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 CH_2O 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).

a. 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.