

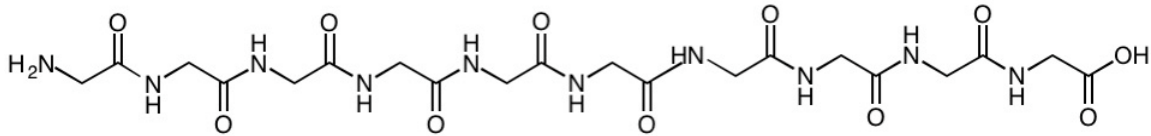
Biochemistry CUME October 2016

Topic: Protein Structure Analysis

Protein structures can be described and characterized at four different levels - primary structure (1°), secondary structure (2°), tertiary structure (3°) and quaternary structure (4°).

1. Primary Structure (25 points):

(a) (10 points) Given the primary structure of a polypeptide (MEVQIAHNYR), please add proper side chains (with chemical structure drawing) to the following protein backbone structure.



(b) (5 points) Group the 10 amino acids in **1(a)** according to the following categories (use 3-letter code).

- Charged:
- Polar:
- Non-polar:

c) (10 points) Describe one biophysical or biochemical technique for primary structure determination of a polypeptide.

2. Secondary Structure (25 points):

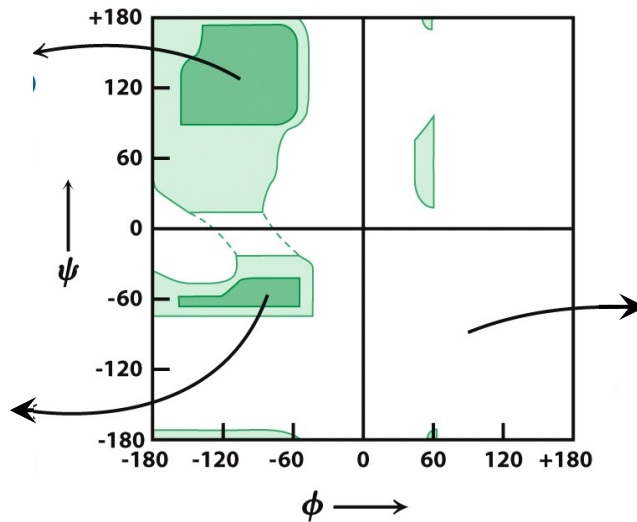
(a) (15 points) Name two secondary structure elements and describe their characteristic features in terms of hydrogen bonding pattern, backbone geometry etc. Use illustration if necessary.

(b) (10 points) Discuss one experimental method for protein secondary structure analysis.

3. Tertiary Structure (25 points):

(a) (5 points) Name four major interactions that drive the process of protein folding into a tertiary structure.

(b) (10 points) The Ramachandran diagram is a scatter plot of two backbone dihedral angles (ϕ , ψ) of a protein structure. Please identify the preferred and disallowed regions in a ϕ - ψ plot (see below) and mark the locations of the secondary structures as named in 2(a).



(c) (10 points) Describe two major experimental methods that are widely used for protein tertiary structure determination.

4. Quaternary Structure (25 points)

(a) (15 points) Provide two examples to illustrate the importance of the quaternary structure in protein functions.

(b) (10 points) Discuss one biochemical method for quaternary structure analysis.