

BIOLOGY 205
Midterm II - 21 May 2010
(100 points total)

Name _____

Multiple choice questions – 3 points each (please circle the letter of single best answer).

1. The enzyme that charges the tRNA molecules with appropriate amino acids and thereby acts as the universal code translator is:
 - A. tRNA isomerase
 - B. amino-tRNA chargeatase
 - C. reverse transcriptase
 - D. aminoacyl-tRNA synthetase
 - E. tRNA primase

2. Which of the following correctly ranks the structures in order of **size**, from *smallest* to *largest*?
 - A. chromosome → gene → codon → nucleotide
 - B. gene → chromosome → codon → nucleotide
 - C. nucleotide → chromosome → gene → codon
 - D. nucleotide → codon → gene → chromosome
 - E. chromosome → codon → gene → nucleotide

3. For decades, we have known that the nucleus contained DNA and histone proteins. The prevailing early opinion was that the histone proteins were the genes and the DNA was a simple “string” that held them together. The reason for this belief was that...
 - A. proteins are made of 20 amino acids and DNA is made of four nucleotides
 - B. proteins take a greater variety of three-dimensional forms
 - C. proteins have four different levels of structure; DNA has only two
 - D. proteins can vary in their polarity and charge; DNA cannot
 - E. all of these are correct

4. Which of the following is **NOT** an example of a transcription factor, DNA binding protein motif?
 - A. Helix-turn-helix
 - B. Zinc fingers
 - C. Arginine toes
 - D. Leucine zippers
 - E. Homeodomains

5. The molecular biological method that takes advantage of thermostable DNA polymerase?
 - A. PCR
 - B. RFLP
 - C. sequencing
 - D. cloning
 - E. hybridization

6. Which of the following enzymes caused a modification of the original central dogma regarding the flow of information?
- reverse transcriptase
 - aminoacyl-tRNA synthetase
 - Taq polymerase
 - RNA II polymerase
 - DNA III polymerase
7. An organism has 20% cytosine in its DNA. What percent of thymine is in its DNA??
- 90%
 - 60%
 - 30%
 - 20%
 - 15%
8. Each of the following statements are correct regarding Eucaryotic genes and genomes EXCEPT?
- Polysomes inside the nucleus are common
 - Repeat sequences are common
 - Capping, tailing and splicing of mRNA is required
 - Introns are common
 - Enhancers and silencers are common
9. The universal genetic code is best described as:
- both ambiguous and redundant
 - degenerate but not ambiguous
 - ambiguous but not redundant
 - neither ambiguous nor redundant
 - missense but not nonsense
10. Imagine that a novel life form is found deep within Europa's Ocean. Evaluation of its DNA yields no surprises in terms of purines and pyrimidines. However, it is found that a codon for this life form contains just two bases. How many different amino acids maximum could this organism be composed of?
- 4
 - 8
 - 16
 - 32
 - 64
11. (5 points - all or nothing) What is the order in which these events occur in the cell cycle? Starting with **G1 phase as #1**, please number the stages (1 through 9):
- | | | |
|-----------------|-------------------|--------------------|
| _____ G1 phase | _____ prophase | _____ anaphase |
| _____ metaphase | _____ telophase | _____ G2 phase |
| _____ S phase | _____ cytokinesis | _____ prometaphase |

12. Match the single best answer of a biological macromolecule that best describes each statement below (i.e., put the correct # next to each statement). The choices may be used once, more than once, or not at all (**2 points each, with one free miss**).

Your choices are:

1. mRNA

2. tRNA

3. DNA

4. Amino Acid

5. Nucleoside triphosphate

6. Polypeptide (i.e., Protein)

- | | | | |
|-------|-----------------------------------|-------|--------------------------------------|
| _____ | The product of translation | _____ | Substrate for RNA polymerase |
| _____ | The product of transcription | _____ | Substrate for a ribosome |
| _____ | A transcription initiation factor | _____ | Template for RNA polymerase |
| _____ | Location of a codon | _____ | Template for a ribosome |
| _____ | Location of an anticodon | _____ | Primary energy carrier (in the cell) |

13. Match the single best answer with the statements below. The choices may be used once, more than once, or not at all (**2 points each, with one free miss**).

Your choices are:

1. Telomere

2. Ribosome

3. Spliceosome

4. Condensins

5. Histone Acetylase (HAT)

6. Cohesins

- | | |
|-------|---|
| _____ | Contains its own short piece of template RNA used to make repetitive DNA. |
| _____ | Affects the packaging/accessibility issue of genes in tightly packed nucleosomes. |
| _____ | Holds sister chromatids together after DNA has been replicated. |
| _____ | Requires the use of snRNPs. |
| _____ | This is where translocation during translation occurs. |
| _____ | Contains both a large subunit and a small subunit necessary for proper function. |
| _____ | The cellular structure that solves the linear end-replication problem for chromosomal DNA. |
| _____ | Helps to form loop domains in the chromosome just prior to M phase. |
| _____ | Used in the processing of mRNA inside the nucleus. |
| _____ | Considered a type of ribozyme (O.K., yes, more than one right answer possible here, can you name them all for 2 bonus points?). |

Short answer – Number of points in parentheses.

14. **(6 points)** How many ATP equivalents does it take to produce polypeptide that is 11 amino acids long?
15. **(3 points)** What does tagging a protein with **ubiquitin** generally result in happening next?
16. **(6 points)** Consider the differences between the **DNA replication** on the lagging strand and on the leading strand. What enzymes are required that are in addition to the enzymes used on the leading strand to solve the problem of Okazaki fragments on the lagging strand?
17. **(3 points)** What are three different types of covalent modifications that are also considered **posttranslational events** which are possible with a newly synthesized protein?

18. **(6 points)** Consider the Meselson and Stahl experiment regarding bacteria with heavy ^{15}N DNA grown in light ^{14}N media. **(A)** Upon CsCl density gradient ultracentrifugation of the first generation DNA, which **model(s)** of DNA replication is/are supported **if** the resulting DNA is both *heavy* and *light* in density? **(B)** Which **model(s)** of DNA replication is/are supported after the second generation **if** the resulting DNA is both *intermediate* and *light* in density?
19. **(5 points)** Consider **negative** operon control. **(A)** Name a pathway that undergo this type of control, **(B)** what is the repressor made from, **(C)** what is the operator made from, AND **(D)** how does the repressor cause negative control to occur?
20. **Extra Credit (8 points max)** Briefly describe the mechanism AND name the family of “suicide” proteases that mediate an intracellular proteolytic cascade during apoptosis.