

**Protein Structure and Function (Chapter 1,2)**

1. Be able to draw the structures of the 20 amino acids, and know the three-letter and one-letter code.
2. Understand the four levels of proteins structure.
3. Understand the relationship of primary and secondary protein structure.
4. Understand how secondary structure affects tertiary and quaternary structures.
5. Be able to draw a short peptide, including side chains, with correct ionization for a given pH.
6. Be able to draw the side and top views of an alpha helix using generic R side groups and indicate distinguishing features such as hydrogen bonds, direction of the net dipole, etc.
7. Be able to draw examples of parallel and antiparallel beta sheets using generic R side groups and indicate distinguishing features such as hydrogen bonds, backbone orientation, etc.
8. Understand amino acid ionization.
9. Know and apply the Henderson-Hasselbach equation relating pH and pKa.
10. Understand how local environment can affect pKa.
11. Be able to draw a titration curve or speciation curve.
12. Be able to calculate the pI of a peptide.

**Protein Folding, Processing and Degradation (supplemental)**

1. Define post-translational modification and give a few examples.
2. Understand how various post-translational modifications alter the physical and chemical characteristics of proteins.
3. Describe protein processing and give two examples. Why is processing important?
4. Understand the forces that contribute to protein folding (bonding, thermodynamics, energy funnel)
5. Understand how chaperones bind proteins and assist in protein folding
6. Understand the GroES-GroEL system.
7. Understand the consequences of improper protein folding.
8. Understand the proteasome system and its relationship to GroEL (compare and contrast).

**Protein Purification (Chapter 3)**

1. Understand the various techniques of protein purification
  - a. Electrophoresis – native PAGE, SDS-PAGE, Western blotting, 2D-PAGE, IEF, diagonal
  - b. Column chromatography – HIC, Ion-exchange, affinity, gel filtration
  - c. Salting out (precipitation) and dialysis
2. Understand how biophysical/chemical properties of proteins can be exploited in purification schema.
3. Understand how post-translational modifications might alter a protein's response to various purification techniques.
4. Be able to deduce amino acid sequence from partial digestion and other clues.

**Nucleic Acids (Chapter 4)**

1. Understand basic nomenclature (base, nucleoside, nucleotide)
2. Be able to draw the five main nucleotides (base + sugar + phosphate) (A,T,G,C,U).
3. Be able to draw a base pair.
4. Understand underlying bonding interactions that result in formation of the double helix in DNA.

**Carbohydrates (Chapter 11)**

1. Be able to identify main sugars (glc, man, gal, xyl)
2. Understand basic nomenclature (anomeric, alpha-, beta-, D, L, pyranose, furanose, etc.)
3. Understand the basic functions of carbohydrates
4. Understand how sugars can be derivatized (methylation, acetylation, sulfation) and how substitutions change physicochemical behavior
5. Describe, compare and contrast the two major types of protein glycosylation.