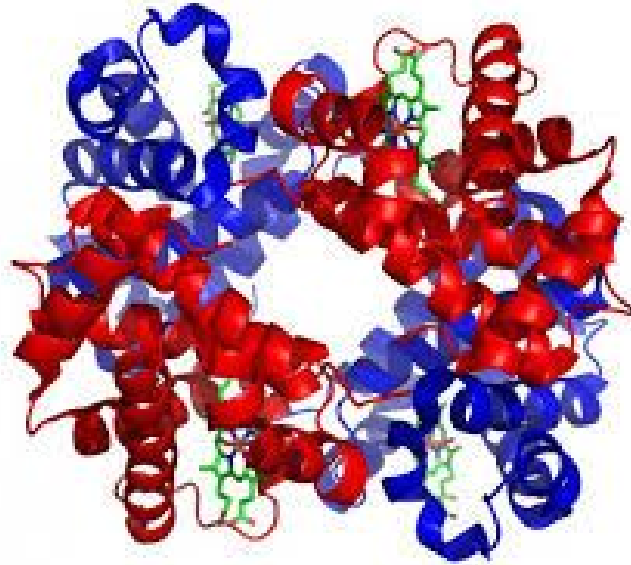


*Daniel.SciO Protein Modeling Test:
Enloe Varsity 2018-19*



1. a) Define what chirality in a sentence or two:

b) Different chiral forms are called _____.

c) i) What are the 2 chiral forms of proteins designated as?

ii) Which type is used by enzymes and are synthesized by ribosomes?

d) All amino acids are chiral except for which?

- A. Tyrosine
- B. Alanine
- C. Glycine
- D. Histidine

e) Explain the difference in the chemical structure of the amino acids you chose for part b that sets it apart from the other chiral amino acids:

2. a) Fill in the blanks: In proteins, the _____ group is acidic, while the _____ group is basic. At physiological pH, free amino acids exist mostly as _____.

b) Draw the chemical structure of a general amino acid below:

c) What is the isoelectric point of an amino acid and why is it important?

d) i) What are pKa values and how are they different from pH?

ii) Why are the pKas of proteins useful for determining the location and behavior of amino acids?

iii) Match each relationship of pH and pKa to the corresponding characteristic of the amino acid:

- | | |
|--------------|-----------------|
| ___ pH < pKa | A. 0 net charge |
| ___ pH = pKa | B. deprotonated |
| ___ pH > pKa | C. protonated |

3. a) Match the properties of each amino acid group to their properties:

- | | |
|---------------|-------------|
| ___ Group I | A. Acidic |
| ___ Group II | B. Nonpolar |
| ___ Group III | C. Basic |
| ___ Group IV | D. Polar |

b) i) Based on the properties of amino acid groups, where would you expect to find each group?

ii) List where you would find each amino acid (use "i" for interior and "e" for exterior).

Glycine:

Valine:

Glutamic acid:

Lysine:

Cysteine:

Proline:

Methionine:

Glutamine:

Phenylalanine:

Histidine:

c) Fill in the blanks: The _____ side chain of Histidine allows it to function as both an _____ and a _____, these types of amino acids are _____.

d) The amino acids that contain sulfur atoms are _____ and _____.

d) The two main characteristics of aromatic amino acids are what?

4. a) i) What are the two main secondary structures? How are they formed?

ii) Give the corresponding secondary structure to the measurements for the following:

_____ has 3.3 residues per turn.

_____ has 3.6 residues per turn.

_____ has 3.0 residues per turn.

_____ has 4.1 residues per turn.

b) i) How are π -helices derived from alpha-helices?

ii) Briefly explain why π -helices are so much rarer than alpha-helices:

c) Where are 3/10 helices usually found in the secondary structure of a protein?

d) Which amino acid is known to destabilize alpha-helices and why?

e) What force dominates secondary structure formation?

- A. Hydrophobic Effect
- B. Salt Bridges
- C. Disulfide Bonds
- D. Hydrogen Bonding

f) What is the difference between antiparallel and parallel beta sheets?

5. a) What are the noncovalent forces involved in protein folding?

b) Explain the significance of Cysteine in tertiary structure formation:

c) i) What types of bonds are involved in salt bridges?

ii) What amino acids are involved in the formation of salt bridges?

d) Describe these methods for analyzing tertiary structure:

X-ray Crystallography:

NMR Spectroscopy:

e) Describe how Gibbs free energy influences protein folding in a sentence or two:

f) Explain briefly what the hydrophobic effect is, and how it relates to thermodynamics:

6. a) i) Explain transcription in detail:

ii) Explain translation in detail:

b) What are transcription factors?

c) Name the function of each site in a ribosome:

d) mRNA translation begins from its ' to ' and the polypeptide is synthesized from -end to -end

e) i) What process forms polypeptide bonds?

ii) Draw out a peptide bond below:

f) Why are there only about half as many tRNA molecules as codons?

7. a) Which structural motif is this? Two antiparallel β -strands connected by a tight turn of a few amino acids between them.

b) Which structural motif is this? Two beta strands with an alpha helix end folded over to bind a zinc ion.

8. Briefly explain the four types of proteins:

9. a) What is the Central Dogma, and who was responsible for it?

b) What is the Levinthal Paradox?

d) What is Anfinsen's Dogma? How did Anfinsen come up with this Dogma?
Explain his experiment:

10. a) What is competitive inhibition?

b) What is noncompetitive inhibition?

c) What are molecular chaperones and what do they do in regards to protein folding?

d) Briefly explain cooperation and allosteric regulation:

