

AP[®] Biology Laboratory 11, Part A

Animal Behavior: Response to Environmental Variables

Objectives

- Observe animal behaviors relating to environmental stimuli
- Observe courtship behavior
- Design and conduct animal behavior experiments

Background to Part A

Ethology is the science of animal behavior. Many behaviors involve the movements of the animal within its environment. In this lab you will investigate some innate (inherited, as opposed to learned) behaviors.

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 the 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 m². The researcher then places a carrion beetle (an insect that eats dead animal tissue) somewhere on the test surface and then observes. The beetle crawls forward for three seconds, turns, and crawls in a different direction for three seconds, and continues in this manner. 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 slowly and covers less ground when it happens to crawl away from the mouse. In this way, the beetle's random movements will bring it to the dead mouse, at which point other behavior patterns, such as feeding, will take over.

Agonistic behaviors are aggressive or submissive displays. A common example is a cat's response to an aggressive dog. The cat fluffs its fur and stands sideways to the dog. This makes the cat appear larger and stronger than it really is.

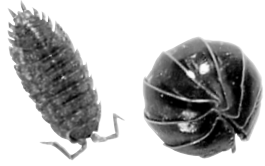
Activity A1: Initial Observation of Isopod Behavior

Materials

10 isopods in a petri dish or cup (with a damp substrate), a sorting brush.

Introduction

Terrestrial isopods are land-dwelling crustaceans commonly known as sow bugs (*Porcellio laevis*) and pill bugs (*Armadillidium vulgare*). They have many other common names, including roly-polies, potato bugs, and wood lice (no relation to body lice). Related to lobsters, crabs, and shrimp, terrestrial isopods



***Porcellio laevis*;
*Armadillidium vulgare***

breathe with gills, which must remain moist. Although similar in size, color, and life cycle, pill bugs and sow bugs are different animals. When threatened, pill bugs curl up into a tight ball for protection, while sow bugs either flee or remain perfectly still, appearing to be dead.

Procedure

Observe the isopods for 10 minutes. Your goal is to observe their undisturbed behavior, so do not bump the container. As you observe, make notes on the isopods' movements. Do they move continuously or do they "settle down" between periods of movement? If two isopods touch each other, what happens?

1. Notes on Isopod Behavior:

2. Review your notes. Did you observe any agonistic behavior? If so, explain the behavior.

3. Are the movements of the isopods better described as taxis or kinesis movements? Give details to support your answer.

Activity A2: Orientation Behavior of Isopods

Materials

10 isopods in a petri dish or cup (with a damp substrate), sorting brush, choice chamber, two pieces of filter paper, dropping pipet, water, marking pen, stopwatch or timer.

Introduction

In this activity, you will observe isopods as they respond to humidity differences in their environment over time.

Procedure

1. Place clean filter paper into each side of the choice chamber.
2. Using the dropping pipet, saturate the filter paper on one side of the chamber. Pour off any excess water; do not let the water run into the other side of the chamber and moisten the paper there.
3. Use the sorting brush to transfer five (5) isopods to each side of the chamber. Put on the lids.
4. Count and record in Table 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.

Data Table 1

Time (min:sec)	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
# on wet side	5																				
# on dry side	5																				

Analysis of Results, Activity A2: Orientation Behavior of Isopods

Graph the data from Table 1 for both the wet side and the dry side of the chamber. Title the graph and supply the following information:

- a. The independent variable is _____.
- b. The dependent variable is _____.

Plot the independent variable on the x-axis, and the dependent variable on the y-axis.

1. Write a hypothesis for this experiment.

2. What serves as a control for this experiment, or what needs to be done to establish a control for this experiment?

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

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

5. How might this behavior be advantageous to isopods?

Activity A3: Designing an Experiment to Test Isopod Behavior

Materials

10 isopods in a petri dish or cup (with a damp substrate), sorting brush, other materials to be determined.

Introduction

In this activity, you will design and conduct your own experiment investigating isopod behavior.

Procedure

Select one variable listed below to investigate.

Variable	Conditions
Temperature	cool vs. warm
Light	light vs. dark; light vs. shade
pH	low pH vs. high pH
Substrate surface	smooth vs. rough

Your teacher will point out the materials available for conducting your experiment. In designing your experiment, be certain that you do not injure the isopods. For example, lamps placed too close to the organisms may generate dangerous heat.

1. State the factor to be tested: _____
2. Based on your laboratory experience with isopods, state a hypothesis for your experiment. Your hypothesis should include the conditions tested, the expected outcome, and a reason for the expected outcome (i.e., "If . . . then . . . because....").

3. List the materials needed for 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.

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 Activities A2 and A3.

Analysis of Results, Activity A3: Designing an Experiment to Test Isopod Behavior

1. Based on the results obtained by your class, what type of environment do isopods seem to prefer?

2. Based on your answer to Question 1 above, would you expect to find isopods anywhere on your school grounds? If so, where?

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?
