TAKE HOME EXAM FOR THE MOLECULAR GENETICS REVIEW BIOL 110

To understand microbiology, it is essential to have a fairly good understanding of such basic points of molecular genetics (proteins, enzymes, DNA, RNA, transcription, translation, and mutation. The purpose of this take home exam is to enable you - or force you if you prefer - to review these topics that you learned in your prerequisite course, BIOL 110. It will also introduce you to mechanisms of genetic recombination in bacteria.

Read the Review of Molecular Genetics for Take Home Exam included in your hard copy of my Lecture Guide. It can be found at the end of Part-1 of my BIOL 230 Lecture E-text following the Unit 3 segment. I would urge you to use the hard copy of this material in conjunction with the illustrations and animations in the online version found on my web page at http://faculty.ccbcmd.edu/courses/bio141/lecguide/takehome/index.html or by clicking on “Take Home Exam” in your Blackboard course menu.

After you read these sections and study the illustrations and animations, answer the following Take Home Exam.
BIOL 230 MICROBIOLOGY

TAKE HOME EXAM FOR THE MOLECULAR GENETICS REVIEW

Name:

Lab Section:

60 points

1. Matching

_____ The process wherein mRNA is synthesized to be complementary to a gene.

_____ The process wherein tRNA carries specific amino acids to the ribosomes and inserts them in proper place according to the mRNA "message."

_____ The order of amino acids in a protein.

_____ The sequence of purine and pyrimidine bases on one strand of DNA that codes for the amino acid sequence of a particular protein or polypeptide.

_____ Metabolic reactions in which molecules are broken down.

_____ The folded, three-dimensional, functional shape of a protein.

A. gene           F. anabolic reactions
B. nucleotide          G. catabolic reactions
C. primary protein structure     H. transcription
D. secondary protein structure     I. transformation
E. tertiary protein structure      J. translation

2. _____ Which describes a DNA nucleotide?

A. 1 deoxyribose, 1 codon, 1 phosphate
B. 1 nitrogenous base, 1 deoxyribose, 1 phosphate
C. 1 nitrogenous base, 1 phosphate, 1 ribose
D. 1 nitrogenous base, 1 protein, 1 ATP
E. faster than a speeding bullet, more powerful than a locomotive, able to leap a Wonder Llama, eg, Sven, in a single bound

3. _____ The sequence of _________________ in a DNA molecule ultimately determines the order of amino acids in proteins.

A. deoxyribose molecules
B. anticodons
C. phosphates
D. purine and pyrimidine bases
E. plasmids
4. Matching

_____ A specific nucleotide sequence at the beginning of a gene to which RNA polymerase binds to start transcription.

_____ The molecules that, along with proteins, form ribosomes.

_____ A series of 3 mRNA bases coding for no amino acid; serves as a signal to terminate translation.

_____ A series of 3 tRNA bases complementary to a specific codon.

_____ The molecule synthesized by complementary base pairing of RNA nucleotides with DNA nucleotides to match a portion of one strand of DNA coding for a protein or polypeptide.

_____ A series of 3 consecutive mRNA bases coding for one specific amino acid.

_____ The site on a 50S ribosomal subunit to which new charged tRNA molecules first attach.

_____ The enzymes that initiate and terminate transcription as well as join RNA nucleotides together.

_____ The molecules that picks up specific amino acids and carries those amino acids to the ribosomes during translation.

A. anticodon         G. "P" site of ribosome
B. "A" site of ribosome      H. promoter region
C. codon          I. rRNA
D. DNA polymerase       J. RNA polymerases
E. mRNA          K. tRNA
F. nonsense (stop) codon

5. _________________ molecules of tRNA with one or more attached amino acids can bind to a single ribosome at one time.
   A. one
   B. two
   C. three
   D. four
   E. 376,251,134.628, + or - pi (which, by one of those strange quirks of fate, just happens to be the telephone number of Olga, booking agent and personal manager to Sven, the Wonderous Wonder Llama - not available for birthdays)

6. _____ Which does NOT describe an R-plasmid?

   A. usually has genes for coding for a sex pilus
   B. carried from one bacterium to another by temperate phages
   C. usually allows for conjugation
   D. found in many Gram-negative bacteria
   E. has genes for multiple antibiotic resistance

7. _____ A tRNA with an ACC anticodon will hydrogen bond with a ______ mRNA codon. (Use your codon sheet, Fig. 8 in the transcription section; Fig. 2 in the translation section.)

   A. UCC
   B. ACC
   C. UGG
   D. TGG
   E. stop
8. _____ Which does NOT describe transcription?
   A. complementary base pairing
   B. RNA polymerase
   C. mRNA synthesis occurs
   D. copying of a portion of one strand of DNA
   E. tRNA carries amino acids to the ribosomes

9. _____ Addition and deletion mutations usually result in:
   A. substitution of one base in the DNA
   B. what happens when the dental technician X-rays your teeth after always leaving the room and giving
      you flimsy excuses for doing so like "I have to go put my socks in the dryer" or "I think my Wonder
      Llama just threw up a hairball"
   C. one wrong codon in the DNA
   D. a reading frame shift
   E. one wrong amino acid in protein

10. _____ The nitrogenous bases cytosine and thymine are:
    A. pyrimidines
    B. proteins
    C. codons
    D. complementary to each other
    E. purines

11. _____ Complementary base pairing is the hydrogen bonding of:
    A. adenine with cytosine; guanine with uracil
    B. adenine with guanine; thymine with uracil
    C. adenine with thymine; cytosine with guanine
    D. adenine with guanine; thymine with cytosine
    E. Mo with Larry; Curly with Sven the Wonder Llama

12. _____ During protein synthesis, the proper amino acid is put in the proper place according to the genetic message
    by:
    A. a nonsense codon
    B. RNA polymerase
    C. an anticodon hydrogen bonding with a codon
    D. transcription
    E. bet you thought I was going to say "Sven" of Wonder Llama fame

13. _____ A tRNA with an ACC anticodon will insert the amino acid ________ during translation. (Use your codon
    sheet, Fig. 8 in the transcription section; Fig. 2 in the translation section.)
    A. Arg
    B. Trp
    C. Ser
    D. Cys
    E. Svn
14. _____ In RNA, uracil hydrogen bands with:
   A. cytosine  
   B. adenine  
   C. thymine  
   D. guanine  
   E. Throckmorton the Mediocre Moose (whose second cousin, by coincidence, is Sven the Wonder Llama)

15. _____ In the primary structure of a protein, the amino acids are connected to one another by:
   A. disulfide bonds  
   B. hydrogen bonds  
   C. congealed Yoo Hoo brand chocolate drink  
   D. peptide bonds  
   E. RNA

**DISCUSSION**

1. Briefly **describe the FUNCTION** of the following in terms of bacterial protein synthesis:  (2 points each)
   A. mRNA
   
   B. codon
   
   C. tRNA
   
   D. anticodon
   
   E. nonsense codon
2. As a result of a substitution mutation, a **DNA base triplet** 3' ATC 5' is charged to 3' ACT 5'. Describe specifically what effect this would have on the resulting protein. (Use your codon sheet, Fig. 8 in the transcription section; Fig. 2 in the translation section and show your reasoning.)

(4 points)

3. Describe **2 different mechanisms** of mutation and, in terms of protein synthesis, describe the **4 possible results** that may occur as a result of these mechanisms. (7 points)

4. **DESCRIBE** how the **order of nucleotide bases along a gene in the DNA** ultimately determines the primary structure of a protein and how the primary structure ultimately determines the **three-dimensional shape and function of the protein** coded for by that gene. (5 points)

5. Describe **R-plasmid conjugation** and state its significance to medical microbiology. (3 points)

6. Contrast **transformation** and **transduction** in bacteria. (2 points)