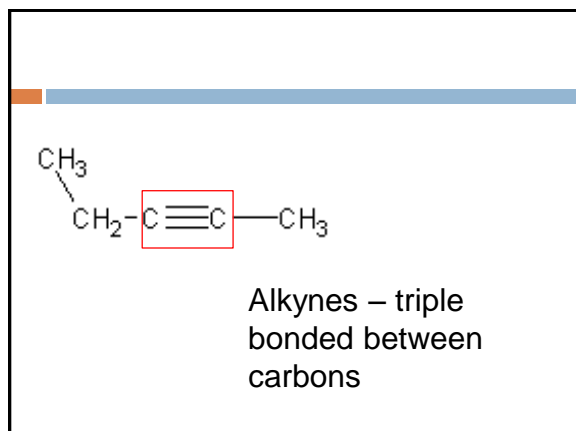
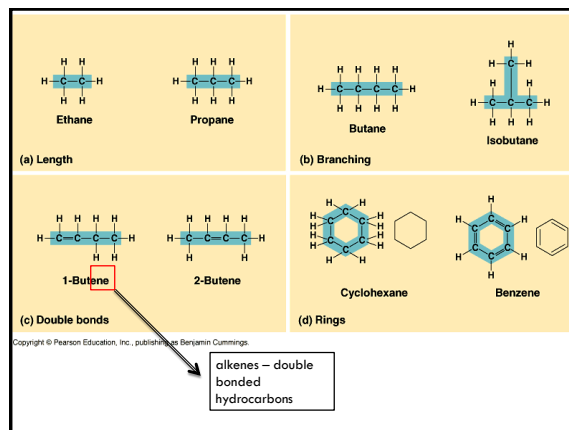
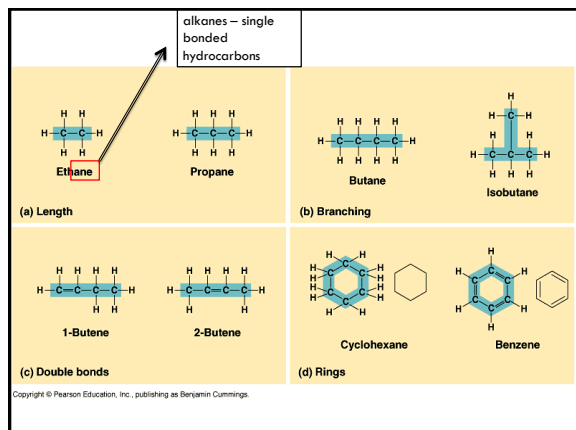
Hydrocarbons



- ▣ Molecules containing mostly Carbon and Hydrogen.
- ▣ Most hydrocarbons are *energy sources*. (Some examples are: Fossil fuels, Oils, And Fats)
 - The more Hydrogen atoms in a molecule; the more energy there is in the molecule.
- ▣ Hydrocarbons are important parts of cell membranes. (The tails of phospholipids)
- ▣ All hydrocarbons are *extremely hydrophobic* because they are nonpolar molecules. ("Afraid of" water's polarity.)

CFU

- ▣ How many valence electrons does carbon have?
- ▣ Can carbon bond to itself?
- ▣ What kind of bonds does carbon typically make?
- ▣ What is a hydrocarbon?
- ▣ Do hydrocarbons mix well with water? Why not?
- ▣ What does a single line between carbons indicate?



To name these compounds

For the number of carbons, use the prefixes :

□ Meth-	1
□ Eth-	2
□ Prop-	3
□ But-	4
□ Pent-	5
□ Hex-	6
□ Hept-	7
□ Oct-	8
□ Non-	9
□ Dec-	10

CFU

- What is the name of a hydrocarbon single bonds between carbons? Double? Triple?
- Which type of hydrocarbon would have the most hydrogen? Least?
- Which hydrocarbons are unsaturated? Saturated?

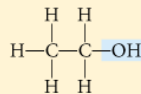
Functional Groups

- Addition of functional groups increase the solubility of the molecules and make them more hydrophilic (more hydrogen bonding).
- These functional groups will give them unique properties to biological compounds.
- 6 types:

1. Hydroxyl	4. Amino
2. Carboxyl	5. Sulfhydryl
3. Carbonyl	6. Phosphate

1. Hydroxyl Groups

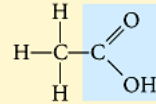
- -OH added
- called alcohols when added to a carbon chain
- ending changes to -ol
- Ex.



Ethanol
(the drug of alcoholic beverages)

2. Carboxyl Groups

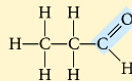
- -COOH added
- carbon atom with a double bond with an oxygen atom and a single bond to a hydroxyl group
- carboxylic acids



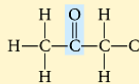
Acetic acid*
(the acid of vinegar)

3. Carbonyl Groups

- =CO added
- if located at the end - aldehyde
- if not - ketone



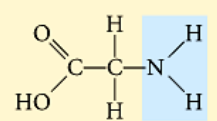
Propanal



Acetone

4. Amino Groups

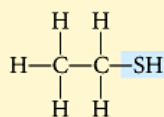
- -NH₂ added
- nitrogen atom attached to two hydrogen atoms and the carbon skeleton
- amines
- act like a base



Glycine*
(an amino acid)

5. Sulfhydryl Group

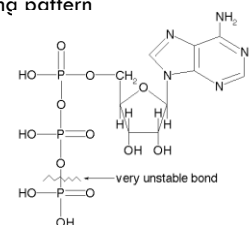
- -SH added
- sulfur atom bonded to a hydrogen atom and to the backbone
- end with -thiols
- help stabilize structure of proteins



Ethanethiol

6. Phosphate Group

- have a -PO₄ group attached
- essential for energy molecules and DNA
- doesn't follow any naming pattern

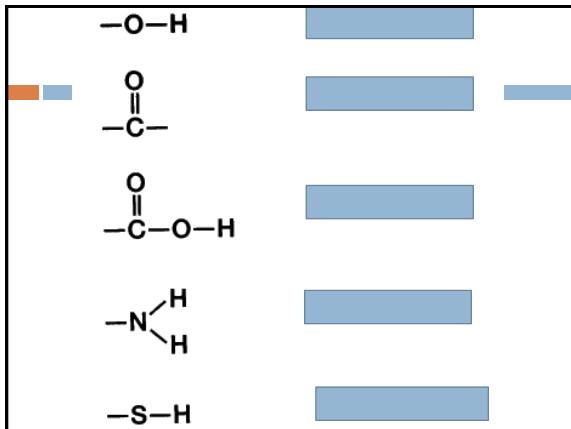


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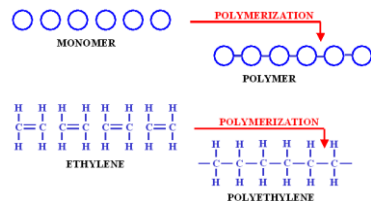
- What does the addition of functional groups do to a hydrocarbon?
- Which functional group tends to give acidic properties to the hydrocarbon?
- Which functional group can be classified as a ketone or an aldehyde?
- Which functional group is found in alcohol?

CFU

- Which functional group is commonly found in ATP?
- Which functional group helps keep proteins together?
- Which functional group has NH_2 ?
- Which functional group is found in amino acids besides amino groups?

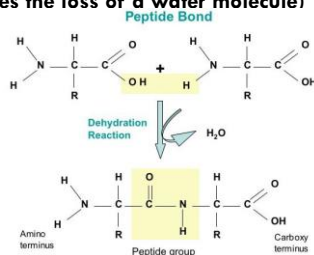


- large organic molecules are called **macromolecules**
- macromolecules are made by joining small molecules together called **monomers**
- large chains are called **polymers** (usually consist of repeated monomers)



DEHYDRATION SYNTHESIS

- monomers are connected by reactions called **dehydration synthesis or condensation reactions** (involves the loss of a water molecule) See below.



HYDROLYSIS

- polymers are broken apart by reactions called **hydrolysis reactions** (involves the addition of a water)

