

BIOL 213
First Exam
February 4, 1999

All atoms, chemical bonding and structures must be complete and correct for full credit. Please print and sign your name on the back page.

(8 pts) 1. Would you use the transmission electron microscope (TEM), scanning electron microscope (SEM), or light microscope to study the structure and function of the following? Give a definitive reason for why.

(2 pts) A. Mitochondria:

(2 pts) B. Ribosomes and the rough endoplasmic reticulum:

(2 pts) C. Cell Surface Receptor:

(2 pts) D. Nucleus:

(2 pts) 2. The endoplasmic reticulum has an intimate association with the nuclear envelope. Explain the detail of this relationship. A drawing properly labeled will suffice

(6 pts) 3. Compare the prokaryotic cell genome with the eukaryotic cell genome in size, structure and genetic complexity.

(4 pts) 4. Give the primary roles or functions for each of the following:

A. Golgi:

B. Extracellular matrix:

(2 pts) 5. Define functional genomics.

(8 pts) 6. Draw the chemical structures for the following carbon-oxygen, carbon-nitrogen or carbon organic phosphate compounds as they exist in solution:

alcohol -

carboxylic acid -

amine -

organic phosphate -

(8 pts) 7. Using the saturated fatty acids,

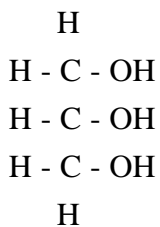
lauric acid - $\text{CH}_3 (\text{CH}_2)_{10} \text{CO}_2\text{H}$

capric acid - $\text{CH}_3 (\text{CH}_2)_8 \text{CO}_2\text{H}$

butyric acid - $\text{CH}_3 (\text{CH}_2)_2 \text{CO}_2\text{H}$

Draw the complete chemical structure for a phosphoglycerolipid. For the carbohydrate, use the ring structure for glucose as covalently bonded through the C1 carbon of the α -glucose form. What word describes the solubility properties of this molecule?

(5 pts) 8. Describe what is meant by covalent bond polarity. Use the molecule glycerol for your explanation.



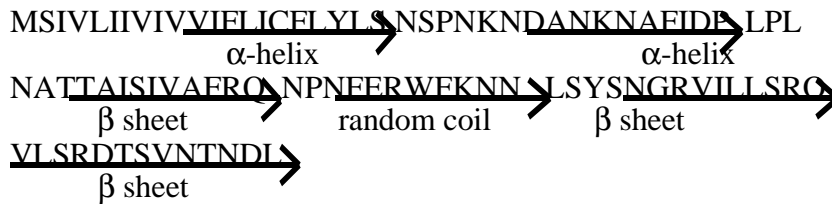
Show the bonding of glycerol with three (3) water molecules as it would occur in solution.

(22 pts) 9. Draw the chemical structure for the following hepta peptide: M I F P L C S

- a) identify each peptide bond in the hepta peptide.
 - b) draw the chemical forms of all reactive groups as they exist in solution.
 - c) identify each AA as to polar, nonpolar, acidic, basic.
 - d) would this heptapeptide form the expected α -helix structure in solution?
 - e) identify each α carbon in the peptide.
- (3 pts) f) If a 0.1M solution of this heptapeptide was made what would you predict the chemical behavior or reactivity of this peptide with itself and/or H₂O molecules. Explain. Showing the appropriate cartoon correctly labeled and described to prove your point will help.

- (8 pts) 10. What are the weak bonding interactions that produce and stabilize specific tertiary and quaternary protein associations; be specific, give both the type, chemical structure, reactive group and show each type of bonding interaction as it would occur.

- (6 pts) 11. The following polypeptide has the secondary structures of α helical coils and β sheets as shown:



Please predict a tertiary structure for this protein as it could occur in solution. Remember that a protein will fold into that conformation with the most stable protein domain interaction and the lowest free energy.

12. The figure shows an SDS gel of viral proteins (Figure 1). The molecular weight markers have sizes of 21.5, 31.0, 45.0, 66.2, and 97.4. the molecular weight markers are used to estimate the sizes of the viral proteins. Band A (← Arrow) of about 32.0 was isolated from the gel and sequenced. The amino acid sequence for a part of the polypeptide was;



FIG. 1

- (12 pts) A. Using a bioinformatics approach how would you identify the protein or any important structure or function for this AA sequence if it is known from any living source in the cellular world.

- (5 pts) B. An antibody was made to protein A and an antibody affinity column prepared in which the protein A specific antibody was attached to small non-reactive beads. I then added a cellular lysate to the affinity column, and eluted all the proteins that did not attach to the antibody coated beads. I then eluted the proteins that had attached to the antibody beads and electrophoresed these on a SDS gel, to my surprise, not only was protein A recovered, as expected, but an unknown protein of about 25.0 which I identified as protein "X". See Fig. 2. Provide possible explanations for the isolation of another protein of a different molecular weight from this antibody column.

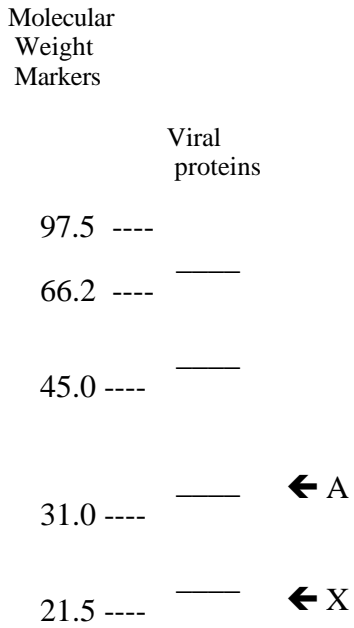


FIG. 2