

PROTEIN MODELING TEST

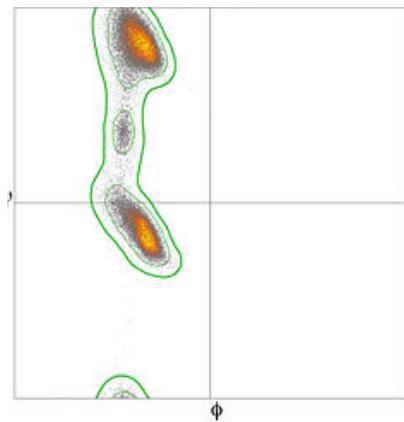
*Note: Obviously, during the pre-season time, specifics about the pre-build protein for the 2019-2020 season are not yet disclosed. Therefore, this test will only focus on broader biochemistry and protein topics.

Multiple Choice

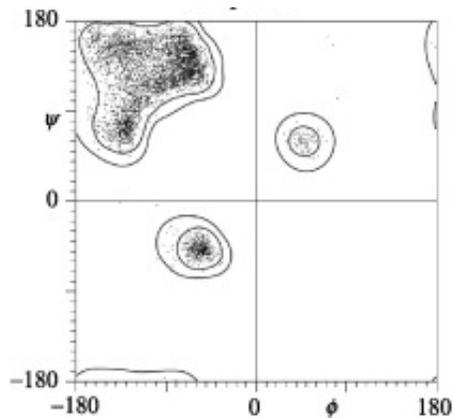
- 1) Which of the following 3 amino acids are extremely common in the structure of collagen?
 - a) Glutamate, serine, proline
 - b) Hydroxyproline, glycine, proline
 - c) Selenocysteine, cysteine, glycine
 - d) isoleucine, leucine, methionine
- 2) Which of the following amino acids encoded by our genes contain sulfur?
 - a) Methionine and cysteine
 - b) Methionine and phenylalanine
 - c) Phenylalanine and aspartate
 - d) Phenylalanine and asparagine
- 3) On a similar note, which of the following amino acids that are not encoded by our genes contain sulfur?
(TIE BREAKER)
 - a) Isovaline and taurine
 - b) Homocysteine and taurine
 - c) Allothreonine and GABA
 - d) Sarcosine and isoserine

- 4) Which of the following Ramachandran Plots is most likely to represent the amino acid glycine?

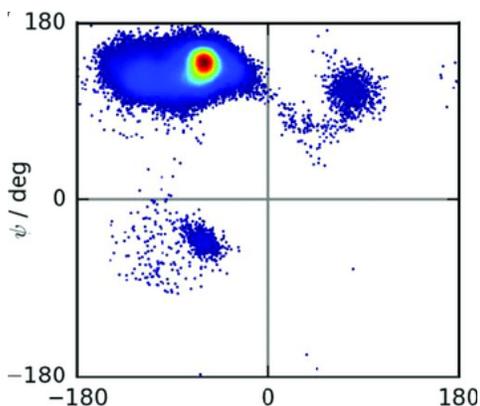
a)



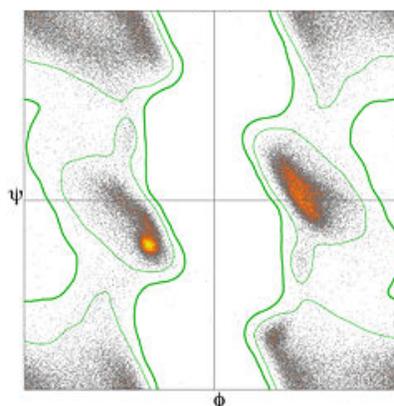
b)



c)



d)



- 5) Identify the correct order of protein synthesis [brackets indicate a process].
- Gene → [translation] → miRNA → [transcription] → polypeptide → [folding] → protein
 - Gene → [translation] → mRNA → [transcription] → polynucleotide sequence → primary, secondary, tertiary and quaternary (if applicable) structure → protein
 - Gene → [transcription] → mRNA → [mRNA processing] → [translation] → polypeptide → [folding] → protein
 - Gene → [transcription] → miRNA → [mRNA processing] → [translation] → polypeptide → [folding] → protein
- 6) An amino acid has which of the following functional groups?
- Amide, carboxyl, and R group
 - Amide, carbonyl, and R group
 - Amino, carbonyl, and R group
 - Amino, carboxyl, and R group
- 7) Which of the following techniques cannot be used to ultimately determine the structure of a protein?
- X-ray crystallography
 - NMR spectroscopy
 - Western blotting
 - Hanging drop method
- 8) What is disease via protein misfolding known as?
- Proteopathy
 - Triproteopathy
 - Proteolysis
 - Proteomics
- 9) Adding 2-Mercaptoethanol to a protein solution will immediately do what to the protein?
- Cleave the bonds between each individual amino acid
 - Reduce disulfide bonding within the protein
 - Disrupt the hydrogen bonding that keeps alpha helices and beta sheets together
 - Phosphorylate it, facilitating the transfer and storage of energy
- 10) Fibrous proteins are _____ in water and globular proteins are _____ in water.
- Soluble, not soluble
 - Not soluble, soluble
 - Soluble, soluble
 - Not soluble, not soluble
- 11) What does the Greek Key motif consist of?
- Two alpha helices interrupted by a single beta sheet
 - Two alpha helices connected by a single loop
 - Two antiparallel beta sheets interrupted by a single alpha helix
 - Four antiparallel beta sheets connected by loops

Short Answer

12) What does SDS-PAGE stand for?

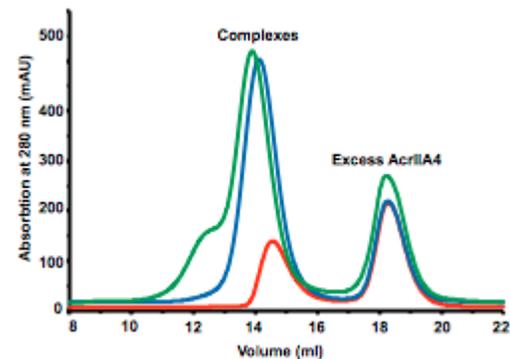
13) Briefly describe the conclusion(s) of the Anfinsen experiment.

14) Rate the following intramolecular forces/interactions from least to greatest strength: disulfide bonds, Van der Waals forces, hydrophobic interactions.

1) _____, 2) _____, 3) _____

15) List 2 amino acids that you would commonly find in beta turns.

16) This is a graph (right) taken from Yang and Patel's paper about last year's pre-build, AcrIIA4. What is the name of the method that allows one to obtain a graph of this sort?



Free Response

1) For each of the following secondary structures/interactions, list 1 commonly present amino acid and explain the process that results in this specific amino acid producing such a secondary structure/interaction.

a) Disulfide bridge

b) Alpha helix (specifically from a heptad repeat)

c) Salt bridge

2)

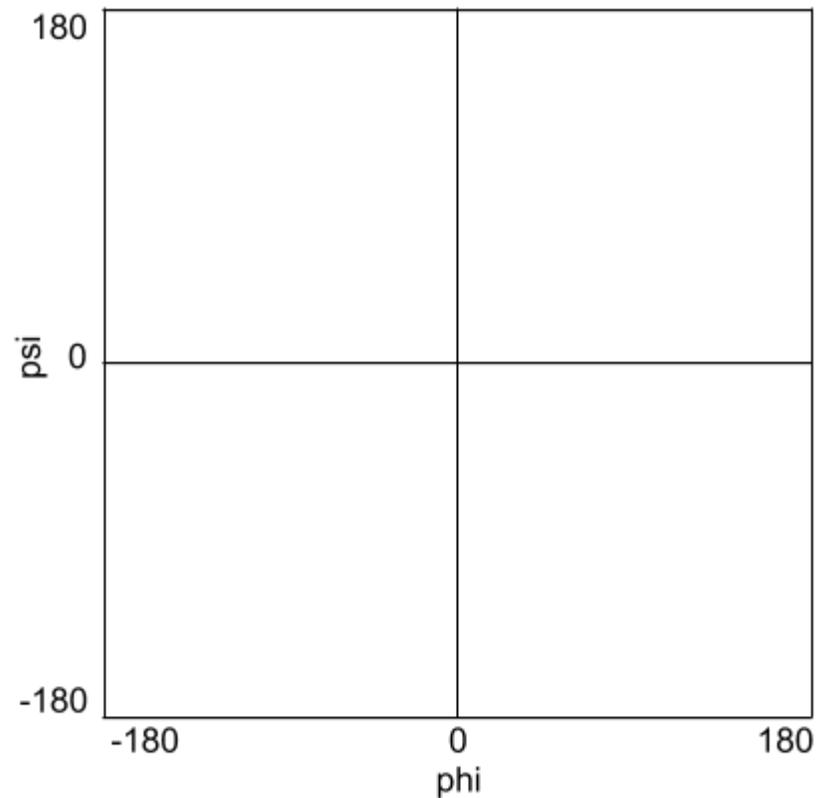
a) Draw the zwitterion form of glycine.

b) What is the net charge of the glycine you just drew?

c) What is the pH point called that allows this glycine to adopt its zwitterion form?

d) What is an alternative definition for the answer to part C? Make sure to include pK_a in your answer.

3) Indicate/circle where on the Ramachandran Plot one can find parallel beta sheets, anti-parallel beta sheets, right-hand alpha helices, left-hand helices, and collagen triple helices.



4) Given this DNA sequence:

AGC-AAG-CTG-CAA-ACT

a) . . .Write down the respective mRNA sequence.

b) . . .Write down the respective amino acid sequence.

c) What is each three-letter section known as?

- d) There is an amino acid missing at the beginning of this sequence. Identify this amino acid and list its respective three-letter mRNA section.
- 5) A solution containing proline, aspartic acid, and arginine is subjected to electrophoresis. When electrophoresis is concluded, which amino acid will be closest to the positive cathode of the gel tray. . .
- a) . . .At a pH of 1?
 - b) . . .At physiological pH?
 - c) Which amino acid will be closest to the negative anode at physiological pH?