

Grades 3–5: Investigating Pill Bug Behavior

Purpose

Students observe pill bug behavior during a checkpoint lab and associate the behaviors with pill bug sense receptors. Then they design investigations to answer their own questions about pill bug behaviors.

Engage

Show students the cover of *Next Time You See a Pill Bug*. Ask them if they have ever collected pill bugs or played with them. If so, where did they find them? What did they do with them? Read aloud pages 6 and 7, which encourage students to pick up a pill bug and let it crawl around on their hands, observe it closely, and describe it. Tell students that before you read the rest of the book, they are going to have an opportunity to do just that! Give each student a pill bug in a small plastic container that has a piece of a damp paper towel in it. Encourage students to interact with the pill bug, reminding them to handle it gently. They can pick it up, try to count its legs and segments, place several in one cup and compare their sizes and colors, and so on. Tell students that they will be reading the rest of *Next Time You See a Pill Bug* after they have had some more experiences with the pill bugs.

Explore

Form teams of three or four and tell students they will be learning about how pill bugs react to their environments. Give each student a copy of the Pill Bug Checkpoint Lab. Explain that in the checkpoint lab, they will work as a group and follow the directions on each page. When they reach a “checkpoint,” they should stop and get a checkmark or stamp from the teacher before they move on. As they work, they should keep their green cup on top of their red cup. If they need help or if they are at a checkpoint, they should put their red cup on top. Even though they are working as a team, each member of the group is responsible for recording data and writing responses. Observe and listen to students as they work on the lab, and watch for red cups. Before you give a team a checkmark or stamp, informally evaluate the students by asking probing questions of each team member. Here are some things to look for in each part of the checkpoint lab:

Part A: Pill Bug Observations

Students should create a drawing of the pill bug with at least three parts labeled. Pill bugs have 14 legs (two per

Materials

- pill bugs
- clear plastic containers (with sides high enough to contain the pill bugs)
- paper towels
- Checkpoint Lab Materials (per group of three or four students)
 - Pill Bug Checkpoint Lab (see Internet Resources to download student packets)
 - red and green cups (for signaling the teacher)
 - shallow box
 - hand lens
 - flashlight
 - newspaper
 - 5–10 pill bugs
 - stamp or marker
- Design an Investigation Think Sheet (see NSTA Connection)



segment). Pill bugs react to touch by rolling up into a ball, stopping, or running away. Make sure students realize that the pill bug does react to their touch.

Part B: Pill Bug Experiment

Teams should come up with an idea for an experiment and draw it. The experiment should test whether pill bugs prefer light or dark areas. The most common answer is a drawing of the pan or box, one half covered with newspaper and the other half under a flashlight. Encourage students to discuss their ideas with each other and to position the materials while they talk. They will not actually perform the experiment until they get the checkpoint stamped.

Part C: Results of the Pill Bug Experiment

Students learn that not all of the experiments will come out the same way. Scientists typically repeat experiments several times and look at the overall results when making a conclusion. Most pill bugs, but not all, will go to the dark area. The question, “What is your evidence?” might be challenging for them. Their evidence is that after looking at their results and the results of five other teams, most of the pill bugs went to the dark area.

Part D: A Moth Experiment

Students will use the data table in Julia’s journal to determine that most moths prefer to be in the light.

Explain

Explain to students that in this checkpoint lab, they had the opportunity to observe various pill bug behaviors, such as rolling into a ball or running away when touched and moving to the dark when they were in light. Ask students to look at the drawings from Part A and think about what parts of the pill bug would help it sense its surroundings. Ask, “How do the pill bugs know you are touching them or sense which areas are light or dark?” Students may say that the pill bugs can feel with their bodies and antennae and see with their eyes. Explain that animals have structures called sense receptors that allow them to sense their environment. The information detected by the receptors is sent to the brain, where it is processed, and then the animal reacts. For example, a pill bug’s eyes are sense receptors. Pill bugs do not have detailed vision but are able to sense light and dark. Ask students how the pill bugs reacted when their eyes detected bright light. (They moved away from it.) This is an example of information processing in an animal. The light was detected by a receptor, signals were sent back and forth through a system of nerves, and then the pill bug responded. Explain that a pill bug’s brain is not like a human brain. All of our thinking is processed inside our brain, and signals to and from our brain are relayed through a complicated system of nerves in our spinal cord and throughout the rest of our body. Pill bugs don’t rely on a central brain to control their entire bodies. Instead, they have a tiny brain behind their eyes and several “minibrains” called ganglia that run along their body, one in each segment. Information from that segment’s sense receptors goes directly to that segment’s ganglion, allowing the pill bug to react quickly with that part of its body. A pill bug’s antennae are also receptors. Pill bugs constantly use their antennae to sense their surroundings. Pill bugs have various other sense receptors throughout their bodies that collect information about their environment and allow the pill bugs to sense danger and find food and water.

Next, ask students whether they have any questions about pill bugs based on the lab. Make a list of some of their wonderings and share some of yours, such as:



- If pill bugs have 14 legs, are they considered insects?
- Do pill bugs lay eggs or give birth to live young?
- Do baby pill bugs look like their parents?
- Why do pill bugs roll up in a ball?
- Why did pill bugs prefer the dark in our experiment?
- How do pill bugs breathe underneath rocks?

Tell students that you have a nonfiction book that will answer some of their questions and help them understand some of the behaviors they observed in the lab. As you read the book aloud, stop when answers are provided to the questions on your list. For example, page 11 explains that pill bugs are crustaceans, page 13 explains that pill bugs lay their eggs in a pouch and that baby pill bugs look much like their parents, and page 15 shows how pill bugs roll up as a defense against danger (CC ELA Connection: Reading – Informational Text, Key Ideas and Details).

Elaborate

Tell students that they are now going to design their own investigation based on a question they have about pill bug behavior. Before students come up with their questions, have a discussion about humane treatment of pill bugs, including handling them gently, being sure they don’t dry out, and keeping them away from long periods of direct sunlight. Then, divide students into teams of 2–4 and ask them to brainstorm questions together, such as:

- Do pill bugs prefer wet or dry areas?
- Do pill bugs react to smells?
- Can pill bugs navigate a maze to find food?
- Do pill bugs prefer soil or sand?

Once students have selected a question, they must get your approval before they move on. Check to make sure that students’ investigations are safe (for them and for the pill bug), their question is testable, and that they have a clear plan. Once approved, they can use the Design an Investigation Think Sheet to create a list of materials and write or draw their plan. Encourage students to organize their data in a table, do multiple trials, and control variables.

Evaluate

When teams have completed their investigations, have them create a poster to share their findings. The poster should include their question, conclusion, and evidence. They should also include a drawing or model of a pill bug with structures labeled, such as antennae, feet, and eyes,

as well as an explanation about how those structures help the pill bug sense and react to its environment. Encourage students to include data tables, photographs, and other graphics to illustrate their findings. Students can present their findings at a poster session or gallery walk (CC ELA Connection: Writing, Research to Build and Present Knowledge).

Internet Resources

The Firefighting Robot

- www.popsci.com/scitech/article/2008-03/firefighting-robot
- www.engadget.com/2007/08/12/ole-pill-bug-robot-concept-

could-fight-forest-fires

The Pill-bot

www.youtube.com/watch?v=vi-5PisiDY

Pill Bug Checkpoint Lab Instructions and Student Packets

www.nexttimeyousee.com/resources/Pill-Bug-Checkpoint-Lab.pdf

NSTA Connection

Download the Pill Bug Observation Sheet and Design an Investigation Think Sheet at www.nsta.org/SC1603.

Connecting to the Next Generation Science Standards (NGSS Lead States 2013):

1-LS1.D Information Processing

www.nextgenscience.org/1ls1-molecules-organisms-structures-processes

K-2-ETS-2 Engineering Design

www.nextgenscience.org/k-2ets1-engineering-design

The chart below makes one set of connections between the instruction outlined in this article and the NGSS. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectations listed below.

| Performance Expectation | Connections to Classroom Activity <i>Students:</i> |
|---|---|
| 1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. K-2-ETS-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. | <ul style="list-style-type: none"> design a solution to a human problem by mimicking the ability of a pill bug to roll up into a ball. create a sketch of a device that mimics a pill bug's ability to roll up into a ball and explain how the parts of the device allow it to work. |
| Science and Engineering Practice | |
| Designing Solutions | <ul style="list-style-type: none"> design a solution to a human problem. |
| Disciplinary Core Ideas | |
| LS1.D Information Processing <ul style="list-style-type: none"> Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. ETS1.B Developing Possible Solutions <ul style="list-style-type: none"> Designs can be conveyed through sketches, drawings, or physical models. These representations are useful to compare and test designs. | <ul style="list-style-type: none"> observe pill bug behaviors, explain reasons for these behaviors, and identify the body parts that help the bugs sense their surroundings and behave the way they do. create a sketch of a device that mimics a pill bug's ability to roll up into a ball and explain how the parts of the device allow it to work. |
| Crosscutting Concept | |
| Structure and Function | <ul style="list-style-type: none"> identify pill bug structures and recognize their functions. explain how a device that mimics a pill bug has structures that aid its functions. |

Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013):

4-LS1 From Molecules to Organisms: Structures and Processes

www.nextgenscience.org/4ls1-molecules-organisms-structures-processes

The chart below makes one set of connections between the instruction outlined in this article and the NGSS. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectations listed below.

| Performance Expectation | Connections to Classroom Activity <i>Students:</i> |
|--|--|
| 4-LS1-2. Use a model to describe how animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. | <ul style="list-style-type: none"> create a model or drawing to identify pill bug sense receptors and explain how they help the pill bug respond to its environment. |
| Science and Engineering Practice | |
| Planning and Carrying Out Investigations | <ul style="list-style-type: none"> design a guided investigation to determine whether pill bugs prefer light or dark areas. design an open investigation to answer a question about pill bugs. |
| Disciplinary Core Idea | |
| LS1.D Information Processing <ul style="list-style-type: none"> Different sense receptors are specialized for particular kinds of information, which may then be processed by an animal's brain. Animals are able to use their perceptions and memories to guide their actions. | <ul style="list-style-type: none"> identify pill bug sense receptors and explain how they are related to pill bug behaviors. |
| Crosscutting Concept | |
| Structure and Function | <ul style="list-style-type: none"> identify structures of a pill bug that function to allow them to sense their environment. |

Connecting to the *Common Core State Standards* (NGAC and CCSSO 2010)

This section provides the *Common Core State Standards for English Language Arts and/or Mathematics* addressed in this column to allow for cross-curricular planning and integration. The Standards state that students should be able to do the following at grade level.

English/Language Arts

Reading Standards for Informational Text K-2: Key Ideas and Details

- Grade 1: Ask and answer questions about key details in a text.

Reading Standards for Informational Text K-2: Integration of Knowledge and Ideas

- Grade 1: Use the illustrations and details in a text to describe its key details.

Writing Standards for K-2: Text Types and Purposes

- Grade 1: Write informative/explanatory texts in which

they name a topic, supply some facts about a topic, and provide some sense of closure.

Reading Standards for Informational Text 3-5: Key Ideas and Details

- Grade 4: Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

Writing Standards for 3-5: Research to Build and Present Knowledge

- Grade 4: Conduct short research projects that build knowledge through investigation of different aspects of a topic.

The *Common Core* for ELA also provide a standard related to the Range of Text Types for K-5, where it indicates that students in K-5 should apply the Reading standards to a wide range of texts to include informational science books.

Name: _____

Design an Investigation

Think Sheet

1. My “testable” question about pill bugs:

2. My prediction:

3. Steps I will follow to investigate my question:

4. Materials I will need:

5. How I will treat the pill bugs with care and respect:

6. How I will share my findings:

Use the back of this paper to draw your ideas.

Teacher Checkpoint

Figure X.

| |
|---|
| <p>My original idea: _____</p> <p>_____</p> |
| <p>Idea that I support now: _____</p> <p>_____</p> |
| <p>Have your ideas changed, if so why? _____</p> <p>_____</p> |
| <p>If your ideas didn't change did you find any information that helped you understand the concept better? _____</p> <p>_____</p> |