2013-14 AP Biology Summer Assignment

Summer Assignment List:

1.Watch Bozeman's "Biology Introduction" podcast http://www.bozemanscience.com/science- videos/2012/3/19/biology.html, "The Hierarchy of Life" podcast http://www.bozemanscience.com/science-videos/2012/2/19/the-hierarchy-of-life.html, "The Essential Characteristics of Life are Conserved" podcast http://www.bozemanscience.com/science- videos/2011/6/26/005-essential-characteristics-of-life-are-conserved.html , and "The Three Domains of Life" podcast http://www.youtube.com/playlist?list=PL7A750281106CD067&feature=plcp

2.Read and take notes on Chapter 1 – **Introduction: Themes in the Study of Life.** These notes will help you answer the guided reading questions and can be taken in any style that you wish. Remember to look for themes and connections.

*3.*Complete Guided Reading Questions for Chapter 1 – *complete sentences! (These are included in this packet.)*

4.Watch Bozeman's "Response to External Environments" podcast http://www.bozemanscience.com/science-videos/2011/9/14/019-response-to-external-environments.html and "Behavior and Natural Selection" podcast http://www.bozemanscience.com/science- videos/2011/9/14/026-behavior-and-natural-selection.html

5.Read and take notes on **Chapter 51 - Animal Behavior**. These notes will help you answer the guided reading questions and can be taken in any style that you wish. Remember to look for themes and connections.

*6.*Complete Guided Reading Questions for Chapter 51 – *complete sentences! (These are included in this packet.)*

7.Complete the How Science Works Tutorial (21 slides) Go to http://undsci.berkeley.edu/index.php, click on How Science Works in Understanding Science 101, and take notes on the back of your How Science Works Flowchart. ****Your notes should focus on the proper way to carry out scientific investigations and present and analyze data.***

8.Watch Bozeman's "Scientific Method" podcast http://www.bozemanscience.com/science- videos/2010/10/3/the-scientific-method.html, "AP Biology Lab 11: Animal Behavior" podcast http://www.bozemanscience.com/science-videos/category/ap-biology-labs. and "Chi-squared Test" podcast http://www.bozemanscience.com/science-videos/2011/11/30/chi-squared-test.html

9.Animal Behavior Lab 11

a. Complete Animal Behavior Pre-Lab reading and quiz on LabBench: http://www.phschool.com/science/biology_place/labbench/lab11/intro.html, print a copy of your completed quiz

b. Complete Lab 11A and 11B-Animal Behavior. Record all data and answers on the pages provided. Use these pages as a reference for your formal lab report. *****Note:*** *there is a teacher designed part and a student designed part. You will be observing crickets in lieu of fruit flies for part B.*

Animal Guidelines: Please return all animals to their original habitat. If you purchase

crickets, then feed them to reptile pets you have or donate them to the pet store. DO NOT release them to the wild!

Tips for finding pill bugs: look in dark, damp areas, especially under outdoor trash cans, logs, etc; do not catch them until you are ready to work on the lab; return them to the capture area when the lab is complete.

c. Once you have completed the entire lab ,you will type up a formal labreport for lab11Aand11B. Lab 11A and 11B will include all required section of a formal lab write-up. Please combine the teacher and student results for lab 11A and then label the second section of your lab write-up as 11B. The lab write up for section 11A will include multiple data tables and graphs to represent the two parts of the lab, but will combine your results into a single conclusion. Do not write in first person. Write in 3rd person (no I, or we, or you.) Your bound report should include a cover page with the lab title, your name, and the date. ****The formal lab report guidelines and a grading rubric is included for you at the end of this packet.***

10. **Book Review Assignment for AP Biology** Science has been undermined in the news numerous times. You are assigned to do a critical analysis on one science book of your choice from the following list – your job is to convince the community how the themes and messages in your book are important issues to consider. Your goal is to make your book SHINE as an important literary piece that EVERYONE must read!

Format of Book Review: Word Count: 1400-1600 words

Summary: Offer a general summary of the book - your summary must be more detailed than the summary offered on Amazon and the paragraphs on the book description. Be sure to emphasize the biological aspect and write in third person.

Include in your summary:

- USE EVIDENCE: Offer at least 3 multiple examples of your favorite parts of the book,
- USE EVIDENCE: Identify themes and/or the "big messages" that the author is trying to portray.

Offer at least 3 examples to support this theme.

Significance: Why should we care?

- - -

Why are the themes and/or messages in this book significant to others? How is this book important? Use: current events connection and/or statistical data

Forecast the applicability of the author's message to future studies/technology or societal problems.

In addition discuss the author's qualifications and sources used in the book. Were the sources used reputable and appropriate for the book.

Bibliography: In APA format http://www.sciencebuddies.org/science-fair-projects/project_apa_format_examples.shtml

Rubric: Read it before you read the book. You will find the rubric at the end of this packet.

List of acceptable books:

You can find these books through the public library system, used book stores, or amazon.com.

Non-Fiction:

Carrol, Sean; *Endless Forms Most Beautiful: The New Science of Evo Devo and The Making of the Animal Kingdom*

Colborn, Theo; *Our Stolen Future*
Darwin, Charles; *Origin of Species*
Dawkins, Richard; *The Ancestor's Tale: A Pilgrimage to the Dawn of Evolution* Dawkins, Richard; *The Selfish Gene*
Dethier, Vincent; *To Know a Fly*
Dixon, Bernard; *From Creation to Chaos: Classic Writing in Science* Frank-Kamenetskii, Maxim D.; *Unraveling DNA: The Most Important Molecule of Life* Gould, Stephen Jay; *Ever Since Darwin: Reflections in Natural History*
Jones, Steve; *Darwin's Ghost*
Lorenz, Konrad; *King Solomon's Ring*
Peters, C.J.; *Virus Hunter: Thirty Years of Battling Hot Viruses Around The World*
Owens, Mark and Delia; *Cry of the Kalahari*
Ridley, Matt *Nature Via Nuture: Genes, Experience and What Makes Us Human* Wilson, Edward; *The Diversity of Life*

Fiction:

Darnton, John; *The Experiment*
Lynch, Patrick; *Omega*
Preston, Richard; *The Hot Zone*
Schreiber, Whitley; *Nature's End: The Consequences of the Twentieth Century*

AP Biology Reading Guide Chapter 1: Introduction: Themes in the Study of Life

Name_____Period_____

Chapter 1: Introduction: Themes in the Study of Life

Begin your study of biology this year by reading Chapter 1. It will serve as a reminder about biological concepts that you may have learned in an earlier course and give you an overview of what you will study this year.

1. In the overview, Figure 1.3 recalls many of the properties of life. Label the seven properties illustrated here, and give a *different* example of each.

Concept 1.1 Themes connect the concepts of biology

2.

3.

What are **emergent properties?** Give two examples.

Life is organized on many scales. Figure1.4 zooms you in from viewing Earth from space all the way to the level of molecules. As you study this figure, write in a brief definition of each level.

biosphere

ecosystem

AP Biology Reading Guide
Chapter 1: Introduction: Themes in the Study of Life

community population organism organs/organsystems tissues
cells organelles molecules

4. Our study of biology will be organized around recurring themes. Make a list here of the themes that are presented, and give an example that illustrates each theme. Watch for these themes throughout your study this entire year. This will help you see the big picture and organize your thinking. (Go to the *Summary of Key Concepts* at the end of the chapter for a concise look at the themes.)

Theme 1: Theme 2: Theme 3: Theme 4: Theme 5: Theme 6: Theme 7:
(Find it in 1.2.)
Example Example Example Example Example Example Example

5. As you read this section, you will be reminded of things you may have studied in an earlier course. Since this material will be presented in detail in future chapters, you will come back to these ideas, so don't fret if some of the concepts presented are unfamiliar. However, to guide your study, define each of the terms in bold as you come to them.
eukaryotic cell prokaryotic cell DNA
genes
genome
negative feedback/positive feedback
Concept 1.2 The Core Theme: Evolution accounts for the unity and diversity of life
6. Life is organized into groups. Study Figure 1.14.
• Which level contains the greatest diversity of organism?
• The least?
• Write out the levels of organization in order.
• Most people use a mnemonic device to remember these levels. If you have one, write it here.

7. Taxonomy is the branch of biology that names and classifies organisms. Because of new molecular information, there have been many changes in placement of certain groups in recent years. Notice that all life is now organized in your text into 3 domains rather than the 5 kingdoms you may have learned earlier. Put the kingdoms mentioned in the text in the space above the proper domain names shown here.
8. What two main points were articulated in Darwin's *The Origin of Species*?
9. What did Darwin propose as the mechanism of evolution? Summarize this mechanism.
10. Study Figure 1.22, which shows an evolutionary "tree." What is indicated by each twig?
11.What do the branch points represent? Where did the "common ancestor" of the Galápagos finches originate?

Concept 1.3 Scientists use two main forms of inquiry in their study of nature

12.What are the two main types of scientific inquiry? Give an example of each.
What is *data*?
13.Distinguish between quantitative and qualitative data. Which type would be presented in a datachart and could be graphed? Which type is found in the field sketches made by Jane Goodall?
14.In science, how do we define *hypothesis*?

15.A scientific hypothesis has two important qualities. The first is that it is *testable*. What is the second?
16.Are scientific hypotheses proved? Explain your answer!
17.Look at Figure 1.24. Use it to write a hypothesis using the "If . . . then . . ., because" format. The is your justification.
18. What is a *controlled experiment*?
19. The text points out a common misconception about the term "controlled experiment". In the snake mimicry experiment, what factors were held *constant*?
20. Why are supernatural explanations outside the bounds of science?
"because"

21. Explain what is meant by a scientific *theory* by giving the three ways your text separates a theory from a hypothesis or mere speculation.
1.
2.
3.
Testing Your Understanding: Self-Quiz Answers
Now you should be ready to test your knowledge. Place your answers here:
1. _____ 2._____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____

Name_____ Period_____

Chapter 51: Animal Behavior

Overview

1. How is *behavior* defined?

Concept 51.1 Discrete sensory inputs can stimulate both simple and complex behaviors

2. a. What is ethology or *behavioral ecology*?

b. What is the difference between *proximate* and *ultimate causation*?
c. Who are the three *ethologists* who shared in a Nobel Prize for their work in 1973?
3. What is a *fixed action pattern* (FAP)? Give an example.
4. What is a *sign stimulus*? Give an example

5. a. Nicholas Tinbergen's work with the stickleback fish is a classic study. Explain what he found using the terms *fixed action pattern* and *sign stimulus* in your response.
b. Define these behavior terms: You may need to use an alternate source.
6. What is migration?

Definition

Example

kinesis

taxis

7.Explain what is meant by *circadian clock* and *circadian rhythms*.
8.Identify two behaviors, either plant or animal, that demonstrate a circadian rhythm. (You may need to refer to Chapter 40 or Chapter 49 for examples.)
9.Discuss two navigational strategies used by birds to migrate.
10.Animals communicate in various ways. Discuss at least three specific examples using different organisms.
Notice the pictures that show fruit fly courtship behavior(see AP Biology Lab 11B on lab bench
http://www.phschool.com/science/biology_place/labbench/lab11/intro.html,
"Reproductive Behavior in Fruit Flies").
11.What different modes of communication are used by the fruit fly?
Karl von Frisch studied European honeybees. What are the two types of dances that a returning worker bee does, and what information does each dance convey? Use a labeled sketch to describe each dance. *For help with your sketch, see page 1121 of your text.*

12. What are *pheromones*? Give three specific types of information that can be transmitted through pheromones.
Concept 51.2 Learning establishes specific links between experience and behavior
13. a. What is the difference between *innate* and *learned* behavior? Give an example of each.
b. Based on *cross-fostering* and *human twin studies*, what are the two factors that contribute significantly to behavior?
14. Describe the process of *imprinting*, and explain what is meant by *sensitive* or *critical period*.
15. Describe the classic study of *parental imprinting* done by Konrad Lorenz.
16. What special challenges did researchers face in order to return whooping cranes to the wild? What would you have to wear if you worked with hatchlings? Why?

17. There are several types of learning. What occurs in *spatial learning*?
18. What are two types of *associative learning*? Which type did *Ivan Pavlov* use to get a dog to salivate at the sound of a bell?
19. What occurs in *operant conditioning*?
20. What is *cognition*? Give three examples of cognition in animal species; include at least one bird behavior.
21. Many bird songs are learned during a critical period. What will happen if a white-crowned sparrow does not hear the song of its species during this time?
Concept 51.3 Selection for individual survival and reproductive success can explain most behaviors
22. What is *foraging behavior*?
23. What is proposed by the *optimal foraging theory*? Explain it in terms of cost and benefit, and cite two examples from your text.

24. To demonstrate that you understand the principle of optimal foraging, describe a food source that you would not be likely to exploit and explain why.
25. Explain each of these mating systems: **promiscuity**:
monogamy: **polygamy**:
polygyny:
polyandry:
26. Explain two factors that may be important in determining the evolution of these systems, and
apply each factor to a particular species.
27. Let's return to an earlier idea from Chapter 23. What is *sexual selection*?
28. There are two types of sexual selection. Explain each of them.
intersexual selection: intrasexual selection:
29. What is *agonistic behavior*? Give one example of this behavior that is not in your book.

Concept 51.4 Inclusive fitness can account for the evolution of altruistic social behavior

30. ***Both genetic makeup and environment contribute to the development of behaviors.***

This concept looks at some very interesting ways that genetic changes affect behavior. Several important case studies that show a genetic component to behavior are presented. Take time to read and enjoy them. The study of voles and their mating behaviors is often discussed in other science articles.
a. To return to fruit fly mating, a single gene called *fru* controls male mating behavior. If males lack a functional *fru* gene (short for *fruitless*), what happens?
b. And what occurs if females are genetically manipulated to express this gene?
c. Explain how the *fru* gene demonstrates a genetic basis of behavior.
31. What is *altruism*?
32. Explain the evolutionary advantage to a population of having members who exhibit *altruistic behavior*.
33. *Altruism* may reduce the fitness of an individual—for example, by making that individual more obvious to a predator. Explain this behavior using the concept of *inclusive fitness*.
34. Explain the logic behind geneticist J.B.S. Haldane's comment that he would lay down his life for two brothers or eight cousins.

35. Contrast *kin selection* and *reciprocal altruism*.
Test Your Understanding Answers
Now you should be ready to test your knowledge. Place your answers here: 1. ____ 2. ____3. ____4. ____5. ____ 6. _____

Animal Behavior Lab 11

Background Information

Terrestrial isopods are land dwelling crustaceans, commonly known as sowbugs or pillbugs (or roly- polies). They are related to lobsters, crabs, and shrimp and terrestrial

isopods breathe with gills. While they look similar, sow bugs are different from pillbugs. Pillbugs will curl into a ball when threatened whereas sow bugs will attempt to flee. Since your isopods are caught from the wild, make sure you are using the same type for your experiments.

Isopod Handling and Rearing

Raise isopods in a clear shoebox or similar, the bottom should be covered with soil or sand and kept moist (use a mister). An old piece of bark and leaf litter should cover the soil. Isopods can be fed carrots, raw potatoes or apples (alternately fish flakes can be used as food). Moldy food or soil should be removed. Females can carry up to 200 eggs in a brood pouch underneath her abdomen and will remain in the pouch for about three weeks - they look the same as adults, only smaller.

Larger isopods can be handled and observed easily with your hand, by picking them up with your fingers or gently scooping them up with a spoon. They are fast walkers and can withstand short drops. Immature isopods are more fragile than adults.

Ethology is the study of animal behavior. Behavior is an animal's response to sensory input, and falls into two basic categories: **learned** and **innate** (inherited).

Orientation behaviors place the animal in its most favorable environment. In **taxis**, the animal moves toward or away from a stimulus. Taxis is often exhibited when the stimulus is light, heat, moisture, sound, or chemicals. **Kinesis** is a movement that is random and does not result in orientation with respect to a stimulus. If an organism responds to bright light by moving away, that is a taxis. If an animal responds to bright light by random movements in all directions, that is kinesis.

Agonistic behavior is exhibited when animals respond to each other by aggressive or submissive responses. Often the agonistic behavior is simply a display that makes the organism look big or threatening. It is sometimes studied in the laboratory with Bettas (Siamese Fighting Fish).

Mating behaviors may involve a complex series of activities that facilitate finding, courting, and mating with a member of the same species.

Additional Information on pillbugs can be found at the following websites:

http://insected.arizona.edu/isoinfo.htm

http://www.ca.uky.edu/entomology/entfacts/ef439.asp

http://crawford.tardigrade.net/bugs/BugofMonth18.html

Exercise 11A: General Observation of Behaviors

In this lab, you will be working with terrestrial isopods commonly known as pillbugs, sowbugs, or roly- polies. These organisms are members of the Phylum Arthropoda, Class Crustacea, which also includes shrimp and crabs. Most members of this group respire through gills.

Procedure:

1. Place 10 pillbugs and a small amount of bedding material (a moist paper towel, or moist soil or sand) in a small petri dish. They generally try to get out so cover the dish with plastic wrap or a petri dish cover upside down.
2. Observe the pillbugs for 10 minutes. Make notes on their general appearance, movements about the dish, and interactions with each other. Notice if they seem to prefer one area over another, if they keep moving, settle down or move sporadically. Note any behaviors that involve 2 or more pillbugs. **Do not interfere with the specimens in any way**.

Isopod Observations

In the first part of this exercise, you will observe pillbugs and record what you see.

Example Data: General Observations

- The larger pill bugs climbed over the smaller sized ones. - Movement mostly around edges of tray.
- Legs move in quick, fluid motion.
- Use antenna to sense closeness of other isopods.
- When flipped on back side, will kick off from ground or other pill bugs to flip back over.

Analysis (these questions will be addressed in your lab report) – Make notes to yourself throughout your experiment as you keep these questions in mind.

How do the pillbugs seem to sense their environment? Are they all the same species?
Can you tell the difference in males and females? How many eyes do they have?
How many legs?
Do they exhibit dominance behaviors?
What are some stimuli they seem to respond to? How do they respire?

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3. **Make a detailed sketch of a pillbug.** Scientific Sketching
When you make a sketch of a pillbug, don't just draw an oval with a few squiggly legs - you are expected to do a scientific illustration similar to the sketch of an earthworm below.
Here are some tips for making an accurate sketch (include in the data section of your lab report before your data tables and graphs – remember a title for the illustration)
Determine the relative proportions (length, width, height as well as lengths of body parts)
Count the number of body segments
Count the number of legs
Locate and label the body parts
Note the size of the pillbug

Kinesis and Taxis in Pillbugs:

1. Prepare a choice chamber. The choice chamber consists of two large plastic petri dishes taped together with an opening cut in between. Several alternatives, such as deli containers, to this concept can be produced. Take 2 plastic petri dishes and cut out 1, 1/2 inch opening at the side of each dish. Place the petri dishes together, matching the cut ends. Now tape the petri dishes together by placing a strip of tape under each one. The dishes now can be used to test for the variables.
2. In this part of the experiment, you will see the pillbug's preference for a wet or dry environment. Choose your variables to be tested – in this case, moisture or hydrotaxis: the orientation of an organism in relation to the presence of water, and set up the choice chambers accordingly. ***Remember that you should only test one variable at a time while you keep any other variables, like light, constant.*** Make one filter paper wet, but not saturated, and leave the other dry. With a paint brush or a pencil eraser, carefully transfer ten pillbugs from the stock culture(where you are storing them) and randomly place them onto both sides of the choice chamber until you have 5 pillbugs on each side. Cover all chambers being used. (see previous figure 11.4)
3. Count how many pillbugs are on each side of the choice chamber every 30 seconds for 10 minutes. Record your data in Table 11.1. Continue to record even if they all move to

one side or stop moving.
Note: you will set up a similar table for your student-designed experiment.
4. Return your pillbugs to the stock chamber.
5. Graph both the number of pillbugs in the wet chamber and the number in the dry chamber using the graph below.

Table 11.1 – Effect of Hydrotaxis on Pillbug Behavior

Time (Mins)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Number in Wet Chamber
Number in Dry Chamber
Other Notes/Observations of Pill bug Behaviors

For this graph you will need to determine the following:
a. Identify the dependent variable. _____ Use this to label the horizontal (X) axis.
b. Identify the dependent variable. _____ Use this to label the vertical (Y) axis.
c. Determine the type of graph – recall that line graphs show a continuous change over time, while bar/column graphs compare categories
Graph 11.1 Title _____
Analysis: ***Include in the final section of your lab write-up***. Write your rough draft responses here. 1. What conclusions do you draw from your data? Explain physiological reasons for the behavior observed in this activity.
_____
_____
_____
_____

_____
_____
2. How do isopods locate appropriate environments?
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_____
_____
_____
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_____
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3. If you suddenly turn a rock over and found isopods under it, what would you expect them to be doing? If you watch the isopods for a few minutes, how would you expect to see their behavior change?
_____
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_____ 4. Is the isopod's response to moisture best classified as kinesis, or taxis? Explain your response.
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_____
Student-Designed Experiment to Investigate Pillbugs' Response to Temperature, pH, Background Color, Light or Another Variable.
If your last name begins with A-I, you will design an experiment to test phototaxis: the orientation of an organism in relation to the presence of light (toward light is positive phototaxis and away from light is negative phototaxis). If your last name begins with J-R, you will design an experiment to test chemotaxis: the orientation of an organism in relation to the presence of a particular chemical (most organisms avoid chemicals, except a few that will have positive chemotaxis to weak acids). ***Check out a pH scale if you are testing chemicals and use proper safety measures.*** If your last name starts with S-Z, you will design an experiment to test trophotaxis: the orientation of an organism in relation to the presence of food. ***You may also choose an additional variable for extra credit. See the chart below for ideas.***
Factor
Materials (suggested)
Temperature

cold pack, warm pack
Light
lamps, flashlights, dark construction paper, aluminum foil
pH
low pH (HCl), high pH (NaOH),
http://staff.jccc.net/pdecell/chemistry/phscale.html
Substrate (surface)
soil, sand, sandpaper, bark, paper, cedar chips, gravel
Odor
ammonia
Food
apple, potato, fish food, lunch meat
Other Organisms
mealworms, crickets, superworms, earthworms

1. Select one of the variable factors above, and develop a hypothesis concerning the pillbug's response to the factor. Remember to use the If, then, because... format.

_____
_____
_____
_____
_____
_____
_____
_____

2. Use the materials available to you to design an experiment. Remember that heat is generated by lamps.

a). state the objective of your experiment.

_____
_____
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_____
_____
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_____
_____ b). List the materials you will use.

_____
_____
_____
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c). Outline your procedure in detail. Remember that it must be repeated if necessary.

_____
_____

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_____

3. Decide what data you will collect, and design your data sheet.
4. Run your experiment.
5. Make any graphical representation of your data that will help to visualize or interpret the data. 6. Write a conclusion based on your experimental results.

7. Return your isopods to the stock culture. **Part 11B: Courtship in crickets**

Background:

What is a cricket?

A cricket is an insect. Insects have three main body parts, six legs, and antennae. A cricket has two pair of legs, with and the last pair longer for jumping. Unlike its cousin the grasshopper, it tends to be dark brown or black. Crickets also tend to be more active at night, although they may be seen during the day. Some males like to call from burrows, which they defend, while other males and females move from one place to another.

How do you distinguish between males and females?

One way to identify the sex of a cricket is to look for a long structure coming out of the tail. This structure is the ovipositor that is used by the female to push eggs into the ground while laying. Another way is to look at the wings: female wings are smooth with the wing veins running straight down the back. A look at male wings reveals a wrinkled effect. There are ridges on the wings that form a scraper and a file. When the wings are rubbed together at high speeds a species specific song is produced.

What kind of life cycle?

The cricket has incomplete metamorphosis. This means that when the tiny nymph (baby cricket) hatches from the egg, it already looks like a cricket. It does not have wings yet, but its body structure is very similar to the adult only smaller.

How do you determine whether or not a cricket is an adult cricket?

The best way is to look for wings. Only adult crickets have fully grown out wings. Male and female behavior is also different. Only females can be seen pushing their ovipositor into the soil. Only males sing and fight. Males also defend territory around their burrow. A male calls for two reasons. One is to call in females who are flying around searching for males. Another reason males call is to signal other males to stay away from his territory.

How can a fly parasitize a cricket?

There is danger in the air on those warm summer nights for the male who is singing. There is a fly that can hear him calling. This fly is a female and is full of larvae ready to drop onto the calling male. The fly locates its host by listening for a calling male. The fly then quietly deposits the larvae on or near the calling male. The tiny larvae immediately dig through the exoskeleton of the cricket. The larvae live and grow inside the body of the male until it is ready to pupate. At this point, it then chews a hole to get out and then pupates on the ground.

Why study cricket behavior?

The cricket is an ideal animal to study for many reasons. They are small and are easily raised. They demonstrate many behaviors that more complex animals also exhibit. Males call females from long distances in the night. They also have a quiet courtship song when they have found an interested female. The males also have an aggressive song they challenge other males with during a fight. Another behavior some males exhibit is quietly sitting close to a singing male and intercepting any female attracted to the calling male. This is called satellite behavior. Sometimes a male takes advantage of finding females without the risk of being attacked by the parasitic fly. A calling male attracts many females but has a short life span due to parasites. The non-calling male does not attract many females at one time but then lives longer and continues to mate. This is seen as the maintenance of two equally successful strategies for mating. This also a classic example of a parasite influence on an animal's sexual behavior. Some of these behaviors are can be easily seen in the classroom.

Cricket mating behavior is especially fascinating. Males rub their wings together and produce a calling song that is species specific. Females are attracted to the song, and the song repels other calling males in a type of territoriality. In many species, males can be observed walking or remaining stationary, very close to a calling male. This so-called satellite behavior sometimes involves the silent male intercepting and mating with females attracted to the caller. To make matters more interesting, in some species of crickets, parasitic flies have evolved the ability to hear males. They find and lay living larvae on calling males. Males that call and attract females don't live as long as males that spend more time in satellite behavior. Laboratory experiments show that the amount of time that a male spends calling is, in part, due to genetic influences, and the maintenance of calling and non-calling male behavior in a population is the subject of much research.

Level of AggressionBehaviors

Level 1

Level 2 Level 3

Level 4 Level 5

Contacts terminated without clear dominance. No apparent retreat and no apparent aggression. Contacts terminated by retreat without apparent aggression.

Contacts terminated by retreat after mild to moderate one-sided aggression or mild reciprocal aggression.

Contacts terminated after moderate to intense reciprocal aggression. Contacts terminated only after sustained combat.

The presence of a female cricket inside a male’s territory will increase aggressiveness toward other males, as well as stimulating courting behavior towards the female. However, the territorial behaviors in males will vary.

These behaviors include:

• chirping
• wing flaring • avoidance
• biting
• pushing
• guarding

Courting behaviors in males also vary. These behaviors include:

• antenna stroking
• chirping

• following • guarding
Females also show specific behaviors, which include • ovipositor insertion
• mounting of males

Crickets and Temperature

Have you ever walked outside in a quiet evening to hear a tiny chorus of crickets chirping? You are most likely hearing the common field cricket. Male crickets have organs that produce sound on their front wings. Male crickets rub their wings together to produce that chirp you hear at night. But they are not just chirping to make the quiet night go by. Male crickets are trying to attract females.

Scientists have noticed a very unusual relationship between crickets' chirpings and temperature. On very cold days, there are large intervals between cricket chirps. That means the space between each cricket chirp is long, and so the chirps are not very frequent. Why do you think it is like this on colder days? On warmer days, the interval between each cricket chirp is smaller, and so the chirps are heard frequently.

Scientists are able to relate the chirping of crickets and temperature of their environment mathematically. The amount of cricket chirps heard (in fifteen seconds) plus 48 is the approximate temperature of the cricket's environment in degrees Fahrenheit!

Cricket Links:
http://telusplanet.net/public/ecade/CricketsintheClassroom/cricketlinks.html **Materials:**

• 10-12 crickets, 1⁄2 male, 1⁄2 female (catch or buy them at a local pet store; have a few extra in case of deaths) **If you buy them, you must isolate each one from the others in separate containers. Otherwise, they may be too accustomed to living in a large group for you to observe aggression.
• Containers with lids for clear observation
• Fishing line
• Egg carton domes for climbing on

Procedure:

Day 1

1. Watch the general population of crickets for about 10 minutes. Note your observations using a table. You should have notations made for each minute.
2. Place a cricket into the observation container and note any observations of behavior that you make. Avoid moving or banging the container.
3. Answer these questions:
a. b. c. d. e. f. g.
observations in a table.
5. Stroke the cricket’s abdomen with the fishing line and note your observations in a table.
6. Isolate any additional males and females, all in separate containers. (you should have 5 males and 5
females)

Day 2

1. Place 2 domes in your observation container. Place 3 male crickets in the container. Note observations of any interactions and encounters that take place for about 25 minutes in a table.
2. Add a 4th male cricket to the container. Note observations for about 10-15 minutes.
3. Add a female to the males. Note activities and behaviors for about 5 minutes.

4. Add a 2nd female to the container. Note observations.
Is the cricket male or female? How could you tell? Take a picture and include in your lab.
Is the cricket adult or immature? How could you tell?
How many legs does the cricket have? How many antennae?
How does it move?
How does it eat?
What does it do with its antennae?
How does it sing?
4. Obtain a piece of fishing line. Stroke the cricket's antennae with the fishing line and note your
5. Add a 3rd female to the container. Note observations.
6. Add a 4th female to the container. Note observations.
7. Write a concise conclusion based on the data collected, including reflection and errors.

Animal and Environmental Safety: When you are finished with your lab, feed the crickets to a pet reptile, bring them to me, or donate them to the pet store. DO NOT release them into the wild unless you captured them yourself. If you captured your own crickets, return them to their original habitat.

Female on left, male on the right

FORMAL LAB WRITE UP/REPORT PROCEDURES

****Use the Experimental Design Reference handout for clarification on any of the terms found below.*** **Log on to blackboard to access this reference handout. ***Always write in 3rd person**

PROBLEM/TITLE

Clearly indicates the subject and scope of the report. The effect of IV on DV is a good format to use. Example: *The effect of light color on the height of plants.*

BACKGROUND/ABSTRACT

Gives background information about the experiment. Outlines the purpose of the experiment, gives an overview of the concept being investigated, and gives a brief overview of the lab.

HYPOTHESIS

This is your testable, educated guess or answer to your proposed problem. The hypothesis is written in an "If, then, because..." format. The "If" is your independent variable (IV). The "then" is your dependent variable (DV), and the "because" is your justification or explanation of your guess based on background knowledge.

Example Hypotheses:

Poor: *I think plants will grow better in red light.*

Better: *If the amount of red light is increased, then the height of the plants will increase, because red light is absorbed by the chloroplasts not reflected as with green light.*

Best: *If plants are grown in red, green, and blue light, then the height of the plants will increase the most in red light because red light is absorbed by chlorophyll not reflected like green light.*

EXPERIMENTAL DESIGN

Outlines the design of the experiment. Identifies the variables (independent and dependent), control, and constants in the experiment. Uses the following format:

IV Groups/

Levels #Trials per group

Control:

MATERIALS
A list of ALL the materials and equipment used in the lab. Be sure to include specific amounts, units of measurement, and concentrations of chemicals used.

PROCEDURE/METHODS
Write a detailed and precise procedure that includes both the correct sequence of steps to be taken and the materials/equipment needed. Be specific but brief. The procedure should be detailed enough so that another experimenter could duplicate the experiment to check and challenge your data without having to ask you ANY questions! Write for one level of the independent variable and add repetitions for repeated trials. Most steps should include a number of some kind: size of pot in mL, amount of soil in grams. A flowchart could also be used

DV

Constants: (1) (2)

(3) (4)

as a procedure. A flowchart is a combination of pictures and brief descriptive words to explain the pictures. You may include a diagram to show the lab setup of equipment and materials. State any hazards that may be encountered in the lab.

DATA/RESULTS **Use the Experimental Design Reference handout for clarification on what this section should look like and/or for example graphs. Log on to Blackboard to access this reference handout.*

All data should be collected and organized in a logical order. Results should be illustrated as charts, tables, graphs, scientific sketches, and/or diagrams. A results sentence is usually written next to the chart/graph. Data tables and graphs must have a descriptive title and be labeled with variables and units. Data may be qualitative (observational without numbers) or quantitative (with numbers) or both. Show work for any calculations as well as appropriate units. Include the equation, if one was used.

Do not hide or eliminate faulty data but present it in your lab report. Later, in your CONCLUSIONS, you will explain why you think your data is incorrect. Often qualitative data may be used to support or explain discrepancies in quantitative data in your conclusion. Good scientists present the data they obtain even when it is suspected to be faulty. This is why a true experiment has many trials and much peer review occurs before the results are accepted by the scientific community at large.

CONCLUSION/ANALYSIS
A Conclusion Paragraph usually contains a description of the purpose of the experiment, a discussion of your major findings, an explanation of your findings, and recommendations for further study. Summarize the important procedures and results of the lab and discuss their significance. The conclusion should clearly tie the results of the experiment to the hypothesis and a discussion of why the hypothesis should be accepted or rejected must be explained in detail. Evidence from the results must be presented to support your acceptance or rejection.

Usually the following questions are presented in paragraph form. ***Do not number them***:

1. What was the purpose of the experiment? (Include I.V. and D.V. in this sentence.)

Format: The purpose of the experiment was to investigate (Insert Title.)

Example: The purpose of the experiment was to investigate the effect of stress on the

growth of bean plants by comparing the growth of bean plants subjected to stress for 15 days with a control (non-stressed plants.)
2. Was the hypothesis supported by the data?
Format: The hypothesis that (Insert Hypothesis) was (supported, partially supported, or not supported/rejected.)
Example: The hypothesis that stressed plants would have a lower mean height was not supported.
3. What were the major findings?
Format: The major findings were (Insert Results Sentence.)
Example: The major findings were that there was no significant difference existed between the mean height of stressed plants and non-stressed plants 30 days after transplanting. The mean height of the stressed plants was 20 cm while the mean height of the non-stressed plants was 22 cm.
4. What sources of error occurred during the experiment?
Identify and explain how sources of error influence the lab results. Include any factors that you think may have actually affected your results.
Example: Some sources of error could be equipment/instrument error, procedural setup error, human error, etc. Be descriptive when you describe the error. Do not just say human error.
5. What happened that you did not expect? How can you explain this?
Format: I did not expect (Insert anomaly if there was one.) I can explain this (insert explanation.)
Example: The stressed bean plants were expected to have a lower height. the fact that they didn't and that Japanese rice farmers stress their points on purpose to achieve better growth means that something about stressing out plants makes them growth better. Perhaps some plants that are stressed release a chemical in response to the stress that promotes better growth and others don't release that chemical, such as rice vs. beans. Or perhaps there is a difference in reaction to stress between monocots and dicots.
6. What recommendations do you have for improving this experiment? Discuss how lab could be modified to improve the results.
Example: Improved experimental design techniques including a larger sample and a longer growing period would benefit a similar study.
7. What recommendations do you have for further study? (This is above and beyond this experiment.) If additional research and experimentation is needed, explain in this section.
Example: Additional investigations using various sources of stress at more frequent intervals would be a good additional experiment. Another idea would be to use different types, such as a monocot and a dicot. If further research were done, perhaps scientists could isolate a chemical released by plants during stress. It would be interesting to investigate the amounts of this chemical released during stress.
8. What did you learn? This section should be based on your background and lab data.
Format: I learned (insert what you learned based on the background information and the data collected in the experiment.)
Example: I learned that bean plants respond to stress in their environment by altering the way they use materials in their cells. Water stress affects practically every aspect of plant growth and metabolism. Plant responses to water deficit depend upon various factors such as duration and degree of stress, growth stage and time of stress exposure. Due to

their sedentary mode of life, plants resort to many adaptive strategies in response to different abiotic or physical stresses such as high salt, dehydration, cold and heat, which ultimately affect the plant growth and productivity. Against these stresses, plants adapt themselves by different mechanisms including change in morphological and developmental pattern as well as physiological and biochemical responses.
9. Additional Analysis Questions, Observations, and Findings. Include answers to additional or analysis questionsposedbyyourteacheroranyanalysisquestionsincludedinthelabdirections. Incorporatethe questions into your answers. This is also the section where you will type up any specimen observations.

Lab Report Rubric

Beginning 1
Developing 2
Accomplished 3
Exemplary 4
Score
Title
Does not directly address the purpose of the laboratory.
NA
NA
Directly addresses the purpose of the laboratory.
Background/ Abstract
Only provides background lab information
Missing 2 of the 3 exemplary requirements
Missing 1 of the 2 exemplary requirements
Provides lab purpose, discusses lab concepts, and gives a procedural overview
Experimental Design
Includes mostly inaccurate variables, constants, and controls
Includes mostly correct variables and controls but is missing accurate constants
Includes accurate variables, controls, and constants, but some constants may not be true constants
Includes accurate and true variables, controls, and 4 constants
Materials and Procedure
Includes a materials list but procedure is too general and does not include specific times and/or amounts with units
Includes a numbered materials list with a numbered procedure that includes some specifics and amounts with units
Includes a numbered materials list with a numbered procedure that is specific and repeatable. Some parts of the procedure may be difficult to follow. Units are included with measurement amounts
Includes a numbered materials list with a numbered procedure that is easily followed, specific, and repeatable. Units are included with measurement amounts
Data and Results
Data tables, charts, illustrations, graphs, and/or diagrams are missing information, labels, and/or are inaccurate.
Data tables, charts, illustrations, graphs, and/or diagrams are not labeled or are labeled incorrectly. Some information is missing or inaccurate.
Data tables, charts, illustrations, graphs, and/or diagrams are correctly labeled with 90% of information correct.
Data tables, charts, illustrations, graphs, and/or diagrams are neat, correctly labeled, and 100% accurate.
Conclusion
Includes purpose and reference to hypothesis but presents an illogical explanation for findings and does not address reflection, error, and/or references to data.
Includes purpose and reference to hypothesis. Presents a logical explanation for findings and includes references to data tables or concepts learned, but is missing either reflection, errors, recommendations,

and/or concepts learned or references to data table
Includes purpose and reference to hypothesis. Presents a logical explanation for findings and includes references to data tables, reflection, errors, recommendations, and concepts learned. Some explanations may be incomplete or fail to make scientific connections to big lab ideas.
Includes purpose and reference to hypothesis. Presents a logical explanation for findings and includes references to data tables, reflection, errors, recommendations, and concepts learned. Explanations make strong scientific connections to big lab ideas.
Additional Questions, Observations
Additional questions and observations lack scientific thought and are illogical.
Additional questions and observations show some scientific thought and display some key lab ideas.
Additional questions and observations demonstrate clear scientific thought and display most key lab ideas.
Additional questions and observations demonstrate a high level of scientific thought and neatly display key lab ideas.
Grammar and Spelling
Very frequent grammar and/or spelling errors
More than three errors
Only two or three errors
99$ of grammar and spelling are correct.
Attractiveness and Presentation
Illegible writing, loose pages, print too small or too large, no illustrations
NA
Hand written, clean and neatly bound in a report cover, illustrations provided
Typed, clean and neatly bound in a report cover, labeled illustrations provided

BOOK REVIEW RUBRIC

SECTION
OUTSTANDING
EXCELLENT
NEEDS IMPROVEMENT

UNSATISFACTORY
Summary
20 PTS.
Summary consists of a discussion of major themes, ideas, and characters providing at least 4 excerpts from the work. It combines ideas from the book into new sentences using your own words.
Summary consists of a discussion of major themes, ideas, and characters providing at least 3 excerpts from the work. It combines ideas from the book into new sentences using your own words.
Summary consists of a discussion of major themes, ideas, and characters providing at least 2 excerpts from the work. It combines ideas from the book into new sentences using your own words.
Summary is mostly an outline of the book and does not discuss themes or major ideas of the work. There may be one direct quote thrown in for effect.
Quotes
10 PTS.
No more than 5 direct quotes from the novel are noted by citing page number in parenthesis, e.g. (48)
2 or 3 direct quotes from the novel are noted by citing page numbers in parenthesis. Quotes overused.
1 or 2 direct quotes from the novel are noted by citing page numbers in parenthesis.
The summary contains direct quotes without any citation of page numbers.
Author and Sources
10 PTS.
Student provides a detailed discussion of the author's qualifications. Sources were examined in detail, and the student determined whether or not they were appropriate for the work.
Student provides a limited discussion of the author's qualifications. Sources were examined in a limited manner, and the analysis may be limited.
Student provides a little discussion of the author's qualifications. Sources may or may not be briefly examined.

The discussion of author and sources is vague or missing and lacks detail.

Critique

20 PTS.

Critique consists of thoughts, responses and reaction to the novel. The student reviewer reacts to the themes, the author's aims or intent, the subject of the book, how well it is written and overall success or failure of the book.

Critique consists of thoughts, responses and reaction to the novel. The student reviewer may discuss only two aspects, for example themes and writer's style. There is not a thorough review of various aspects.

Critique consists of thoughts, responses and reaction to the novel. The student may discuss only one aspect of the novel, such as themes. This review just states, "Well, I liked it." or Well, I hated it." It lacks a critical eye.

Critique consists of a basic opinion based on personal feeling of "I liked it" or "I hated it" and is not considered a critique because it does not focus on themes, author's intent, or writer's style.

Organization

10 PTS.

Structure of the paper flows and is easily read because of smooth transitions from paragraph to paragraph. The sequence of topics is in logical order. There is a clear cut introduction, body, and conclusion.

Structure of the paper flows and is easily read, but 1 or 2 transitions may be faulty or missing. There is some illogical order in sequence of topics. There is a clear cut introduction, body, and conclusion.

Structure of the paper does NOT follow a logical order. The writing or ideas may jump around. It is not cohesive. There is not a clear cut introduction, body, and conclusion.

Structure of the paper does NOT follow a logical order. There are no transitional phrases that make it easy to read the paper, or review is just a copying of the original book.

Impact

15 PTS.

Provided details concerning the link between the theme(s) present in the book and current issues along with future impact. Details were well-developed with at least 3 references to parts of the book.

Two references to the book included. All outstanding criteria included.

No direct reference to the book, but current issues and future impact were discussed.

The references were poorly understood or lacking altogether.

Spelling

10 PTS.

0-2 spelling errors

3-5 spelling errors

6-8 spelling errors

Over 9 spelling errors

If you have any questions email me at shane.gipson@cmcss.net any time this summer. All work is due the 1st day of class. Expect a test on Ch. 1 and 51 the 1st week. Have a great summer and be ready to go this Fall.