



**SCIENCE OLYMPIAD**  
— AT THE —  
**UNIVERSITY OF FLORIDA**

Northern Regional: January 19<sup>th</sup>, 2019

# Protein Modeling C Test

**Name(s):** \_\_\_\_\_

**Team Name:** \_\_\_\_\_

**School Name:** \_\_\_\_\_

**Team Number:** \_\_\_\_\_

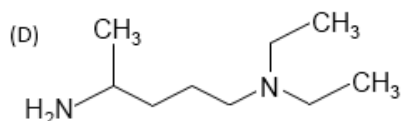
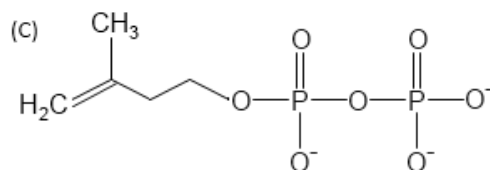
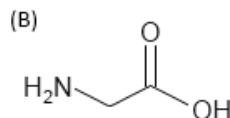
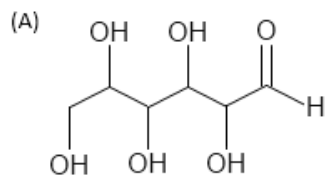
**Rank:** \_\_\_\_\_

**Score:** \_\_\_\_\_

## Multiple Choice

1. Which molecule is produced by the **cas** genes in the CRISPR-Cas mechanism? (1pt.)
  - a. pre-crRNA
  - b. CRISPR-Cas surveillance complexes
  - c. cDNA
  - d. Cas protein
  - e. All of the above
2. Which of the following is associated with the Cas9 protein? (1pt.)
  - a. Restriction enzyme
  - b. Transpeptidase reaction
  - c. Endonuclease
  - d. all of the above
  - e. a and c
3. Which of the following amino acids is correctly matched with its characteristics? (1pt.)
  - a. Tryptophan- Basic
  - b. Phenylalanine- aromatic, least hydrophobic
  - c. Proline- cyclic
  - d. a and b
  - e. none of the above
4. Which of these reactions is involved with peptide bond formation? (1pt.)
  - a. Elimination Reaction
  - b. Redox Reaction
  - c. Dehydration
  - d. Hydrolysis
  - e. a and d
5. Which of these families of proteins are considered natural protease inhibitors? (1pt.)
  - a. lipocalin
  - b. trypsin
  - c. thrombin
  - d. none of the above
  - e. a and b
6. Which molecule's function does the anti-CRISPR protein AcrIIA2 block, and to what extent does it do so? (1pt.)
  - a. crRNA (fully)
  - b. dSpyCas9 (fully)
  - c. dSpyCas9 (partially)
  - d. crRNA (partially)
  - e. none of the above

7. Which of the following structures is not an amino acid but has a tertiary amine? (1pt.)



8. What mechanism does Cas9-mediated dsDNA cleavage use? (1pt.)

- a. anabolism
- b. catabolism
- c. exergonic
- d. endergonic
- e. b and c

9. What two functional groups must a molecule possess to be considered an amino acid? (1pt.)

- a. alcohol group and  $-\text{COOH}$
- b.  $-\text{OH}$  and  $-\text{ROR}$
- c. phosphate group and  $-\text{NH}_2$
- d.  $-\text{COOH}$  and amino group
- e. none of the above

10. Which of the following makes each amino acid unique? (1pt.)

- a. side chain
- b. number of carbons on the alpha hydrogen
- c. number of hydrogens on the beta carboxyl group
- d. how many water molecules are attached to the nitrogen of the amino group
- e. all of the above

## Short Answer

11. What does PAM stand for in respect to the CRISPR-Cas9 systems and what importance do they hold in the activity of the Cas9 protein? (3 pts.)
  - a. Which stage of the CRISPR-Cas system do spacers function in, and how? (1 pt.)
12. What amino acid does the bridge helix in the structure of AcrIIA4–SpyCas9–sgRNA have an abundance of, and what role does the bridge helix play in enhancing or inhibiting the progress of this molecule? (4 pts.)
13. What are the three stages of the CRISPR-Cas immunity response? (Give a detailed response) TIEBREAKER\*\*\* (3 pts.)
14. Conformational changes in the Cas9 are triggered by the binding of what nucleic acid molecule? Be sure to be specific. TIEBREAKER\*\*\* (4 pts.)
15. AcrIIA2 and AcrIIA4 block the enzymatic activity of SpyCas9 in a \_\_\_\_\_ manner. (2 pts.)
16. Describe primary, secondary, and tertiary folding in respect to proteins. (3 pts.)