AP Biology Lab Investigation 12(new)/11(old): Pillbug Behavior

Indicates that this should be written in lab notebook.

GROUP MEMBERS

LEADER - _____ MATERIALS MANAGER - _____

DATA COLLECTOR - _____ SAFETY/CLEAN UP - _____

GENERAL QUESTION (copy)

What environmental factors trigger a pillbug response?

LEARNING OBJECTIVES:

- To investigate the relationship between pillbugs and its response to different environmental conditions
- To design a controlled experiment to explore environmental factors that either attract or repel pillbugs in the laboratory setting
- To analyze data collected in an experiment in order to identify possible patterns and relationships between environmental factors and a living organism
- To work collaboratively with others in the design and analysis of a controlled experiment

PRE-LAB QUESTIONS (answer)

1. Before reading the article, write down anything you know (or think you know) about pillbugs AKA roly-polies. Where and when do you normally see pillbugs?
2. Read and annotate the article, "HOW NOW, SOW BUG?". While reading, take notes about pillbugs, particularly focusing on what types of environments pillbugs favor.
3. A **variable** is anything that can be changed during an experiment. Based on what you read about pillbugs, list variables that your group might like to test in your experiment.

INTRODUCTION

In this lab, you will be working with terrestrial isopods commonly known as **pillbugs**. These organisms are members of the Phylum Arthropoda, Class Crustacea, which also includes shrimp and crabs. They are characterized by a flattened body, fused abdominal segments, and seven pairs of legs. Pillbugs respire through gills, like their ocean counterparts, which they need to keep moist. Their respiratory organs are completely infolded by perforated plates to retain moisture. Also known as sow bugs, or "roly-polies," pillbugs are common in most regions of the world. Found frequently in gardens, they live under rocks or in other damp places and feed on decaying animal or vegetable matter. They also sometimes feed on living plants and can become agricultural pests. Pillbugs are capable of rolling themselves into a ball when disturbed. The species vary in color from gray to black.

Ethology is the study of animal behavior. Behavior is an animal's response to sensory input, and falls into two 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 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.

Part 1: General Observation of Behaviors (answer)

1. Place 10 pillbugs and a small amount of bedding material in a petri dish. They generally don't climb, but if they do, you may cover the dish with plastic wrap or the petri dish cover.
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 two or more pillbugs. Try to make your observations without disturbing the animals in any way. Don't prod or poke or shake the dish, make loud sounds, or subject them to bright lights. You want to observe their behavior, not influence it or interfere .
3. Make a detailed sketch of a pillbug.

Part 2: Kinesis in Pillbugs

QUESTION

With your lab group, discuss which variable you would like to test. Make sure you take into account that whichever variable you choose, you will be responsible for the experimental set up. Ms. Lin will let you know what materials are available for your group and what materials you may have to bring on your own. Once you have decided on which variable your group would like to test, formulate your experimental question (Ex: "Do fruit flies prefer 5% glucose water or distilled water?").

IDENTYFYING THE VARIABLES (answer)

1. What is your dependent variable? (what you are measuring/counting – this will be graphed on Y-axis.)
2. What is your independent variable? (the environmental condition(s) you are testing – this will be indicated on your graph with a KEY. Time is an additional independent variable and will be graphed on X –axis.)
3. What are your (standardized) controlled variables? (the environmental conditions that will be the same on both sides of the choice chamber.)

HYPOTHESIS

Write down your group's hypothesis in an "If…then…" statement.

PROCEDURE (document in flowchart format OR draw a detailed experimental set-up)

1. Prepare your chambers according to the variable your group has chosen – be detailed on how you will set this up in your lab notebook. Make sure Ms. Lin approves your set up before you start your experiment!!!
2. Place 5 pillbugs in each side of the choice chamber. Cover the chambers (optional).
3. Count how many pillbugs are on each side of the choice chamber every 30 seconds for a minimum of 10 minutes, and record in data table. Continue to record even if they all move to one side or stop moving.
4. Return your pillbugs. Use soap and water to wash choice chambers and other materials used for experiment. Wipe down lab benches.

DATA TABLE

TIME (min.)	Condition: _____ NUMBER IN CHAMBER 1	Condition: _____ NUMBER IN CHAMBER 2	OTHER OBSERVATIONS
0.0			
0.5			
1.0			
⋮			

GRAPH

Graph your data on graph paper, then cut and glue it into your lab notebook. Make sure you include a title, labeled axes, and a key.

CHI-SQUARE ANALYSIS (copy table and answer questions in notebook)

Calculate the average number of pillbugs (to the one-hundredth decimal place) found in each chamber for the duration of the experiment.

	Chamber 1 Condition: _____	Chamber 2 Condition: _____	Total
Observed (Averages)			
Expected			
O-E			
$(O-E)^2$			
$(O-E)^2/E$			$\chi^2=$

- What is your null hypothesis?
- Calculate your chi-square value.
- Based on your chi-square value, should you accept or reject your null hypothesis? Why? (using p=0.05)

CONCLUSION (answer)

Based on your observations, results, and chi-squared value, what conclusion can you draw about what environmental factors trigger a pillbug response? What is the answer to your group's question? Do you accept or reject your original hypothesis? If you had to do this experiment again, what changes could you make to improve the experimental design and why?

DISCUSSION (answer)

1. Obtain results from all lab groups in your class. Based on the class results, which types of environment do isopods seem to prefer? How do the data support these conclusions? Give specific examples.
2. Is the isopod's response to moisture best classified as kinesis or taxis? Explain your response.
3. Imagine that a biologist deposits 50 isopods on the surface of the leaf litter in a forest. The back of each isopod is marked with a dot of paint for identification purposes. The biologist departs, then returns one hour later and attempts to retrieve as many of the isopods as possible. Where will most of the isopods likely be found and why?

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