Dr. Reichler's Bio 325 University Extension TTh 7:30-9pm Print Name:_____KEY_____
Exam #1 September 27, 2007

Read each question carefully and don't hesitate to ask if a question seems unclear. If possible, answer each question in the space provided, but if needed, continue on the back. If you use a drawing as part of your answer, be sure to also include a written explanation. These questions have specific answers, although for some, more than one answer is possible. To receive full credit you must clearly and fully answer the question being asked. This exam is worth 103 points with the points for each question noted in parentheses.

1. Using rules one and two of Strong Inference answer the following question: What is the function of the 5' untranslated region of mRNA? (8pts)
Use Strong Inference. Propose two or more hypotheses and at least one experiment to disprove the hypotheses. Ex: Hypos- The 5' UTR helps initiate translation. The 5' UTR helps stabilize the mRNA. The 5' UTR has no function. Expt- Remove the 5' UTR and see what happens to the mRNA.

2. If researchers studying mad cow disease destroyed the proteins in some infected tissue thereby stopping the transmission of the disease, and they claimed that mad cow disease was therefore caused by prions. Did these researchers use Strong Inference? Why or why not? (6pts)
No. They are using positive proof and a single hypothesis. Destroying proteins in the infected tissue does not mean that the disease is transmitted via proteins. A virus could require a certain protein to infect cells. OR Yes. Since they could not disprove this hypothesis, they are keeping it as valid.

3. Is any of the promoter sequence transcribed? Explain. (6pts)
No. The promoter is where the transcription factora and RNA polymerase bind, but where transcription begins is considered the coding region. OR Yes. There are transcription factors that bind downstream of the transcription initiation site, the initiator promoter element and the downstream core promoter +30, so they are part of the coding region and promoter.

4. Relate RNA to **two** of the five perspectives of a gene. (6pts)
Any two of: Genes code for proteins via RNA. Problems with genes or gene expression can cause diseases via improperly functioning RNA. Genes contain heritable information, and that information is dispensed via RNA. Genes can control development often via RNA. Genes are self-replicating units, and RNA may have been the first self-replicating molecules (RNA World).

5. Would a transposon from a eukaryotic cell that was placed in the DNA of a bacterium be able to move? Why or why not? (6pts)
No. Transposase is needed for the transposon to move, and since gene expression, promoters, processing, etc, are different in pro- and eukaryotes then a transposase that could be expressed in eukaryotes would not be expressed in prokaryotes.

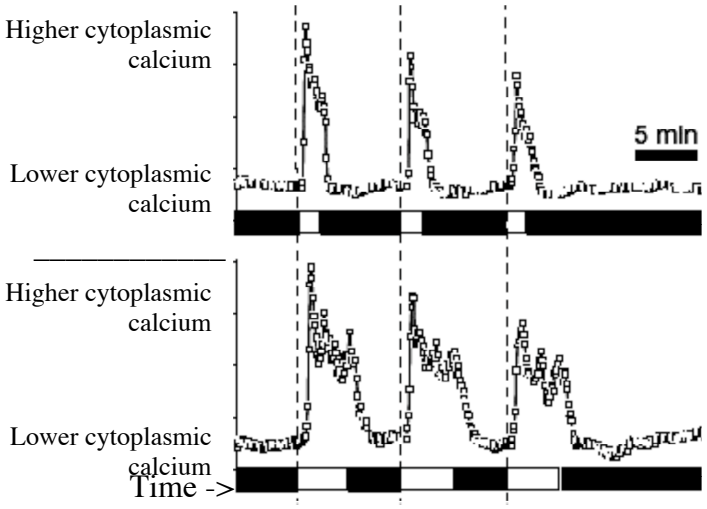
6. Are the 5' cap and 3' poly-A tail required for translation to occur? Why or why not? (6pts)
No. In the experiment with luciferase, the mRNA without the cap or tail still produced some light which is evidence of some very low level of translation.

7. You are comparing mature mRNA sequence from three different species (*H. sapiens, H. erectus, and H. habilis*).
A) Between *H. erectus* and *H. sapiens* you find only one different nucleotide in the coding region. Could the protein produced from these two mRNA's be the same. Why or why not? (4pts)
Yes, there is redundancy in the genetic code so a nucleotide change does not always mean a change in amino acids.

B) When you compare the mRNA from *H. habilis* and *H. erectus* you also find only one different nucleotide in the mRNA coding region, but these mRNAs produce proteins with many different amino acids. Explain. (4pts)
The different nucleotide could be in a start or stop codon that would cause several amino acids to be added or deleted. A single nucleotide change could introduce a premature stop codon thereby deleting some amio acids.

8. How could the same pattern, timing of influx and efflux, of calcium give two different responses in the same cell? (6pts)
The influx could be in two different parts of the cell. In other words, a different spatial distribution of calcium could lead to different responses.

9. The calcium flux pattern in the upper panel led to very little stomata closing while the pattern on the bottom led to much more stomata closing. Does this data, by itself, disprove the switch or signature hypothesis? Why or why not? (8pts)



No, more calcium led to more closing which does not eliminate the switch hypothesis, but to eliminate the signature hypothesis they need to look at even higher levels of calcium.

10. Describe a situation in which both strands of a region of DNA are transcribed into RNA (not necessarily simultaneously). (6pts)
(A drawing might be helpful, but be certain to give some written explanation as well.)
Two promoters facing towards each other.

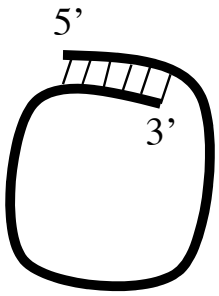
11. Would a signal transduction chain that led to a cell producing a protein with a different amino acid composition than what existed before the stimulus necessarily involve changes in transcription? Why or why not? (6pts)
No. Alternative splicing or changes in RNA editing could lead different proteins being produced without any difference in transcription.

12. How could someone gain non-gene DNA? (6pts)
Replication of transposons within the DNA.

13. When studying the Body Mass Index (BMI) of identical twins adopted into different families, why would it be important to know the socio-economic situation of the adopting families? (8pts)
If the twins grew up in very different environments, the differences in the environments can mask similarities in genes.

14. Hunger in people is at least partially controlled by hormones. Why might increasing hormone levels that signal a full stomach not decrease someone's appetite? (8pts)
If they have fewer receptors for the hormone, adding more hormone may not make a difference.

15. Could RNA form a partially double-stranded molecule like this? Why or why not? (6pts)



No. The strands are not anti-parallel.

Bonus: What evidence led researchers to conclude that the restart of arrested rRNA transcription after DNA damage depended on the repair of the damaged DNA? (3pts)
Null mutants lacking proteins involved in DNA repair are slower at recovering normal transcription levels after inhibition of rRNA transcription by DNA damage.