

AP Biology Lab 11

ANIMAL BEHAVIOR

OVERVIEW

In this lab you will observe some aspects of animal behavior.

1. In Exercise 11A you will observe pillbugs and design an experiment to investigate their responses to environmental variables.
2. In Exercise 11B you will observe and investigate mating behavior in fruit flies. Your teacher may suggest other organisms or other types of animal behavior to study.

OBJECTIVES

Before doing this lab you should understand:

- The concept of distribution of organisms in a resource gradient, and
- The difference between kinesis and taxis.

After doing this lab you should be able to:

- Describe some aspects of animal behavior, such as orientation behavior, agonistic behavior, dominance display, or mating behavior, and
- Understand the adaptiveness of the behaviors you studied.

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 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.

EXERCISE 11A: General Observation of Behaviors

In this lab you will be working with terrestrial isopods commonly known as pillbugs, sowbugs, or roly-polies. These organisms are members of the Phylum *Arthropoda*, Class *Crustacea*, which also includes shrimp and crabs. Most members of this group respire through gills.

PROCEDURE

1. Place 10 pillbugs and a small amount of bedding material in a Petri dish. Pillbugs generally do not 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 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 it or interfere with it.

3. Make a detailed sketch of a pillbug.

Kinesis in Pillbugs

1. Prepare a choice chamber as illustrated in Figure 11.1. The choice chamber consists of two large, plastic petri dishes taped together with an opening cut between them. Cut the opening with scissors and use tape to hold the dishes together. Line one chamber with a moist piece of filter paper and the other with a dry piece of filter paper.
2. Use a soft brush to transfer ten pillbugs from the stock culture into the choice chamber. Place 5 pillbugs in each side of the choice chamber. Cover the chambers.
3. Count how many pillbugs are on each side of the choice chamber every 30 seconds for 10 minutes and then record your data in Table 11.1 (page). Continue to record even if they all move to one side or stop moving.
4. Return your pillbugs to the stock culture.
5. Graph both the number of pillbugs in the wet chamber and the number in the dry chamber using Graph 11.1 on page.

Figure 11.1 Choice Chamber

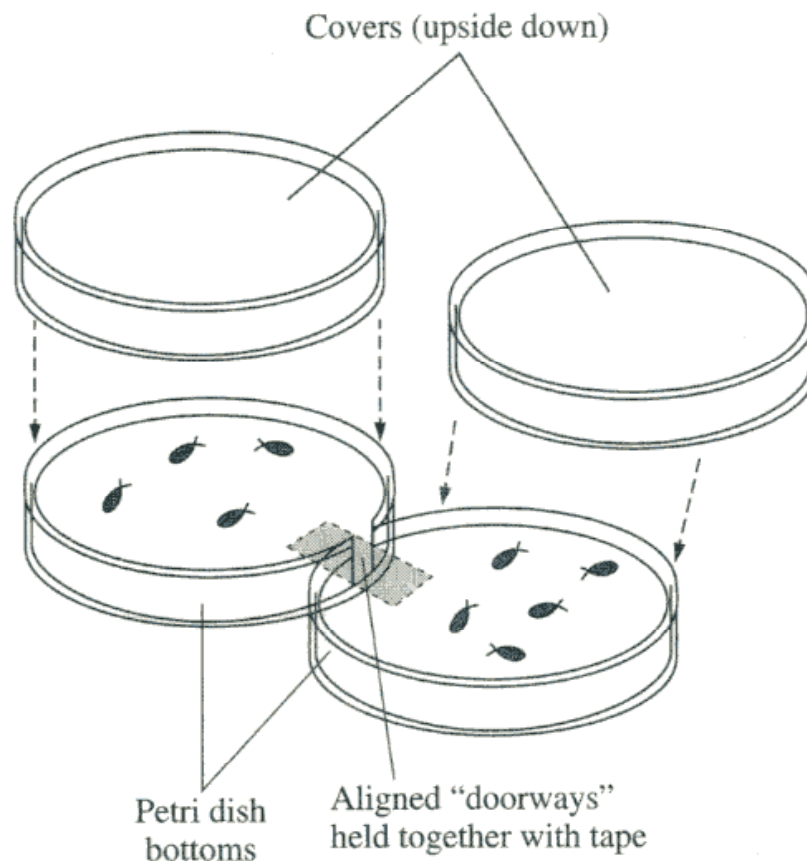


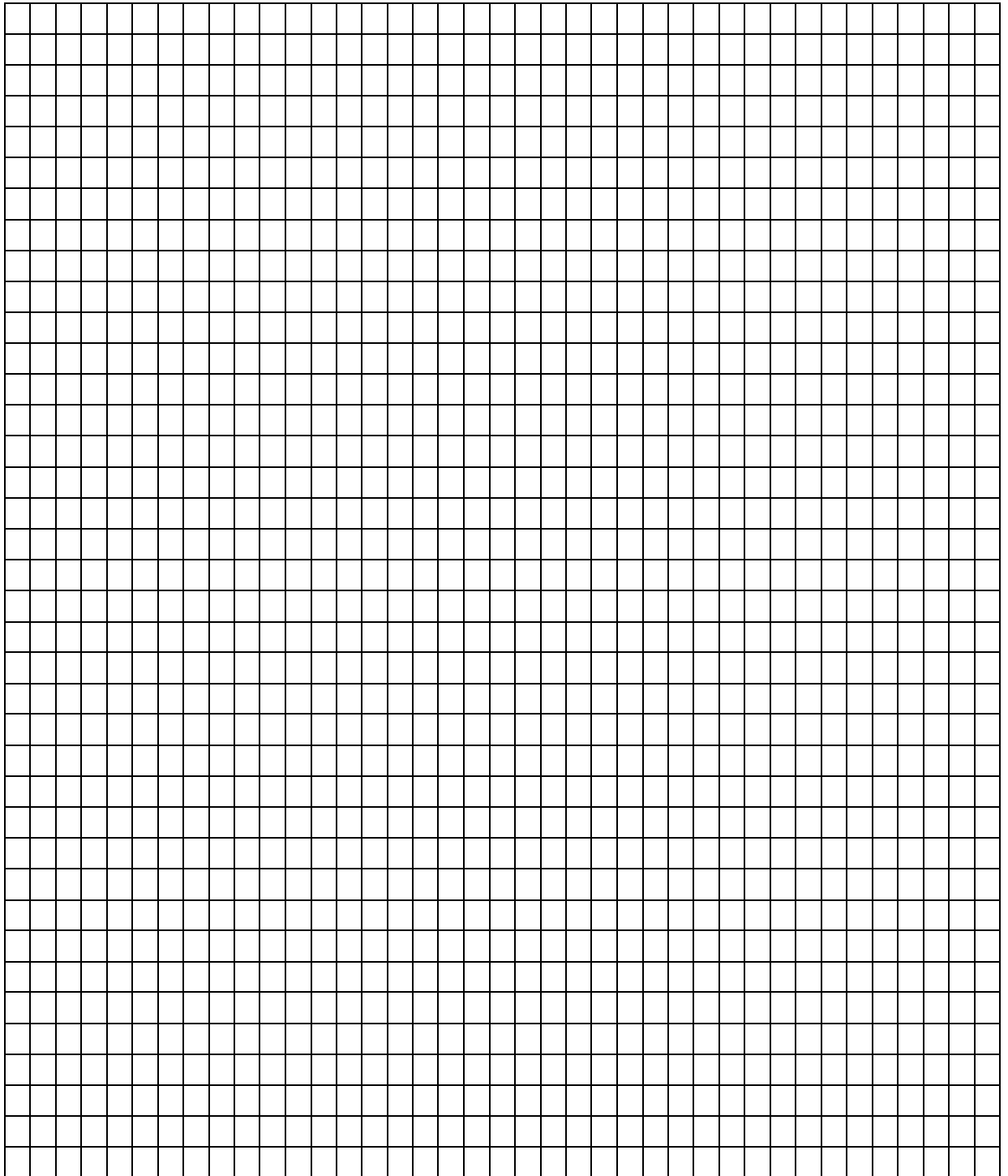
Table 11.1

Time (mins.)	Number in Wet Chamber	Number in Dry Chamber	Other Notes
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			

For this graph you will need to determine the following:

- a. The **independent** variable: _____ . Use this to label the x-axis.
- b. The **dependent** variable: _____ . Use this to label the vertical (y) axis.

Graph 11.1 Title: _____



ANALYSIS

1. What conclusions do you draw from your data? Explain the physiological reasons for the behavior observed in this activity.
2. Obtain results from all of the lab groups in your class. With respect to humidity, light, temperature, and other environmental conditions, which type of environment do isopods prefer? How do the data support these conclusions? Give specific examples.
3. How do isopods locate appropriate environments?
4. 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?
5. Is the isopod's response to moisture best classified as kinesis or taxis? Explain your response.

Student-Designed Experiment to Investigate Pillbug's Response to Temperature, pH, Background Color, Light or other Variable

1. Select one of the variable factors listed above and develop a hypothesis concerning the pillbug's response to the factor.
2. Use the materials available in your classroom to design an experiment. Remember that heat is generated by lamps.
 - a. State the objective of your experiment.
 - b. List the materials you will use.
 - c. Outline your procedure in detail.
 - d. Decide what data you will collect and design your data sheet.
3. Run your experiment.
4. Make any graphical representation of your data that will help to visualize or interpret the data.
5. Write a conclusion based on your experimental results.
6. Return your isopods to the stock culture.

Exercise 11B: Reproductive Behavior in Fruit Flies

INTRODUCTION

In this experiment you will place 3 or 4 virgin female *Drosophila melanogaster* flies in the same vial with 3 or 4 male flies, and using a dissecting microscope or hand lens, observe the behavior of each sex. Mating in *Drosophila melanogaster* follows a strict behavioral pattern. Five phases can be distinguished (see Figure 11.2):

- A. Orientation
- B. Male song (wing vibration)
- C. Licking of female genitalia
- D. Attempted copulation
- E. Copulation
- F. Rejection (extrusion of ovipositer)

Figure 11.2 Courtship Behavior in *Drosophila melanogaster*

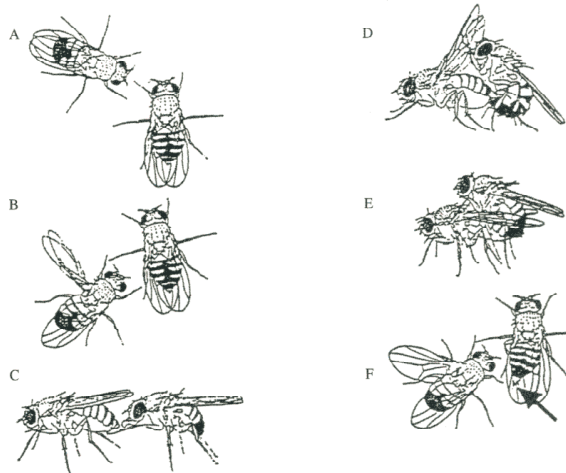


Figure 11.2 A-F. Courtship behavior in *D. melanogaster*. A. Orientation of the male towards the female. B. Wing vibration by the male. C. The male licks the female's genitalia with his proboscis. D. Mounting by the male with genital contact. E. Flies in copulation. F. A rejection response by the female. The female turns her abdomen towards the male and extends her ovipositor (see arrow).

At least 14 different behaviors have been described. Listed below are 10 of the most easily recognized of these behaviors. Six of the behaviors are seen in males, 4 in females.

Male Behaviors

1. **Wing vibration.** The male extends one or both wings from the resting position and moves them rapidly up and down.
2. **Waving.** The wing is extended and held 90° from the body, then relaxed without vibration.
3. **Tapping.** The forelegs are extended to strike or tap the female.
4. **Licking.** The male licks the female's genitalia (on the rear of her abdomen).
5. **Circling.** The male postures and then circles the female, usually when she is nonreceptive.
6. **Stamping.** The male stamps forefeet as in tapping but does not strike the female.

Female Behaviors

1. **Extruding.** A temporary tubelike structure is extended from the female's genitalia (Figure 11.2 F).
2. **Decamping.** A nonreceptive female runs, jumps, or flies away from the courting male.
3. **Depressing.** A nonreceptive female prevents access to her genitalia by depressing her wings and curling the tip of her abdomen down.
4. **Ignoring.** A nonreceptive female ignores the male.

PROCEDURE

1. Set up the stereomicroscope.
2. Have a paper and pencil handy. The behaviors may happen very rapidly. One person should call out observations while the other person records.
3. Obtain one vial containing virgin females and one vial containing males, and gently tap the male flies into the female vial.
4. Observe first with the naked eye, and once the flies have encountered each other, use the stereomicroscope to make observations.
5. As you identify the various behaviors, record their sequence and duration. Quantify your observations. To do this you may consider counting the number of times a behavior takes place and timing the duration of the behaviors.
6. Discuss possible original experiments investigating reproductive behavior in flies.

RESULTS

Prepare a detailed account of the behaviors you have observed. Include sketches and quantitative analysis as appropriate.

Student Designed Experiment to Investigate Reproductive Behavior in Fruit Flies

Design a simple experiment to investigate none of the following questions or any other that you devise.

- a. Will males placed in a vial with only males demonstrate courtship behavior?
 - b. Will males respond to dead females?
 - c. Do males compete?
 - d. How will males respond to already mated females?
1. Develop a hypothesis concerning the fruit fly behavior.
 2. State your objective.
 3. List the materials you will use.
 4. Outline your procedure in detail.
 5. Decide what data you will collect and design your data sheet.
 6. Run your experiment.
 7. Make any graphical representation of your data that will help to visualize or interpret the data.
 8. Write a conclusion based on your experimental results.