BCH 4054 **PRE-TEST 4** **GROUP NAME _____**
November 6, 1998

This test is take-home and open book, and it is intended that all members of the group contribute to completing it. Only one copy is to be submitted by the group, and all members who participated should sign their names below. **Test is due at the end of class on Monday, November 16.**

Please use dark pencil or ink and write legibly.

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Page	Points
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Points

(9) 1. Covalent modification of a protein by phosphorylation is a common method of regulating activity of the protein. At least three kinds of kinases have been implicated in regulation of cellular processes by hormones that do not enter the cell. Explain how a hormone can activate each type of kinase by identifying the intermediate signaling steps between the hormone and the kinase.
(a) cyclic AMP dependent kinase

(b) tyrosine kinase

(c) protein kinase c

(6) 2. To illustrate the importance of tautomeric structure in the Watson-Crick base pairing, draw base pair structures showing how **cytosine** in the less stable tautomer can base pair with **adenine**, and how **guanine** in a less stable tautomer can base pair with **thymine**.

(6) 3 Following are some properties of a tissue that are consequences of the **absence** of a particular enzyme in that tissue. Identify the missing enzyme, either by name or by reaction catalyzed.

(a) Muscle cannot produce glucose, even by breaking down protein.

(b) Adipose tissue cannot synthesize triglyceride in the absence of glucose.

(c) Liver cannot oxidize ketone bodies.

(4) 4. In the Meselson-Stahl experiment, bacteria were grown in ^{15}N medium, transferred to ^{14}N medium, and removed after 0, 1, and 2 generations. The DNA was isolated and banded in a density gradient ultracentrifugation experiment. Describe how the density bands would have looked had DNA replication been **conservative** rather than **semi-conservative**.

(7) 5. You have prepared DNA from two organisms isolated from the swamps of south Georgia, designated **culture A** and **culture B**. DNA from **culture A** contains 24% G, while DNA from **culture B** contains 30% G. Complete the following table for the expected composition of the other purine and pyrimidine bases.

	%G	%A	%T	%C	Total
Culture A	24	____	____	____	100%
Culture B	30	____	____	____	100%

DNA from which organism will have the higher melting temperature?

(8) 6. From the following DNA sequences, write the complementary sequence under it (in the 3' to 5' direction), and <u>circle</u> the bases of the resulting double stranded DNA which are palindromic sequences at least four base pairs in length.

(a) 5'-GCTTCGAAC-3'
3'- 3'-

(b) 5'-CTACTACTA-3'

(c) 5'-GCGCAACG-3'
3'-

(d) 5'-TTATTGCAAG-3'
3'-

(10) 7. A circular DNA plasmid of length 1040 bp is supercoiled with a twist (T) value of 100 and a linking number (L) of 94.

(a) What is the value of the writhing number (W)?

(b) Is the plasmid negatively or positively supercoiled?

(c) What effect would topoisomerase I have on L, T, and W?

(d) What effect would DNA gyrase and ATP have on L, T, and W?

(e) Ethidium bromide is an intercalating agent that inserts between the stacked base pairs, separating the stacks and causing local unwinding that decreases the value of T. What effect would ethidium bromide have on the migration rate of the plasmid during electrophoresis?

(f) If part of the plasmid were to undergo a transition from B-DNA to Z-DNA, what would be the effect on L, T, and W?

(6) 8. Describe an Okasaki fragment. When and where is it made, and what happens to it?

(9) 9. DNA polymerase I, DNA ligase, and topoisomerase I catalyze the formation of phosphodiester bonds. What is the activated intermediate in the linkage reaction catalyzed by each of these enzymes? What is the leaving group?

(8) 10. When DNA polymerase inserts a new nucleotide into the growing DNA chain, a mistake in base pairing can be made if the base happens to be in the wrong tautomeric form. There are two mechanisms to correct this mistake. Describe them.

(6) 11. There are two mechanisms to repair thymine dimers. Explain them.

(9) 12. Deamination of bases can be a source of mutations in DNA. For each of the following possible deaminations, explain what type of mutation would occur in the DNA sequence, and how the mutation would be repaired:

(a) Deamination of cytosine

(b) Deamination of Adenine

(c) Deamination of Guanine

(6) 13. Describe the role of a glycosylase and an AP endonuclease in excision repair.

(6) 14. Explain the role of the recBCD complex in recombination.