ADVANCED PLACEMENT® BIOLOGY

Laboratory 11

Animal Behavior

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TEACHER'S MANUAL

CAROLINA

World-Class Support for Science & Math

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LABORATORY 11. ANIMAL BEHAVIOR

Objectives

In this laboratory, students will

- observe various aspects of the behavior of a terrestrial isopod
- conduct experiments examining the responses of isopods to various environmental factors
- design and conduct an investigation of animal behavior
- hypothesize as to the reasons for the behaviors they observe

Required Knowledge

Before beginning this laboratory, students should understand

- the concept of distribution of organisms in a resource gradient
- the difference between kinesis and taxis

Expectations

At the completion of this laboratory, students should be able to

- describe some aspects of animal behavior, such as orientation behavior
- understand that behaviors are adaptations of an animal to its environment

Time Requirements

Exercise 11A (General Observation of Isopod Behavior) requires 45 minutes.

Exercise 11B (Orientation in Isopods) requires 45 minutes.

Exercise 11C (Student-Designed Experiments on Isopod Behavior) requires varying amounts of time. The planning portion, or even the entire activity, can be assigned as homework.

Preparation

Photocopy the Student Guide from this manual for your class.

Note: Send in the card requesting delivery of your isopods at least two (2) weeks before you plan to conduct the lab.

Acclimating and Holding Isopods

Upon receipt, immediately open the shipping container of isopods and check their condition. They are shipped in damp paper towel to give them the humidity they require. After examining the isopods, close the container and prepare a holding pail. Punch air holes in the lid of the holding pail. Place a cup of moist potting soil in the bottom of the pail. If possible, place a slice of raw potato or apple on the soil. Mist the inside of the pail with room temperature water. Place the shipping container in the pail and empty its contents onto the bottom of the pail. Remove the shipping cup. Gently unfold the crumpled, moist paper towel and shake off as many of the isopods as possible. If you are unable to dislodge all the isopods, leave the paper towel in a loose tangle in the pail, and replace the lid. Leave the pail in a darkened area for at least an hour. Most of the isopods should leave the paper towel and move down to the damp soil. Use a sorting brush to remove any that remain. Mist the inside of the pail again and replace the lid. The isopods can be held like this for several hours or overnight, until they are needed.

Care of Isopods

Other than humidity, isopods need little care. At the end of this lab, return the isopods to the holding pail. Feed them leaf litter and pieces of raw potatoes, apples, or carrots. Immediately remove food that becomes moldy. The isopods should thrive and even reproduce. The female carries up to 200 eggs in a brood pouch located under her thorax. The young hatch in the pouch and remain there for about three weeks. They resemble the adults, except for their smaller size and paler color, and will molt four or five times as they grow.

Student Materials and Equipment

Following is a list of the materials needed for one group of students to perform the exercises in this lab. Prepare as many setups as needed for your class.

Setup for Each Group

	Exercise 11A	Exercise 11B	Exercise 11C
isopods	10	10	10
choice chamber		1	1
filter paper		2	2
sorting brush	1	1	1
pipet		1	1
*petri dish or plastic cup, 9-cm or larger diameter	1		
*marking pen	1	1	1
*lamp	1		as needed
*thermometer			as needed
*stopwatch or clock with a second hand		1	1

*Items not included in kit.

Student-Designed Experiments

Below are suggested additional materials that students can use for designing and performing their experiments in Exercise 11C.

Choice	Chamber Side 1	Chamber Side 2
cool vs. warm	resealable plastic bag filled with ice	resealable plastic bag filled with warm water
light vs. dark	one side exposed to light	one side wrapped with aluminum foil
light vs. shade	one side exposed to light	one side covered with several screens
low pH vs. high pH	a few drops of NaOH on filter paper	a few drops of HCl on filter paper
bedding material vs. absence of bedding	bedding material present	bedding material absent

Note that many additional isopod experiments are possible using materials that are easily found at home or in the classroom. This could include the effects on behavior of various foods, colored objects, colors of light, sounds, etc.

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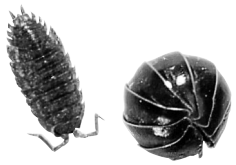
Background



Armadillidium vulgare; Porcellio laevis

Isopods: Pill bugs and Sow bugs *(Armadillidium vulgare; Porcellio laevis)*

Terrestrial isopods are land dwelling crustaceans, commonly known as sow bugs or pill bugs. They have many other common names: potato bugs, wood lice (no relation to body lice), and roly-poly are just a few. Related to lobsters, crabs, and shrimp, terrestrial isopods breathe with gills. Although similar in size, color, and life cycle, pill bugs and sow bugs are different. When threatened, pill bugs can curl up into a tight ball for protection, while sow bugs either attempt to flee or remain perfectly still, appearing to be dead.

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 (inherited, as opposed to learned) behaviors of isopods.

Orientation is the 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. The animal may turn away from, toward, perpendicular to (etc.), the stimulus. The turning may or may not be followed by a corresponding movement of the animal in relation to the stimulus. **Kinesis** is random turning or movement of an animal in relation to a stimulus. Consider the following experiment: a researcher places a dead, rotting mouse in the center of a test surface of 1 m^2. The researcher then places a carrion beetle (an insect that eats dead animal tissue) somewhere on the test surface and observes. 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, at which point other behavior patterns, such as feeding, will take over.

Exercises 11A: General Observation of Isopod Behavior

Procedure

1. Place a small amount of bedding into a petri dish or plastic cup. Use a sorting brush to transfer 5 isopods into the dish. Try to choose isopods of similar size.

2. Observe the isopods for 10 minutes. Make notes on their general appearance, movements, and interactions with each other. Note whether they seem to stay in one area, or if they move sporadically or continuously. Note any behaviors in which two or more isopods interact. Make observations without disturbing the animals in any way. Do not move the dish, make loud noises, or subject the animals to bright light. The goal is to observe their behavior while influencing it as little as possible. Record your observations below.

   _____

   _____

   _____

   _____

   _____

   _____

3. In the space provided below, make a detailed sketch of an isopod. Label your drawing.

Exercises 11B: Orientation in Isopods

Procedure

1. Place clean filter paper into each side of your Choice Chamber.
2. Using a dropping pipet, saturate the filter paper on one side of the chamber. Pour off any excess water so that it cannot run into the other side of the chamber and moisten the paper there.
3. Use a sorting brush to transfer five (5) isopods to each side of the chamber. Put on the lids.
4. Count and record, in Table 11.1, the number of animals on each side of the chamber every 30 seconds for 10 minutes. Continue to record, even if the isopods all move to one side or stop moving at all.

Table 11.1 Orientation in Isopods

Time (min:sec)	# in Wet Chamber	# in Dry Chamber	Other Notes
0:00			
0:30			
1:00			
1:30			
2:00			
2:30			
3:00			
3:30			
4:00			
4:30			
5:00			
5:30			
6:00			
6:30			
7:00			
7:30			
8:00			
8:30			
9:00			
9:30			
10:00			

5. Return your isopods to the stock culture or separate holding area.

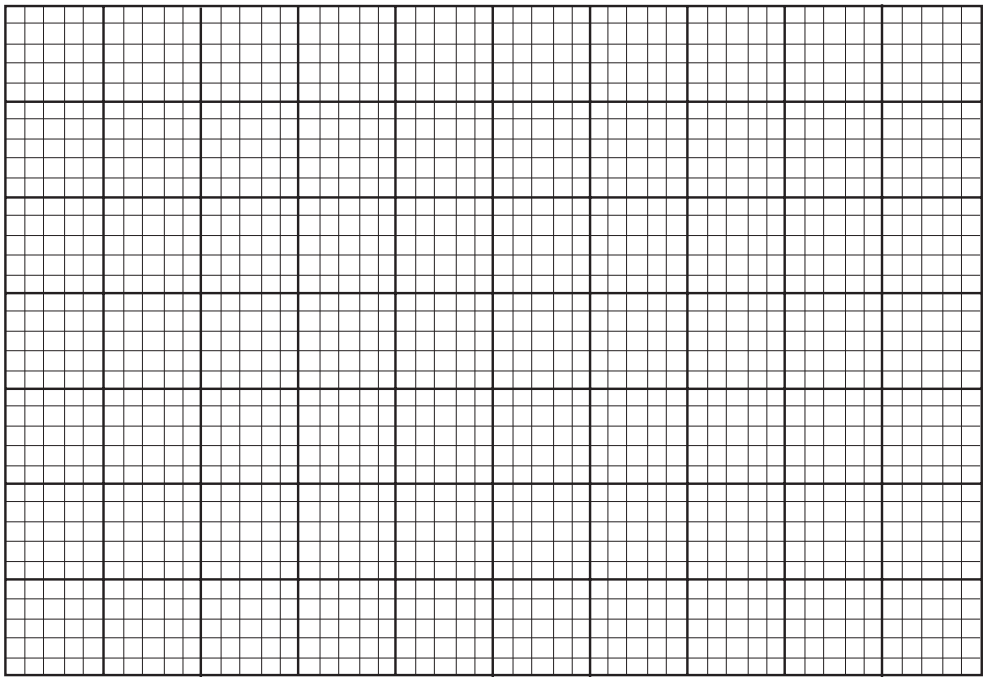
6. Generate Graph 11.1 using two sets of data: the number of isopods on the wet side of the chamber and the number of isopods on the dry side of the chamber over time. For the graph, determine the following:

   a. The independent variable is _____.
      (Use to label the horizontal x-axis.)

   b. The dependent variable is _____.
      (Use to label the vertical y-axis.)

Graph 11.1

Title: _____



Label (y-axis):

_____

_____

_____

Label (x-axis): _____

Questions

1. Based upon your observations, do isopods orient with respect to moisture in the environment? Explain your answer.

2. If you answered "yes" to Question 1 above, was the orientation achieved through taxis or kinesis? Support your answer.

3. How might this behavior be advantageous to isopods?

Exercises 11C: Student-Designed Experiments on Isopod Behavior

Procedure

- Select one factor listed below to investigate.

Factor	Conditions
temperature	cool vs. warm
light	light vs. dark, or light vs. shade
pH	low pH vs. high pH
substrate (surface)	smooth vs. rough

- Your teacher will now point out the materials available for conducting your investigation. In designing your experiment, be careful not to injure the isopods. Lamps placed too close to the organisms, for example, may generate dangerous heat.

1. State the factor to be tested: _____

_____

2. Based on laboratory experience with isopods, state the hypothesis to be explored:

_____

_____

_____

_____

_____

_____

_____

3. List the materials used in the experiment:

_____

_____

_____

_____

_____

_____

_____

4. List the procedure to be followed (step-by-step):

_____

_____

_____

_____

_____

_____

_____

5. Describe the data that will be collected and how the results will be displayed. (Use Graph 11.2, on page 12, if appropriate.)

_____

_____

_____

_____

_____

_____

_____

6. Perform the experiment.

7. Return the isopods to the stock culture.

8. State your conclusions concerning the hypothesis tested.

_____

_____

_____

_____

_____

_____

_____

9. Obtain results from all groups in your class for both the kinesis experiment and the designed experiments.

Graph 11.2

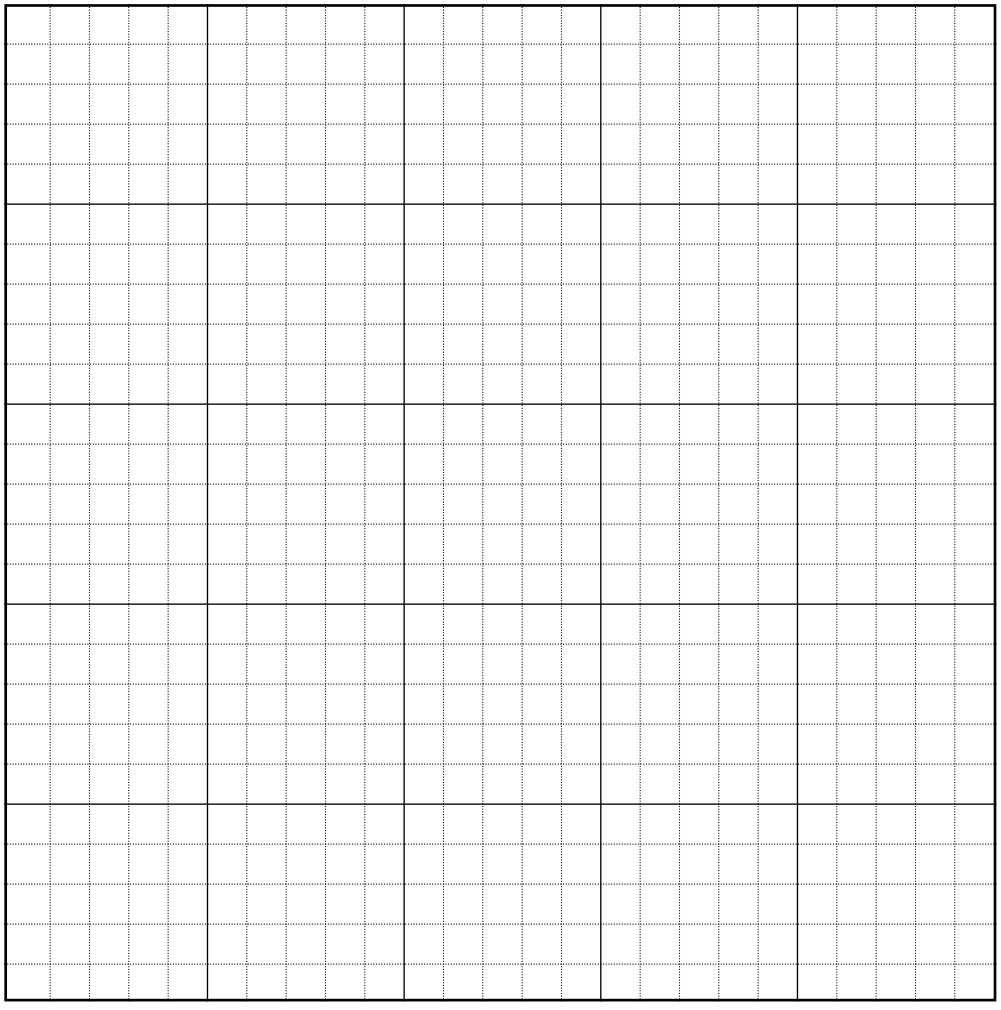
Title: _____

Label (y-axis):

_____

_____

_____



Label (x-axis): _____

Questions

1. Considering all of the factors tested by your class, what type of environment do isopods seem to prefer?

_____

_____

_____

_____

_____

_____

2. How do you think isopods locate appropriate environments?

_____

_____

_____

_____

_____

_____

3. If you suddenly turned a rock over and found isopods under it, what would you expect them to be doing? If you watched the isopods for a few minutes, how would you expect to see their behavior change?

_____

_____

_____

_____

_____

_____

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