Chapter Two: The Chemistry of Life
Lesson 2.3: Carbon Compounds

The term “organic” means many things.

- Naturally grown without the use of pesticides or fertilizers
- Living things
- Pertaining to carbon
    - Carbon can bond to many elements – H, O, P, S, N
    - Carbon can bond to itself forming long chains

Macromolecules: large organic molecules found in living things

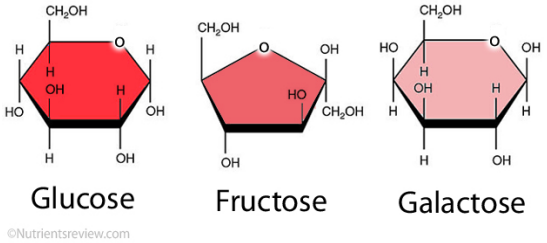
Monomer: a small chemical unit that makes up a polymer

Polymer: molecule composed of many monomers

- Makes up macromolecules

4 major groups of macromolecules:

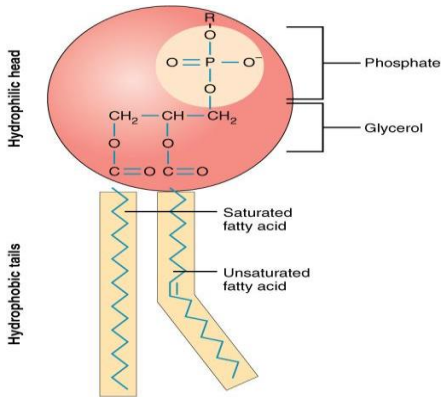
1. **Carbohydrate:** compound made of carbon, hydrogen, and oxygen atoms usually in a ratio of 1:2:1
    a. Types of nutrients that are the major source of energy (store and release) to the body as well as structural support and protection
    b. Examples include sugar (table sugar), starch (potato), and cellulose (wood or paper)
    c. Monosaccharides: single sugar molecules such as glucose (honey), galactose (milk), and fructose (fruits)



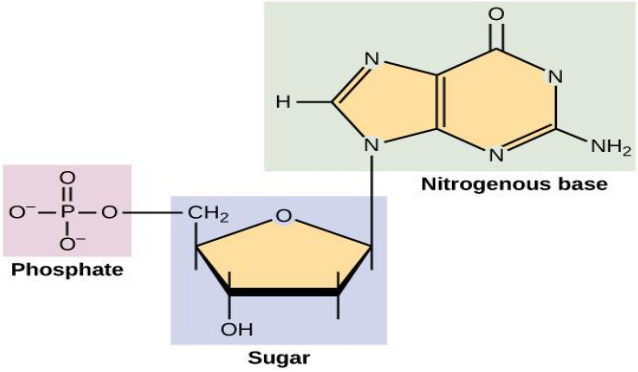
d. Disaccharides: two sugar molecules joined together such as sucrose (table sugar)
e. Polysaccharides: many monosaccharides joined together such as glycogen (excess sugar stored away in the body)
    i. When the level of glucose runs low, your body breaks down the glycogen into glucose which is released into the blood
    ii. Glycogen provides energy for muscle contraction
    iii. Starch is also a polysaccharide
        1. Used in plants mostly. Starch is used for storing excess sugar. Cellulose is made by plants for their strength and firmness. (Humans do not make cellulose or have the enzymes to break it down)

2. **Lipid:** macromolecule made mostly from carbon and hydrogen atoms that are not soluble (won't dissolve) in water
    a. Includes fats, oils, and waxes
    b. Used to store energy, form important biological membranes and waterproof coverings (plasma membrane)
    c. Many lipids form when combined with fatty acids.
        i. Carbon-carbon single bonds = saturated fat
            1. Solids at room temperature like butter
        ii. Carbon-carbon double or triple bond = unsaturated fat

1. Liquids at room temperature like olive or canola oil

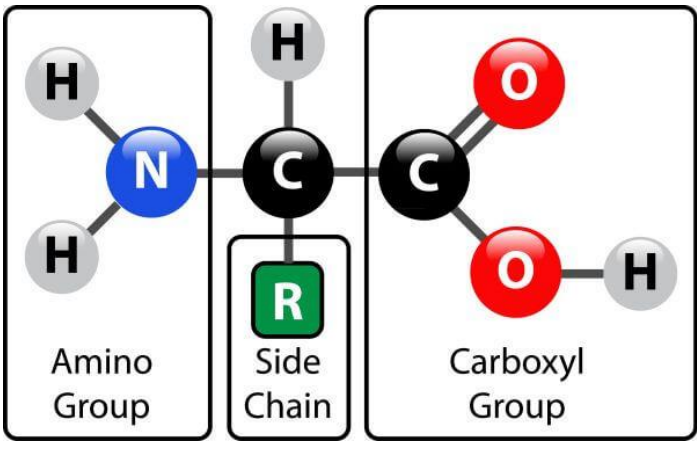


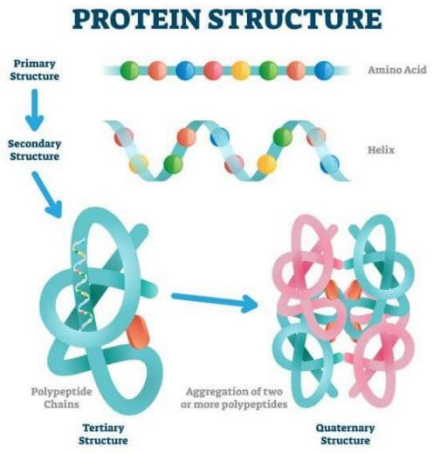
3. **Nucleic acid:** macromolecules containing hydrogen, oxygen, nitrogen, carbon, and phosphorus
    a. **Nucleotide:** subunit of which nucleic acids are composed
        i. Made up of a 5-carbon sugar, a phosphate group (-PO_4), and a nitrogenous base
    b. Two kinds of nucleic acids
        i. RNA – Ribonucleic acid – contains sugar ribose
        ii. DNA – Deoxyribonucleic acid – contains sugar deoxyribose
    c. Nucleic acids build other molecules such as proteins and store and transmit hereditary (genetic) information



4. **Protein:** macromolecule that contains carbon, hydrogen, oxygen, and nitrogen
    a. Needed by the body for growth and repair

b. **Amino acid:** compound with an amino group (-NH_2) on one end and a carboxylic acid group (-COOH) on the other end
    i. Covalent bonds called peptide bonds hold amino acids together to form a polypeptide.
    ii. One hydrogen from the amino group bonds with the OH from the acid group and water is released
    iii. Proteins are formed from one or more polypeptides
        1. Control the rate of reactions and regulate cell progresses
        2. Form important cellular structures
        3. Transport substances into or out of cells and help to fight diseases
c. Examples in your body include hair and nails made of the tough protein called keratin.
d. There are 20 different amino acids found in nature.
e. Proteins are the most diverse macromolecules.
f. Proteins are not linear but bend and twist in 3-D shapes.





Amino Acid