**Study Guide for General Biology I**

**Chapter 3**

***Make Flash Cards:***  It is highly recommended to make flash cards of all vocabulary terms in the chapter and in the lecture notes (PowerPoints).

***Use the following expected student learning outcomes as a guide for studying this chapter…***

**CHAPTER 3: THE CHEMICAL BUILDING BLOCKS OF LIFE**

3.1 Carbon: The Framework of Biological Molecules

* Explain how carbon’s chemical bonding behavior means it can form a diversity of molecular shapes.
* Define hydrocarbon.
* Define functional group.
* Know the names and structures, and give examples of, the following functional groups: hydroxyl, carboxyl, amino, phosphate, methyl, carbonyl, and sulfhydryl (see Figure 3.2).
* Define isomer. Distinguish between a structural isomer and an enantiomer.
* Define polymer and monomer.
* Identify the chemical reaction that builds polymers and the reaction that breaks down polymers.

3.2 Carbohydrates: Energy Storage and Structural Molecules

* Identify the monomers of carbohydrates, nucleic acids, and proteins.
* Define monosaccharide, disaccharide, and polysaccharide.
* Name the type of bond that joins monosaccharides to form di- and polysaccharides.
* Recognize ribose, deoxyribose, glucose, fructose and galactose as monosaccharides (with different numbers of carbons) that are found in important biologically-important molecules.
* Know that, although glucose is linear in structure, it often forms a hexagonal ring.
* Know that glucose as six carbons, and is thus a “hexose” sugar.
* Know the molecular formula for glucose.
* Distinguish between the glucose polymers know as starch, cellulose, glycogen, and chitin. Give a biological example for the function each of them.

3.3 Nucleic Acids: Information Molecules

* Define nucleic acid.
* Know that nucleic acids function to carry information.
* List the two main varieties of nucleic acids, and briefly describe that main function of each.
* Know that nucleic acids can serve as templates for production of copies of themselves.
* Define template.
* Define messenger RNA and briefly describe its function.
* Draw the structure of nucleotide and name the parts. Recognize that the nitrogenous base can vary.
* Know that nucleotides are strung together by way of covalent bonds to form nucleic acid polymers.
* Know that polymers of nucleotides have a “5’ phosphate” end and a “3’ hydroxyl” end. Identify these in Figure 3.15.
* Know what is meant by the term “antiparallel”.
* Name the purines and pyrimidines, and show where they would be located in your drawing of a nucleotide.
* Know which of the nitrogenous bases are found in DNA and which are found in RNA.
* Explain why DNA is often called a “double helix”.
* State what type of chemical bond holds two strands of DNA to each other.
* State the complementary base pairing rules.
* Know that DNA is the hereditary material, and that RNA has many different roles in a cell.
* Make a table showing the differences between DNA and RNA.
* Define ATP and describe its role in a cell. Know that ATP is a single nucleotide and therefore part of the group of molecules known as nucleic acids.

3.4 Proteins: Molecules with Diverse Structures and Functions

* Define protein.
* List the 7 functional categories for proteins and give examples of each.
* Know that proteins are polymers of amino acids.
* Define amino acid.
* Identify the two functional groups found on all amino acids.
* Know that there are 20 common amino acids in five categories.
* Define R group.
* Using Figure 3.20, describe the general chemical characteristics of R groups for each category of amino acid.
* Note: You do not need to memorize all the names and individual structures of each amino acid.
* Draw the general structure of an amino acid, using a box with a letter “R” to represent the R group.
* Define peptide bond.
* Define polypeptide. Know that a protein may consist of only one polypeptide chain, or many.
* Explain the primary, secondary, tertiary and quaternary levels of protein structure. Explain the type of chemical interactions that occur between amino acids in each level of protein structure.
* Define domain as it relates to proteins.
* Identify the function of chaperone proteins.
* Define denaturation and explain what causes it.
* Define dissociation as it relates to proteins with quaternary structure.

3.5 Lipids: Hydrophobic Molecules

* State the common characteristic shared by all lipids.
* Define triglyceride (also known as “fat”).
* Define fatty acid.
* Distinguish among saturated, unsaturated, and polyunsaturated fatty acids.
* Describe how “trans fats” differ from most naturally occurring fats and how they are linked to health problems.
* Describe how the occurrence of double bonds influences a fatty acid’s response to temperature changes.
* Know that fats are excellent for energy storage.
* Know that cholesterol and other steroids are considered lipids and know their general functions in cells.
* List the parts of a phospholipid.
* Draw a simple icon representing a phospholipid (see Figure 3.29).
* Know that phospholipids are important components of biological membranes.
* Discuss the different chemical characteristics of the “head” and “tails” of a phospholipid and how these relate to the way phospholipids are arranged in a biological membrane.

**In addition to the above objectives, also do the following:**

* Accomplish the “Learning Outcomes” in this chapter and be able to do the “Learning Outcomes Review” items.
* Read and look at the information in any “Scientific Thinking” figures for this chapter and be able to use the information to illustrate the classic steps and process of a scientific investigation.
* Know the material in the Chapter Review.
* Do the “Understand” and “Apply” questions in the chapter Review Questions and know *why* the correct answer is the right choice (and *why* the incorrect answers are the wrong choices). Be able to answer similar questions based on any of the above specific learning objectives.