

Biology 111 Closed Book Take-Home Exam #3 – Emergent Properties

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 Nov. 7. **EXAMS ARE DUE BY 9:30 am ON MONDAY NOVEMBER 7.** 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 directly under the questions** 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, state Figure #x and do NOT 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 no Quick Recall questions on this exam.

-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):

average 85%

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:

5 pts.

1) When you have bacteria growing on a plate that contains the antibiotic you have been using for your selection process, describe where on the plate you would take cells for the next round of selection. **Limit your answer to 3 sentences or less.**

pick near the highest concentration of antibiotic, big colonies better than small

5 pts.

2) What is the general rule slime mold cells use for their refractory period? Explain why this rule makes sense. You can draw a picture if that helps your explanation. **Limit your answer to 4 sentences or less.**

refractory period needs to be less than the wave frequency, but long enough that cells don't sense the wave that just past them

Lecture Questions:

16 pts.

3) In the figure to the right, How many mL of oxygen would be delivered to muscles by hemoglobin if it were: A) high affinity binding protein; B) low affinity binding protein; and C) normal hemoglobin? Assume complete hemoglobin saturation carries 25 mL of oxygen. Support your answer numerically. **Limit your answer to 1 sentence each.**

(type your answer below)

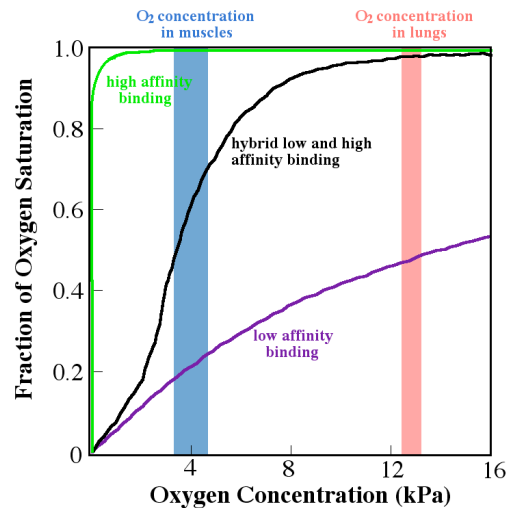
A) 0 mL

B) 7.5 mL

C) 10 mL

D) What physiological factor increases the amount of oxygen hemoglobin delivers to your muscles? Support your answer with data. **Limit your answer to 3 sentences or less.

pH, muscles have lower pH and this releases more O₂. Figure #2



8 pts.

4) When a λ phage first infects an *E. coli* cell, what lifestyle choice is the most common? Explain how this choice becomes the default choice. Support your answer with data. **Limit your answer to 3 sentences or less.**

lytic. The best figure is 6 which shows that 60% of the lysogenic viruses spontaneously flip to lytic. Good to mention higher RNA polymerase affinity for P_R.

8 pts.

5) Support each answer with data. **For each answer, limit yourself to 3 sentences or less.**

a) Is circadian rhythm adaptive or just coincidental?

adaptive – out compete in natural lighting Figure #8

b) How can cells in a mixed population maintain their synchrony?

light or temperature, but temperature had data to support it Figure 9

10 pts.

6) When Kandel wanted to determine which neurons were in the direct pathway between touching its siphon and the gill retraction, his team did not use neurotransmitter to artificially stimulate neurons. Explain how they depolarized the neuron under investigation and NOT use a neurotransmitter? You may choose a figure to augment your answer.

electrical stimulation by a probe/electrode, see Figure #12

10 pts.

7) Answer both parts of this question.

a) Use the internet to look up what cycloheximide does to cells. For this one question, tell me what cycloheximide does in 1 sentence. You must provide the URL of your source or you will not get any credit.

translational inhibitor – many sources

b) Why does cycloheximide block long-term memory formation? **Limit your answers to 2 sentences or less.**

new proteins must be produced to store long term memory – protease, transcription factors, and synapse

16 pts.

8) List four characteristics of long genetic pathways compared to short pathways. Support your answer with data. **Limit each answer to 3 sentences or less.**

Longer pathways are:

A) #18 sensitive to ligand concentration changes

B) #17 delayed in time

C) #17 noisier in output

D) #20 less prone to false starts due to transient input

10 pts.

9) Support each answer with data. **Limit your answers to 2 sentences or less.**

a) What causes mammals and birds to reject non-self tissue transplants?

T cells #14

MHCI most, peptide second #13

b) What protects a fetus from its mother's immune system?

MHC IG #21 and interleukin 10 (IL10) – no data provided

12 pts.

10) Answer all three parts to this question.

a) Summarize the disposable soma theory in two sentences or less.

Live long but don't reproduce as early or often

Die young (predation) but reproduce early and abundantly

b) Choose two data sets that support the theory and explain how these data support it. **Limit your answers to 2 sentences or less for each data set.**

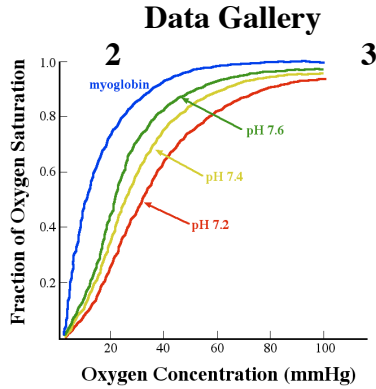
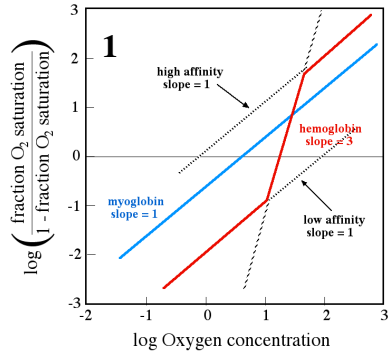
#16 flies and artificial predation

#25 and flower bolting/senescence

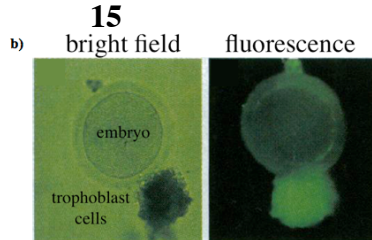
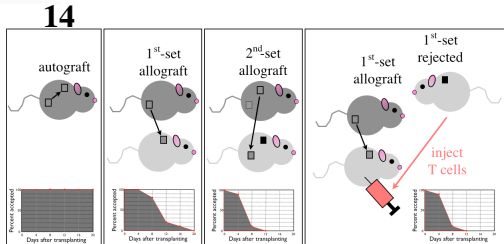
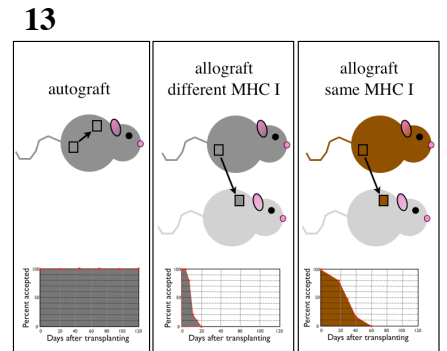
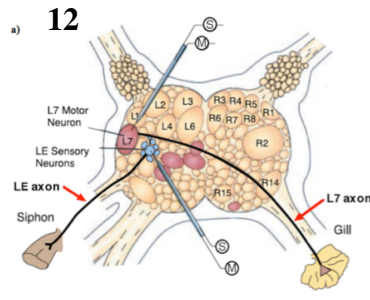
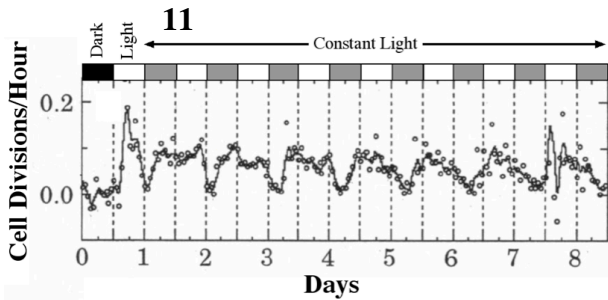
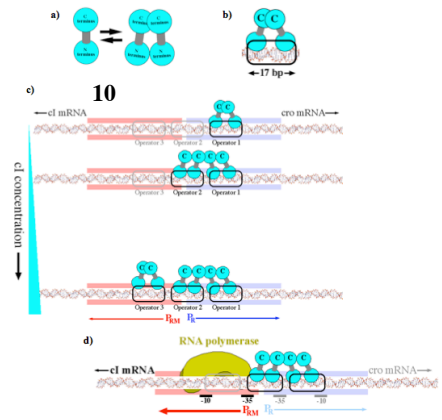
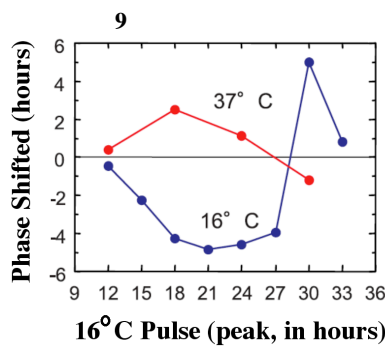
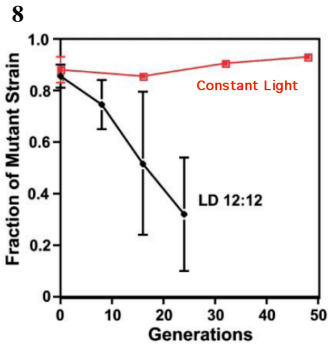
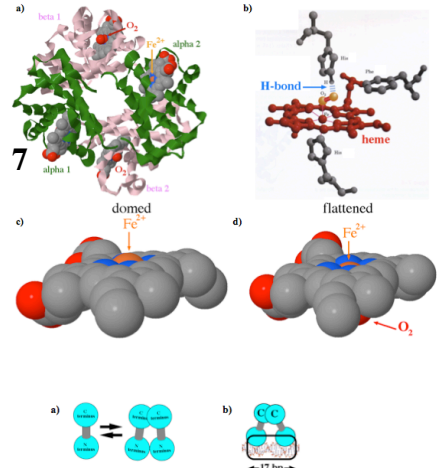
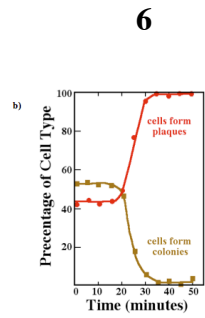
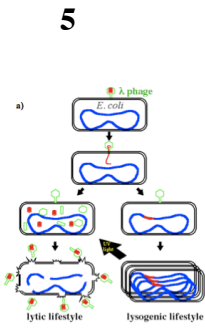
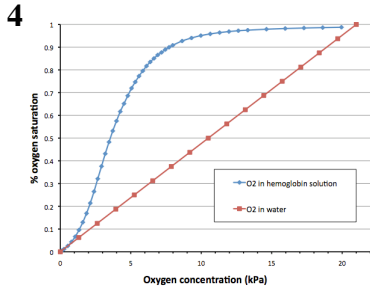
c) List two species that research has produced surprising results about how they age. Support your answer with data. **Limit your answers to 2 sentences or less.**

i) mice

ii) naked mole rats - # 28, oxidation is greater in the long-lived NMR, very unexpected



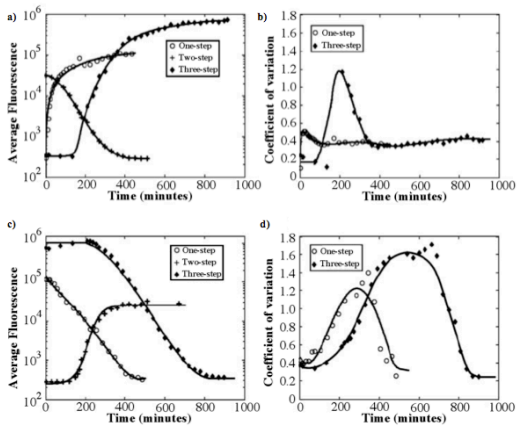
Gas	Percentage
N ₂ nitrogen	78%
O ₂ oxygen	21%
All others, including CO ₂	1%



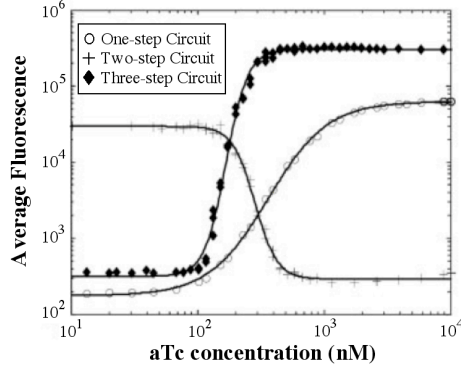
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Trait	High adult mortality		Low adult mortality		P-values
	# of flies	average	# of flies	average	
Female development (hrs)	389	254	345	272	0.0041
Female dry weight (µg)	90	242	90	261	0.0156
Fecundity (avg. no. offspring)	340	40.8	322	27.0	0.0035
Male development (hrs)	389	260	334	276	0.0061
Male dry weight (µg)	388	197	332	217	0.0182

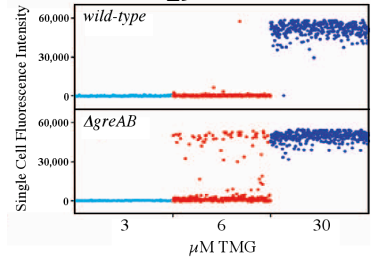
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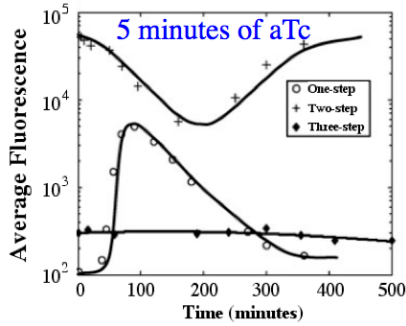
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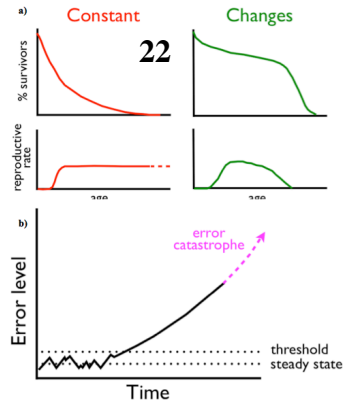
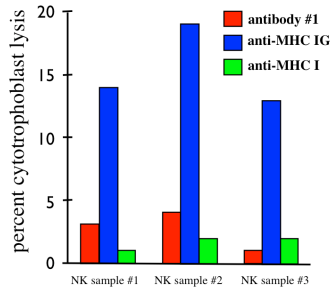
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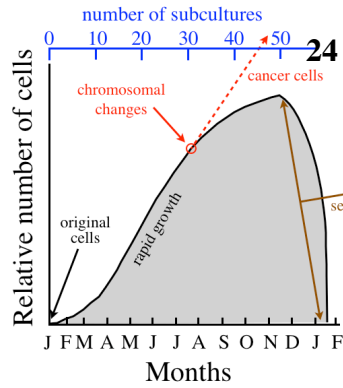
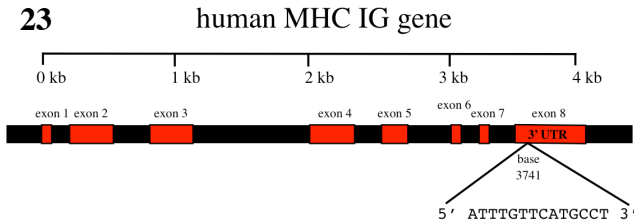
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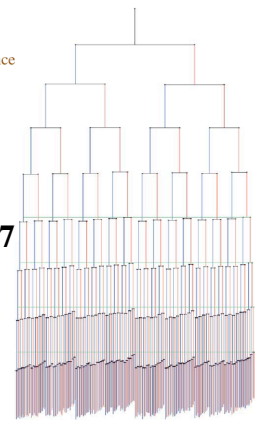
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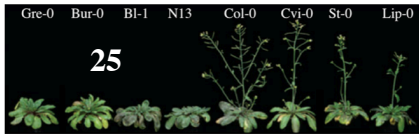
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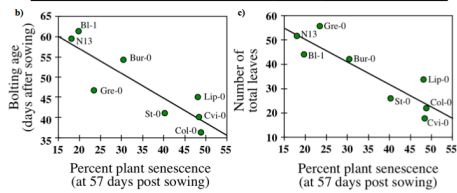
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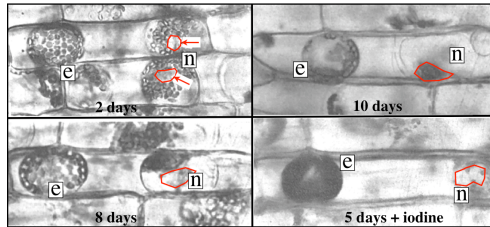
a)



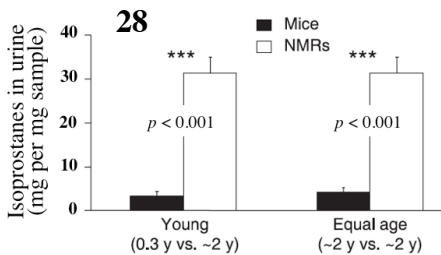
b)



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