

## **Biology 111 Closed Book Take-Home Exam #2 – Information**

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 5 pages in this test, including this cover sheet. 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 9:30am on Monday Oct. 17. **EXAMS ARE DUE BY 9:30 am ON MONDAY OCTOBER 17.** If you turn in your exam late, then you lose a letter grade for each day you are late. The **answers to the questions must be typed on the test pages** unless the question specifically says to write the answer in different place. If you do not write your answers in the appropriate location, I may not find them.

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 image 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, however. You must explain the significance of the data and how they support your answer. I have given you sentence limits so be concise.

There are 5 Quick Recall questions that are multiple choice. The questions are available only online so you will need internet access to take this exam. <http://moodle.davidson.edu/moodle/>

**-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 together when finished with the exam. Do not print test pages without answers. I only want to see your answers. You can type your answers right under each question.

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:

**5 pts.**

1) Let's assume you are able to generate antibiotic resistant bacteria. If the cells were not resistant before you started, how did they become resistant? Limit your answer to no more than 3 sentences and be precise in your word choice.

(type your answer here)

**5 pts.**

2) Describe the emergent property of slime mold that you have seen in lab. To get full credit, you must describe which aspects you personally saw in lab. Limit your answer to no more than 3 sentences and be precise in your word choice.

(type your answer here)

Lecture Questions:

**15 pts.**

2) List the five tenets of natural selection and provide an example of each using data describing the abiotic origins of life. As appropriate, choose one figure (by citing its number) from the data gallery to support your example by explaining how the data support your example. **The five items you list below should be limited to no more than 3 sentences each.**

- A.
- B.
- C.
- D.
- E.

**8 pts.**

3) Use the origins of eukaryotes to address how the concept of a “missing link” is both informative and futile when discussing evolution. Support your answer with data. **You answer cannot exceed 4 sentences.**

(type your answer here)

**8 pts.**

4) Most Americans don't really understand the relationship between natural selection and evolution. Give one example of evolution that happened quickly and another example that took much longer. You may NOT use the origin of eukaryotes as one of your examples. Choose a figure by number and explain how those data are relevant to your answer. **Limit your answer to no more than 4 sentences.**

(type your answer here)

**10 pts.**

5) Science is often perceived by the general public as a smooth, continuous progression toward improved understanding (though they often use the word prove).

a) Describe an example (with figure number) from these four chapters where incorrect information was published and later retracted.

b) Explain how the example you chose differs from fabrication, falsification and plagiarism.

(type your answer here)

**8 pts.**

6) Appraise the benefits and potential hazards of mutualism when it comes to evolution at the cellular level. Support your answer with data by citing figure number(s) and explaining how the figure(s) is/are relevant to your answer. **Limit your answer to no more than 3 sentences.**

(type your answer here)

**12 pts.**

17) List four hallmarks of signal transduction. Give a specific example for each hallmark you list. **Limit each item to no more than two sentences.**

A.

B.

C.

D.

**9 pts.**

8) Describe how a neuron manages to move the action potential in only one direction. Be sure to address 1) depolarization 2) repolarization and 3) resetting the neuron for another action potential. Support your answer with data appropriately by choosing a figure number and explaining how the data are connected to your answer. **Limit your answer to a maximum of 6 sentences total.**

(type your answer here)

**10 pts.**

9) You learned about a wide range of cells that seem to violate “rules” biologists propose to characterize different types of cells. The large cell called *Epulopiscium fishelsoni* presented a problem based on its size. **Limit your answer to a maximum 3 sentences each.**

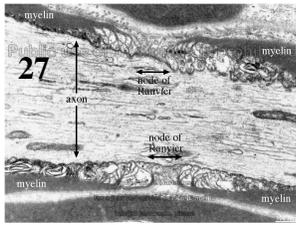
a) What problem were biologists able to resolve related to *E. fishelsoni*'s large size?

b) What limitation does *E. fishelsoni* face that was not resolved by data presented in the book, when you compare *E. fishelsoni* to other cells such as *E. coli* or the really tiny bacterium *Pelagibacter ubique*? This answer requires that you integrate your knowledge.

(type your answer here)

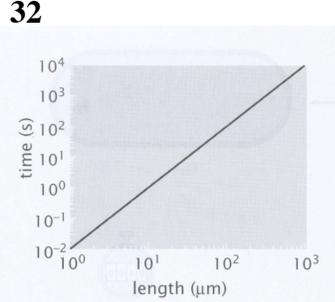
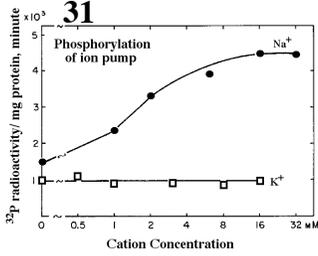
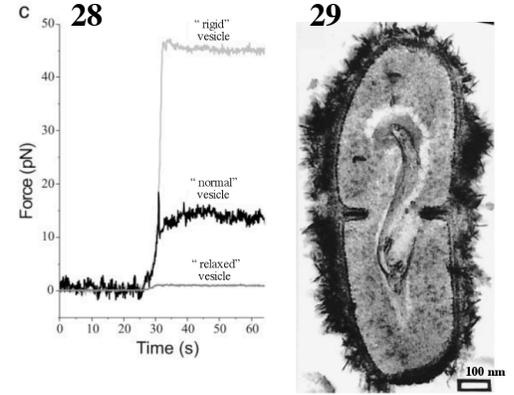
**Five “Quick Recall” Questions for 2 points each**     <http://moodle.davidson.edu/moodle/>





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Gene Name	Average Copy Number	Copy Number Range
<i>ftsZ</i>	80,600	35,800-198,800
<i>dnaA</i>	48,700	29,800-153,000
<i>recA</i>	120,000	60,300-205,000
16S rRNA	368,000	241,000-737,000



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Species	Domain	Description	Genome Mbp	Proteins
<i>Candidatus Carsonella ruddii</i>	Bacteria	Plant eating insect endosymbiont	0.16	182
<i>Candidatus Sulcia muellerii</i>	Bacteria	A leafhopper symbiont	0.25	227
<i>Bacteroides aphidicola</i>	Bacteria	Endosymbiont of the aphid	0.44	362
<i>Nanoarchaeum equitans</i>	Archaea	Hot vent tube worms symbiont	0.49	536
<i>Mycoplasma genitalium</i>	Bacteria	Urinary tract pathogen	0.58	477
<i>Candidatus Phytoplasma mali</i>	Bacteria	Apple proliferation disease	0.60	479
<i>Ureaplasma parvum</i>	Bacteria	Urinary tract pathogen	0.75	614
<i>Mycoplasma pneumoniae</i>	Bacteria	bronchitis and pneumonia	0.82	689
<i>Borrelia burgdorferi</i>	Bacteria	Tick-borne relapsing fever	0.92	818
<i>Chlamydia trachomatis</i>	Bacteria	Leads to blindness and STDs	1.00	874
<i>Escherichia coli</i>	Bacteria	Darjeem (from undercooked meat)	5.50	5423

**Table 11.2 Mobility of proteins in and on *E. coli*.**

Protein	Location	Diffusion Rate ( $\mu\text{m}^2 / \text{sec}$ )	Fold Slower
GFP	Water	$87.0 \pm 2.0$	n.a.
GFP	Cytoplasm <i>E. coli</i>	$8.0 \pm 2.3$	-10 X
GFP over produced	Cytoplasm <i>E. coli</i>	$3.6 \pm 0.7$	-24 X
GFP + sugar-binding protein	Cytoplasm <i>E. coli</i>	$2.5 \pm 0.6$	-35 X
GFP	Periplasm <i>E. coli</i>	$2.6 \pm 1.2$	-33 X
GFP + TatA protein	Outer Membrane <i>E. coli</i>	$0.13 \pm 0.03$	-669 X

