Walch Hands-on Science Series

Arthropods

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Contents

To the Teacher

This book on arthropods is one of a series of books devoted to hands-on science activities for middle school and early high school students. The activities in this book are intended as a supplement to the textbook and curriculum. Their purpose is to provide enrichment and to engage students' curiosity about living organisms. They may also be used as a springboard for science projects or club activities and to involve other members of the family in science as a process.

The thrust of these studies is to observe arthropods in natural or laboratory environments and to teach youngsters to respect and appreciate biodiversity. This book is not about dissection or experiments involving animal sacrifice but rather about assuming the role of behavioral scientists and treating animals humanely.

The organisms that have been selected for these activities have several traits in common. They are harmless to humans and easy to obtain and maintain in a school laboratory. Although these organisms are readily available from biological supply houses, some, such as pill bugs and sow bugs, may be collected locally. To help minimize expense and storage space, organisms such as crickets, and fruit flies may be used for more than one activity.

Most of the equipment used here is simple and inexpensive. Small plastic tanks covered with screens will provide housing for most of the organisms, and shoe boxes may be used as arenas for various experiments. It will be helpful, however, if one or more stereomicroscopes are available for making more detailed observations of these animals.

The activities range in difficulty as well as time needed to complete them. Some can be completed in one class period (Terrestrial Crustaceans: Pill Bugs and Sow Bugs); others require several weeks (Incomplete Metamorphosis: A Cricket's Life Cycle). Although most can be done in class, some must be completed out-of-doors (Finding Arthropods: The Backyard Laboratory). Choose the activities that meet the needs of your students.

Each activity has suggestions for follow-up exercises as well as a teacher resource page. The latter contains helpful hints, adaptations for high and low achievers, Internet tie-ins, and quiz questions. Instructional objectives and National Science Standards are included to help you meet state and local expectations. Above all, these activities are intended to open students' eyes to the wonders of arthropods. Enjoy!

Terrestrial Crustaceans: Pill Bugs and Sow Bugs

Teacher Resource Page

Instructional Objectives

Students will be able to

- record observations of living organisms.
- record data in a data table.
- perform simple calculations.
- formulate hypotheses about aspects of isopod behavior.
- draw conclusions based on data.

National Science Standards Addressed

Students demonstrate understanding of

- structure and function in living systems.
- regulation and behavior, such as response to environmental stimuli.
- evolution, diversity, and adaptation of organisms, such as speciation, adaptation, and variation.
- big ideas and unifying concepts, such as form and function, and cause and effect.

Students demonstrate scientific inquiry and problem-solving skills by

- identifying variables in research settings.
- working in teams to collect and share information and ideas.

Sudents demonstrate competence with the tools and technologies of science by

- using technology and tools such as traditional laboratory equipment to observe and measure organisms and phenomena.
- collecting and analyzing data using concepts in mathematics.
- acquiring information from multiple sources, such as print, the Internet, and experimentation.

Students demonstrate effective scientific communication by

- arguing from evidence, such as data produced through his or her own experimentation.
- communicating in a form suited to the purpose and the audience, such as writing instructions that others can follow.

Helpful Hints and Discussion

Time frame: Single period of instruction
Structure: Groups of four students
Location: In class

In this activity, students compare and contrast pill bugs and sow bugs. Both are terrestrial isopods that live in soil and eat decomposed plant material. Although they are called bugs, they are not insects but belong to the two groups of *crustaceans* that can spend their entire lives on land. They are similar in appearance but belong to different families. They can easily be distinguished from each other by their reactions when disturbed. Pill bugs will roll up into a ball or pill; sow bugs will not.

These animals are excellent laboratory animals because they are inexpensive (or free), easy to maintain, and require little care. They also move slowly and reproduce in large numbers. They may be kept in a large jar or bucket with a layer of 2 to 3 cm of moist soil on the bottom. Add slices of potato for food and small pieces of wood for the isopods to hide under. You may find them under rocks or purchase them from a biological supply house, such as Carolina Biological Supply Company.

When working with isopods, simply scoop them up with a plastic spoon or similar instrument and transfer them to the container in which you will be examining them. Although these animals are completely harmless to humans, some people may be allergic to certain arthropods. Therefore, it is advisable to wear gloves if you handle them. Remember to stress that these organisms are alive and should be treated humanely.

Materials

Each group of four students will need

- Container of pill bugs
- Container of sow bugs
- Metric ruler
- Plastic gloves
- Petri dish
- Hand lens or stereomicroscope
- Deep tray or shoe box
- Plastic spoon or similar instrument
- Stopwatch or clock with a second hand

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Adaptations for High and Low Achievers

High Achievers: These students should help lower achievers by working with them in a group. Also, encourage these students to perform additional behavioral experiments based on follow-up activity 3.

Low Achievers: During your introduction, review characteristics of arthropods, particularly crustaceans and insects. Provide a glossary and/or reference material for the italicized terms in this activity. Heterogeneous groupings will enable students of higher ability to help those having difficulty carrying out the activity. Encourage these students to complete follow-up activity 2.

Scoring Rubric

Full credit should be given to students who use complete sentences to correctly answer all the questions and accurately complete the two data tables provided. Extra credit should be given to students who complete any of the follow-up activities.

Internet Tie-ins

http://www.gene.com/ae/AE/AEC/AEF/index.html (Access Excellence)
http://www.weneedyou.com./clark_bugs/sowpillbug.html (Sow Bug/Pill Bug)

Quiz

1. A student brings a jar containing terrestrial isopods to class. Describe two ways that you can determine whether they are pill bugs or sow bugs.
2. Why are these terrestrial isopods believed to be more closely related to shrimps and lobsters than to beetles or ladybugs?

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Terrestrial Crustaceans: Pill Bugs and Sow Bugs

STUDENT ACTIVITY PAGE

BEFORE YOU BEGIN

Neither pill bugs nor sow bugs are bugs. They belong to the two groups of *crustaceans* that can spend their entire lives on land. Both of these *terrestrial isopods* live in soil and eat decomposed plant material. Although they are similar in appearance, they can easily be distinguished from each other by their reactions when disturbed. Pill bugs will roll up into a ball or pill; sow bugs will not.

These animals are easy to maintain in the laboratory and require little care. They may be kept in a large jar or bucket with a 2- to 3-cm layer of moist soil on the bottom. Add slices of potato for food and small pieces of wood for the isopods to hide under.

In this activity, you will learn about similarities and differences between pill bugs and sow bugs. They move rather slowly and are easy to handle. Simply scoop them up with a plastic spoon or similar instrument and transfer them to the container in which you will be examining them. Although these animals are completely harmless to humans, some people may be allergic to certain arthropods. Therefore, it is advisable to wear gloves if you handle them. Remember that these organisms are alive and should be treated humanely. At the end of the activity, return them to their original container.

MATERIALS

- Container of pill bugs
- Container of sow bugs
- Metric ruler
- Plastic gloves
- Petri dish
- Hand lens or stereomicroscope
- Deep tray or shoe box
- Plastic spoon or similar instrument
- Stopwatch or clock with a second hand

PROCEDURE

1. Observe pill bugs and sow bugs in their containers for two minutes. Write a description of each type of animal in the Data Collection and Analysis section. Be specific enough in your description that the members of your learning group can distinguish between the two organisms when they are placed together.
2. Transfer three pill bugs to a petri dish. Cover the dish. Using a hand lens or stereomicroscope, count the number of antennae, body segments, and legs on each pill bug. It might help to hold the dish up over your head so that you can see the organisms' *ventral* surfaces. Record this and all observations in the appropriate tables in the Data Collection and Analysis section.
3. Transfer the pill bugs to a deep tray or shoe box. Touch one gently with the back of your spoon. How does it react?
4. After the animal recovers, touch the other bugs in a similar manner. This time use a stopwatch or a clock with a second hand to determine the length of time it takes each pill bug to recover.

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Name _____ Date _____

Terrestrial Crustaceans: Pill Bugs and Sow Bugs *(continued)*

STUDENT ACTIVITY PAGE

5. Measure the length and width of each pill bug, in mm.
6. Place one of the pill bugs on its back, or *dorsal* surface. Place the top of your spoon along the midline of the *ventral* surface. Try to lift the pill bug. How does it react? Do the same to the other two pill bugs. How do they react?
7. Measure the length of your tray or box in centimeters. Place an animal at one end. How long does it take it to get to the other end? Calculate the speed in cm/sec. Do the same with each of the other pill bugs.
8. Return the pill bugs to their original container. Repeat steps 2 to 7 with sow bugs.
9. When you have finished, return all organisms to their original containers, clean up your laboratory station, and wash your hands thoroughly.

DATA COLLECTION AND ANALYSIS

1. Complete the following table.

Table 1: Description of Terrestrial Isopods

Pill Bug	Sow Bug

2. Complete the following table.

Table 2: Characteristics of Terrestrial Isopods

Characteristic	Pill bug	Sow Bug
# of antennae		
# of body segments		
Pairs of legs/segment		
Reaction to touch		
Average recovery time (sec)		
Average length (mm)		
Average width (mm)		
Ratio of length/width		
Can it be lifted from ventral surface?		
Average speed (cm/sec)		

(continued)

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Terrestrial Crustaceans: Pill Bugs and Sow Bugs *(continued)*

STUDENT ACTIVITY PAGE

3. Based on the information in Table 2, write a paragraph or prepare a concept map on the back of this sheet describing the two types of terrestrial isopods (pill bugs and sow bugs) in as many ways as possible.

CONCLUDING QUESTIONS

Answer all questions on the back of this sheet or on a separate page.

1. How are these isopods adapted to survive in soil?
2. How is each type of isopod adapted to avoid enemies?
3. Why are pill bugs and sow bugs good organisms to study in a school laboratory?
4. Why are these organisms classified as crustaceans, rather than insects?
5. Why is isopod a good name for these organisms?

FOLLOW-UP ACTIVITIES

1. Use printed material or the Internet to learn about the anatomy and life cycle of other crustaceans, such as lobsters and shrimps. Present your findings as a written report or artwork.
2. Use printed material or the Internet to learn about food webs in the soil. Draw a diagram of a food web that includes isopods.
3. Design an experiment to learn more about the behavior of isopods. (For example: Can they learn? How strong is a pill bug?)