Dr. Reichler's Bio 325 University Extension TTh 7:^{30}-9pm Print Name:_____KEY_____
Exam #1 September 23, 2008

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: Why do students born during summer have better average test scores than students born during other times of the year? (10 pts)
Propose two or more hypotheses: Babies born in the summer are exposed to better nutrition. Babies born in the summer get more sunlight, which helps brain development. Babies born in the summer are older than the other kids in their class. Propose an experiment to eliminate one or more hypothesis: Look at the southern hemisphere and see if the effect is the same or different according to their summer

2. As we saw in class, damage to DNA results in reduced rDNA transcription via phosporylation of the ATM protein. You are a researcher interested in further understanding of this response. Propose **one** hypothesis about what ATM does and what it interacts with. Give a rationale for why you have proposed this hypothesis. (8 pts)
Several answers are possible such as: ATM phosphorylates RNA polymerase or transcription factors inactivating them thus inhibiting rDNA transcription. ATM phosporylates some other protein activating it and eventually leading to the above.

3. In the experiment looking at the function of the 5'-cap and the poly-A tail, how do we know that the reduction in translation seen after removing the 5'-cap is not simply due to the loss of mRNA stability? (8 pts)
Without the 5'-cap mRNA stability is decreased by about half, but the decrease in translation is much more dramatic, about 95+%.

4. Relate signal transduction to **two** of the five perspectives of genes. (8 pts)
Any two of: Genes code for proteins- Signal transduction can change which proteins are present. Genes are inherited- Effectors are often proteins, which are inherited. Genes act as switches- Signal transduction can lead to different development. Genes cause disease- Improper signal transduction can lead to disease.

5. You are looking at some corn, and it has all yellow kernels. Does this corn contain an active transposon? Why or why not? (8 pts)
Either- No, the corn is homozygous recessive for the recessive allele = yellow. No, the transposon is disrupting the purple allele, but it is not active, because it does not jump out.

6. You are studying the response of fingertip cells to taking a genetics test, and you have observed that when correct answers are being written calcium enters the cells in a distinct pattern of calcium influx and efflux. You are able to induce this pattern of calcium fluxes in the fingertip cells, but wrong answers are written. Why? (10 pts)
The calcium is not in the correct location of the cell.

7. What are **two** similarities between transcription and translation? (8 pts)
Any two of: Have a start, elongation, and stop.

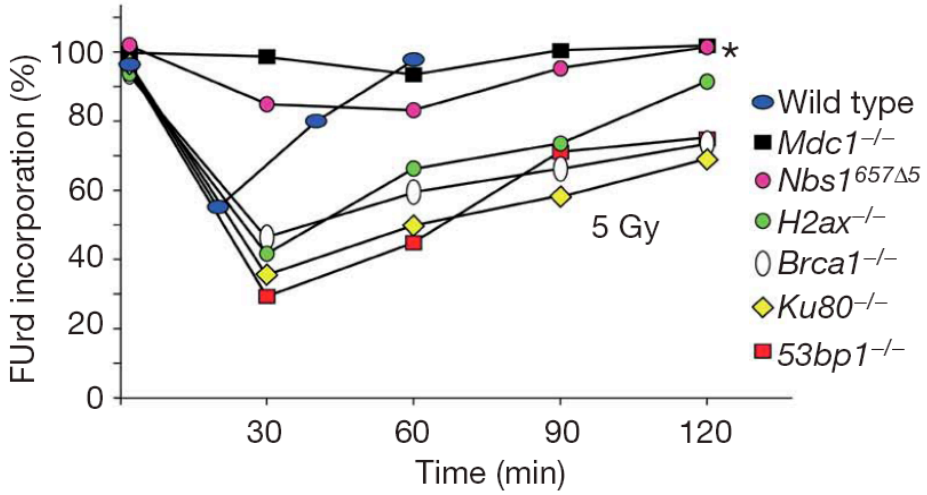
8. Does the tRNA anticodon more closely match the DNA coding or non-coding strand? Give **two** reasons why the match might not be perfect across all three codon nucleotides. (8 pts)
The coding strand. RNA has U; DNA has T. Wobble means that not every tRNA exactly matches the codon.

9. How could the change of a single nucleotide in the coding region of a gene cause the protein coded for by this gene to be shorter than normal? (8 pts)
Introduce a stop codon, or delete a start codon.

10. You are interested in identifying sequences critical for translation initiation. Describe an experiment that would allow you to identify this sequence. (8 pts)
Either- Look for similar nucleotide sequences in the 5' end of several mRNA's. Change or delete nucleotides in the 5' end of the mRNA and see how translation is affected.

11. You identify the coding region of a gene that is 400 nucleotides long. There are no introns. This coding region codes for a functional protein. Why is this surprising, and how could it be true? (8 pts)
Coding regions must be in multiples of 3. RNA editing might be adding the necessary nucleotides.

12. Given this figure from the experiment looking at the arrest of rDNA transcription after DNA damage: (For a. and b. below you can draw your answer on this graph, or describe your answer, but make certain that your answer is clear and obvious.)



a. What would the wildtype line look like if the cells were exposed to more radiation, 10Gy? Why? (2 pts)
It would dip further down because more radiation inhibits more transciption.

b. If the cells <u>lacking</u> the ATM protein were shown in this figure, what would that line look like? Why? (2 pts)
A straight line. ATM is part of the signal transduction pathway leading to inhibition of transcription, and without it, there will be no inhibition.

c. What are **two** conclusions that can be reached from the data for cells lacking **either** H2ax, Brca1, Ku80, **or** 53bp1? Explain. (4 pts)
These proteins are not directly involved in inhibiting transcription. Slower DNA repair means slower recovery.

Bonus: Give **two** examples of how van Helmont did <u>not</u> follow the rules of Strong Inference when he did his experiment looking at "what plants eat" by growing a plant in a pot with soil. For each answer, tell what rule he did <u>not</u> follow, and what he needed to change to correctly follow that rule. (3 pts)
He did not have multiple hypotheses. He did not do any controls or have multiple samples.