

Biology 113 Closed Book Take-Home Exam #3 – Evolution

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 7 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 by 12:30 on Monday Nov. 19. **EXAMS ARE DUE BY 12:30 ON MONDAY NOVEMBER 19.** If you turn in your exam late, then you lose a letter grade for each day you are late. Your **answers 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. **Print all the pages with questions and answers, but do not print the data gallery.**

I have provided you with 3 pages of "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 insufficient support for your answer, however. You must explain the relevance of the data and how they support your answer. I have given you sentence limits so be concise. **PLEASE DO NOT PRINT THE DATA GALLERY.**

-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:

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:

6 pts.

1) In the space below, draw a pair of pictures showing your predicted outcome of your bacterium exposed to your antibiotic before and after the directed evolution lab experiment.

looking for labeled diagrams showing either change in radius on a plate or growth at higher antibiotic concentration in liquid.

6 pts.

2) Construct a summary that shows how TAS2R38 and plant toxins are connected to the “big ideas” of information and evolution. **Limit your answer to a maximum of three sentences.**

Needed to connect bitter taste to poisons and how natural selection would favor this in humans.

Plants produce poisons to protect themselves from predation.

Many of us have lost taste capacity due to information from other sources and loss of hunter-gatherer lifestyle.

Lecture Questions:

12 pts.

3) A common misconception about evolution is that it must take place slowly and gradually. Give three genome-level examples of rapid change and explain which mechanism of evolution is illustrated for each one. Support each answer with distinct data. **Limit your answer to a maximum of three sentences for each example.**

A. Mutation: #2, genome duplication

B. Mutation: #26, inversions, deletions, insertions

C. Mutation: #3, chromosomal duplications

10 pts.

4) An angry parent goes to a PTA meeting and screams at the principal about a new food policy. The parent says Pat must eat peanut butter every day to be happy. Furthermore, “If no student has died from peanuts at this point in the school year, no student ever will.”

a) Explain how the particular mechanism of evolution is working with the development of allergies. Support your answer with two sets of data. **Limit your answer to a maximum of 4 sentences.**

Needed to connect Figs. #11 and 17, natural selection and increased affinity.

b) If you were a smooth principal, what would you say to a chunky parent about the possibility of an allergy-related death in school? Your answer should incorporate science as well as an ELSI evaluation of the situation. **Limit your answer to a maximum of 3 sentences.**

Needed to include increased affinity with each exposure, death is possible (science) and then some evaluation such as carry epipens, eat PB after school, designated days and locations, etc.

10 pts.

5) You know from your studies and from your daily life that variation of traits within populations is very common, though not true in every instance. Explain two distinct causes of variation in phenotype and support your answers with data for each cause. You may NOT use the same figures for questions 5 and 6. **Limit your answers to a maximum of 3 sentences each.**

A. environment = #12 predatory snail and barnacle

B. genetics = 5-8, 30 and a few others. #29 bad choice because we don't know the cause.

12 pts.

6) Use different data for each answer for a – c below.

a) Use data from two experiments to explain how natural populations contain both drab and bright guppy males. **Limit your answers to a maximum of 4 sentences.**

#14 drab with females to mate

#4b bright preferred in absence of predator

b) Use data from one experiment to explain why someone could logically predict that only drab males would survive in a wild population. **Limit your answers to a maximum of 2 sentences.**

#9 timid (~drab) survive longer

c) Use data from one experiment to explain why someone could logically predict that only bright males would survive in a wild population. **Limit your answers to a maximum of 2 sentences.**

#13c bright flee sooner from predators

12 pts.

7) Choose three different scales-of-distance examples that illustrate a single mechanism of evolution which slows the rate of speciation. To get full credit, you must describe in general or name the species and how each figure is connected to this mechanism. **Limit your answers to a maximum of 3 sentences each.**

A. #10 or 16, 100s of meters, fungus, gene flow

B. #5, 10s of km, flower, gene flow

C. #25, 1000s of km, bird, gene flow

8 pts.

8) How does a “bottle neck effect” contribute to evolution? Use one specific example, name the mechanism of evolution, and support your example with at least two data sets. **Limit your answers to a maximum of 4 sentences.**

genetic drift, grouse & #15

#1 and graph to show loss of alleles and heterozygosity

#23 and table to show increased genetic distance

10 pts.

9) Coevolution is not uncommon, but it is difficult to document.

a) Give one example of diffuse coevolution and support your answer with data. **Limit your answers to a maximum of 3 sentences.**

birds and fruits, #20 (multiple species on both sides)

b) Give one example of pairwise coevolution and support your answer with data. **Limit your answers to a maximum of 3 sentences.**

several choices (moth/yucca, coral, newts/snakes) – one species each side

14 pts.

10) You will study global climate change in more detail in Chapter 25 during Bio114, but in Chapter 10, we looked at the response of populations in response to climate changes.

a) Give one example of a population changing in response to climate change. **Limit your answers to a maximum of 3 sentences.**

grasshopper expanding range in England #22

b) What information is likely to be the stimulation that led to the change in phenotype?

Limit your answers to a maximum of 2 sentences.

increased temperature

c) Design an experiment to determine if true evolution (see bonus question) is happening or not? This question was not an integrating question in the book but allows you to use your increased understanding of experiments to design your own experiment in general terms, not details. **Limit your answers to a maximum of 3 sentences.**

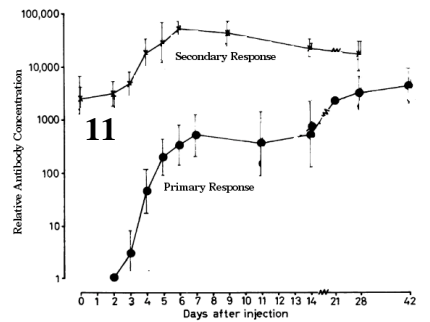
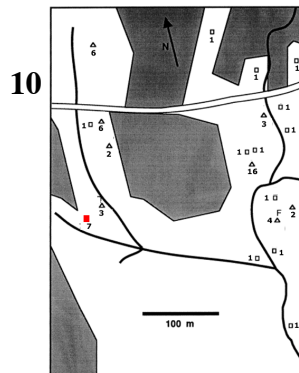
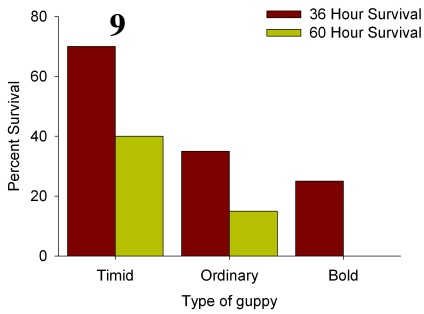
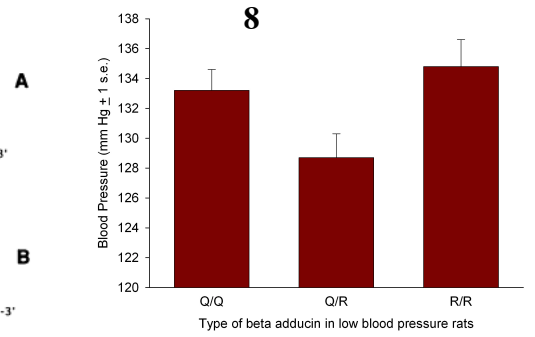
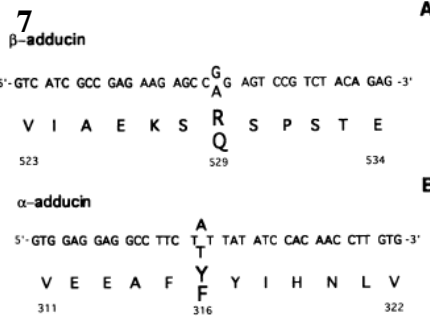
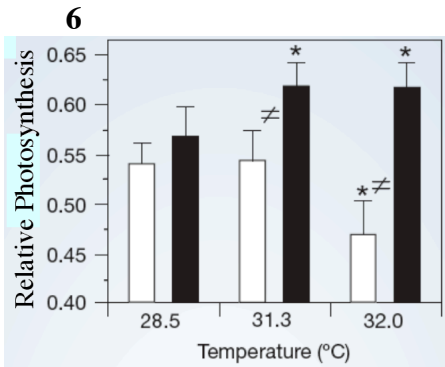
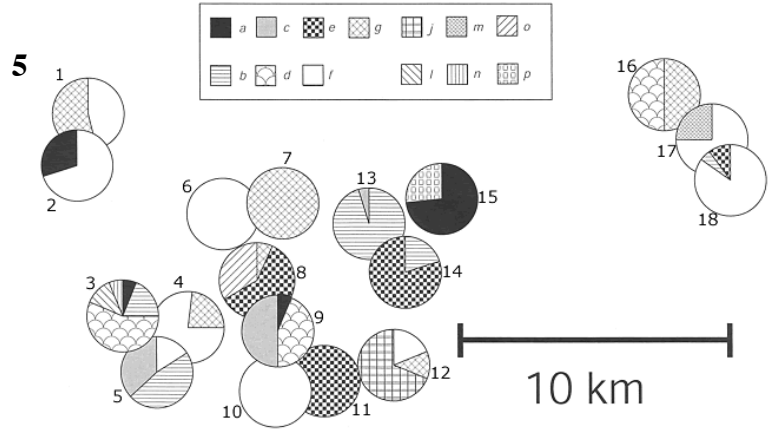
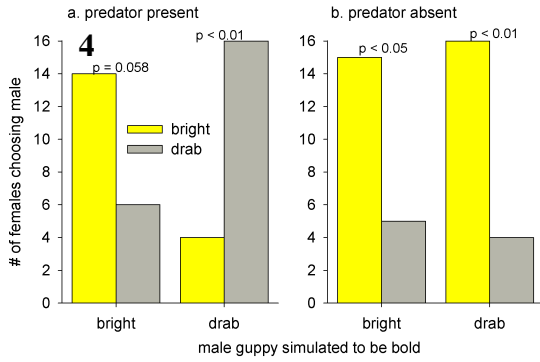
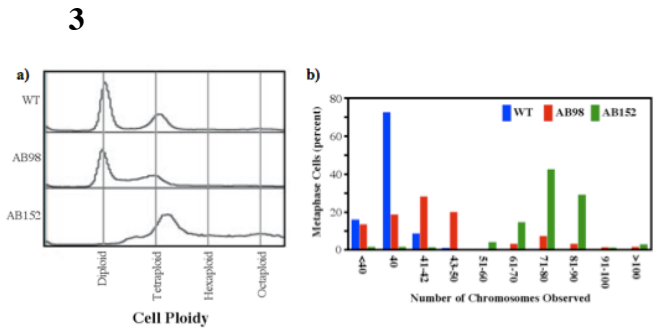
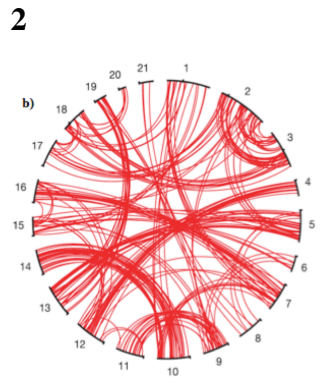
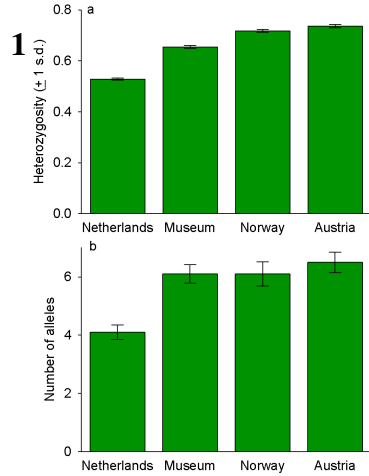
You needed to test the DNA directly and compare allele frequencies in short vs. long winged individuals. Sequencing whole genome, or identifying the gene involved. Could bring back fertilized eggs to lab and see if wing length was similar (env.) or different (genetics) in eggs from different populations.

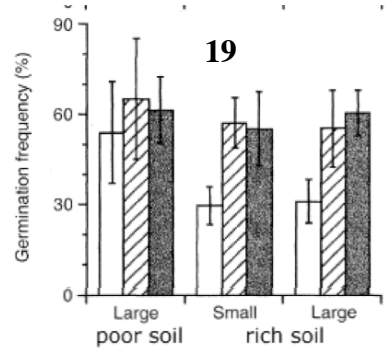
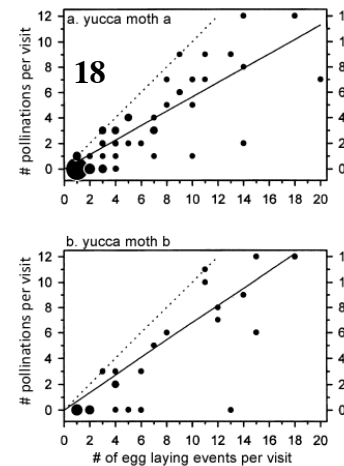
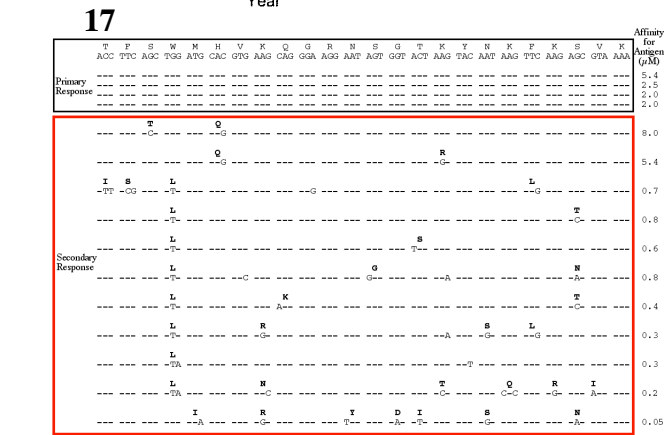
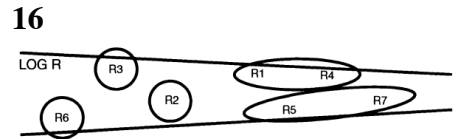
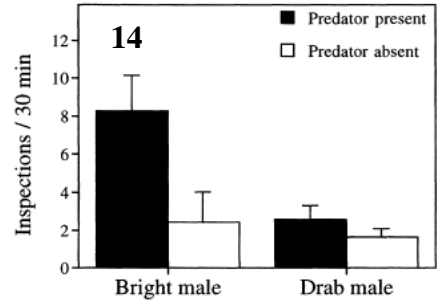
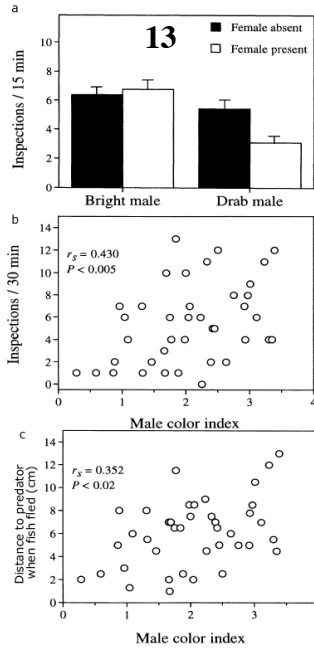
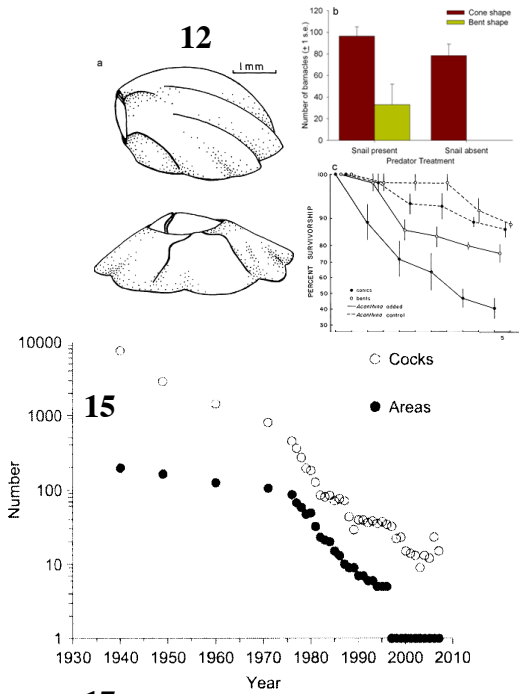
+2 pts

Bonus Question: During Dr. Paradise's presentations, he gave a very clear and specific definition of evolution. Define evolution in one sentence.

Evolution is a change in allele frequency in a population over time.

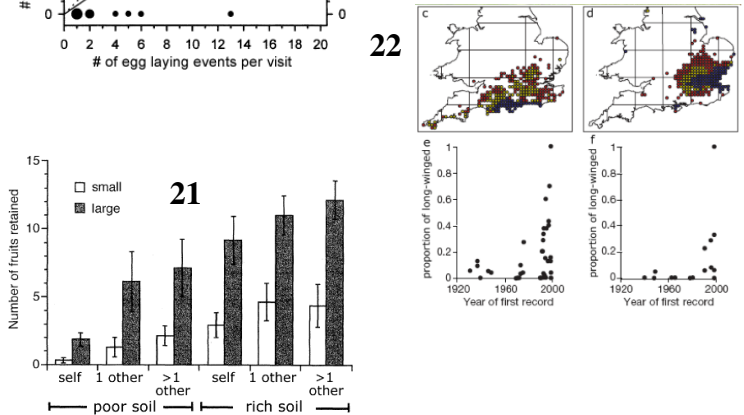
Data Gallery





20

variable	OP term	season			s.s.?
		summer	autumn	winter	
water content (%)	WP	67.9 ± 6.2	60.0 ± 9.2	52.0 ± 16.4	yes
relative yield	(1-WP)*P/(P+S)	16.3 ± 6.2	20.9 ± 7.6	23.5 ± 8.1	yes
pulp dry mass (mg)	(1-WP)*P	52.9 ± 56.7	97.2 ± 86.9	122.8 ± 245.6	no
fruit wet mass (mg)	P + S	324.1 ± 340.6	414.9 ± 296.7	468.0 ± 738.8	no
number of seeds	-	3.5 ± 5.6	2.1 ± 2.3	2.8 ± 3.2	
lipid content (%)	d ₁	2.5 ± 1.2	7.4 ± 13.7	19.7 ± 18.7	yes
protein content (%)	d ₂	4.3 ± 1.7	4.3 ± 1.8	5.0 ± 1.4	no
lipid profitability	OP ₁	0.38 ± 0.21	1.55 ± 2.96	4.73 ± 4.64	yes
protein profitability	OP ₂	0.69 ± 0.29	0.85 ± 0.34	1.12 ± 0.38	yes



23

	Dutch museum	Norway	Austria
Dutch present	0.111 (0.062-0.177)	0.162 (0.124-0.193)	0.152 (0.108-0.194)
Dutch museum		0.050 (0.011-0.109)	0.036 (0.006-0.078)
Norway			0.031 (0.013-0.050)

