

Biology 113 Closed Book Take-Home Exam #2 – Chapters 4 - 7

There is no time limit on this test, though I have tried to design one that you should be able to complete within 3 hours. There are 6 pages in the exam, including this cover sheet and the data gallery. You are not allowed to look at someone else's test, nor use your notes, old tests, the internet, any books, nor are you allowed to discuss the test with anyone until all exams are turned in no later than 9:30 am on Monday October 20. **EXAMS ARE DUE BY 9:30 am ON MONDAY OCTOBER 20.** If you turn in your exam late, you will lose a letter grade for each day you are late. The **answers to the questions must be typed within this test** unless you want to draw on a separate page. If you do not write your answers in the appropriate location, I may not find them. Tell me where to look if you put your answer at the back of your test.

I have provided you with a “Data Gallery” in the form of figures and tables. To choose a figure in support of your answer, simply state Figure #x. You do NOT need to move the figure on your test. Do not assume how many of the data images you will use, or not use. **Simply choosing the data is not sufficient support for your answer. You must explain the significance of the data and how they support your answer.** I have given you sentence limits so be concise.

-3 pts if you do not follow this direction.

Please do not write or type your name on any page other than this cover page.

Staple all your pages (INCLUDING THE TEST PAGES) together when finished with the exam.

Name (please print):

Read the pledge and sign if you can do so with honor:

On my honor I have neither given nor received unauthorized information regarding this work, I have followed and will continue to observe all regulations regarding it, and I am unaware of any violation of the Honor Code by others.

How long did this exam take you to complete?

Lab Questions:

7 pts.

1) Last year, I had a student leave for fall break and never return. Later that year, I saw this student on a reality TV show where a couple tries to survive in the wilderness wearing no clothes, but I digress. The point being, the promoter data never got finished.

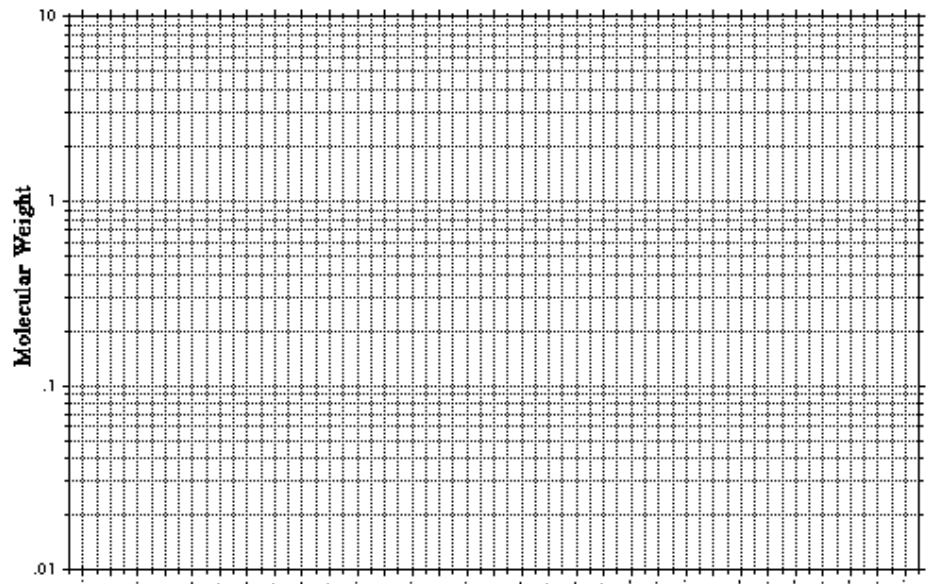
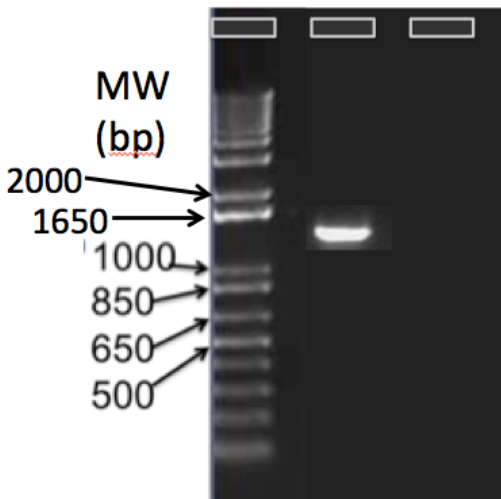
a) Generate a graph using data in the attached file (Exam2_data_2014.xlsx) to show the results, including error bars of the standard deviation. Insert your graph into the exam in the space below.

b) Evaluate the strength of the two experimental promoters from the graph you produced.

(maximum of 40 words)

3 pts.

2) What is the molecular weight of this unknown band in lane 2? To get credit for this answer, you must show your work drawn by hand on the graph paper provided here.



Answer: _____

Lecture Questions:

16 pts.

3) The origin of life is a fundamental concept in biology.

a) Explain the RNA world theory and support it using four experimental results from the data gallery. (maximum of 40 words per experiment)

- 1.
- 2.
- 3.
- 4.

b) Why is surface area to volume ratio relevant to the origin of cells? (maximum of 30 words)

14 pts.

4) Evolution is perhaps the main distinction between biology and the other STEM disciplines.

a) What are the five tenets of natural selection? Use data to support each one. (maximum of 40 words per tenet)

b) Which mechanism(s) of evolution is/are relevant to the origin of life? Use data to support each one. (maximum of 40 words per mechanism)

14 pts.

5) One form of information is DNA.

a) What do DNA polymerases need to start making a new copy of DNA? Use data to support your answer. (maximum of 40 words)

b) Describe five forms of mutation that lead to evolution in cell populations in short periods of time. Use data to support your answer for each one. (maximum of 40 words per form)

- 1.
- 2.
- 3.
- 4.
- 5.

12 pts.

6) The evolution of eukaryotes is a major advance in the complexity of life.

a) Compare and contrast the data that supported the “tree of life” vs. the “ring of life” with attention to the origin of eukaryotes. Use one example of data to support each of the two displays of eukaryote evolution. (maximum of 40 words per example)

b) What is the most likely origin of chloroplasts and mitochondria. Use data to support your answer for each one. (maximum of 30 words for each organelle)

mitochondria:

chloroplasts:

c) Explain why the outdated “tree of life” display for the evolution of eukaryotes is NOT an example of scientific misconduct.

9 pts.

7) Another major step in evolution was the origin of multicellularity.

a) Using algae as your example, explain why multicellularity evolved rather than the algae remaining unicellular species. Use data to support your answer. (maximum of 40 words)

b) Did the evolution of the division of labor in colonies happen at the same time as the evolution of the first colonies? Use data to support your answer. (maximum of 30 words)

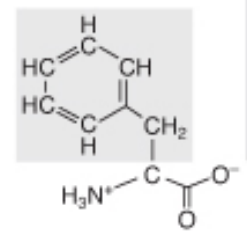
c) Calculate the average value (to two decimal places) from the frequency distribution in Figure #28 below. Show your work to get credit.

8 pts.

8) Hopefully, when you started this test you were not scared. Remain calm and you will do well.

a) What level(s) of protein structure is/are affected by allosteric modulation? (maximum of 30 words)

b) Is this amino acid hydrophobic, hydrophilic, or neither? → (maximum of 20 words) To get credit, support your answer using chemical properties of the molecule.



c) Explain why the fear response requires signal transduction but steroid modulation of gene activity does not. (maximum of 30 words)

9 pts.

9) By now, you should be very calm because you are nearly done with the exam.

a) How do we know that epinephrine is the cause of glucose release from the liver? Use data to support your answer. (maximum of 30 words)

b) Can G protein alpha subunits be reactivated or are they permanently inactivated by GDP? Use data to support your answer. (maximum of 30 words)

c) When an enzyme is covalently modulated by a kinase, is the modified enzyme's activity enhanced or repressed? Use data to support your answer. (maximum of 30 words)

8 pts.

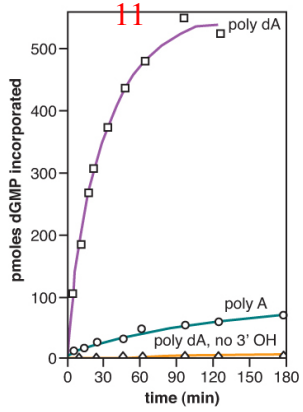
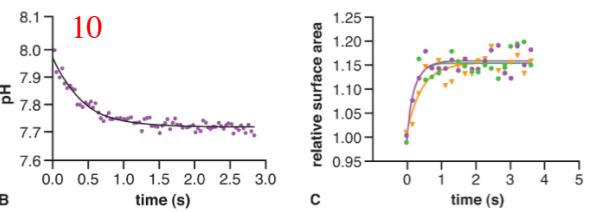
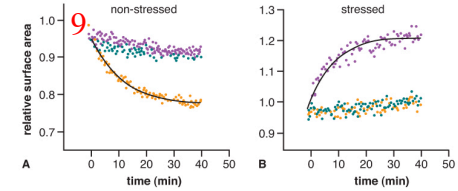
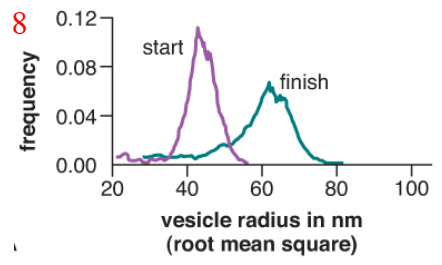
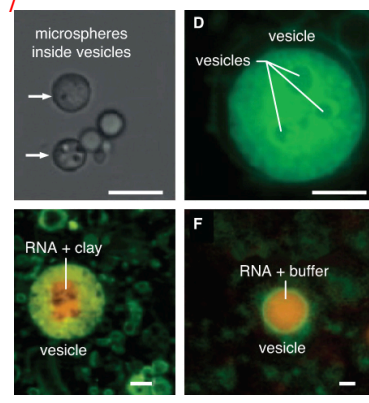
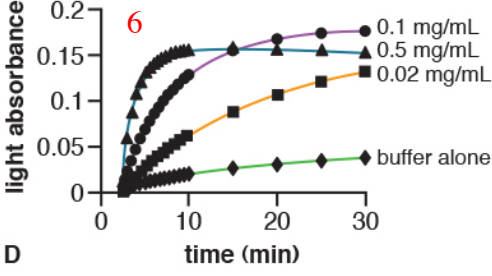
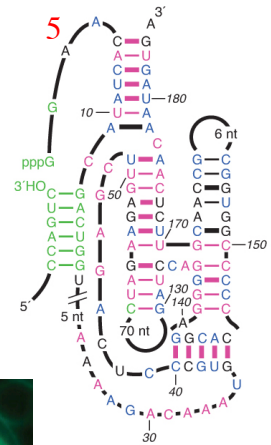
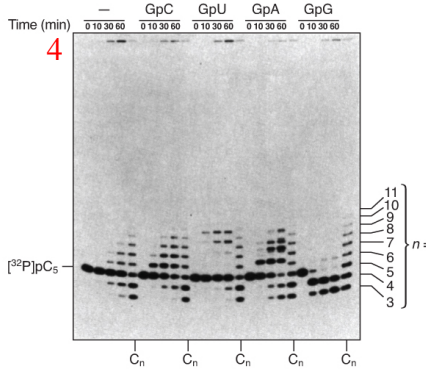
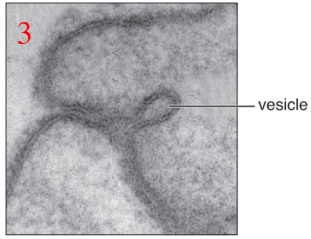
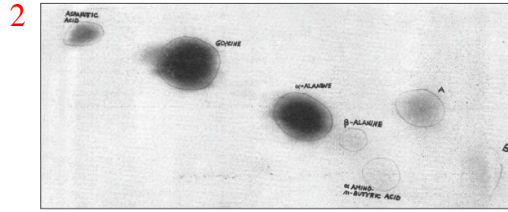
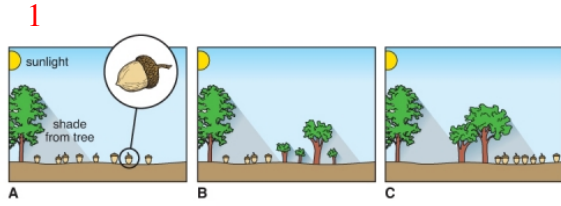
10) Many membranes are not planar - they undulate.

a) What is the selective advantage to an undulating membrane? Give one real example where this happens. Use data to support your answer. (maximum of 30 words)

b) What is the selective advantage for different eukaryotic organelles having different lipid compositions? Use data to support your answer. (maximum of 30 words)

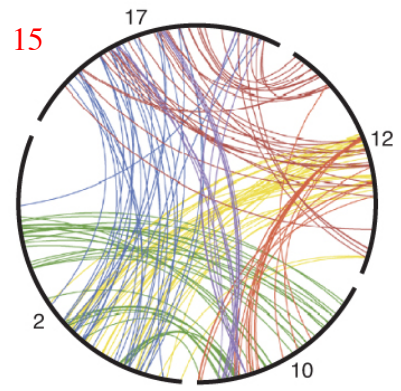
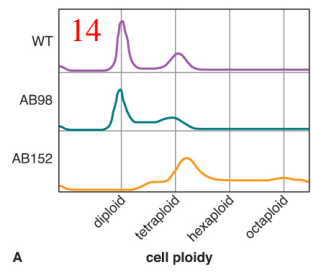
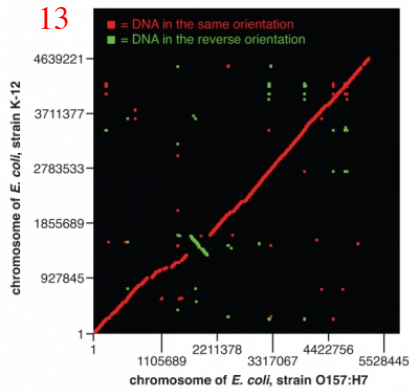
c) What role could lipid composition have played in the evolution of very ancient and primitive cells? Use data to support your answer. (maximum of 30 words)

Data Gallery

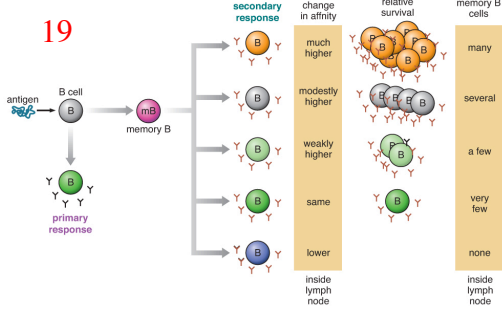
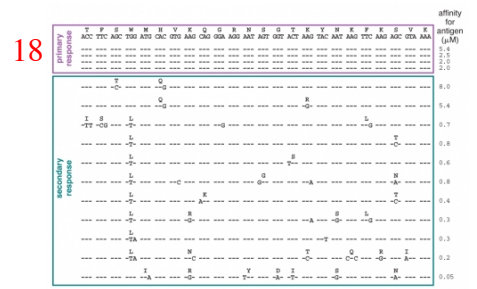
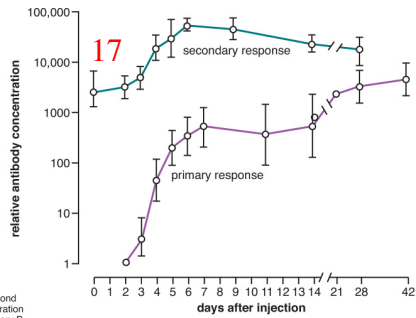


12

ions (concentration in mM)	error rate
Mg ²⁺ (1.0)	1 in 41,000
Ni ²⁺ (1.0)	1 in 5,030
Ni ²⁺ (2.0)	1 in 1,850
Cd ²⁺ (0.1)	1 in 7,810
Cd ²⁺ (0.2)	1 in 5,070
Ca ²⁺ (0.6)	1 in 7,520
Ca ²⁺ (1.0)	1 in 5,500
Ca ²⁺ (2.5)	1 in 3,760



Dr. Campbell's Bio113 Exam #2 – Fall 2013



21

human protein number	protein function	protein location	best match domain
NP_001009	translation	cytoplasm/ER	archaea
NP_003185.1	transcription factor	nucleus	archaea
NP_001001937	ATP synthase	mitochondria	bacteria
NP_005521	energy harvesting	mitochondria	bacteria
NP_000393	energy harvesting	cytoplasm	bacteria
NP_004138	cell signaling	cytoplasm	archaea
NP_061816	cytoskeleton	cytoplasm	bacteria

