Biology 113 Closed Book Take-Home Exam #2 – Chapters 4 - 6

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 <u>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</u> until all exams are turned in no later than 12:30 pm on Monday October. 22. **EXAMS ARE DUE BY 12:30 pm ON MONDAY OCTOBER 22**. 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 immediately below each question unless you are instructed to draw something**. 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 can refer to subparts of figures by letter or say upper vs. lower or left vs. right panels. 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:

4 pts.

1) A particularly excited student, Gimme Morelab, obtained some results from lab but was not sure how to interpret them. Please help Gimme by answering this question:

a) What can you say about the relative strength of the promoter called "bigbang"? Bars in the graph represent the average of three experiments and the error bars are standard deviation. For + vs – controls, $p = 0.005$. For – control vs. "bigbang + inducer", $p = 0.0812$. Gel image shows PCR products around the promoter: 1 = + control; 2 = - control; 4 = bigbang + inducer; 5 = bigbang - inducer. Limit your answer to a maximum of 2 sentences.
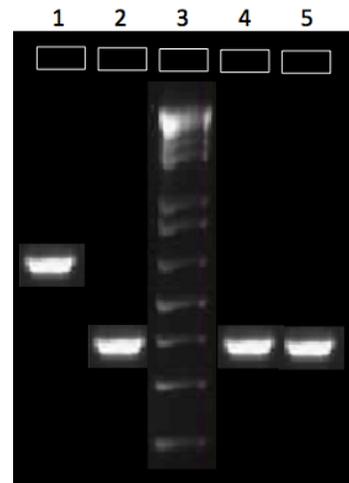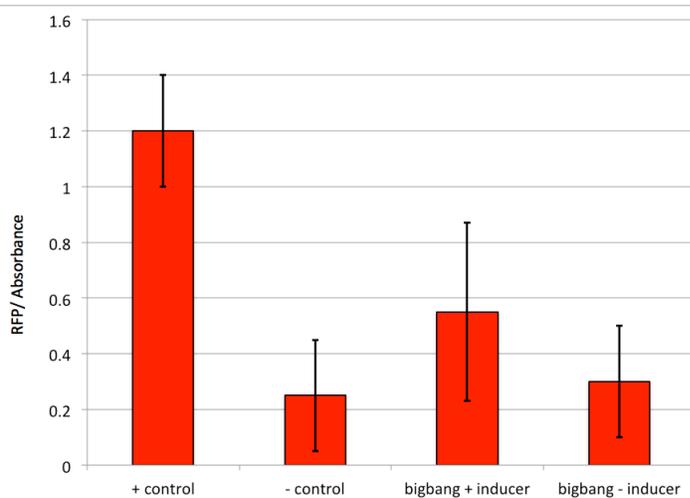
6 pts.

2) You **may NOT USE the Guided Tour file**. You must answer this question using your own experience of analyzing DNA sequences. I emailed you a zipped file that contains two sequences. I want you to use ApE to:

a) Tell me how many SNPs are in "variant 1" and their nucleotide positions.

b) Translate both ORFs and describe the variant protein compared to the original mystery protein. This question is a bit tricky so be careful when you analyze the translation. Do not list all the amino acids, just describe the differences.

Lecture Questions:

10 pts.

3) Analyze the relationship between light flash interval and temperature for male and female fireflies. Support your answer with data. **Limit your answer to a maximum of 4 sentences.**

10 pts.

4) *Vibrio fischeri* is able to communicate more information than you might have predicted prior to taking Bio113.

a) What is the physical form for *V. fischeri* communication? Support your answer with data. **Limit your answer to a maximum of 2 sentences.**

b) Describe the population outcome when *V. fischeri* uses its communication. Support your answer with data. **Limit your answer to a maximum of 3 sentences.**

10 pts.

5) Most people fail to understand how plants communicate. If anything, they will cite the colors or fragrances of flowers as the only communication produced by plants, but those lucky enough to take Bio113 know better. Give three examples (A – C) of plant communication that we have studied. Support your answer with data. **Limit your answer to a maximum of 6 sentences total (two per example).**

     A.

     B.

     C.

10 pts.

6)

a) What information do mole crickets convey with sound? Support your answer with data. **Limit your answer to a maximum of 2 sentences.**

b) Do other species use mole cricket sound information? Explain your answer. Support your answer with data. **Limit your answer to a maximum of 2 sentences.**

c) Compare and contrast frog-eating bats with the mole cricket example. Support your answer with data. **Limit your answer to a maximum of 3 sentences.**

10 pts.

7) In the space provided below, sketch a picture that shows when a horned lizard should stop feeding at one ant nest and move onto the next one. In your diagram, you must indicate:

a) the average time it takes to travel between nests

b) the average time when a lizard should leave.

c) Explain in a maximum of two sentences what the response of a lizard would be if the ant density of each nest doubled.

10 pts.

8)

a) What evidence exists to support the claim that pre-biotic Earth contained the necessary organic molecules to assemble the first cell? Support at least part of your answer with data. **Limit your answer to a maximum of 2 sentences.**

b) What property of lipids enables them to form abiotic membranes? Support your answer with data. **Limit your answer to a maximum of 2 sentences.**

c) Living cells exhibit three characteristics that separate them from inanimate objects. List all three (A – C) and choose at least one figure (one may be sufficient but you might see more than one which is allowed) for each characteristic that shows abiotic processes could have produced the first living cell. Support your answer with data. **Limit your answer to a maximum of 6 sentences (two fort each characteristic).**
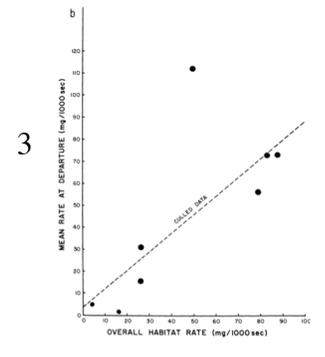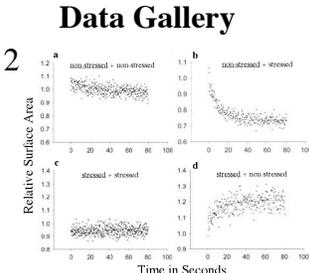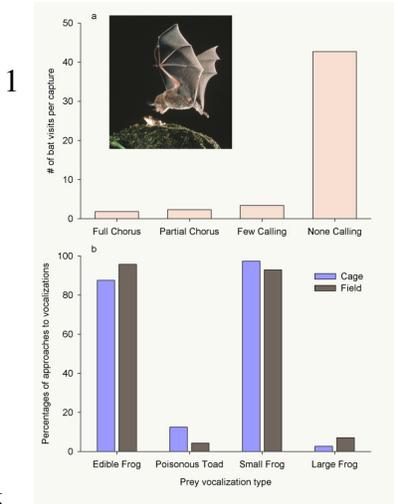
    A.

    B.

    C.

10 pts.

9) A very popular anti-evolution arguments can be summarized as, "Complexity cannot derive naturally from simplicity." Use data from the gallery to illustrate how complex properties can emerge by combining simple components. Bias your data selection towards big leaps of complexity rather than minor variations of structures. **Limit your answer to a maximum of 6 sentences.**
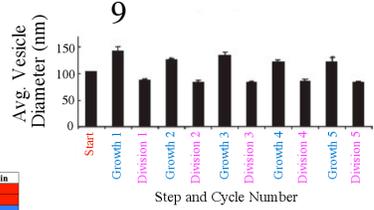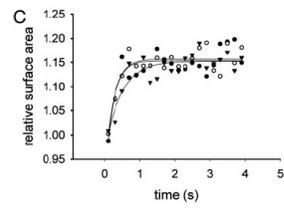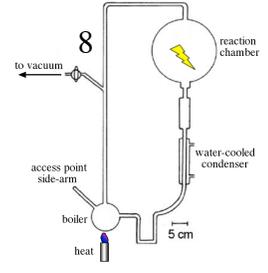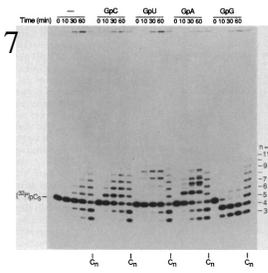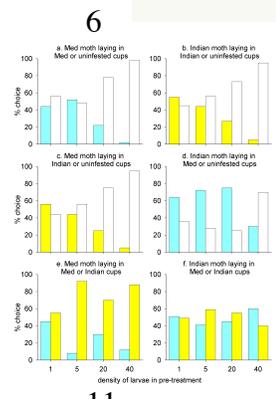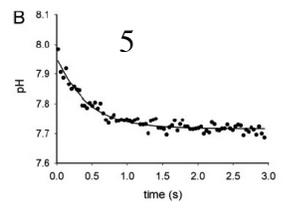
10 pts.

10) In my many years of parenting, I have seen good and bad parents. A good parent exhibits behaviors that nurture the next generation. Choose three examples from the data gallery of species providing for their progeny with the assistance of information. Each example needs to come from very different species. In other words, don't chose two or more examples from the same or closely related species. Think broadly about next generation and do not limit yourself to examples of sexual reproduction. **Limit your answer to a maximum of 6 sentences total.**

Dr. Campbell's Bio113 Exam #2 – Fall 2012

Data Gallery

1

2

Relative Surface Area — Time in Seconds

3

4

mole cricket call	number of tachinid flies
southern	24
tawny	51
imitator	33
changa	0
northern	0

5

B — pH vs time (s)

C — relative surface area vs time (s)

6

a. Med moth laying in Med or uninfested cups
b. Indian moth laying in Indian or uninfested cups
c. Med moth laying in Indian or uninfested cups
d. Med moth laying in Med or uninfested cups
e. Med moth laying in Med or Indian cups
f. Indian moth laying in Med or Indian cups

density of larvae in pre-treatment

7

8

reaction chamber, to vacuum, water-cooled condenser, access point side-arm, boiler, heat, 5 cm

9

Avg. Vesicle Diameter (nm) — Step and Cycle Number: Start, Growth 1, Division 1, Growth 2, Division 2, Growth 3, Division 3, Growth 4, Division 4, Growth 5, Division 5

10

| (a)		call uttered	
situation of the bird	Chattering	Chattering and grating	Grating
bird alone (n = 96)	38	35	23
flown over by another bird (n = 69)	33	18	18
facing another bird (n = 95)	9	16	70

(b) compared situations	χ^2	p-value
alone *vs.* flown over	2.05	0.36
flown over *vs.* facing another	41.5	1×10^{-9}
alone *vs.* facing another	48.7	2×10^{-11}

11

Human Protein #	Protein Function	Protein Location	Best Match Domain
NP_001009	Translation	Cytoplasm/ rER	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

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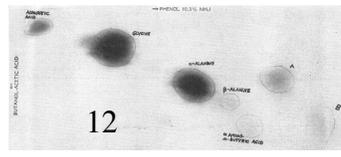
13

male-male interactions (n = 45)				
	grating call 1	grating call 2	χ^2	p-value
frequency	29	16	3.76	0.053
percentage	64%	36%		
male-female interactions (n = 37)				
	grating call 1	grating call 2	χ^2	p-value
frequency	4	33	26.57	2.5×10^{-7}
percentage	11%	89%		

14

Mean # of petrels responding (+/- 1 s.e.) — Direct Flight, Circle Flight, Landed — Playback Call: Chattering, Grating, Chattering + Grating, No Call

15

$y = 121.9 - 5.277x + 0.077x^2 - 0.00038x^3$

Interpulse interval (sec) vs Temperature (oC)

16

(a) time interval between guards (min); (b) time interval between guards (min) — no sentinel, sentinel quiet, sentinel vocalizing; background noise, sentinel calls (n = 4)
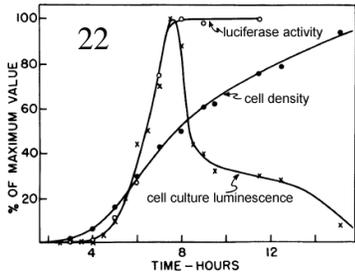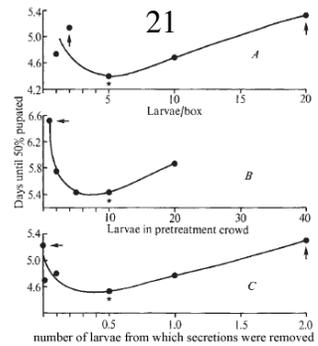
17

Southern mole cricket male call — Tawny mole cricket male call — Control (no sound); Percentage; Southern, Tawny

18

	Ovule **with** associated pollen tube after 20 hours	Ovule **without** associated pollen tube after 20 hours
Normal ovule	124	60
Abnormal ovule	0	189

19

20

21

22
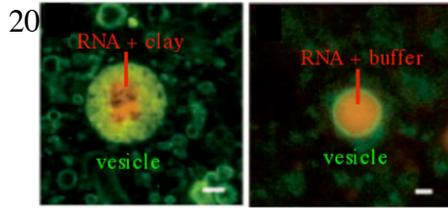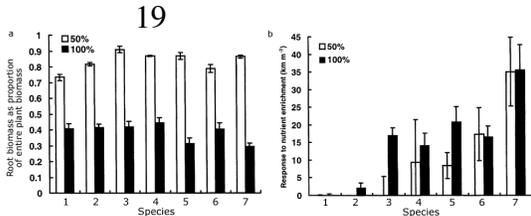
23

Treatment	Hypothesized to be present in medium when cells are added to culture		Optical density at point of luminescence after inoculation with …	
	Strain 1 signal	Strain 2 signal	Strain 1	Strain 2
Control	No	No	0.3-0.4	0.1-0.15
Strain 1 fluid	Yes	No	Immediate	0.03-0.05
Strain 1 fluid, filtered twice	Yes	No	Immediate	
Strain 1 fluid, boiled	Yes	No	0.03-0.05	
Strain 2 fluid	No	Yes	0.03-0.06	Immediate
Strain 2 fluid, filtered twice	No	Yes		Immediate
Strain 2 fluid, boiled	No	Yes		Immediate

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Treatment	mean number of trials	standard error	sample size
inexperienced bat with experienced bat	5.3	1.7	10
two inexperienced bats	96.8	3.2	5
one inexperienced bat	96.2	3.8	5

25

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33