

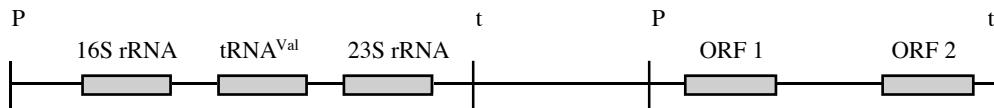
NAME: _____

MICR/MBMB 460: First Hourly Exam - 2007

The following abbreviations are used in this exam: DNAP = DNA polymerase; ORF = open reading frame; P = promoter; t = terminator.

1. (8 pts) Draw a DNA strand of three nucleotides. Indicate the position of the nitrogenous base with an "N" (there's no need to draw the base) and the phosphate with a "P" (no need to draw the oxygens). Number the carbons on one of the nucleotides. With an arrow, indicate the exact bond that would be broken by a 3'>5' exonuclease.

2. (8 pts) From the following graphic:



- Label the transcribed spacer(s) with an 'A'.
- Draw a BOX around each transcriptional unit.
- Draw a CIRCLE around each gene.
- Indicate where the ribosome binding site(s) should be with an 'X'.

3. (2 pts) DRAW the reason why it is not necessary that RNAP be able to proofread.

4. (6 pts)

a) Describe the phenotype (in brief phrases) of an *E. coli* strain that has the following genotype: *tyrA*, *bla*, *malD*.

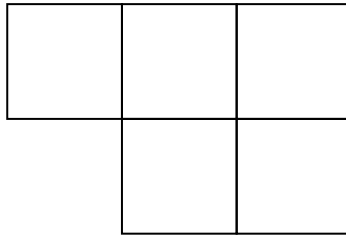
b) Would this organism form colonies on the following plates? (Just yes or no for each)

Minimal media (no amino acids) + glucose

Minimal media (no amino acids) + maltose (no glucose) + tyrosine

Minimal media (no amino acids) + glucose + tyrosine

5. (2 pts) In the graphic below, **DRAW** the charged and uncharged (empty) tRNAs as they would appear in the ribosome **IMMEDIATELY BEFORE** translocation took place.



6. (2 pts) Name **ONE** of potentially three parts of a transcriptional unit that is transcribed but not translated.

7. (2 pts) **DRAW** the fate of a protein produced through the action of tmRNA.

8. (4 pts) Regarding the Cairns experiments discussed in class, is it possible that DNAP IV and/or DNAP V play a role in selection-induced adaptive mutations? Why or why not (1-2 sentences only)?

9. (2 pts) Following a period of exponential growth (the log phase), all bacterial cultures in the lab eventually enter stationary phase. Why?

10. (2 pts) Why did the fluctuation test NOT prove that mutations were random in space (positional space)? (Answer in one sentence.)

11. (4 pts) DRAW photoreactivation repair, making sure to label the dimer and the photolyase.

12. (8 pts) In a maximum of five complete sentences, explain why UV light is mutagenic. In your answer, you must include SOS, RecA, LexA, DNAP IV and DNAP V.

13. (14 pts) You suspect a section of DNA you recently sequenced is a gene because it contains an ORF (open reading frame). The sequence upstream of the ORF is:

GAATTACGACGCTATAATCGAACGGAGCCGAGAAG

The sequence downstream of the ORF is:

GGCTATAATCAGGCATCCCATAGGGATGCCAACCACA

- a) CIRCLE the putative -10 region of the promoter.
- b) What specifically happens at the -10 region during transcription? (5 words maximum)

- c) Put a BOX around the putative terminator region.
- d) (Circle the correct answer) This is likely a rho dependent / rho independent terminator.
- e) How would you identify an ORF? (One sentence only)

- f) Give the sequences of the stop codons.

14. (10 pts)

a) BRIEFLY (1-2 sentences) describe one of the experiments described by Cairns that demonstrated selection-directed mutagenesis.

b) What would the results have been if ALL mutations were random in space and time?

c) DRAW the Wright theory discussed in class (hint: involves a transcription bubble) that explains how selection-directed mutations arise. You may use labels to describe your drawing.

15. (2 pts) As discussed in class, none of the Cairns' experiments involved antibiotic sensitivity/resistance. In one sentence, explain why.

16. (24 pts) You have isolated an *E. coli* strain in which the fidelity of the primase is much lower than normal. That is, it incorporates the incorrect nucleotide much more often than normal. In essay format, what would be the consequence to the replication process of this mutation? In your answer, you must include: primase, helicase, gyrase, SSB, n' protein, DNAP III, DNAP I, ligase, leading strand and lagging strand.