PILLBUG PREFERENCES : (*Armadillidium vulgare)* Pillbugs, roly polies
Modified from "OLD" AP BIO LAB 11

INTRODUCTION

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 the stimulus. If an organism responds to bright light by moving away, that is called taxis. If an animal responds to bright light by random movements in all directions, that is called kinesis.

Classification: These organisms are members of the *Phylum Arthropoda, Class Crustacea*, which also includes lobsters, shrimp and crabs.

Physical Description: All arthropods have a tough outer cuticle, segmented body, and jointed legs. Pillbugs have 7 pairs of legs, antennae, and breathe with sets of overlapping gills found on the underside of their bodies. Pillbugs in North America vary from gray to brown in color.

Blue Blood: Many crustaceans have hemocyanin in their blood. Unlike our hemoglobin, which contains iron, hemocyanin contains copper ions. When oxygenated, pillbug blood appears blue.

Respiration: Like their marine cousins, terrestrial pillbugs use gill-like structures to exchange gases. They require moist environments to breathe, but cannot survive being submerged in water.

Molting: Organisms with hard exoskeletons must molt to grow bigger. Pillbugs molt in sections. First, the back half splits and slides off. A few days later, the front section is shed. If you find a pillbug that's gray or brown on one end, and pink on the other, it's in the middle of molting. During molting they are more vulnerable to predation and DESSICATION (drying out).

Reproduction: Females carry the fertilized eggs in a fluid filled pouch (MARSUPIUM) on their abdomen. Upon hatching, tiny juveniles stay in the pouch for several days before leaving to explore the world. Females can have 2-3 broods per year averaging 100 offspring.

Food Habits: Pillbugs are omnivores; feeding on fungi, live/dead plants, and other arthropods. Pillbugs also eat feces, including their own. Each time a pillbug poops, it loses a little copper, an essential element it needs to live. To recycle this precious resource, a pillbug will consume its own poop (COPROPHAGY).

Defense: Body armor, glands that release unpleasant secretions, and camouflage. They are famous for curling up into a tight ball for defense called *CONGLOBATION*.

Ecosystem Roles: Pillbugs are detritivores and play an important role in recycling nutrients in ecosystems. They part of the community of species including earthworms, snails, and millipedes that break down dead plants and animals.

Animmal Diversity Web University of Michigan Department of Zoology
http://www3.northern.edu/natsource/INVERT1/Pillbu1.htm
http://insects.about.com/od/isopods/a/10-facts-pillbugs.htm

PILLBUG PREFERENCES LAB:

GROUP MEMBERS _____ _____ _____

WRITE A NULL HYPOTHESIS (H_0)for this experiment.

_____

_____

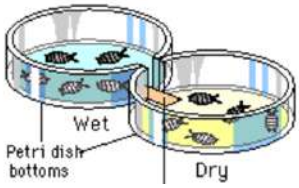
Write an alternate hypothesis (H_A). It should state WHAT YOU THINK THE PILLBUGS WILL DO and WHY.

_____

_____

SET UP THE EXPERIMENT:

1. Prepare a choice chamber as illustrated at the right. Moisten a piece of filter paper and place it on one side of the chamber. Place a dry filter paper on the other side the chamber.



2. Use a soft brush to transfer 10 pillbugs from the culture container into the choice chamber. Wait 10 minutes to allow the pillbugs to become familiar with their new surroundings. 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. Try to make your observations without disturbing the animals in any way. DO NOT PROD OR POKE OR SHAKE THE DISH, MAKE LOUD SOUNDS, OR SUBJECT THEM TO BRIGHT LIGHTS. You want to observe their behavior, NOT influence or interfere with it.

_____

_____

_____

LOOK CLOSELY AND DRAW A PICTURE
OF A PILLBUG IN THE SPACE AT THE RIGHT:

BEGIN THE EXPERIMENT

1. Gently move 5 pillbugs to each side of the chamber.

2. Start your timer and count how many pillbugs are on each side of the choice chamber every 30 seconds for 10 minutes. Record your data in the chart provided. Decide how you will record bugs found in between the two sides.

3. Do not poke or prod the pillbugs. You want them to respond to their environmental "choices" not your interference.

DATA COLLECTION:

WET = SIDE ____ DRY = SIDE _____

	# of pillbugs	
TIME (min)	A SIDE	B SIDE
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		
TOTAL	_____	_____

TOTAL PILLBUGS ON WET SIDE = _____

TOTAL PILLBUGS ON DRY SIDE = _____

Calculate the average # of Pillbugs on each side for your group's data.

Avg # of Pillbugs on WET side _____

Avg # of Pillbugs on DRY side _____

ENTER YOUR DATA FOR THE TOTAL PILLBUGS ON EACH SIDE INTO THE CLASS SPREADSHEET.

CLASS DATA:

TOTAL PILLBUGS ON WET SIDE = _____

TOTAL PILLBUGS ON DRY SIDE = _____

Avg # of Pillbugs on WET side _____

Avg # of pillbugs on DRY side _____

USE THE CHI-SQUARE TEST TO ANALYZE RESULTS FROM CLASS DATA:

Chi square analysis ALWAYS uses counting data not % or averages. So use the TOTAL # of pillbugs

CHI-SQUARE NULL (H_0) HYPOTHESIS:

_____

_____

Classes	Expected (e)	Observed (o)	o-e	$(o-e)^2$	$\frac{(o-e)^2}{e}$

Degrees of freedom= _____
(number of classes-1)

Σ =_____

ANALYSIS QUESTIONS

$$X^2 = \sum \frac{(o-e)^2}{e}$$

1. What is the X^2 value for the class data? _____

2. Which column on the Chi square chart is used for most scientific experiments? _____

3. What is the *p* value for your X^2 statistic? _____

3. Given your *p* value, do your REJECT or FAIL TO REJECT your NULL hypothesis?
EXPLAIN your answer.

_____

_____

_____

_____

STUDENT-DESIGNED EXPERIMENT

Use a choice chamber to design an experiment to test the response of pillbugs to one of the following factors: temperature, pH, background color, light, or other variable.

1. Select your environmental factor and develop a hypothesis concerning the pillbugs' response.
Write a hypothesis (H_1) below. Remember your hypothesis should include what the pillbugs will do and why.

_____

_____

Outline your procedure in detail ON A WHITE BOARD.
After the GROUP CRITIQUE, fill in your final experimental design plan below.

DRAW A PICTURE OF YOUR EXPERIMENTAL SET UP BELOW.

What is the independent variable in this experiment? _____

What is the dependent variable in this experiment? _____

Does this experiment have a control group? EXPLAIN

LIST ALL THE CONTROLLED VARIABLES IN THIS EXPERIMENT:

CONDUCT YOUR EXPERIMENT: COLLECT DATA

A side = ____________________ B side = _______________________

	# of pillbugs	
TIME (min)	A SIDE	B SIDE
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		

	# of pillbugs	
TIME (min)	A SIDE	B SIDE
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		

	# of pillbugs	
TIME (min)	A SIDE	B SIDE
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		

TOTAL NUMBER OF PILLBUGS ON SIDE A= _____ AVG # of PILLBUGS on SIDE A _____

TOTAL NUMBER OF PILLBUGS ON SIDE B = _____ AVG # of PILLBUGS on SIDE B _____

Use the CHI-SQUARE TEST to ANALYZE your results
Remember to use COUNTING data not AVERAGES!

CHI-SQUARE NULL (H_0) HYPOTHESIS:

_____

_____

Classes	Expected (e)	Observed (o)	o-e	$(o-e)^2$	$\frac{(o-e)^2}{e}$

Degrees of freedom= _____ Σ =_____
(number of classes-1)

1. What is the X^2 value for your data? _____

$$X^2 = \sum \frac{(o-e)^2}{e}$$

2. What is the *p* value for your X^2 statistic? _____

3. Given your *p* value, do your REJECT or FAIL TO REJECT your hypothesis?
EXPLAIN your answer. What CONCLUSION(S) can you draw from your data?

_____

_____

_____

_____

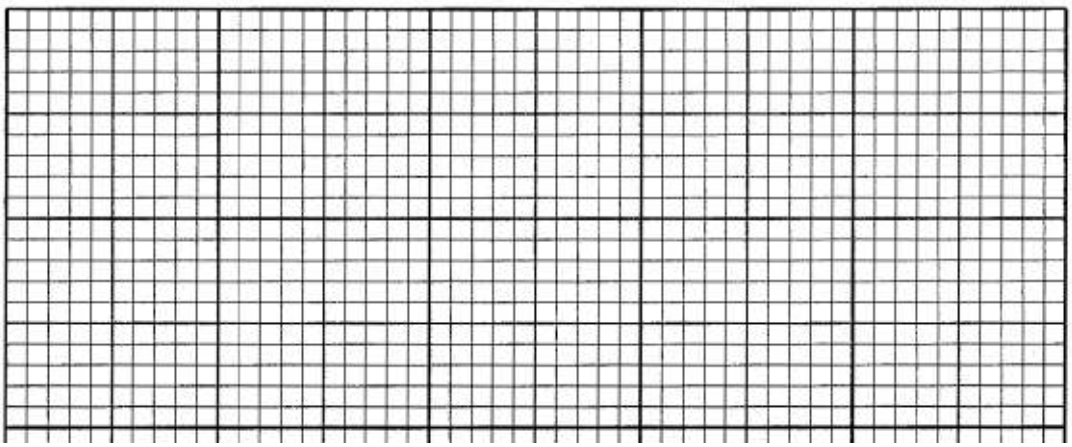
_____

_____

_____

_____

MAKE A GRAPH of your group's wet/dry averages, the class wet/dry averages, and the averages for your experiment. Add a graph to show results if the pillbugs had NO preference.
Remember the rules for making graphs!



DISCUSSION/CONCLUSIONS

In the real world pillbugs prefer to be in dark, moist environments. Did you see a significant difference in wet vs dry choice in the class data. What factors might account for this? What factors might impact where the the pillbugs to choose to be in this experiment besides the choices you are testing?

_____

_____

_____

_____

_____

Is there a difference between YOUR GROUP'S DATA and the CLASS DATA for WET vs DRY choices ? Which do think would be more dependable? EXPLAIN

_____

_____

Did the pillbugs show a preference for the wet or dry choice? WHAT IS YOUR EVIDENCE? (CER)

_____

Did the pillbugs show a preference for the choices provided on DAY 2? WHAT IS YOUR EVIDENCE? (CER)

Do you think the pillbugs' response to moisture is best classified as kinesis or taxis? EXPLAIN your answer.