**Chapter 20. Proteins**

**20.1 Characteristics of Proteins**

**20.2 Amino Acids: The Building Blocks for Proteins**

**20.3 Chiralityand Amino Acids**

**20.4 Acid-Base Properties of Amino Acids**

**20.5 Cysteine: A Chemically Unique Amino Acid**

**20.6 Peptide Formation**

**20.7 Biochemically Important Small Peptides**

**20.8 General Structural Characteristics of Proteins**

**20.9 Primary Structure of Proteins**

**20.10 Secondary Structure of Proteins**

**20.11 Tertiary Structure of Proteins**

**20.12 Quaternary Structure of Proteins**

**20.13 Fibrous and Globular Proteins**

**20.14 Protein Hydrolysis**

**20.15 Protein Denaturation**

**20.16 Glycoproteins**

**20.17 Lipoproteins**

Students should be able to:

1. Characterize the structure of a protein using the terms polymer, monomer, amino acid, peptide bond, amide, and amino acid side chain.

2. Describe several types of functions of proteins.

3. Identify an α - amino acid.

4. Compare the polarity of the side chains of several amino acids and classify the side chains as hydrophobic, hydrophilic, non-polar, polar, neutral, basic, or acidic.

5. Compare the essential and non-essential amino acids.

6. Predict the structure of an amino acid in acidic solution and basic solution.

7. Illustrate the acid/base properties of amino acids and describe how the structure of an amino acid depends on pH.

8. Explain the relationship between the zwitterions form of an amino acid and its isoelectric point (pI).

9. Explain how the laboratory technique of electrophoresis is used to characterize proteins and amino acids.

10. Identify a chiral carbon.

11. Predict the products of any of the following reactions of amino acids, peptides, and /or proteins

• peptide formation

• hydrolysis of a polypeptide

• oxidation of cysteine to form a disulfide bond

12. Distinguish between primary, secondary, tertiary, and quaternary structure of proteins.

13. Compare different types of secondary protein structure (alpha helix, etc.).

14. Identify the N and C terminals of a peptide chain.

15. Describe the types of interactions involved in each level of protein structure (covalent and non-covalent interactions).

16. Predict the side-chain interactions between two amino acids.

17. Draw the structure of a peptide given the structures of amino acid residues.

18. Distinguish between a fibrous and a globular protein. Give examples of each.

19. Characterize the chemistry of several modes of protein denaturation.

20. Give some examples of applications of proteins in everyday life.