

Student name: _____

Student number: _____

BCH / BIO 3170

Molecular Biology

Fall 2003

Midterm Exam, Thursday, October 16, 2003

Note:

1. This is closed book exam.
2. Please answer six of the following seven questions
3. Answer the questions in the space provided.
4. Each question is worth 5 points (30 points total for this exam).
4. Don't forget to write your name and student number at the top of this page.
5. Please ensure that you have signed the attendance sheet before you leave.

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1. In DNA, the nucleotide bases are either purines or pyrimidines.

(i) Name the purine bases (1 point)

(ii) Illustrate, using a simple sketch, the difference between purines and pyrimidines; it is not necessary to show all of the specific side groups (2 points).

(iii) DNA contains thymine rather than uracil, and deoxyribose rather than ribose. How have these differences between DNA and RNA been explained? (2 points).

2. Given the RNA sequence below:

5' AUGGGCGCUAAAUUCUAA 3'

(i) write the sequence of the DNA strand from which it was transcribed. Remember to write the DNA sequence in the usual 5' to 3' direction. (2 points).

5'

3'

2. (cont).

(ii) Using the attached genetic code table write the amino acid sequence that would be translated from this mRNA. (1 point).

(iii) How is the amino acid selenocysteine incorporated into proteins? (2 points).

3. (i) What is the composition of the 30 nanometer chromatin fiber? (2 points)

(ii) What is the proposed function of histone "tails"? (1 point).

(iii) What role do Sir proteins play in chromatin? (2points).

4. Briefly outline the functions of each of the following enzymes (1 point for each).

(i) primase

(ii) helicase

(iii) topoisomerase I

(iv) telomerase

4. (cont.)

(v) ligase

5. (i) In the context of DNA damage, distinguish between deamination and depurination (1 point).

(ii) A pair of homologous chromosomes that pair during meiosis contains a total of how many homologous strands of DNA? Briefly explain your answer (2 points).

(iii) What is the relationship between heteroduplex formation and gene conversion? (2 points).

6. (i) True or False: transcriptional promoters can occur on both strands of chromosomal DNA. Briefly explain your answer. (1 point).

(ii) Distinguish between activator proteins and general transcription factors (2 points).

(iii) Name at least one function of the eukaryotic transcription factor TFIIF (2 points).

7. (i) What is the function of intron branch point sequences? (1 point).

(ii) Outline the major steps in the polyadenylation of eukaryotic mRNAs (2 points).

(iii) The translational machinery in human cells uses 47 different tRNAs to translate 61 different codons into 20 different amino acids. How is this possible? (2 points).

Table 1. RNA triplet codons and their corresponding amino acids.

	U	C	A	G
U	UUU Phenylalanine UUC Phenylalanine UUA Leucine UUG Leucine	UCU Serine UCC Serine UCA Serine UCG Serine	UAU Tyrosine UAC Tyrosine UAA Stop UAG Stop	UGU Cysteine UGC Cysteine UGA Stop UGG Tryptophan
C	CUU Leucine CUC Leucine CUA Leucine CUG Leucine	CCU Proline CCC Proline CCA Proline CCG Proline	CAU Histidine CAC Histidine CAA Glutamine CAG Glutamine	CGU Arginine CGC Arginine CGA Arginine CGG Arginine
A	AUU Isoleucine AUC Isoleucine AUA Isoleucine AUG Methionine	ACU Threonine ACC Threonine ACA Threonine ACG Threonine	AAU Asparagine AAC Asparagine AAA Lysine AAG Lysine	AGU Serine AGC Serine AGA Arginine AGG Arginine
G	GUU Valine GUC Valine GUA Valine GUG Valine	GCU Alanine GCC Alanine GCA Alanine GCG Alanine	GAU Aspartate GAC Aspartate GAA Glutamate GAG Glutamate	GGU Glycine GGC Glycine GGA Glycine GGG Glycine