

## 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 **10:30 am on Monday October 24**. The **answers to the questions must be typed in this Word file** unless you are asked to draw on a separate page, or you want to use scratch paper. 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.**

Name (please print):

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

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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:

**16 pts.**

1) By now, you are an expert at GGA. Here are some questions about the method you have done twice using pClone Red ([http://parts.igem.org/Part:BBa\\_J119137](http://parts.igem.org/Part:BBa_J119137)).

a) Summarize what color colonies you expect to see with these 3 functional promoters used in combination with pClone Red and GGA. Explain *how* you reached your conclusion. (25 words maximum for each promoter)

1) expected color: \_\_\_\_\_

How:

```

5' TTCTTTTAATGTTTTTTTAATTGAATATTTAAGATTATAACATATATTTAAAGTGT
   |||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
3' AAGAAAATTACAAAAAATTAAGTTATAAATTTCTAATATTGTATATAAATTTTACA
           -35                               -10

```

2) expected color: \_\_\_\_\_

How:

```

5' CCGCGGCTATTTTATTGAAAATTTCCCTTTTGTGGTATAATAGATAA
   |||||||||||||||||||||||||||||||||||||||||||||||||||
3' CCGATAAAATAACTTTTAAAGGGAAAACACCATATTATCTATTTCAGC
           -10                               -35

```

3) expected color: \_\_\_\_\_

How:

```

3' TATTGACATTAATCTTAATTAATAAATAAGATATTAAATCAGCCAGC
   |||||||||||||||||||||||||||||||||||||||||||||||
5' CCGCATAACTGTAATTAGAATTAATTTTTATTCTATAATTTAGTCG
           -10                               -35

```

b) Take this piece of DNA and run it through the obligator (<http://gcat.davidson.edu/iGem10/oligos.pl>). Paste in the DNA you would order from the company to maximize the chances of successful GGA using pClone Red to produce RFP (-35 underlined): TGTAAACCTGGCTTGCGCATGTCTTGTATAGACAAGTATATGTATCTACGTAAACA

Class Questions:

**20 pts.**

2) Cell theory assumes cells already exist. These questions examine the evolutionary origins of the first cell.

a) What evidence in the data gallery supports the RNA world hypothesis. For each figure you select from the gallery, summarize how it supports RNA world hypothesis. (30 words maximum for each figure)

b) Use two figures from the data gallery to support the claim that abiotic vesicles could evolve by natural selection to become a living cell. Start with the definition of evolution. Then make a numbered list of natural selection's tenets and explain how your two figures support the tenets in your list. Include a mathematical argument as part of your answer. (35 words maximum for each tenet)

Definition:

1.

**18 pts.**

3) This question focuses on evolution at the cellular level.

a) What does DNA polymerase need to complete the S phase of a cell cycle? Make a numbered list of ingredients and summarize the role of each ingredient. (30 words maximum for each ingredient)

1.

b) How does cellular evolution improve your immune response? Support your answer with 2 figures. (40 words maximum)

**12 pts.**

4) Eukaryotes are complex organisms.

a) Use the ring of life to explain the origins of eukaryotes. Support your answer with data. (35 words maximum)

b) How did mitochondria appear in Eukaryotes? Support your answer with three figures. (30 words maximum per figure)

**16 pts.**

5) Race cannot be defined biologically but it has biological consequences.

a) Explain one incorrect example of data used to justify race-based medicine. Then use data to explain why race should *not* be used in this example. Support your two part answer with one figure for each part. (40 words maximum)

b) Use skin color as an example of why races cannot be defined biologically. Support your answer with data. (35 words maximum)

**18 pts.**

6) Protein shape is vital.

a) Use figures 2 and 19 to explain the importance of shape specificity. (40 words maximum)

Fig 2:

Fig 19:

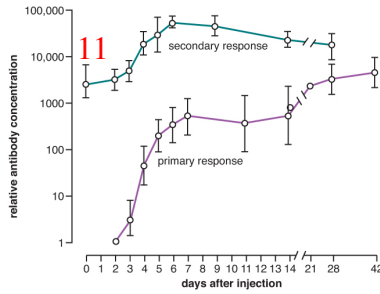
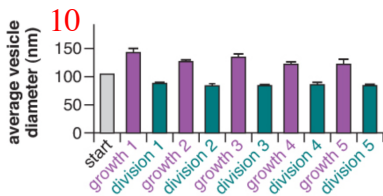
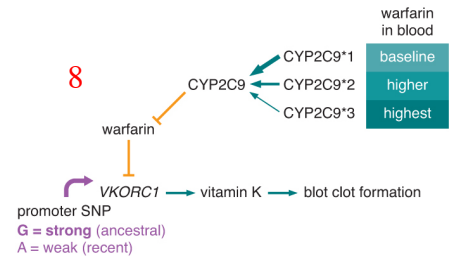
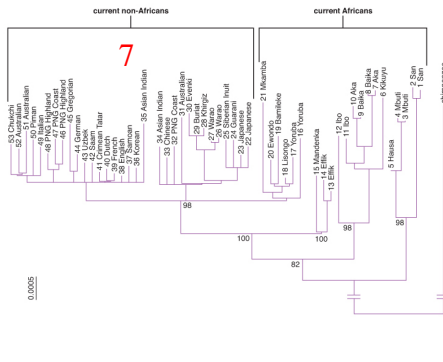
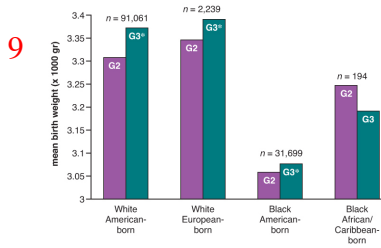
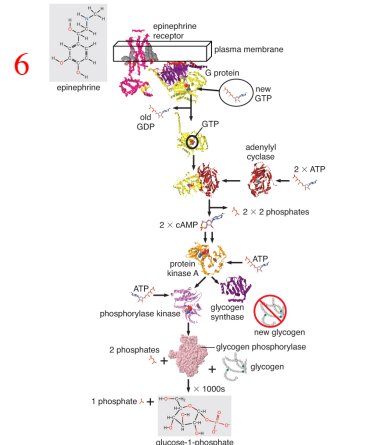
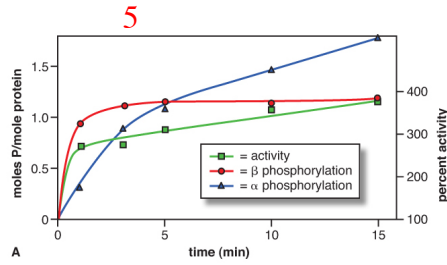
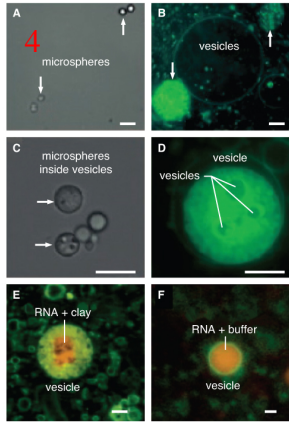
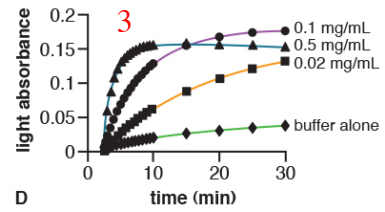
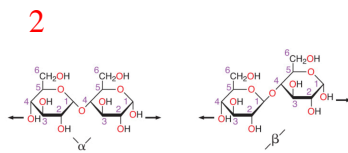
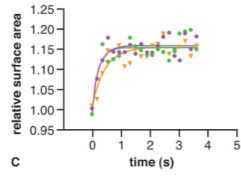
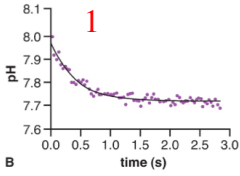
b) From the gallery, give one example of allosteric modulation and one example of covalent modulation. Support your answer with data and indicate the functional consequences of the modulation. (30 words maximum for each modulation example)

c) Summarize signal transduction and list its four hallmarks. Give one example in the data gallery for each hallmark. (30 word maximum for summary; 25 words maximum for each hallmark)

Summary:

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

Data Gallery



12

gene name	human variant	age of human variant
<i>MFSD12</i>	darker skin color	~996,000 years
<i>OCA2#</i>	lighter skin color	~629,000 years
<i>DDB1</i>	lighter skin color	~250,000 years
<i>HERC2</i>	lighter skin color	~247,000 years
<i>SLC24A5</i>	lighter skin color	~30,000 years*

\*introduced to East Africa ~5,000 years ago  
# null allele causes albinism

