

**BIOL 213**  
**Second Exam**

All atoms, chemical bonding and structures must be complete and correct for full credit. Please print and sign your name on the back page.

(10 pt) 1. By drawing a structure (cartoon) and labeling the important structure and functional features, describe the molecular structure of a transfer RNA molecule. Identify any other molecular characteristics needed to complete the description.

(4 pt) 2. A transfer RNA molecule carries out specific and essential functions and interactions before, and during the initiation of translation. Identify the three major functions/interactions.

- (6 pt) 3. I've decided to insert a gene from yeast into a mouse cell line genome to determine if it will be expressed and function in the mouse cell as it does in the yeast cell. A part of the N-terminal amino acid sequence of a highly conserved domain in the protein is given for the yeast protein of 50 amino acids. I know that the yeast gene promoter works normally in the cells because I've tested it previously with another gene.

I find that in the transformed mouse cell line there are abundant levels of the yeast gene messenger RNA, yet by antibody detection or SDS gels I detect very low amounts of the yeast protein. Please speculate on all the possible reasons for these results. There is more than one. I've included tables for the universal genetic code and a table for some exceptions for this. From the yeast amino acid sequence compare the predicted mouse protein amino acid sequence.

Yeast: N-term...M G A S S C F R R M S T Q L W ...C term.

Mouse: N-term... C term.

- (15 pt) 4. Draw and label the arrangement of all the sequence elements in a given coding for a eucaryotic messenger RNA.

(8 pt) 5. Eucaryotic primary messenger RNA transcripts are processed to a form that is translated by cytoplasmic ribosomes. With the necessary drawings and descriptive terms, list the types of processing and where the specific processing occurs in the cell.

(12 pt) 6. Explain the GU/AG rule in Group III intron removal, and the role of the spliceosome.

(10 pt) 7. Describe (cartoon, label, brief explanation) the molecular process for selecting the AUG initiation codon to initiate translation. Show details for selecting the initiation codon.

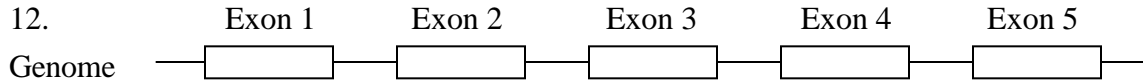
(5 pt) 8. After translation proteins can be processed in several ways. Identify five (5) co-translational or post-translational protein modifications that would qualify as “protein processing” in eucaryotic cells.

(5 pt) 9. Describe the molecular basis for the specific interaction of a DNA binding protein with the DNA regulatory element involved in the initiation of transcription. For your answer use, as an example, one of the families of DNA binding proteins that are transcriptional regulators.

(8 pt) 10. Explain combinatorial control in the transcriptional expression of a single gene.

(10 pt) 11. Explain the molecular mechanisms involved in double homologous DNA cross over that would occur to produce a recombinant bacterial plasmid.

(6 pt)



In smooth muscle cells exon 1 contains the gene promoter regulatory elements and with exons 1, 2, 3, and 5 are joined through splicing to produce a transcript that is translated to a protein that regulates cell cytoskeleton functions. In striated muscle cells splicing is controlled in a way that exons 2, 3, and 4 are joined to produce a protein important to the function of the smooth muscle cell cytoskeleton.

A transposable element that is specific for target insertion site of C G A T T T inserts then excises within the DNA sequence of exon 1.

G C T A A A

- a. Consider as many as possible of the potential consequences of the insertion/excision? What assumptions are you making for your answers?

- b. What are the chances that translation initiation would be altered?

There is another transposon target site in exon 5. What are the consequences (as many as you can think of) for the effects of the insertion/excision function of the protein as it is spliced in:

- a. Smooth muscle cells:

- b. Striated muscle cells: