Carolina LabSheets™

Pill Bug Behavior

This activity is an introduction to animal behavior. Students conduct an experiment to test the response of pill bugs (*Armadillidium vulgare*) to conditions of low and high humidity. Pill bugs are crustaceans. Most crustaceans are aquatic, but pill bugs are terrestrial. Even so, they retain gills as respiratory organs, which restricts them to damp terrestrial habitats. Thus, the activity can be used to introduce the topic of behavioral adaptation.

Needed Materials

Pill bugs (143082) or Sow bugs (143072)
Choice Chambers (746618)
filter paper (712800), or circles of paper towel
dropping pipets
cups with lids, or petri dishes
potting soil or good garden soil
pail with lid
beakers or cups for water
springwater or deionized water or tap water treated to remove chloramines
plastic spoons
stopwatches (preferred), watches with second hands, or smartphones with stopwatch application

Safety

Ensure that students understand and adhere to safe laboratory practices when performing any activity in the classroom or lab. Demonstrate the protocol for correctly using the instruments and materials necessary to complete the activities, and emphasize the importance of proper usage. Use personal protective equipment such as safety glasses or goggles, gloves, and aprons when appropriate. Model proper laboratory safety practices for your students and require them to adhere to all laboratory safety rules.

Procedures

Upon receipt of your pill bugs, immediately open the shipping container and check their condition. They are shipped in damp paper toweling to provide the humidity they require. If the paper towel is not damp, add just enough water to remoisten it. After examining the pill bugs, close the container. If you use the pill bugs right away, no additional care is needed. If you need to keep them for more than a day before use, prepare a holding pail. Punch air holes in the lid of a pail, cover the bottom with moist potting soil, and place a slice of raw potato or apple on the soil. Mist the inside of the pail with room-temperature water. Gently, empty the contents of the shipping container into the pail. Carefully unfold the crumpled paper towel and shake off as many of the pill bugs as possible. If you are unable to dislodge all the pill bugs, use a soft artist's brush to remove any that remain. Mist the inside of the pail again and replace the lid.

Pill bugs need little care, other than humidity and food. At the end of this lab, return the pill bugs to the holding pail. Feed them leaf litter and pieces of raw potatoes, apples, or carrots. Immediately remove any food that becomes moldy. This provides all that the pill bugs need to thrive and even to reproduce. The female carries up to 200 eggs in a brood pouch located ventrally on her thorax. The young hatch in the pouch and stay there for about 3 weeks. The young resemble the adults, except for their smaller size and paler color, and will molt four or five times as they grow.

Shortly before the lab, prepare a cup (or petri dish) for each student team by adding a bit of moist potting soil or moist paper towel and 10 pill bugs. Place a lid on the cup.

Supply each student team with the following:

- cup of 10 pill bugs
- cup of water
- dropper
- choice chamber
- 2 pieces of filter paper
- plastic spoon
- stopwatch or other timer

It is important that students moisten but not drench the filter paper used on the damp side of the choice chamber. If the paper is too wet, humidity in the chamber may be so high that the pill bugs stay on the dry side.

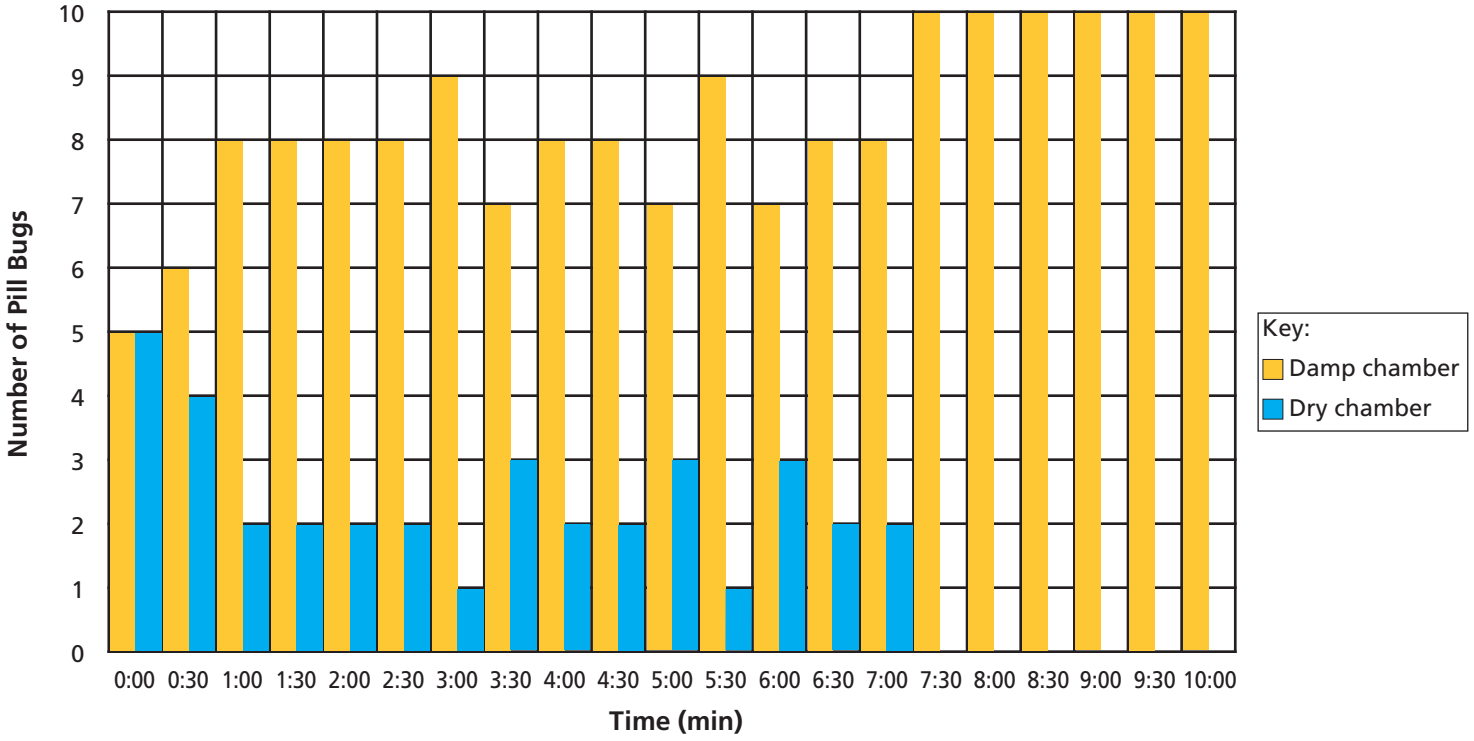
Optional: After completing the main activity, have students design and conduct their own experiments to test pill bugs' responses to additional factors, e.g., light, temperature, pH, substrate texture, substrate color, and food. This activity may be conducted not only with pill bugs, but also with sow bugs (143072 *Porcellio laevis*). One option is to have some student teams use pill bugs and others use sow bugs. Then, the teams can share and compare their observations.

Answer Key to Questions Asked on the Student LabSheet

Sample Data Table

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 damp side	5	6	8	8	8	8	9	7	8	8	7	9	7	8	8	10	10	10	10	10	10
# on dry side	5	4	2	2	2	2	1	3	2	2	3	1	3	2	2	0	0	0	0	0	0

Sample Graph Distribution of Pill Bugs



Graph your data for both the damp side and the dry side. Title the graph and supply the following information:

The independent variable is **time**.

The dependent variable is **number of pill bugs**.

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

Note: This graph is best done as a histogram, not as a line graph, because it is comparing two quantities and the data are discrete; for example, there may be 4 pill bugs or 5 pill bugs, but not 4.56 pill bugs. Constructing the graph by hand is tedious. It is best to enter the data into an electronic spreadsheet and generate a graph within the spreadsheet.

1. Write a hypothesis for this experiment.

   Pill bugs will respond to differences in humidity in their environment. Pill bugs will move to the damp side of the choice chamber.

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

   This is a difficult question. Some students may argue that because pill bugs are normally found in humid environments, the damp side of the chamber represents the normal condition and is therefore the control. Some may argue that the dry side is the control because it is the side to which nothing has been added (i.e., water). Others may argue that there is no control and that the activity should be repeated with damp filter paper on both sides and then with dry filter paper on both sides to establish a baseline of behavior under the tested conditions. This last argument is best. In an environment of uniform humidity, the pill bugs should distribute themselves at random within the choice chambers. This is the null hypothesis. Without a control using a uniform humidity on both sides of the choice chamber, we cannot be confident that the pill bugs are responding to humidity. They might be responding to a magnetic field, to areas of polarized light, or to any of a number of other factors.

3. Can you conclude from your observations that pill bugs respond to different levels of moisture in the environment? Explain your answer.

   Yes, the data support the hypothesis that pill bugs move to areas of high humidity. (Students who responded to the previous question with the call for further testing may prefer to withhold judgment.)

4. How might this behavior be advantageous to pill bugs?

   Pill bugs breathe by gills and require humidity for gas exchange. Spaces under leaves, rocks, and other materials generally are more humid than exposed areas are, and pill bugs tend to go under such materials. This also hides them from predators.

NAME _____

DATE _____

Pill Bug Behavior

In this activity you will investigate the response of pill bugs to moisture.

1. Place a clean filter paper disk into each side of your choice chamber.
2. Using the dropping pipet, **dampen** the filter paper on one side of the chamber. Make sure there is no excess water not absorbed by the paper.
3. Use a plastic spoon to transfer five pill bugs to each side of the chamber. Put the lids on the chamber.
4. Count and record on the data table the number of pill bugs on each side of the chamber every 30 seconds for 10 minutes. Continue to record even if they all move to one side or stop moving.

Data Table

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 damp side																					
# on dry side																					

Analyzing your results

Graph your data for both the damp side and the dry side. Title the graph and supply the following information:

The independent variable is _____

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 currently serves as a control for this experiment, or what may be done to establish a control?

3. Can you conclude from your observations that pill bugs respond to different levels of moisture in the environment? Explain your answer.

4. How might this behavior be advantageous to pill bugs?

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