

Biochemistry 694:301
Final Exam Sweder & Deis
Tue. Dec. 18, 2001

Name _____
last 5 digits I.D. Num _____
Row Letter ____ Seat Number _____

This exam consists of two parts. Part I is multiple choice. Each of these 25 questions is worth two points. Answer the Part I questions on this sheet, below. Answer the Part II questions on the question pages.

Please use BLOCK CAPITAL letters like this --- A, B, C, D, E. Not lowercase!

- | | | |
|----------|-----------|-----------|
| 1. _____ | 10. _____ | 18. _____ |
| 2. _____ | 11. _____ | 19. _____ |
| 3. _____ | 12. _____ | 20. _____ |
| 4. _____ | 13. _____ | 21. _____ |
| 5. _____ | 14. _____ | 22. _____ |
| 6. _____ | 15. _____ | 23. _____ |
| 7. _____ | 16. _____ | 24. _____ |
| 8. _____ | 17. _____ | 25. _____ |
| 9. _____ | | |

GRADE:

Part I Total _____

Part II:

II-1 _____

II-2 _____

II-3 _____

II-4 _____

II-5 _____

Part II Total _____

Total, I & II _____

1. What happens immediately after the initiator protein (dnaA) binds to an origin of DNA replication?
 - A. superhelical tension disappears
 - B. DNA polymerase I binds to the DNA
 - C. DNA locally unwinds
 - D. DNA becomes hemimethylated
 - E. Okazaki fragments are made

2. A single nucleotide substitution of a purine for a pyrimidine in the DNA sequence of a gene is referred to as a:
 - A. deletion mutation
 - B. debilitating mutation
 - C. insertion mutation
 - D. transition
 - E. transversion

3. How does the β' subunit of the DNA polymerase III holoenzyme assist DNA replication?
 - A. Removes RNA from the DNA template
 - B. Acts as a sliding clamp, improving DNA polymerase III processivity
 - C. Acts as a sliding proofreader, improving replication fidelity
 - D. Removes negative supercoiling from the DNA template
 - E. Acts as a sliding clamp, decreasing DNA polymerase III processivity

4. Topoisomerase II makes a break in both DNA strands of the double helix to relieve superhelical tension. The cleavage and ligation carried out by topoisomerase II changes the linking number by:
 - A. -2
 - B. -1
 - C. 0
 - D. +1
 - E. +2

5. Why is DNA polymerase III a better enzyme than DNA polymerase I for replicating the *E. coli* chromosome?
 - A. DNA polymerase III uses a primer
 - B. DNA polymerase III doesn't require dNTP's
 - C. DNA polymerase III has a proofreading function
 - D. DNA polymerase III is more processive
 - E. DNA polymerase III doesn't require magnesium

6. DNA forms extensive regions of double-stranded DNA of the B form because:
 - A. DNA possesses complementary base ratios (amt. of A = amt. of T etc.)
 - B. Lack of 2'-OH allows sugar ring to fit nicely in B form DNA
 - C. Lack of 3'-OH allows sugar ring to fit nicely in B form DNA
 - D. Answers A & B
 - E. Answers A & C

7. What does puromycin resemble which enables puromycin to terminate peptide chain elongation?
- A. amyl nitrite
 - B. aminoacyl-tRNA synthetase
 - C. aminopterin
 - D. aminoacyl-tRNA
 - E. aminoglycosides
8. One difference between RNA polymerases and DNA polymerases is that RNA polymerases don't require a:
- A. activated precursors (nucleotide triphosphates)
 - B. RNA template
 - C. Primer
 - D. DNA Template
 - E. divalent cation
9. How does actinomycin D inhibit RNA transcription?
- A. terminates RNA chain growth
 - B. blocks the rNTP binding site
 - C. prevents DNA from serving as a good template
 - D. binds the β subunit of RNA polymerase
 - E. prevents ATP hydrolysis
10. What happens when helicase is loaded onto the unwound region of DNA at the origin of replication?
- A. the initiator protein, dnaA, forms a large DNA-protein complex
 - B. the rest of the replication complex loads onto the replication fork
 - C. DNA becomes hemimethylated
 - D. Yokoono fragments are made
 - E. Superhelical tension disappears
11. Proteins are made starting from:
- A. the amino end and proceeding toward the carboxyl end
 - B. the carboxyl end and proceeding toward the amino end
 - C. the middle and proceeding toward both amino and carboxyl end
 - D. the 3' end toward the 5' end
 - E. the 5' end toward the 3' end
12. Why don't the DNA intermediates float away from gyrase during the cleavage and ligation steps?
- A. reaction intermediates are constrained by the nuclear matrix
 - B. reaction intermediates are covalently attached to gyrase
 - C. reaction intermediates are constrained by superhelical tension
 - D. reaction intermediates are constrained by the nuclear membrane
 - E. insufficient energy to complete the reaction

13. During transcription RNA polymerase uses one strand of the DNA double helix as a template. Which of the following sentences is true?
- A. the coding strand is the transcribed strand
 - B. the coding strand is the nontranscribed strand
 - C. the noncoding strand is the nontranscribed strand
 - D. the coding strand is the antisense strand
 - E. none of the above
14. What is a distinguishing feature of the sites recognized and cleaved by restriction endonucleases (or restriction enzymes)?
- A. the DNA forms a hairpin
 - B. the DNA contains a palimpsest
 - C. the DNA contains a palindrome
 - D. the DNA contains a palomino
 - E. a distinct limp in its gait
15. Which protein is modified at diphthamide residues (a modified form of histidine) by diphtheria toxin to shut down protein synthesis?
- A. elongation factor 2 (EF2)
 - B. initiation factor 2 (IF2)
 - C. initiator protein dnaA
 - D. 30S ribosomal subunit
 - E. subunit of RNA polymerase
16. Why isn't the nucleotide sequence in messenger RNA (mRNA) in eukaryotes the same as the nucleotide sequence in the DNA?
- A. post-translational modification
 - B. DNA proofreading
 - C. RNA splicing
 - D. polycistronic transcription and processing
 - E. beats me
17. Urinary tract infections can be treated with ciprofloxacin or nalidixic acid. What process is inhibited in bacteria by these compounds?
- A. ligation by DNA ligase
 - B. transcription by RNA polymerase
 - C. replication by DNA replication
 - D. translation by the ribosome
 - E. cleavage and ligation by gyrase
18. Why is methotrexate used as a chemotherapeutic agent?
- A. Inhibits DHFR
 - B. prevents Thymine synthesis
 - C. stops tumor growth
 - D. inhibits cell division
 - E. all of the above
19. Gout is due to high levels of
- A. salvage enzymes
 - B. Urea
 - C. Goutamine
 - D. Uric Acid
 - E. Uricase

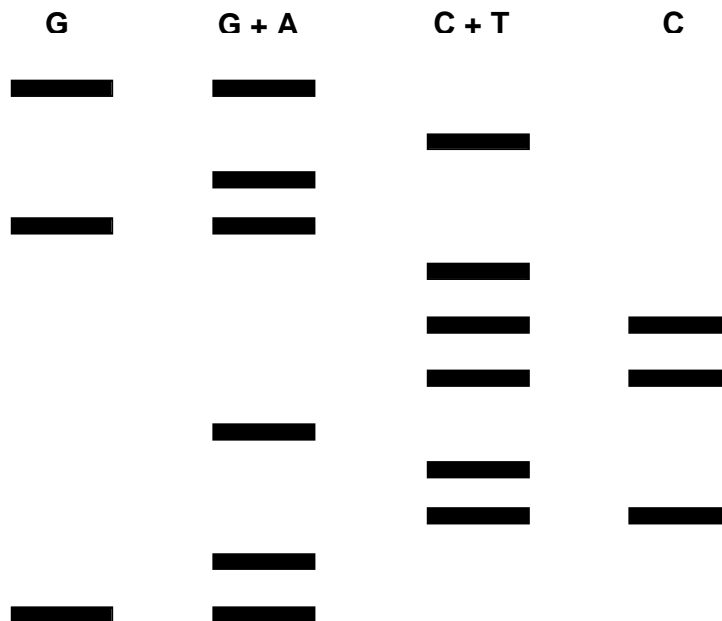
PART II Answer these questions here on the question pages.

1. a. Maxam-Gilbert sequencing involves the differential chemical cleavage of purines or pyrimidines in radioactively labeled DNA. Products of the cleavage reaction are resolved from each other by denaturing polyacrylamide electrophoresis (i.e., the DNA is all single-stranded during the electrophoresis). X-ray film is exposed to the acrylamide gel containing the resolved DNA fragments. How does the acrylamide matrix enable resolution of the DNA molecules from one another? How does exposure of the X-ray film to the acrylamide gel enable an investigator to determine where the DNA fragments are in the gel?

(5)

- b. The X-ray film shown below was exposed to a denaturing polyacrylamide gel containing cleavage products of an unknown DNA sample. The unknown DNA sample was analyzed by Maxam-Gilbert sequencing. Please write the DNA sequence of the unknown DNA sample.

(5)



2. a. The Sanger, or enzymatic, method for DNA sequencing takes advantage of 2',3' dideoxy nucleotides. Why are 2',3' dideoxy nucleotides used in the Sanger method of DNA sequencing? Why are there four different reactions used to determine the DNA sequence? For full credit write a clear, concise, and complete answer.

(5)

- b. Using the chart of the Genetic Code below, decipher the peptide that is encoded by the RNA molecule shown. Use the single-letter designation for amino acids, start with the first start codon, and end at a stop codon.

5'-CCCUGCGAUGUAUGAACUGGUGAUUAGCCUAAUAGUUGAGAGUUGAUAGGCG-3'

3 a. What is the function of the σ subunit of the RNA polymerase holoenzyme?

(3)

b. What is unusual about the 5' end of prokaryotic RNA molecules?

(3)

c. Describe the two methods for termination of bacterial RNA synthesis.

(3)

d. Where does the signal reside that determines when prokaryotic transcription termination takes place?

(1)

- 4 a. Eukaryotic messenger RNA molecules contain the information necessary to make proteins, yet the genes encoding the messenger RNA contain intervening sequences which do not encode for proteins. What are the protein-encoding portions of the genes called? How are the intervening sequences removed and where does the information for removing intervening sequences reside? Explain how the protein-encoding sequences are aligned and joined together. Be clear and complete in your answer.

(5)

- b. What is unusual about the 3' ends of eukaryotic messenger RNA molecules? What is the putative advantage of these 3' end modifications?

(3)

- c. How would you discriminate between the three eukaryotic RNA polymerases in a biochemical experiment, i.e., is there an inhibitor you could use?

(2)

5. a. Show the cyclic portion of the Urea Cycle. Draw all reactants and products and indicate all cofactors.

(7)

b. Using "stick and P" figures, plus the full structure of Methionine, show how SAM (S-Adenosyl Methionine) is synthesized.

(3)