**Isopod Behavior, or The Pill Bug Lab**

**Objectives:**

* Observe various aspects of a terrestrial isopod
* Conduct experiments examining the responses of isopods to various environmental factors
* Design and conduct an investigation of animal behavior

# Background Information

***Terrestrial isopods*** are land dwelling crustaceans, commonly known as sowbugs or pillbugs (or rollypollys). They are related to lobsters, crabs, and shrimp and terrestrial isopods breath with gills. While they look similar, sow bugs are different from pill bugs. Pill bugs 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. (You do not want to use some pill bugs and some sow bugs for example)

***Ethology*** is the study of animal behavior. Many behaviors involve movement of the animal within its environment. In this exercise, you will investigate some innate (instincts) behaviors of isopods.

***Orientation*** is a process by which animals position themselves with respect to spatial features of their environments. ***Taxis*** involves the turning of an animal's body relative to a stimulus - either toward or away. ***Kinesis*** is a random turning or movement of an animal in relation to a stimulus.

Consider the following example: A researcher places a dead rotting mouse in the center of a test area and adds a carrion beetle (an insect that eats dead animals) somewhere on the surface. The beetle crawls forward for three seconds, turns and crawls in a different direction for three seconds, and so on. The researcher concludes that the beetle is moving randomly in relation to the dead mouse. Continued observation reveals that the beetle crawls faster (and covers more ground) when it happens to turn in the direction of the dead mouse. In addition, the beetle crawls more slowly (and covers less ground) when it happens to crawl away from the mouse. In this way, the beetle's random movements will eventually bring it to the dead mouse. It is important to take in details such as time spent crawling in one direction or another when observing the movements of the animals.

# Part A: Isopod Observations

In the first part of this exercise, you will observe pillbugs and record what you see. Take 10 pill bugs and place them in the single petri dish. Observe them for 5 to 10 minutes. Make notes on their general appearance, movements above 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. Try to make your observations without disturbing the animals. Do not prod or poke or shake the dish, make loud sounds or subject them to ultra bright lights. You want to observe their natural behavior, not influence it or interfere with it. *Attempt to use the terms "orientation, taxis and kinesis" in your observations.*

# Step 1 Observation Questions (include in lab notebook)

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

# Step 2 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 your lab notebook)

* 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
* Include the date

**Part B: Orientation of Isopods in Response to Moisture**

You will be conducting an experiment to figure out if isopods prefer a moist or dry environment or have no preference. To do this, you will be putting 10 isopods into a choice chamber (two Petri dishes that are connected by a door) and observing them for 10 minutes.

Begin with a null hypothesis and an alternate hypothesis, often written as an IF-THEN statement, or “EXPLANATION, PREDICTION”

|  |
| --- |
| Poor: I think isopods won’t show a preference of a choice chamber.  Better: IF-THEN: If isopods do not have a preference for moist or dry, then when they are randomly placed on both sides of a wet/dry choice chamber and allowed to move about freely for 10 minutes, the average number on either side will be close to 5. Or: EXPLANATION, PREDICTION: Pillbugs are adapted to live in conditions that go through both periodical rain and drying out. This means that they will spend roughly equal amounts of time in both the dry and moist chambers.   |

Null Hypothesis (Ho): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Hypothesis (H*alt*): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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* 1. **Set** up your behavior chamber so that you have one side moist and one side dry by **placing** filter paper on either side. Make sure the moist filter paper does not touch the dry filter paper to keep the dry side dry.
		1. Why is it important to put dry filter paper on the dry side, why not have one side with wet filter paper and the other side with dry plastic? (Hint, what’s the purpose of the dry side?
	2. Carefully **put** 5 isopods on either side so there is a total of 10 isopods in your choice chamber. **Cover** each side with an upside down Petri dish. Be careful, the isopods are likely to try to escape during your experiment if you leave any gaps.
	3. **Count** how many isopods are on each side of the choice chamber every 30 seconds for 10 minutes, and then **record** your data in **Table 1**. Continue to record even if they all move to one side or stop moving. If anything unusual happens (some isopods stop moving for a long time, some escape, etc), be sure to record it in the table
	4. **Return** your isopods to the Petri dish you used to gather them initially.

Data Table 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Time** **(Min)**  | **Number in wet chamber**  | **Number in dry** **chamber**  | **Other notes**  |
| **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**  |  |  |  |
| **Average**  |  |  |  |

* 1. Collect class data and calculate chi square value.
	2. What did the class data indicate about the conclusion? Was the null hypothesis rejected or accepted?

Part C – Student Designed Experiment (**Orientation of Isopods in Response to Different Environmental Conditions).**

# Procedures: (Include your materials and procedures in your lab notebook)

Select what your independent variable is going to be, that is what will you test? Ideas include moisture preference, food preference, light/dark preference and background color preference. Please decide as a group and get your idea approved.

|  |  |
| --- | --- |
| Factor | Possible Materials |
| Temperature | Cold pack, warm pack, ice, warm water |
| Light | Lamps, flashlights, dark construction paper, aluminum foil |
| pH | HCL, NaOH, vinegar, baking soda |
| Subtrate (surface) | Soil, sand, bark, cedar, gravel |
| Odor | Ammonia, perfume, lemon juice |
| Food | Potato, fish flakes |
| Organisms | Crickets, earthworms, plants |

Design your procedures so that your choice chamber will have one chamber with stimulus 1 and another with stimulus 2. So for example if you were testing moisture preference you would set up your behavior chamber so that you have one side moist and one side dry (using paper towels). If you were testing food preference you would place dry paper towels inside the choice chamber and then put different foods on each side. If you were testing background color preference you would cut out different colors of construction paper etc.

Carefully collect 10 isopods from the central container. Be careful so as not to hurt them. Transfer 10 isopods to the chamber (5 on each side). Count and record the number of animals in each of the chamber every 30 seconds for **15 minutes**. Please create a data table such as the following in your lab notebook. Also remember to include what condition you used in chamber A, and which condition you used in chamber B. When you finish please return your isopods to the stock culture.

Chamber A:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Chamber B:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
|  **Time (minutes)**  | **Number in Chamber A**  | **Number in Chamber B**  | **Other Notes** **(example - speed of movement etc)**  |
| 0  |   |   |   |
| 0.5  |   |   |   |
| 1.0  |   |   |   |
| 1.5  |   |   |   |
| 2.0  |   |   |   |
| 2.5  |   |   |   |
| Continue until you get to 15 minutes  |   |   |   |

**Lab Report (to be done in your lab notebook)**

1. Begin with the **title**.
2. Include the **objectives** of the lab. You may copy this from the lab handout.
3. **Background information:** Summarize the important information from the lab handout.
4. **Observations**: Here you will record all of your observations. Remember to answer all of the questions in the observation section.
5. **Diagram** one of your isopods. (follow the procedures listed in the lab handout).

**Part B**

1. Write your **null hypothesis and alternative hypothesis**, often written as an IF-THEN statement (include in your lab report)

|  |
| --- |
| Poor: I think pillbugs will move toward the wet side of a choice chamber.  Better: If pillbugs prefer a moist environment, then when they are randomly placed on both sides of a wet/dry choice chamber and allowed to move about freely for 10 minutes, most will be found on the wet side.  |

1. Write your **procedures**. Write down every step you did in conducting your experiment
2. List all **materials** used. This should be a numbered list of every item you used.
3. Include a **data table** as shown in the lab handout.
4. Make a **bar graph** of your data.For the graph you need to determine the following:

The ***independent variable*** (x-axis) :\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Hint: What did you test/manipulate)

The ***dependent variable*** (y-axis):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Hint: What did you measure?)

Remember to include a ***title*** for your graph and ***label each axis***! Also, your graph should take the entire page. If it is hard to see it is hard to grade.

11. Include your chi square analysis data.

12. Write a **conclusion** based on the following questions:

1. Did your data support your hypothesis, or fail to support it? Which condition did your isopod prefer? How do you know (refer to specifics from your data)?

**Repeat #’s 6 to 12 for Part C using your student designed experiment**

**Summary Questions:**

1. Obtain results from other lab groups. With respect to the environmental conditions tested by your class, what type of environment do you think isopods prefer?
2. If you were to repeat this experiment what might you change to expand your knowledge of the subject?