

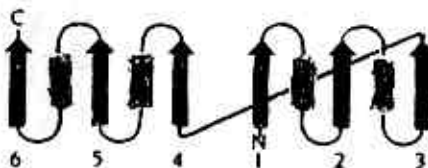
DEPARTMENT & COURSE NO: Chemistry 2.463TIME: 3 HOURSEXAMINATION: Biochemistry of ProteinsEXAMINER: J. O'Neil

Section 1: *You must answer all of the following questions in Section 1. As a guide you can spend up to 2 hours and 20 minutes on this part of the exam. Wherever possible use **diagrams** to enhance your answers.*

Marks

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|----|---|--|
| 6 | 1 | Draw the chemical structure of the tripeptide Phe-Leu-Ala at pH 7 and label <u>all</u> the dihedral angles with Greek letters or names. |
| 6 | 2 | Give a definition of "dihedral angle". Use a diagram and explain what is the polypeptide angle ψ (psi). |
| 10 | 3 | What information did V. N. Ramachandran use to construct his Plot? Draw a Ramachandran Plot and label the locations of the right and left-handed α -helices, parallel and antiparallel β -sheets, the right-hand 3_{10} helix, and the collagen triple helix. |
| 12 | 4 | Describe the properties of the β -strand and its organization into sheets. |
| 8 | 5 | Describe the polyproline helix and its role in protein structure and function. |
| 12 | 6 | Explain why Proline and Glycine are termed <u>helix breakers</u> . Does Alanine have a strong or weak helix propensity? Explain. What about Valine? |
| 6 | 7 | Explain how a hydropathy plot is constructed. In general, what information does it convey? |
| 8 | 8 | Below are 2 schematic diagrams. Explain why one forms a closed barrel and the other an open, twisted sheet. Where is the topological switch point in one of the diagrams and what generally is its function? |

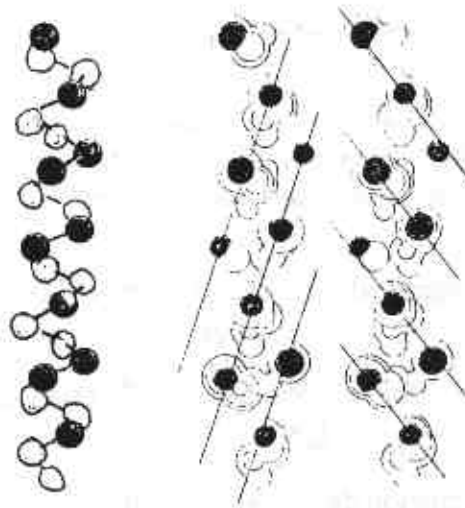
A



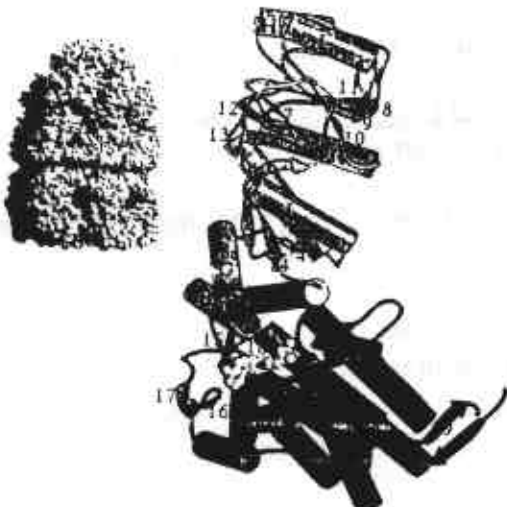
B



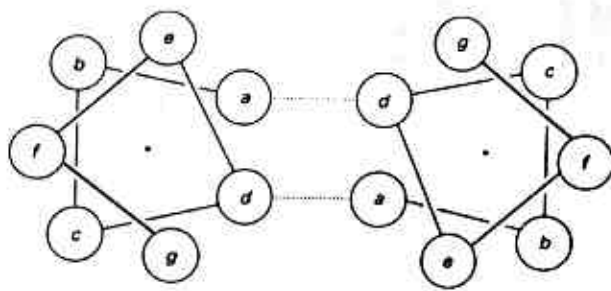
- 8 9 Prostaglandin H2 synthase-1 is thought to reside in only 1 leaflet of the membrane bilayer. Describe the protein domain which anchors this protein in the leaflet. Name 1 drug molecule that inhibits 1 of the enzymatic activities of this enzyme. Explain why this molecule is a target for the design of new drugs for cancer prevention.
- 6 10 Using the diagrams below explain the common ways in which α -helices pack together.



- 12 11 Identify the following structures. What are the main features of each?
- A B



C



D



- 4 12 What is known about the β -sheet propensities of the amino acids? What are Chameleon sequences?
- 8 13 What is the hydrophobic effect? What is its role in protein folding?
- 4 14 What is a Lennard-Jones potential?
- 6 15 Give a description of helix formation according to the theories of Zimm-Bragg / Lifson-Roig.
- 2 16 How many different conformations can a 6 amino acid peptide adopt if each amino acid can adopt 9 different conformations?

Section 2: *Answer 1 of the following questions in Section 2. You can spend about 20 min. on this question.*

- 16 17. Cells have evolved a number of mechanisms to assist protein folding. Describe 6 such mechanisms and name the factors involved in the process.
- 16 18. Describe the "protein folding problem". Explain the concept of *cooperativity* and indicate its relevance to protein folding. Describe the hydrophobic zipper model of protein folding.