Appendix 3. BIOL 2104 Exams 2 – 4. Exams 2 and 3 were taken in class, during the regular 75 minute period. Exam 4 was a take-home exam.

BIOL 2104 Spring 04 Exam 2

Name:_____

There are 10 questions worth 10 points each. Please take care to answer each part of each question. Partial credit will be given so please don't leave your answer blank.

1. Each of the following individuals is a Nobel Laureate. What was the major contribution of each group to cell and molecular biology? Does each deserve a Nobel Prize? Why or why not?

Watson, Crick and Wilkins 1962 Nobel Prize in Physiology or Medicine

Temin and Baltimore 1975 Nobel Prize in Physiology or Medicine (shared with Dulbecco whom we did not discuss)

Prusiner 1997 Nobel Prize in Physiology or Medicine

2. In 1993, Kary Mullis shared the Nobel Prize in Chemistry for his development of the polymerase chain reaction (PCR). How does Mullis' Nobel-winning work differ from that of the others listed above? Is Mullis' deserving of a Nobel prize? Why or why not?

3. What is a DNA microarray? How has the practice of science been fundamentally changed by the development of microarray technology and techniques that allow for sequencing of entire genomes (e.g. the Human Genome Project)? How do you feel about these changes?

4. In stories about the Human Genome Project, Craig Venter of Celera is often portrayed as a villain. Why? Do you think this is an accurate and fair portrayal? Why or why not?

5. The most common metaphor for the human genome is "the book of life". How might this metaphor influence the way scientific studies of the human genome are performed?

Give your own metaphor for the human genome. Why did you choose this metaphor?

6. DNA replication in the cell, the polymerase chain reaction (PCR) and DNA sequencing are all essentially DNA synthesis reactions.

Name four ingredients common to all three reactions:

1.

2.

3.

4.

Name one ingredient or feature that is unique to each.

DNA replication in the cell:

PCR:

DNA sequencing:

7. What are restriction endonucleases?

Give two examples of when you would use the enzymes.

1.

2.

8.What is a DNA library?

For each of the following projects, state whether you would screen a genomic or cDNA library. Justify your choice.

a. You have cloned a mouse gene, PU1, that encodes a protein responsible for stinky feet, and want to screen a human library for a related gene.

b. You have cloned the human BRCA1 gene from a cDNA library and want to clone and sequence its promoter

9. You have cloned the human PU1 gene and hypothesize that the level of PU1 mRNA are elevated in people after exercise (thus leading to stinky feet). Describe the experiments you would perform to test this hypothesis.

10. In writing assignment 7, you were asked to e-mail a scientist you didn't know. What did you learn from this exercise? Did it change your perception of what a scientist is like?

BIOL 2104 Spring 04 Exam 3

Name:_____

There are 10 questions worth 10 points each. Please take care to answer each part of each question. Partial credit will be given so please don't leave your answer blank.

1. Draw a flow chart showing where energy is stored and converted (and what form it takes) as it enters glycolysis as glucose and ends up in mitochondria as ATP.

2. Compare and contrast transport of proteins into the nucleus with transport into the mitochondrial matrix.

3. Refer to the diagram below.

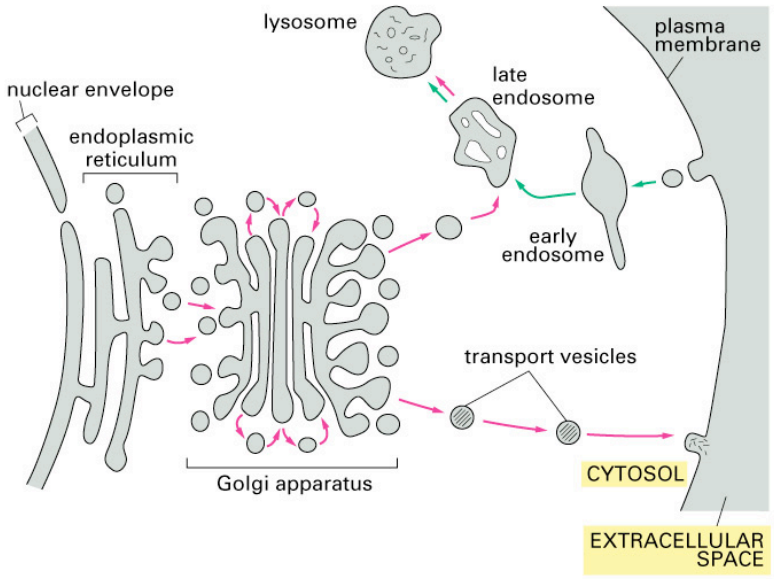

Figure 15-17 Essential Cell Biology, 2/e. (© 2004 Garland Science)

In class, we divided the cell into two domains shown here in gray and white. What was the basis of this distinction?

The arrows in the figure are meant to show the flow of materials in the endomembrane (gray) domain. What is the problem with this depiction?

Sort the following organelles (not shown) into the proper domain:

mitochondria:

chloroplast:

nucleus:

4. Shown below are some of the membrane transport systems in an intestinal epithelial cell.

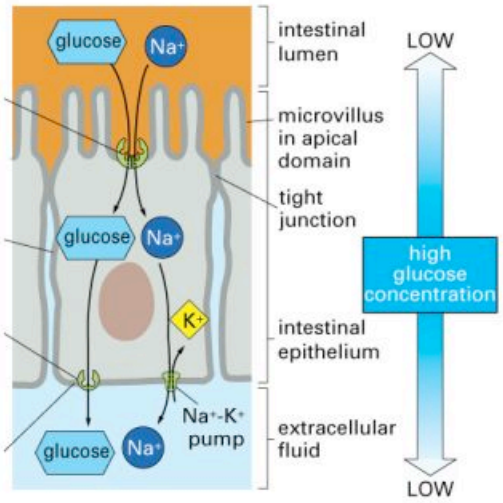

Figure 12-15 Essential Cell Biology, 2/e. (© 2004 Garland Science)

Where is transport of glucose active?

Where is transport of Na+ active?

What is the role of the Na+/K+ pump in the transport of glucose through the intestinal epithelium?

5. You have cloned a gene encoding a protein never previously described. When you express a GFP (green fluorescent protein)-tagged version of this protein, you observe that it resides inside the Golgi.

Where was this protein translated?

You believe that the first 10 amino acids encoded by the gene are a signal sequence. How could you prove that these amino acids were **necessary** for directing this protein to the Golgi?

How could you prove that these amino acids were **sufficien**t for directing this protein to the Golgi?

6. You have cloned another gene encoding a protein never previously described. Using an antibody that recognizes that protein, you determine that it resides in the mitochondria.

Where is this protein translated?

If you couldn't answer the above question for sure (hint, hint), how might you determine where this protein was translated? (don't panic, there are a number of ways you might do this, just think it through).

7. Hans-Jorg Rheinberger has suggested that our representations of the natural world, e.g. in pictures and diagrams that describe the results of our experiments, are compared with each other, rather than with Nature. Do you think he is correct? What is the consequence of this for science?

8. It has recently been determined that a number of human pathologies, e.g. diabetes and Alzheimer's, might be based, at least in part, by mutations in the mitochondrial genome. Why has the study of mitochondrial diseases been quite elusive (difficult) and controversial?

9. Describe one complete cycle of the actin myosin motor beginning with a myosin head attached to the actin filament. What metaphor could you use for this process?

10. Critique the term "cytoskeleton".

BIOL 2104 EXAM 4
Due by Sat, May 8 at 10 AM

1. What is cancer? (50 points) probably 3-6 pages??

2. How can we treat or cure cancer? (25 points) 2-3 pages?

3. You serve on the Biomedical Ethics Advisory Panel to President Bush. Recommend to him specific policy guidelines regarding the use of human embryonic stem cells for research. (25 points) Justify your recommendations based on ethical and scientific guidelines. 1-2 pages??

Some ground rules:

You may discuss these questions with anyone you want but your written answers should be your own work. Please indicate who you worked with and talked to,

Feel free to tailor the questions to your own perspectives. Question 1 should be detailed and from a molecular cell biology point of view, but you may want to add environmental, social, etc. perspectives. For question 2, you might decide we cannot cure cancer. If so, you need to rationalize this point-of-view.

If you want to show up regular final exam time to answer these questions, you may. However, I prefer a carefully considered and typed response.