

Name _____

Mic 226 Fall 1995 Exam II

Read the questions carefully. Answers which are correct in content but not relevant to the question cannot be scored correct. Understanding the questions is part of the exam. Please do not ask questions about the questions unless they are ambiguous, in which case the class will be interrupted and the same explanation made to everyone.

I. (12 pts) A. AZT, azido dideoxy thymidine, a structural analog of thymidine, can be phosphorylated and incorporated into a growing DNA strand, thereby inhibiting further DNA polymerization. Draw the structural formula for AZT. Give a written explanation of why AZT incorporation inhibits further DNA synthesis. It is not necessary to draw the structure of a growing polynucleotide chain.

B. Why is AZT selectively toxic against HIV ? _____

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2. (12 pts) The following words or expressions refer to chromosome replication. Define or tell how this material is used in replication.

A. Template _____

B. Primer _____

3. (36 pts) Most genes are expressed by transcription into mRNA which is translated into one or more proteins. Genes of bacteria consist of Hydrogen-bonded double- stranded DNA ; the nucleotide (G-A-T-C) sequence of the DNA is the genetic information of that gene. List twelve additional characteristics of transcription or its control. These characteristics, structures, sequences, or compounds can be relevant to any of the following: The structure or function of genes; Compounds or other materials required for mRNA polymerization; Signals in messenger required for translation; or Factors involved in gene regulation. Briefly list the function of each. Low molecular weight precursors should be grouped in one answer. Specific sequences mentioned for DNA cannot be repeated as a separate answer for mRNA.

A. _____

B. _____

C. _____

D. _____

E. _____

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3. Continued

F. _____

G. _____

H. _____

I. _____

J. _____

K. _____

L. _____

4. (16 pts) For each of the mutations below, describe in a sentence without abbreviations the phenotype of the mutant bacterium. Assume that each mutation inactivates the protein product of the gene. It is not necessary to describe the phenotype of the wild-type organism. Then, tell why the inactive protein causes the phenotype. Mutations in:

A. The lactose operon gene for beta-galactosidase. Phenotype: _____

Why: _____

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4. Continued

B. The gene for adenylate cyclase (the wild-type enzyme catalyzes synthesis of cyclic AMP from ATP).

Phenotype: _____

Why: _____

5. (12 pts) Operons have sites and structural genes. Give two ways in which sites and structural genes are different. For each of these ways, describe the characteristics of both sites and genes.

A. _____

B. _____

6. (12 pts) The mutagen, nitrous acid, deaminates cytosines to form uracils.

A. Give structural formulas for both cytosine and uracil (identify each).

B. Assume that the sequence 5' AATC 3' exists within one strand of a gene (and its complement exists in the other strand). Assume that nitrous acid converts the C to a U. Diagram the changes which occur in both strands (if any) during the deamination and over the following two generations. Show both strands and label their 5' and 3' ends. Indicate only the identities of the nucleic acid bases and use abbreviations.