The Molecules of Life

I. Carbon

A. Carbon is special
   1. It has 4 valence electrons
   2. This means it can make 4 bonds with 4 other atoms

B. It creates the framework for all molecules in living things
   1. 3 basic structures
      a. Straight Chain
      b. Branched chain
      c. Ring
   2. These basic structures are called MONOMERS
      a. Two linked together are called a DIMER
      b. Many linked together are called a POLYMER

II. Four types of carbon-based macromolecules

A. Carbohydrates
   1. Have carbon, hydrogen and oxygen in a 1:2:1 ratio
   2. Most end in –ose (sugar)
   3. Monomers=Monosaccharides
      a. AKA Simple sugars
      b. Structure = Ring
         - 5 carbon or 6 carbon
      c. Example = Glucose
   4. Dimers=Dissacharides
      a. Example = Sucrose
   5. Polymers = Polysaccharides
      a. Long chains that store energy and can be broken apart to release energy
      b. Plants
         i Make:
         - Starches (branched and for energy)
         - Cellulose (straight and structural)
      c. Animals
         i Make:
         - Glycogen (very branched and used for energy)

B. Proteins
   1. More than half of cellular compounds are proteins
   2. Monomer = Amino Acids
      a. 20 essential amino acids
      b. Same basic structure
      c. Example = Leucine
   3. Polymer = Polypeptide Chain
      a. Many amino acids linked together by peptide bonds
      b. These chains fold to form proteins
      c. Example = Collagen
   4. Denatured proteins
      i Shape lost due to temperature or pH changes
      ii Change in shape = no function or malfunction

C. Lipids
    1. Non-Polar molecules = Don't dissolve in water
    2. Used to store energy, or provide structure
    3. Monomers = Fatty Acids
        a. Saturated = Full of H
        b. Unsaturated = Double C bonds (not full of H)
    4. Polymers
        a. Triglycerides
            i 3 fatty acids connected to a glycerol
            ii Animals
                - Fats
                - Saturated fatty acids
                - Solid
            iii Plants
                - Oils
                - Unsaturated fatty acids
                - Liquid
        b. Phospholipid
            i 2 fatty acids connected to a glycerol and phosphate group
            ii The phosphate head is polar, tail is non-polar
        c. Steroids
            i Make up hormones
            ii Important for delivering messages in the body

D. Nucleic Acids
    1. 2 types
        a. Deoxyribonucleic Acid (DNA)
        b. Ribonucleic Acid (RNA)
    2. 1 function
        a. Instructions for making proteins
    3. Monomer = nucleotide
        a. Nucleotide = Sugar + Phosphate + base
    4. Polymer = Nucleic Acids

Summary of the Molecules of Life

	Proteins	Lipids	Nucleic Acids	Carbohydrates
Function	Structure, signaling, catalysis	Energy storage, signaling, membrane constituents	Store genetic material	Energy source, energy storage, structural
Monomer	Amino acid		Nucleotide	Monosaccharide
Polymer	Polypeptide, protein		RNA, DNA	Polysaccharide
Example	Insulin, transcriptase (an enzyme)	Corn oil	A chromosome	Glucose