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.