

Name _____

BIOCHEMISTRY 353, FINAL EXAM, SECTION 1, MAY, 2002

Before you start, **PRINT** your name top of this page and every page. Notes of any kind are NOT permitted.

Confine your answers to the space provided. Only answers in the space provided will be graded. If you cross out an entire answer, you may write your new answer in the same amount of space on the back of the page. Be sure to state clearly in a box on the front of the page that the answer is on the back of the page, or your answer will not be seen by the grader.

THIS SECTION OF THE EXAM IS 6 PAGES LONG. BEFORE STARTING CHECK TO BE SURE THAT YOU HAVE ALL OF THE PAGES.

DO NOT TURN THIS PAGE OVER UNTIL INSTRUCTED TO DO SO BY A PROCTOR

Part I _____/24 points

Part II _____/24 points

Part III _____/20 points

TOTAL FOR SECTION 1 _____/ 68 points

Part I. TRUE-FALSE (points, 2 points each) Circle T for statements that are True and F for statements that are false. **There is no deduction for wrong answers. You are free to guess.**

- T F 1. Activation of transcription by eukaryotic transcription factors bound to DNA is much less common than repression of gene transcription by eukaryotic transcription factors bound to DNA.
- T F 2. The DNA binding domains of steroid hormone receptors contain bound iron.
- T F 3. When *E. coli* are grown in a medium containing glucose but no lactose, lac repressor is almost always bound to the Lac operator.
- T F 4. If radioactive 2'3' dideoxy ATP is added to a dideoxy sequencing reaction, the appropriate enzymes and components are all present, and there is not premature termination, after the reaction, radioactive 2'3' adenosine will be the last nucleotide at the 3'-end of the DNA.
- T F 5. Histone H1 is not found in the core histone octamer.
- T F 6. For a constitutively expressed non-regulated prokaryotic gene, mutations that change the sequence of the -10 region so that it contains a higher proportion of G:C base pairs than the starting sequence will usually decrease the rate of transcription of that gene.
- T F 7. In transcription by eukaryotic RNA polymerase III the newly synthesized RNA chain grows in the 3'→5' direction.
- T F 8. Addition of a new inhibitor that blocks the enzymatic activity of most histone acetylases (also called histone acetyl transferases or HATs) to a cell-free transcription system using a test gene organized into a native chromatin structure would likely decrease the rate of transcription of the test gene.
- T F 9. Transcription by RNA polymerase II almost always terminates at the last nucleotide of the AAUAAA sequence that specifies polyadenylation.
- T F 10. An important step in demonstrating that DNA is the hereditary material was the demonstration that DNase had no effect on the ability of material isolated from heat killed *Pneumococcus* bacteria to infect and kill mice.
- T F 11. If you very rapidly label the newly synthesized DNA in an *E. coli* mutant containing 5 times more DNA ligase than normal *E. coli*, the fragments of newly synthesized DNA (hint: Okazaki fragments) isolated from the bacteria containing the increased level of DNA ligase will be shorter than those in the bacteria containing normal DNA ligase levels.
- T F 12. A mutation in eukaryotic RNA polymerase II that prevented the “clamp” from closing would probably result in the synthesis of RNA transcripts that are longer than usual.

Part II. Matching: (24 Points, 2 points each, There is no penalty for guessing) Next to each of the statements write the **NUMBER** of the item on the list that best carries out the reaction or process. If none of the items on the list is an appropriate answer write in 15. You may use a given answer more than once, or not at all.

1. Bacteriophage T4 DNA ligase
2. Zinc
3. Histone deacetylase (HDAC)
4. RNA polymerase III
5. Hammerhead ribozyme
6. Luciferase
7. DNA topoisomerase I
8. DNA polymerase
9. Sigma factor or sigma subunit
10. Leucine zipper
11. 5'-CCGGTC-3'
3'-GGCCAG-5'
12. Sigma factor (or sigma subunit)
13. Luciferase
14. Magnesium
15. None of the above

- _____ a. An enzyme that requires a primer to copy DNA.
- _____ b. An enzyme that covalently joins two blunt ended double stranded DNA fragments in the presence of ATP.
- _____ c. Recognizes the AAUAAA sequence near the 3'-end of most eukaryotic mRNAs.
- _____ d. An enzyme that increases the linking number of negatively supercoiled DNA by 1. In other words, it makes the linking number less negative.
- _____ e. Base pairs with a complementary sequence in its RNA substrate and cleaves the substrate.
- _____ f. This enzyme correctly initiates transcription even if all of the sequence upstream of the transcription start site is deleted.
- _____ g. This protein is widely used as a reporter gene in transient transfections of eukaryotic cells.
- _____ h. When this enzyme is inhibited by trichostatin A, the ability of histones bound to DNA to repress transcription is decreased.
- _____ i. A motif important in protein dimerization and in protein-protein interactions.
- _____ j. When this is missing from prokaryotic RNA polymerase transcription of nicked DNA increases.

5. Histones repress transcription. Modification of lysine side chains on the amino acids in the N-terminal region of histone H3 by acetylation or methylation is associated with relief of histone repression of transcription. To get rid of these positively charged amino acids side chains entirely, a student deleted the entire N-terminal 30 amino acids from histone H3, and produced large amounts of mutant histone H3. The mutant histone H3, or the wild-type histone H3, and the other wild-type histones were used to reconstitute correctly spaced nucleosomes on a test promoter containing thyroid hormone response elements (TREs) in the 5'-region upstream of the transcription start site. Transcription was then studied in a system containing a crude HeLa cell nuclear extract that supports regulated cell-free transcription. This extract lacks thyroid receptor. Thyroid hormone and thyroid receptor were added to initiate high level transcription of the test promoter. As expected, forming nucleosomes containing the mutant histone H3 or wild-type histone H3 repressed basal transcription of the test promoter. When thyroid hormone and thyroid receptor were added to the templates reconstituted with the wild-type Histone H3, there was a large increase in transcription. In contrast, when thyroid hormone and thyroid receptor were added to the templates reconstituted with the mutant histone H3 lacking the N-terminal 30 amino acids there was very little increase in transcription.