

**Biology 3072 (Genetics)**  
**Problem Set #7 (57 Points)**

**Name:** \_\_\_\_\_  
**Due Date: November 28, 2006**

1. Put the following components in the proper order for initiation of translation: **(4 points)**

- \_\_\_\_\_ a. the small ribosomal subunit binds to mRNA
- \_\_\_\_\_ b. the large ribosomal subunit binds to mRNA
- \_\_\_\_\_ c. the charged met-RNA binds to mRNA with the help of IF's
- \_\_\_\_\_ d. transcription produces mRNA

2. A mRNA has the following sequence:

5'-GGCGAUGGGCAAUAAACCGGGCCAGUAAGC-3'

- A. Place a **single line** under the start codon. **(1 point)**
- B. Place a **double line** under the stop codon. **(1 point)**
- C. Determine the amino acid sequence of the polypeptide translated from the open reading from this mRNA (use the genetic code given in your text) **(7 points)**
- D. Designate the carboxyl and amino termini of the polypeptide chain in C above. **(2 points)**
- E. Give the polarity and nucleotide sequence of the template DNA strand that coded for this mRNA. **(4 points)**

3. Mutations can alter the function of an operon. Predict how the following mutations would affect the Lac Operon gene transcription (a) in the presence of lactose and (b) in the absence of lactose? **(6 points)**

A. Mutation of the operator so that the repressor can no longer bind to it.

B. Mutation of the promoter so that it is no longer bound by RNA polymerase.

C. Mutation of the promoter for the *lacI* repressor so that it is no longer bound by RNA polymerase.

4. If a tRNA molecule carries glutamic acid, what are the two possible anticodon sequences that it could contain? Be specific about the 5' and 3' ends. **(6 points)**
  
5. The products of the Trp operon are responsible for the synthesis of the amino acid tryptophan. What would be the effect on regulation of tryptophan levels if there were a mutation in the operator so that it could no longer be recognized by repressor? Explain your answer. **(4 points)**
  
  
  
  
  
  
  
  
  
  
6. The mechanism of attenuation requires the presence of a leader region. Predict what effect the following changes would have on regulation of the trp operon. **(6 points)**
  - A. The entire leader region is deleted.
  
  
  
  
  
  
  
  
  
  
  - B. The sequence encoding the leader peptide is deleted.
  
  
  
  
  
  
  
  
  
  
  - C. The leader region does not contain an AUG codon.

7. For the lac operon in *E. coli*, I = lacI, the repressor gene, P = the lac promoter, O = the lac operator, Z = lacZ or the beta galactosidase gene, Y = lacY, the permease gene. (+ = gene intact; - = gene deleted or nonfunctional). Fill in the table below using a '+' to indicate the presence of the enzyme and '0' to indicate the absence of the enzyme. Although there is residual expression in the absence of lactose, please call this '0', since there is a thousand-fold increase in the presence of lactose. **(16 points)**

Genotype	No Lactose		Lactose	
	Lac Z	Lac Y	Lac Z	Lac Y
I <sup>+</sup> P <sup>+</sup> O <sup>+</sup> Z <sup>+</sup> Y <sup>-</sup> /F' I <sup>+</sup> P <sup>+</sup> O <sup>+</sup> Z <sup>+</sup> Y <sup>+</sup>				
I <sup>+</sup> P <sup>+</sup> O <sup>c</sup> Z <sup>+</sup> Y <sup>+</sup> /F' I <sup>+</sup> P <sup>+</sup> O <sup>+</sup> Z <sup>-</sup> Y <sup>-</sup>				
I <sup>+</sup> P <sup>+</sup> O <sup>c</sup> Z <sup>+</sup> Y <sup>-</sup> /F' I <sup>+</sup> P <sup>+</sup> O <sup>c</sup> Z <sup>-</sup> Y <sup>+</sup>				
I <sup>+</sup> P <sup>+</sup> O <sup>+</sup> Z <sup>+</sup> Y <sup>+</sup> /F' I <sup>+</sup> P <sup>+</sup> O <sup>+</sup> Z <sup>+</sup> Y <sup>-</sup>				