Chapter 1 Notes

I. Biochemistry

- A. Organic compounds are based on carbon atoms that have been combined with hydrogen and oxygen.
 - 1. Nitrogen, sulfur, and phosphorus are frequently found on organic compounds as well.
 - 2. Carbon atoms combine to make a "backbone" that other atoms attach to, giving structure and function.
 - 3. Monomers can be joined together into polymers through dehydration synthesis or broken by hydrolysis.
- B. Carbohydrates are composed of carbon, hydrogen, and oxygen in a CH₂O ratio.
 - 1. Monosaccharides (glucose, etc.) are carbo. monomers.
 - 2. Two monosaccharides can be combined to form disaccharides such as sucrose, maltose, or lactose.
 - 3. Several glucose molecules can be combined to form complex carbohydrates (polysaccharides).
 - Starch and glycogen are important energy-storage molecules for plants and animals respectively.
 - b. Cellulose is a structural molecule in plants used to build cell walls (cotton, wood, etc.).

- C. Lipids (fats and oils) are used for long term energy storage and as the structural parts of cell membranes.
 - 1. Lipids are made from C, H, and O, but not in a fixed ratio like carbohydrates.
 - 2. Simple fats (triglycerides) are made from three fatty-acid molecules and one glycerol molecule.
 - a. Unsaturated fatty acids can be recognized by C=C and are oily liquids at room temperature.
 - b. Saturated fatty acid carbon chains are full of hydrogen and tend to be solids at room temperature.
- D. Proteins provide most of the functionality (structure, defense, chemical reactions, etc.) to organisms.
 - 1. Amino acids (the protein monomer) have three main functional groups joined to a central carbon atom.
 - a. The amine group (NH_2) and the acid group (COOH) serve to attach one amino acid to another.
 - b. The R group can be one of twenty structures that give the A.A. characteristics like polarity.
 - 2. Proteins (polypeptides) are created by joining A.A.'s together with peptide bonds.

- 3. The sequence of a protein's amino acids is (primary structure) determines its shape and function.
 - a. Most proteins fold/twist to form alpha helices and beta sheets secondary structure.
 - b. More complex folding caused by the polarity of R groups creates tertiary structure → function.
 - c. Some proteins gain functionality only after 2+ tertiary structures combine into a quaternary structure.
- E. Nucleic acids code for the order of amino acids in proteins.
 - 1. The two basic types of nucleic acids are DNA (the genetic code) and RNA.
 - 2. Nucleic acid monomers (nucleotides) are composed of three main parts.
 - a. The phosphate group can covalently bond with the sugar group of another nucleotide.
 - b. A five carbon sugar is in the middle of the molecule
 - c. Attached to the sugar is a nitrogen-containing base.
 - i. DNA has four possibilities: adenine (A), guanine (G), thymine (T), and cytosine (C).
 - ii. RNA has the same four nitrogenous bases except thymine is replaced by uracil (U).

II. Genetic Coding in Cells

- A. A paper proposing the structure of DNA was published by Watson and Crick in 1953 Nobel Prize.
 - 1. X-ray diffraction data gathered by Rosalind Franklin suggested:
 - a. DNA is two long chains of nucleotides each of which is connected by sugar-phosphate bonds running in opposite directions.
 - b. The two chains are joined because of hydrogen bonding between specific nitrogenous bases: A with T and C with G.
 - c. The two strands intertwine, forming a double helix (like a twisted ladder).
- B. DNA forms genes that code for proteins and are passed on from one generation to the next.
 - 1. DNA nucleotides are arranged to form codons groups of three "letters."
 - 2. The order of codons in a gene dictates the order of amino acids in the protein the gene codes for.