

# *Lesson Sample*

## *Grade 4*



# *Plant and Animal Structures*

*A New Generation*





## Materials List

### Needed from the kit

96 bean seeds

1 bottle of clove oil

1 bottle of food coloring

1 bottle of peppermint oil

2 bunches of model lilies

8 cardboard tubes

9 clothespins

40 cotton balls

1 Cow Eye Dissection Mat

8 flat marbles

21 foam trays

30 hand lenses

9 large plastic cups

13 large resealable plastic bags

1 Literacy Series Reader: *Plant and Animal Structures*

30 medium resealable plastic bags

30 paper bags

3 plastic tanks, 1 gal

32 small plastic cups

126 pairs of disposable gloves

8 pairs of dissection scissors

8 pairs of forceps

1 pair of safety goggles, large

30 pairs of safety goggles, small

8 penlights

1 Plant and Animal Structures Photo Card Set

1 Preserved Package  
10 squids  
2 cow eyes  
1 sheep brain

1 roll of aluminum foil

1 roll of paper towels

1 roll of wax paper

16 rubber bands

1 scalpel

24 small resealable plastic bags

8 Squid Dissection Mats

8 thumbtacks

Playfoam®

Radish seeds

Sandpaper

### Provided by the teacher

9 celery stalks

30 glue sticks

30 individually wrapped hard candies

60 jelly beans

31 lab aprons

1 large container

3 large trash bags

30 living flowers

1 pair of sharp scissors

30 pairs of scissors

8 paper clips

30 permanent markers

60 potato chips

8 rolls of clear tape

30 rulers, 30 cm

32 sheets of paper

8 towels (optional)

2 gal water

Additional materials brought from home (for eye models, optional)

Chart paper

Crayons, markers, or colored pencils

Darkened classroom

Disinfectant cleaner

Light source or brightly lit window

Markers

Paper towels (for cleanup)

Projection system (optional)

Sunlit window or other warm area

Various craft materials

### Provided by the student

1 science notebook



# Plant and Animal Structures

A New Generation

Teacher's Guide



 Building Blocks  
of Science®

## Unit and Lesson Summaries

### Unit Overview

*Plant and Animal Structures* introduces students to a variety of internal and external structures of plants and animals using a variety of activities including animal and plant dissections and models. Students explore how these structures allow plants and animals to survive, grow, and reproduce in their environments; how these structures influence the senses; the brain's role in processing the world; and how light helps our eyes to see objects.

To begin, students are pre-assessed on what they already know about plant and animal structures. Throughout the unit, students will build on these concepts as they observe and investigate a variety of structures of plants and animals and their functions. The unit culminates with a project-based assessment in which groups develop a 3-dimensional model of the eye. Groups present their models and use them to describe the process of sight, including the role of the brain, while presenting their project and answer questions that tie the entire unit together.

### Assessment

This unit offers several ways to assess students, including a pre- and a post-unit assessment opportunity. Teachers can also use class discussions and charts to assess each lesson. Student activity sheets and science notebook entries—including drawings, writings, and dictated statements—can be used to gauge individual understanding of objectives and key vocabulary throughout the unit. A general rubric is provided to help teachers evaluate individual students at any point in the unit. The rubric provides a progression of skills and understanding that covers exploration, vocabulary, concept building, and notebook entries. Finally, a summative assessment gives students the opportunity to demonstrate unit-specific content knowledge by responding to questions in a variety of formats.

### Lesson 1: What Do We Know About Plant and Animal Parts?

Students understand that plants and animals are different from one another. Lesson 1 begins with a class brainstorming session about the structures that plants and animals could have that allow them to better survive in their environment. After brainstorming, students sort images of various structures into categories based on what they believe the purpose of each is. Finally, students plant radish seeds using just a paper towel, water, and a plastic bag.

### Lesson 2: Animal Structures

Students investigate the difference between internal and external structures found within different animal species. Students come to understand the importance of these structures and how they relate to the survival, growth, and reproduction of that species. Students begin by exploring external structures. After applying the concept of external structures to humans, students identify structures on a preserved squid specimen. Students then investigate internal structures in animals. To help strengthen understanding of what goes on internally, students explore a diagram and dissect their squid to view its unique internal structures.

### Lesson 3: Plant Structures

This lesson begins with a review of the external structures of a plant and their functions. To do this, students examine their radish plants from Lesson 1 and identify the structures that are helping the plant survive. Students then investigate the internal structures of a plant. They perform a seed dissection to look closely at the parts of a seed that enable a new plant to grow. Students then explore the veins of a plant, which help move materials around the plant's body. They observe these veins first hand using celery, carnations, and colored water. To conclude, students read to learn more about different structures found in the flower and how they aid in reproduction, and then dissect a flower to explore these structures first hand.

### Lesson 4: Animal Senses

This lesson focuses on the five senses and the brain's role in processing information gathered by the senses. Students review this concept by performing an activity that engages all five senses. Next, students explore the structure of the brain and how information is sent to the brain for processing, developing the understanding that we then react to the information in different ways. Students more closely explore the brain's structure through an interactive sheep brain dissection. Finally, students reengage their five senses through a series of activities, this time explaining the brain's role in the processing and response.





### **Lesson 5: Exploring the Eye**

Students extend the knowledge gained about the brain Lesson 4 and begin to dig deeper into how we are able to see the world around us. To begin, students are pre-assessed on what they already know about the human eye. This leads to a discussion about the significance of light when it comes to viewing images. Students then explore the main structures within an eye that allow animals to view the world around them through an interactive cow eye dissection. Students then apply what they learn from observing the internal structures of the eye to a diagram of the eye, following the path of light from the object all the way to the brain. Finally, students investigate the backwards, upside-down image the eye creates, and how the brain corrects this as it processes the information that it is sent.

### **Lesson 6: Structure and Function**

In this final lesson, students display the knowledge they have gained throughout the unit by participating in a culminating project-based assessment. Groups work together to design and build a 3-dimensional eye model. Students are expected to explain—to the teacher or to the class—the path that light takes into the eye and how animals are able to see images. Students then describe the brain's role in helping animals see the world around them.

## Lesson 2: Animal Structures

Lesson Essentials	Next Generation Science Standards	Language Arts and Math Standards
<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>Describe structural adaptations and their importance to survival.</li> <li>Determine the difference between external and internal structures.</li> <li>Investigate both internal and external adaptations by dissecting a squid.</li> </ul> <p><b>Time Requirements:</b></p> <p><b>Teacher Preparation</b></p> <p><b>Part A:</b> 15 minutes  <b>Part B:</b> 5 minutes  <b>Part C:</b> 30 minutes</p> <p><b>Lesson</b></p> <p><b>Part A:</b> 2 class sessions  <b>Part B:</b> 1 class session  <b>Part C:</b> 2 class sessions</p> <p><b>Essential Questions:</b></p> <ul style="list-style-type: none"> <li>How do both internal and external structures work together to help an animal survive, grow, and reproduce?</li> </ul> <p><b>Vocabulary</b></p> <p><b>Science Words</b></p> <ul style="list-style-type: none"> <li>Dissection</li> <li>Ectotherm</li> <li>Endoskeleton</li> <li>Endotherm</li> <li>Exoskeleton</li> <li>External structure</li> <li>Internal structure</li> <li>Invertebrate</li> <li>Reproduction</li> <li>Vertebrate</li> </ul>	<p><b>Performance Expectations</b></p> <ul style="list-style-type: none"> <li><b>4-LS1-1:</b> Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.</li> </ul> <p><b>Disciplinary Core Ideas</b></p> <ul style="list-style-type: none"> <li><b>LS1.A:</b> Structure and Function</li> </ul> <p><b>Science and Engineering Practices</b></p> <ul style="list-style-type: none"> <li>Engaging in Argument from Evidence</li> </ul> <p><b>Crosscutting Concepts</b></p> <ul style="list-style-type: none"> <li>Systems and System Models</li> </ul>	<p><b>Language Arts</b></p> <ul style="list-style-type: none"> <li><b>RI.1.7:</b> Integration of Knowledge and Ideas</li> <li><b>RI.4.1:</b> Key Ideas and Details</li> <li><b>RI.4.2:</b> Key Ideas and Details</li> <li><b>RI.4.3:</b> Key Ideas and Details</li> <li><b>SL.4.1:</b> Comprehension and Collaboration</li> <li><b>W.4.1:</b> Text Types and Purposes</li> <li><b>W.4.2:</b> Text Types and Purposes</li> </ul> <p><b>Math</b></p> <ul style="list-style-type: none"> <li><b>4.MD.A.1:</b> Solve problems involving measurement and conversion of measurements.</li> </ul>





Cross-Curricular Connections	Literacy	Assessment Strategies
<ul style="list-style-type: none"> <li> Science Notebooks</li> <li> Language Arts</li> <li> Math</li> <li> Science</li> <li> Technology</li> <li> Geography</li> <li> Movement Education</li> </ul>	<p><b><i>Plant and Animal Structures Literacy Reader*</i></b></p> <ul style="list-style-type: none"> <li>• “Animal Structures—Structures That Support the Body,” pgs. 2–3</li> <li>• “Animal Structures—Structures for Keeping Warm,” pgs. 4–5</li> <li>• “Animal Structures—Structures for Reproduction,” pgs. 8–9</li> <li>• “Science and Engineering Practices—Explain the Structure!” pg. 14</li> </ul> <p><i>* See Appendix E for Literacy Connections for before, during, and after reading.</i></p> <p><b>Additional Reading Suggestions:</b> TG pg. 23</p> <ul style="list-style-type: none"> <li>• <i>Creature Features</i> by Steve Jenkins and Robin Page (HMH Books for Young Readers, 2014)</li> </ul>	<p><b>Student Activity Sheets:</b></p> <ul style="list-style-type: none"> <li>• Student Activity Sheet 2A: <i>Observing External Structures</i></li> <li>• Student Activity Sheet 2B: <i>Squid Dissection</i></li> <li>• Student Activity Sheet 2C: <i>Squid Dissection Guide</i></li> </ul> <p><b>Science Notebook Opportunity:</b></p> <ul style="list-style-type: none"> <li>• Students choose an animal and list three external structures it has and what the purpose of each is. (TG pg. 19)</li> <li>• Students answer questions about squids after reading Literacy and Science 2: <i>All About Squids</i> in complete sentences. (TG pg. 18)</li> </ul> <p><b>Formative Assessment:</b></p> <ol style="list-style-type: none"> <li>1. Notebook prompt: Describe three external and three internal structures that a tiger has. Explain what that structure does and whether it helps the animal survive, grow, or reproduce.</li> <li>2. Use information written in their science notebooks during Part A to assess students’ understanding of external animal structures and their functions.</li> <li>3. Use Student Activity Sheet 2A: <i>Observing External Structures</i> as an additional assessment of external structures and functions.</li> <li>4. Use Student Activity Sheet 2B: <i>Squid Dissection</i> to assess student understanding of internal animal structures and their functions.</li> <li>5. Use Science Notebook Opportunities to formatively assess the class and adjust instruction as needed.</li> <li>6. Evaluate student understanding through class discussions.</li> </ol> <p><b>General Rubric:</b></p> <ul style="list-style-type: none"> <li>• Refer to the General Rubric included in Appendix D to assess individual progress.</li> </ul> <p><b>Science Notebooks</b></p>



# Lesson 2

## ANIMAL STRUCTURES

### MATERIALS

#### Student

- 1 science notebook\*
- 1 Student Activity Sheet 2C: *Squid Dissection Guide*
- 1 Literacy and Science 2: *All about Squids*
- 1 pair of safety goggles
- 1 lab apron\*
- 2 pairs of disposable gloves
- 1 hand lens

#### Team of four students

- 1 Student Activity Sheet 2A: *Observing External Structures*
- 1 Student Activity Sheet 2B: *Squid Dissection*
- 1 Teacher Sheet 2B: *Internal Animal Structures*
- 1 squid dissection mat
- 1 foam tray
- 1 squid
- 1 pair of dissection scissors
- 1 pair of forceps
- 1 large resealable plastic bag
- 1 clothespin
- 1 permanent marker\*

#### Teacher

- 1 Teacher Sheet 2A: *Squid Dissection Questions*
- 1 Literacy Series Reader: *Plant and Animal Structures*
- 1 Plant and Animal Structures Photo Card Set
- 2 squids
- 2 foam trays
- 1 pair of dissection scissors
- 1 pair of forceps
- 3 pairs of disposable gloves
- 1 pair of safety goggles
- 1 lab apron\*
- 1 large resealable plastic bag
- 1 clothespin
- 1 large container\*
- 1 large trash bag\*

\*These materials are needed but not supplied.

- “Animal Structures” class chart (from Lesson 1)\*
- Projection system (optional)\*
- Disinfecting cleaner\*
- Paper towels\*
- Chart paper\*
- Markers\*
- General Rubric (Appendix D)

### LESSON OVERVIEW

Students observe the difference between external and internal structures in various animal species. They come understand the importance of these adaptations and how they relate to the survival, growth, and reproduction of the animals.

Students begin by observing external structures, first in humans and then in a squid. Small groups of students will investigate the external structures of a squid firsthand while developing their observation and prediction skills. Then, students explore internal structures of animals and how these parts assist in their survival. They come to understand that if one structures fails, the animal will not be able to survive. Finally, groups dissect their squid specimens to explore the internal structures vital to this animal. By the end of this lesson, students understand not only the difference between external and internal structures, but also that animals could not survive without them.

### OBJECTIVES

- Describe structural adaptations and their importance to survival.
- Determine the difference between external and internal structures.
- Investigate both internal and external adaptations by dissecting a squid.

### VOCABULARY

#### Science Words

- Dissection
- Ectotherm
- Endoskeleton
- Endotherm
- Exoskeleton
- External structure
- Internal structure
- Invertebrate
- Reproduction
- Vertebrate

### TIME CONSIDERATIONS

#### Teacher Preparation

- Part A ..... 15 minutes
- Part B ..... 5 minutes
- Part C ..... 30 minutes

#### Lesson

- Part A ..... 2 class sessions
- Part B ..... 1 class session
- Part C ..... 2 class sessions

### TEACHER PREPARATION

#### Part A

- Make one copy of Literacy and Science 2: *All about Squids* for each student.
- Make one copy of Student Activity Sheet 2A: *Observing External Structures* for each group of four students.
- Locate the squid card from the Plant and Animal Structures Photo Card Set.
- Have the Literacy Series Reader *Plant and Animal Structures* available from the kit.
- Familiarize yourself with the external anatomy of a squid by reviewing the structures and their functions on the Squid Dissection Mats included in the kit.



**6.** In a distribution center, set out 30 pairs of safety goggles, 30 pairs of disposable gloves, 30 lab aprons, and 30 hand lenses. Have a pair of safety goggles and disposable gloves for yourself as well.

**7.** Make a copy of Teacher Sheet 2A: *Squid Dissection Questions*. Have this available when the class views the squid specimens. It is recommended that you make a copy rather than use the original in the Teacher's Guide to protect it from damage from the specimen. You can discard the copy after the discussion.

**8.** Prepare a squid for each group of four students.

**NOTE:** Review the Safety Data Sheet for Specimens in Carosafe® prior to handling the squid. While handling the squid, it is strongly recommended that you wear safety goggles, gloves, and a lab apron. Handle the squids in a room with adequate ventilation, and open a window.

Carefully cut open the bag and then secure the open bag with a clothespin to prevent the liquid from spilling out (this liquid will help preserve the squid and should remain in the bag). Place each squid bag on its own foam tray.

**9.** If you have the technology available, consider preparing to display a squid for the class using a document camera or similar device. This will allow you to point to structures on the squid for the whole class to see. Alternatively, plan to visit groups to point out structures as needed.

**NOTE:** Ten squids are provided in the kit. Eight are for student groups. Two are for your use. It is suggested that you dissect one prior to leading the class through the dissection (see Preparation for Part C below). The other squid can be used during the external structures demo in Part A, and then cut open and displayed for the class during Part C, if desired. See Preparation for Part C for suggestions.

**10.** Each group of four students will need a large resealable plastic bag and a permanent marker at the end of the activity. Have these ready to distribute.

**11.** Obtain a disinfectant cleaner and a roll of paper towels, and have this on hand for students to clean up their work areas after working with the squid.

**12.** Identify a place where the squid trays can be stored until Part C. The squid should be kept in its original bag (with the liquid), secured with a clothespin, on the foam tray, in a large resealable plastic bag. These can be stored at room temperature, but should be kept out of direct sunlight and away from heat sources.

**13.** Obtain several sheets of chart paper and a marker or plan to use the board.

**14.** On the board or on an additional sheet of chart paper, write the notebook prompt that students will respond to at the end of the activity.

- Choose an animal that we did not already talk about in class and list three external structures that it has and why you think the animal has those structures.

### **Part B**

**1.** Have available the internal structures card from the Plant and Animal Structures Photo Card Set.

**2.** For each group, make one copy of Teacher Sheet 2B: *Internal Animal Structures*.

**3.** Display the "Animal Structures" chart the class developed during Lesson 1, Part A. Have a marker handy.

### **Part C**

**1.** Before leading the class through the squid dissection, it is recommended that you familiarize yourself with the internal anatomy of a squid by preforming the dissection. A squid has been provided in the kit for you to practice on before the student dissection day. Utilize a Squid Dissection Mat and Student Activity Sheet 2C: *Squid Dissection Guide* to guide you through the steps.

**NOTE:** Dissect in a well-ventilated room, preferably with an open window. It is strongly recommended that you wear safety goggles, gloves, and a lab apron at all times while working with the specimens. If you have not already done so, review the Safety Data Sheet for Specimens in Carosafe® at [www.carolina.com](http://www.carolina.com).

**2.** On the day of the class dissection, set up a distribution center with 30 lab aprons, 30 pairs of safety goggles, 30 pairs of gloves, 30 hand lenses, 8 pairs of dissection scissors, 8 pairs of forceps, and the squids on the foam trays from Part A. Have a pair of safety goggles, a lab apron, and a pair of gloves for yourself as well.

**3.** Choose a location for dissection that is well ventilated and preferably has a window that can be opened.

**4.** For each group, make one copy of Student Activity Sheet 2B: *Squid Dissection*.

**5.** Make a copy of Student Activity Sheet 2C: *Squid Dissection Guide* for each student.

**6.** A squid has been provided for you to dissect during the activity. If you have the technology available, consider preparing to display a squid for the class using a document camera or similar device. This will allow you to dissect a squid in full view of the entire class and to easily point out specific internal structures of the squid. Alternatively, plan to visit groups to point out structures as needed.

**7.** Develop a squid disposal method so that you can guide students in cleanup after the dissection. Begin by finding out what your local regulations are for disposing of the squids after the dissection. You should have a trash bag available to collect the specimens, foam trays, and used paper towels after the dissection. In addition, have available a container into which students can place dissection tools, safety goggles, and dissection mats for you to clean later on. You will need to thoroughly clean all of these with hot soapy water for reuse later in the unit.

**8.** Have available a disinfectant cleaner and a roll of paper towels for students to clean up their work areas after the dissection.

## BACKGROUND INFORMATION

To survive, an animal must be able to take in and digest food, obtain nutrients, eliminate wastes, move, maintain body temperatures, grow, and reproduce. To accomplish this, each animal's body plan is well adapted to meet these needs.

Animals have many unique external structures which are found on the outer part of their body. These structures have many purposes and help an animal grow, reproduce, and ultimately survive. Some examples of external structures include horns, fur, gills, wings, eyes, thumbs, feathers, scales, ears, stingers, antenna, nose, eyelids, shell, bright colorations, and so forth.

Animals also have internal structures which assist in the animals' survival, growth, and reproduction. These structures are found inside the animal's body and include the major organs such as the heart, brain, stomach, kidney, lungs, and so forth. Internal structures are not limited to organs, however. They can also include veins, nerves, saliva, taste buds, the ability to regulate body temperature, and so on. Many of the internal structures, particularly the organs, have to work together to keep an animal alive. If one stops working, the others will not be able to do their jobs, and the animal to die.

This lesson focuses on an invertebrate known as a squid. These animals are ocean dwelling and have many unique external and internal structures that help them to survive in a saltwater habitat. Students will investigate external structures through a hands-on activity that allows them to directly touch and handle a real squid. After learning about internal structures, students will have the opportunity to dissect their squid to view the many different internal parts that help keep this animal alive. Learn more about squids by reading Literacy and Science 2: *All about Squids* and performing your own dissection beforehand.

## ACTIVITY INSTRUCTIONS

# Part A

### External Animal Structures

# 1

On the board or a sheet of chart paper, create a list of animals as a class. Have each student provide at least one example of an animal and record their responses on chart paper or on the board. After each student has contributed an example, examine the list together as a class. Ask,

- Which animals on our list have at least one adaptation or part on their body that help it survive? (Accept all reasonable answers, but students should realize that every animal has adaptations that allows it to better survive.)

# 2

Explain that in this activity, students will explore animal structures, or parts, that help the animals better adapt to their environment. Read aloud pages 2–3 in the Literacy Series Reader *Plant and Animal Structures*. After reading, ask students to touch their spine in the middle of their back. Ask,

- What are you feeling? (Bones/backbone)
- Using the new vocabulary words from the reading, what does having these bones mean? (Humans are **vertebrates** and have an **endoskeleton**.)

# 3

Refer the list of animals from Step 1. Have students identify which animals from the list have backbones and endoskeletons. Circle each vertebrate as it is identified. Prompt students if they miss any.

# 4

To transition to the invertebrates and exoskeletons, ask,

- What about these other animals? Why did we not circle them? (They do not have a backbone.)
- What do we call animals without a backbone? (Invertebrates)
- Since invertebrates do not have a backbone, what do many of them have for protection instead? (An exoskeleton)

# 5

Explain that every animal, whether invertebrate or vertebrate, has special structures that help it survive in its environment. These structures are divided into two groups: internal structures and external structures.

6

Write both terms on chart paper or on the board and ask students to predict what each word means. After their predictions, discuss the difference between the two.

7

Have students write each term and its definition in their science notebooks:

- Internal structure: A part found inside an animal
- External structure: A part found on the outside of an animal

8

Emphasize that not all animals have the same structures. For example, some animals have wings while others do not. Some animals do not possess a heart while others have five. Each type of animal is unique and is specially adapted to its environment due to its internal and external structures.

9

Explain that for the rest of the lesson, students will focus on external structures. Challenge students to think of structures that humans have on the outside of our bodies that better help us survive. (*Arms, legs, fingers, thumbs, eyes, hair, skin, nose, ears, and so forth.*)

10

Hold up the squid card from the Plant and Animal Structures Photo Card Set for the class to view. Ask,

- Does anyone know what type of animal this is? (*A squid*)
- Where do you think this animal lives? (*Water/ocean*)
- What do you notice about the squid's body? (*Answers will vary.*)

11

To better understand a squid's body plan, have students stand up and put their hands up towards the ceiling. Explain that both their arms and legs will represent the tentacles of a squid. Ask,

- Think about what you already know about a squid. Should your tentacles (arms and legs) be at opposite ends of your body if you are a squid? (*No*)

Direct students bend at the waist and move their arms and hands down by their feet. Now all their "tentacles" are facing the correct direction. Ask,

- Where is your head right now? (*Close to the "tentacles"*)

Explain that this is exactly how a squid's body is laid out. The head is attached to the feet and the rest of their body is located above the head, in a structure called a mantle. If humans were to rearrange our bodies to be like a squid, we would have to swap our heads and torsos and move our arms down to our legs. Refer to the photo card for a visual. Direct students to practice being a squid with their tentacles facing towards the ground. Direct them to move their tentacles and predict what the squid would use them for.

### Teacher Tip

If students struggle with the concept of internal versus external structures, point out the first few letters of each word. *Internal* = in, which they should associate with inside the body. *External* = ext, which looks like exit. Exits lead outside and they should associate this term with outside the body, like exoskeleton.

### Teacher Tip

This is a good place to break if you need to teach this lesson over two class sessions. To save additional time, you might have students answer the questions at the end of *Literacy and Science 2: All about Squids* as homework.

### Teacher Tip

Students may need practice using the hand lens properly and effectively. Two good methods follow:

- Hold the hand lens up to one eye and close the other eye if possible. They should hold the object to be viewed in the other hand and bring it closer to the eye until it comes into focus.
- Place the object on the table and move their hand toward the object until it comes into focus. This is the best method for large objects and classroom animals.

### Teacher Tip

Using a projecting device like a document camera to review the squid's external structures with the class will allow you to clearly point out the squid's tentacles, eyes, head, mantle, fins, and so forth during the discussion for all students to see at the same time.

### Teacher Tip

 If you would like to record students' ideas, do so on chart paper for them rather than having them get out their science notebooks while working with the dissection specimen.

12

Distribute a copy of *Literacy and Science 2: All about Squids* to each student. Read and discuss the information about squids in the article. Assign students to answer the questions that follow either in class or for homework.

13

Explain that students will observe the external structures of a squid. Emphasize that the animal they will receive is a real squid. Point out that these specimens were once living and should be handled respectfully. Discuss the importance of following lab safety rules and the directions. Explain that everyone will have to wear their safety goggles and gloves at all times during the lesson.

14

Have one member of each group go to the distribution center and collect a pair of goggles, a lab apron, and a pair of gloves for each student in their group. Direct all students to put on both of these items. Model lab safety by wearing goggles, an apron, and gloves yourself.

15

Distribute four hand lenses and a copy of *Student Activity Sheet 2A: Observing External Structures* to each group. Go over the directions and expectations while handling their squid.

16

Distribute a squid on a foam tray to each group and have them begin their external observations. Circulate from group to group as students work. As you do so, distribute a large resealable plastic bag and a permanent marker to each group.

17

After ample time, direct students' attention to a class discussion of their observations. Use *Teacher Sheet 2A: Squid Dissection Questions* to help with the discussion.

18

Explain that students will get to explore the internal structures of the squid during another class session. As a class, predict and discuss what internal structures a squid might have that allows it to better survive.

19

Guide the class in cleanup. Direct each group to place its squid back in the bag it came in and secure it with the clothespin. They should then slide the squid in the bag, on the foam tray, into the large resealable bag you provided. Be sure each group writes its members' names on the bag using the permanent marker before bringing the specimen to the designated storage area.

# 20

Once they have placed their squid in the storage area, instruct students to throw away their gloves, place their safety goggles and aprons in the designated area for you to clean later, and then to use disinfecting cleaner and paper towels to thoroughly clean their workstation. Make sure that all students wash their hands thoroughly after cleaning up.

### Teacher Tip

If students used disposable lab aprons, instruct them to throw them away with their gloves.

### Science Notebook Opportunity

#### Notebook Prompt:

Choose an animal that we did not discuss in class. Identify three external structures that it has and why you think the animal has those structures.

## Part B

### Internal Animal Structures

# 1 2 3 4

Review external animal structures with students.

Explain that students will focus on internal structures in animals during this activity. Ask students to explain what an internal structure is.

Point out that internal structures are equally as important as external structures for an animal's survival.

In groups, have students brainstorm a list of structures that a human has inside of its body that helps keep them alive. Students should record their group's list in their science notebooks. After some time, go over their ideas as a class. (*Answers may include brain, heart, blood, bones, muscles, liver, kidneys, stomach, etc.*) Ask,

- What would happen if your heart stopped working?
- What if you didn't have any blood in your body?
- What if your stomach stopped digesting food? (*Students should recognize that for all these examples, the human could not survive.*)

**5** Read aloud pages 4–5 in the Literacy Series Reader *Plant and Animal Structures*, and then discuss the difference between an **endotherm** (a warm-blooded animal) and **ectotherm** (a cold-blooded animal). Explain that each type of animal has structures in its body that helps keep its body temperature steady. Both groups rely on their brains and other parts to help control their body temperature. In endotherms, the brain sends a signal to other structures when it is time to cool down or warm up. In ectotherms, the brain sends a signal informing the animal when it is time to move into the sun or seek shade to cool down.

**6** Read aloud pages 8–9 in the Literacy Reader. After reading, ask students to explain some of the internal structures that living things have that allow them to reproduce. For example, some animals' bodies create eggs in which the offspring develop while others have their young develop inside their bodies until it is time for them to be born. Students should understand that reproduction is important because it helps keep a species, or group of living things, alive on this planet.

**7** Distribute a copy of Teacher Sheet 2B: *Internal Animal Structures* to each group. As a class, go over the internal structures found within these animals. Display the internal structures card from the Plant and Animal Structures Photo Card Set to show students color versions of the images during the discussion. Ask students to make predictions about the use of some of the structures and why they believe each structure is important. Emphasize that these structures work together to keep the organism alive. If one part stops working, the animal could not survive.

**8** Refer to the “Animal Structures” chart the class developed in Lesson 1, Part A. Ask students to decide whether each structure they listed is an internal or external structure. Circle the external structures and put a checkmark by the internal structures.

## Part C

### Squid Dissection

**1** Explain that students will look at the squid's internal structures. Emphasize that the structures they will look at do not resemble the insides of a human. Instead, the structures are adapted to help the squid survive in its ocean habitat.

2

Distribute one copy of Student Activity Sheet 2C: *Squid Dissection Guide* to each student and one copy of Student Activity Sheet 2B: *Squid Dissection* to each group.

3

Have each group select a recorder. Emphasize that the recorder will not be able to touch the squid at first, but will be supplied gloves for afterwards. The recorder may still observe the animal and use their hand lens, they just cannot touch the animal. Once the group has answered all the questions on Student Activity Sheet 2B: *Squid Dissection*, the recorder may put on their safety gloves to explore the internal parts of the animal if they choose.

4

Send two students from each group to the distribution center to retrieve the following materials:

- 4 safety goggles
- 4 pairs of gloves
- 4 lab aprons
- 4 hand lenses
- 1 pair of dissection scissors
- 1 pair of forceps
- 1 Squid Dissection Mat

5

When all groups have their materials, go over the name of each tool they can use during the dissection and how to use it. Be sure that students understand that the dissection scissors are for cutting and removing structures while the forceps can grip and move structures.

6

Direct students to put on their safety goggles, lab aprons, and gloves. Model safety by wearing goggles, gloves, and an apron yourself. Have one member of each group retrieve its squid from the storage area. As a class, review external structures and the difference between the head and the mantle. Remind students that these specimens were once live animals and should be handled respectfully.

7

Preview Steps 1–9 on Student Activity Sheet 1C with the class, and then allow ample time for the first stage of the dissection.

### Teacher Tip

As you walk around and monitor the class, you can have all the groups start and stop each section together. Another option would be to have the groups continue working at their own pace, checking in with you as stated in the directions. Choose the best option for your classroom.

### Teacher Tip

 After the dissection is complete but before students clean up, you might distribute a ruler or two to each group and ask students to measure their squid's various internal and external structures in centimeters. Students can measure the length of the entire body, the tentacles/arms, the beak, the eyes, the ink sac, and so forth. Afterward, encourage students to convert their centimeter measurements into millimeters and kilometers.

### Teacher Tip

If you have the technology available, project the cut-open squid you prepared and point out the internal structures during the discussion.

8

**Preview Steps 10–16 with students and then allow ample time for the second stage of the dissection.**

9

**Preview Steps 17–25 with students and then allow ample time for them to complete the dissection.**

10

**After completing the dissection, guide groups to clean up their work areas thoroughly using the following steps:**

- Direct groups to place their squid and all its internal structures back in the large resealable plastic bag. Collect all the squids and squid parts into one trash bag and dispose of them as outlined by your area's local regulations.
- Have a container available (or the sink) for students to drop their hand lenses, scissors, safety goggles, aprons and forceps in so that you can disinfect them later for reuse. They should throw away their gloves.
- If students used disposable aprons, direct them to throw them away with their gloves.
- Sanitize the dissection mats using a disinfectant spray or soapy water and a paper towel. Do not use bleach-based sprays or submerge the mats in water.
- Have students sanitize their work areas and then wash their hands.

11

**Facilitate a class discussion about the dissection by going over Student Activity Sheet 2B and discussing the function of each internal structure that students examined.**

12

**Emphasize the importance of both internal and external structures. Ask,**

- Could a squid survive without its gills? Why? (*No, because it would not be able to get the oxygen it needs to survive.*)
- Could the squid survive with only two hearts instead of three? Why? (*No, all the hearts work together to pump blood around the squid's body.*)
- Could the squid survive without tentacles? Why? (*No, it would not have no way to attack and catch prey.*)

**Discuss how both external and internal structures work together to keep this animal alive. If one structure stops working, the squid could be in serious trouble and could even die.**

## EXTENSIONS

### **Animal Discovery**

-  Have students research squids or an animal of their choosing more extensively using online resources. Have students write a brief report of their findings. Some topics to have students consider during their research include:



-  The group of animals it belongs to
-  The types of food it eats, and whether this makes it an herbivore, omnivore, or carnivore
-  The habitat and location(s) throughout the world in which it can be found
-  The external structures it has to help it survive in the wild.
-  The internal structures it has to help it survive in the wild.
-  Its potential predators

### **Virtual Frog Dissection**

-  To strengthen understanding of both external and internal adaptations, have students use the website below to explore the external structures of a frog as well as eight organ systems inside the frog. Have students make notes during their exploration in the science notebooks, and then discuss their findings as a class. Ask students to explain what would happen if any of the frog's organ systems suddenly stopped working.



-  [www.mhhe.com/biosci/genbio/virtual\\_labs/BL\\_16/BL\\_16.html](http://www.mhhe.com/biosci/genbio/virtual_labs/BL_16/BL_16.html)

### **All Systems Go!**

-  Have students use the interactive website below to explore several different human organ systems and the organs that work together to complete the system.

-  <http://sciencenetlinks.com/afterschool-resources/all-systems-go/>

### **Creature Features**

-  As a class, read *Creature Features* by Steve Jenkins and Robin Page. Each page includes a statement about an external structure of a unique animal. Read the statement aloud and challenge students to predict what they think the animal uses that particular structure for. Then, read the rest of the information on the page and allow students to see if their predictions were correct. Afterward, allow time for students to research other unique external structures that members of the animal kingdom have, and to present their findings to the class.



### **Literacy Series Reader: *Plant and Animal Structures***

-  As a class, in small groups, or in pairs, have students explore the informational text in the literacy reader for this unit. Refer to Appendix E for strategies for before, during, and after reading the lesson-specific chapters or for exploring the literacy reader as a whole after the unit.



## EVALUATION/ASSESSMENT

1. Notebook Prompt: Describe at least three external and three internal structures of a tiger. Explain what each structure does and whether it helps the animal survive, grow, or reproduce.
2. Use information written in their science notebooks during Part A to assess students' understanding of external animal structures and their functions.
3. Use Student Activity Sheet 2A: *Observing External Structures* as an additional assessment of external animal structures and their functions.
4. Use Student Activity Sheet 2B: *Squid Dissection* to assess student understanding of internal animal structures and their functions.
5. Use Science Notebook Opportunities to formatively assess the class and adjust instruction as needed.
6. Evaluate student understanding through class discussions.
7. Use the General Rubric in Appendix D to assess individual progress as needed.



### PLANNING AHEAD

#### Preparing for Lesson 3

##### Part A

Purchase a white carnation and celery stalk for each group of four students. You will need a carnation and a celery stalk as well.

##### Part B

The day before this activity, fill a plastic tank from the kit about halfway with warm water and place approximately 60 bean seeds in the tank to soak overnight.

##### Part E

Purchase flowers for dissection. Each student will need his or her own flower, and you will need one as well. It is preferable to have a couple of extras available in the event that groups get an “imperfect” flower. Carnations work well for dissection and are very affordable, but any variety will do.

## Teacher Sheet 2A

### Squid Observation Questions

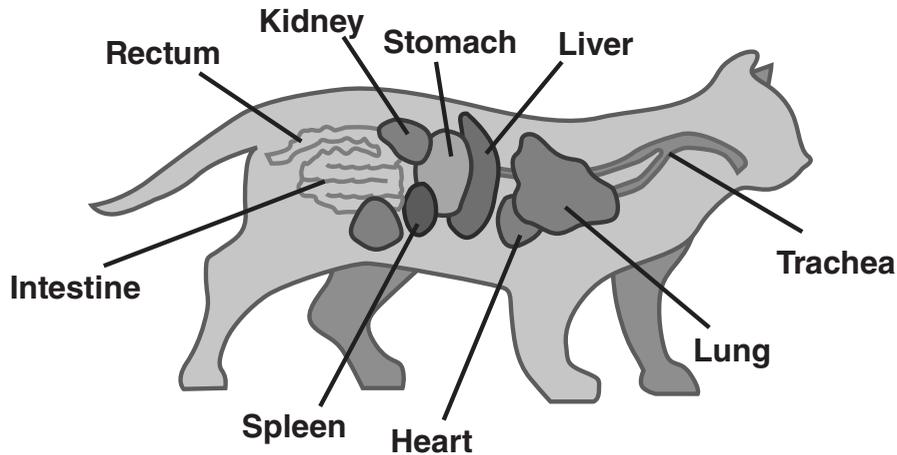
After students have had time to make observations of the squid's external structures, facilitate a class discussion to review those observations. Use some or all of the following questions to ensure the class discusses all the major structures and body plan.

- Where are the squid's fins?
- Did you find the head?
- Does the head go all the way up to the top of its body? *(No. Point out that the massive part on top of the head is called the mantle. Most of the squid's organs are kept safely in the mantle.)*
- How many eyes does a squid have? *(Two)*
- Look behind the eyes. You should see a tube-like structure called a siphon. This external structure sucks water in and pushes it back out. What do you think this does for the squid? *(Answers will vary, but be sure that students understand that the process of sucking in and pushing out water propels the squid through the water. As the siphon pushes water out, it moves the squid through the water like a rocket. The siphon can also move, allowing the squid to change its direction of movement.)*
- How many tentacles/arms did you count? *(10)*
- What are on the tentacles/arms? *(Sucker cups)*
- What do you think these sucker cups are used for? *(Answers will vary. Be sure that students understand that they are primarily used to hold on to prey.)*
- What did you notice about the tentacles/arms? *(They are different sizes: two are really long and eight are short.)*
- What do you think the long tentacles are for? *(Catching food and bring it closer to the mouth)*
- What about the short arms? *(Answers may vary, but students should understand that these are primarily used for holding the food in place.)*
- Where is the mouth? *(In the middle of all the tentacles)*
- What is all over the squid's body? *(Tiny dots)*
- What do you think these dots are for? *(Answers will vary. Be sure students understand that the dots are chromatophores, which are used to help the squid rapidly change color.)*
- Why might a squid want to change color? *(To protect itself, to blend in with the environment to hide from predators, to attract a mate, to communicate, etc.)*

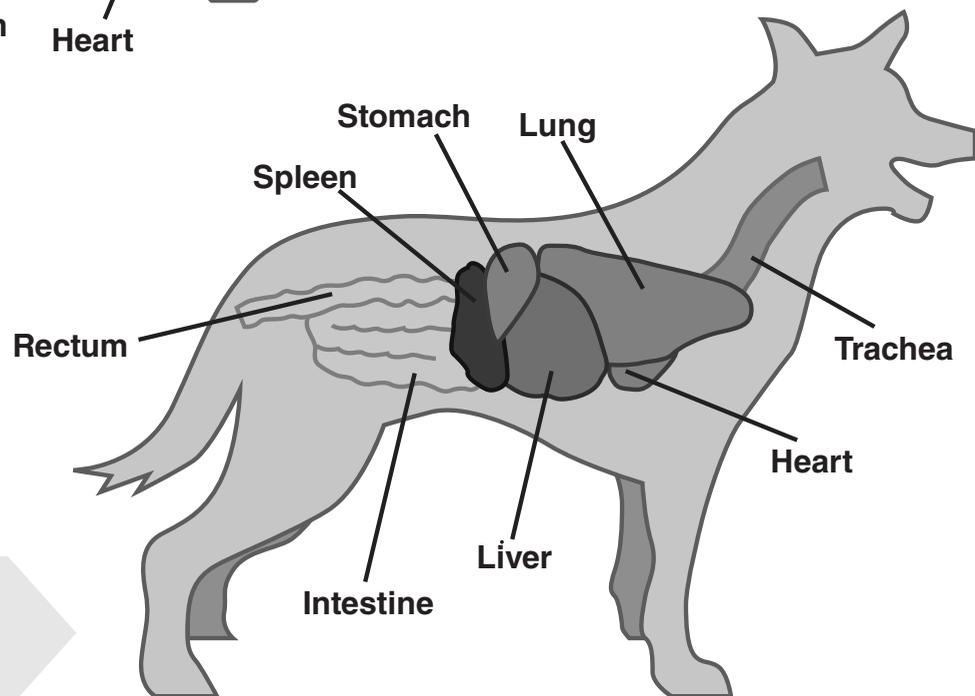
## Teacher Sheet 2

### Internal Systems

**NOTE:** These diagrams show several common internal structures. It is important to know that not all organisms have these structures, and that these organisms have more structures than just those shown here.



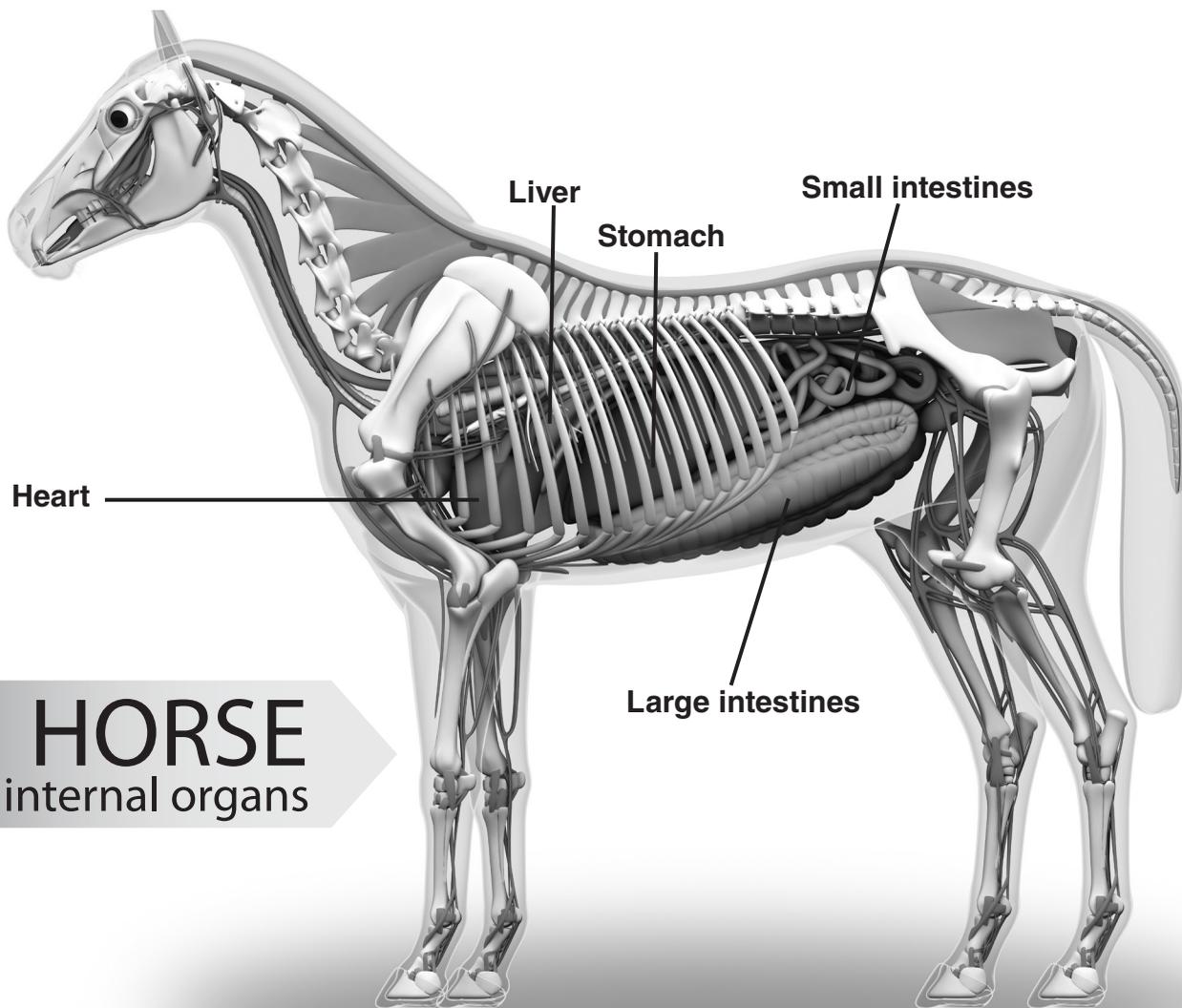
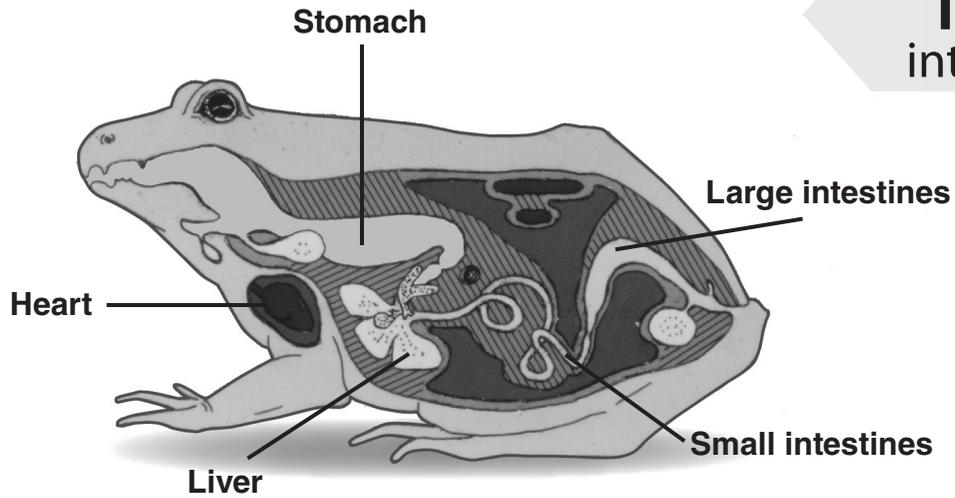
**CAT**  
internal organs



**DOG**  
internal organs

# FROG

internal organs



# HORSE

internal organs

## All about Squids

**Directions:** Read the article and answer the questions that follow.

## Squids

A squid is an ocean-dwelling invertebrate. This means that squids live in salt water and do not have a backbone. Squids are related to the octopus, cuttlefish, and nautilus, which all belong to a group known as cephalopods. Cephalopod means “head-foot” which describes a squid perfectly. Their feet, which are the tentacle structures, are directly attached to their head. The top part of a squid is called a mantle, and this is where most of their organs are located. In other words, from top to bottom, the squid’s body plan is mantle, head, and then feet/tentacles.

There are over 300 species, or different kinds, of squid. The smallest squid is less than an inch long while the largest can be around 50 feet long! Squids do not exactly swim in the water. They move instead by jet propulsion. They take in water through their mantle and then push it out of a structure called a siphon. As they push the water out, the force propels them forward through the water.

No matter how big or how small, squids are predators and hunt for their food. They use their two long tentacles, which have sucker cups, to reach out in the water and grab their prey. Once they catch something, the tentacles bring it to their eight shorter arms. These eight arms are covered in sucker cups to hold the prey in place. The squid then uses the beak inside of its mouth to tear the food into smaller pieces. Squids enjoy eating fish, shrimp, crabs, and sometimes even other squids! Since they only eat meat, squids are considered to be carnivores.

A squid’s body is very soft and is vulnerable to predators. Some animals that hunt squids include sharks, whales, larger fish, penguins, seals, and

even humans. Have you ever ordered calamari at a restaurant? Calamari is fried squid!

Squids have different structures that help them survive in their habitat. A squid has an internal structure called an ink sac. An ink sac is just like it sounds, a structure filled with ink! If a predator approaches, the squid will release a lot of black ink into the water, creating a black cloud that tastes horrible to predators. This ink cloud usually confuses the predator and allows the squid to swim away and hide.

Squids also have the ability to change color and blend in with their surroundings. They have special cells called chromatophores, which help the squid change color when it feels scared or threatened by a predator. By camouflaging themselves, they have a better chance at surviving in their environment.

Squids have been around for millions of years and are well adapted to their ocean environment. Later in this lesson, you will take a closer look at a squid and the other structures it has to help it survive during its lifetime.



**1.** How many tentacles/arms does a squid have? \_\_\_\_\_

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**2.** What do the tentacles/arms do for the squid? \_\_\_\_\_

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**3.** In your own words, explain how squids can avoid being eaten. \_\_\_\_\_

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**4.** Why do squids belong to the group known as a “cephalopod”? \_\_\_\_\_

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**5.** Why are chromatophores helpful to squids? \_\_\_\_\_

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**6.** Construct an argument, using evidence from this reading, that squids have internal and external structures that help them survive, grow, and reproduce during their lifetime. \_\_\_\_\_

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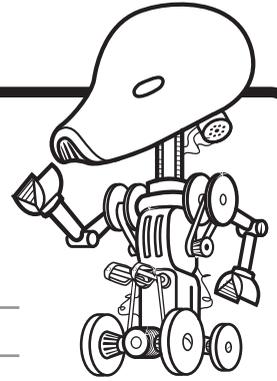
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# Student Activity Sheet 2A

Name \_\_\_\_\_

## Observing External Structures



**Date:** \_\_\_\_\_

**Team of Scientists:**

**A)** \_\_\_\_\_ **B)** \_\_\_\_\_

**C)** \_\_\_\_\_ **D)** \_\_\_\_\_

**Equipment:** 4 pairs of safety goggles    4 pairs of disposable gloves    4 hand lenses    1 squid  
1 large resealable plastic bag    1 permanent marker    4 lab aprons

### A. Prepare

- Your group will be given a squid to observe. This animal is no longer alive but should be treated with respect.
- During this activity, you must wear your safety goggles and gloves at all times.
- Designate one member of your group to be the recorder during the activity. This person will write down the group's observations and ideas. This person may not touch the squid while their gloves are removed to record, but may touch the squid when their gloves are put back on.

### B. Observe and Record

1. Describe how the squid feels. You may gently pick up and touch the squid if you would like.

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**2.** Observe the squid closely. In the chart below, list all the external structures you observe in the first column. In the second column, explain what you think the structure is used for. If you need more space, continue writing on the back of this sheet of paper.

External Structure	Use



## B. Eye

1. What the layer around the eye do? \_\_\_\_\_

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2. Does a squid eye look like a human eye? Why or why not? \_\_\_\_\_

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3. Locate the lens of the eye, which is exactly in the center. The lens focuses the image around the animal. Is the squid's lens soft or hard? \_\_\_\_\_

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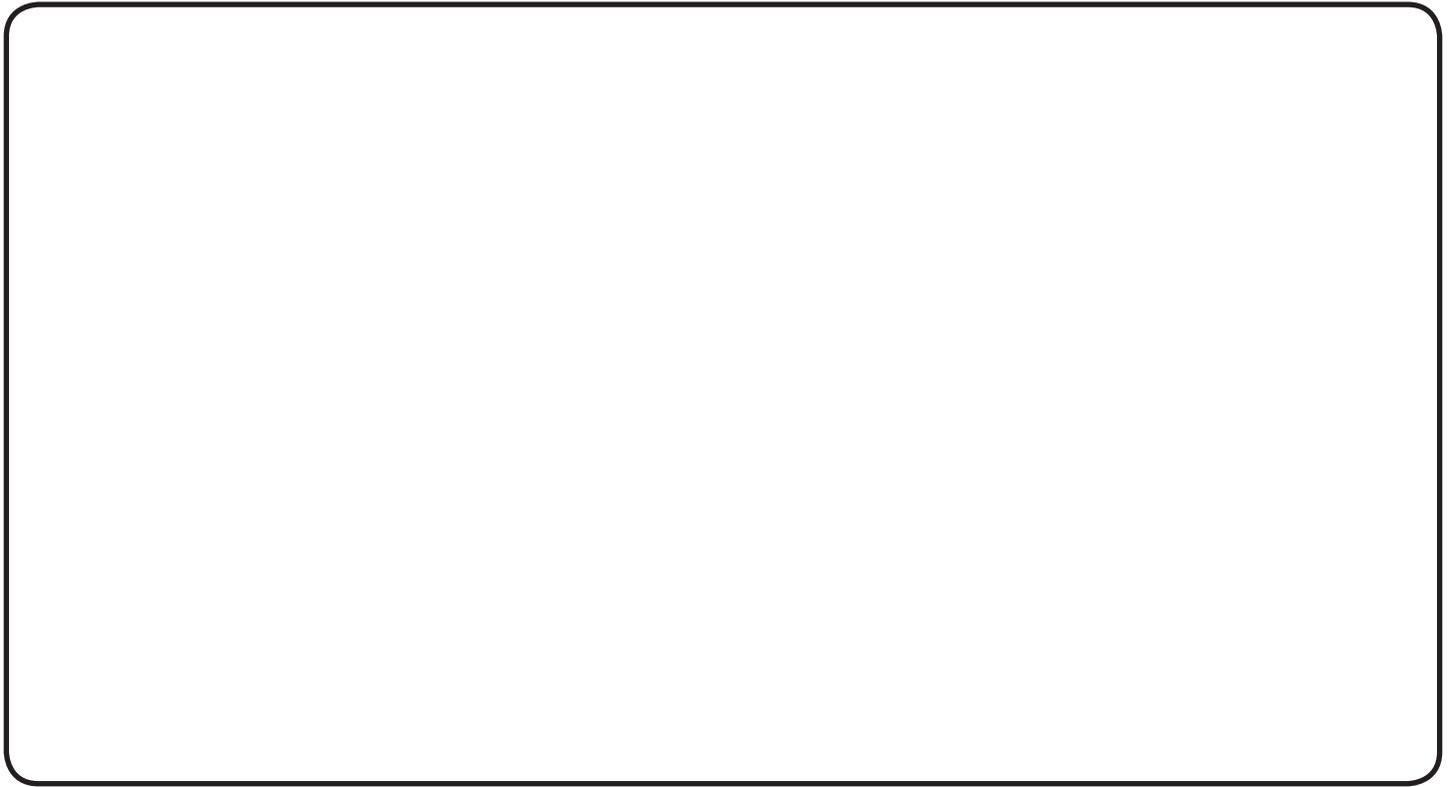
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## C. Male or Female?

Our squid is  
**male / female**  
(circle one)

## D. Gills

1. Draw a picture of what the squid's gills in the box below.



2. Predict: What do squids use the gills for? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## E. Hearts

1. What do you think the hearts do for the squid? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Predict: Why does a squid have three hearts but humans only have one? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## F. Caecum and Stomach

1. Is your squid's caecum large and full, or flat? \_\_\_\_\_

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2. What does this tell you about your squid before it was caught? \_\_\_\_\_

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3. Cut open the squid's stomach. Had your squid eaten recently? \_\_\_\_\_

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(Pink and white pieces may be the remains of crustaceans like crabs or shrimp. Small scales or bones are probably from a fish it ate.)

## G. Ink Sac

1. Why would a squid want to release black ink into the water? List as many reasons as you can think of. \_\_\_\_\_

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2. Have each group member use the gladius, or pen, that you removed from the squid in Step 19 of the dissection guide to write their name in the space below using the ink from the squid's ink sac. If your squid released its ink shortly before being preserved, you may not have enough ink for all group members to do this. If this happens to your group, obtain your teacher's permission to take your paper and "pen" to another group's and borrow some of theirs.

## Student Activity Sheet 2B (Teacher's Version)

### A. Buccal Bulb

1. The buccal bulb is found right behind the mouth. What do you think it does? (*Student predictions will vary. The buccal bulb is a large muscle that houses the beak and allows food to pass through on its way to the esophagus.*)
2. Use the dissection scissors to cut into the buccal bulb. What did you find inside? (*Students should find a beak-like structure.*)
3. What do you think the squid used this for? (*Student predictions might include that the beak helps the squid eat or defend itself. The beak is primarily used to tear and shred food.*)

### B. Eye

1. What does the layer around the eye do? (*Answers will vary.*)
2. Does a squid eye look like a human eye? Why or why not? (*Students should see some similarity between the squid's eye and their own, although the squid's eye has a much larger pupil [dark circle].*)
3. Locate the lens of the eye which is directly in the middle. The lens focuses the image around the animal. Is the squid's lens soft or hard? (*Hard*)

### C. Male or Female?

Our squid is  
**male / female**  
(*Answers will vary.*)

## **D. Gills**

**2.** Predict: What do squids use the gills for? *(Predictions will vary. The gills are used to take in oxygen from the water and remove carbon dioxide from the squid's body.)*

## **E. Hearts**

**1.** What do you think the hearts do for the squid? *(Student predictions will vary. The hearts pump blood around the squid's body.)*

**2.** Predict: Why does a squid have three hearts and humans only have one? *(Predictions will vary. The squid's two smaller hearts pump deoxygenated blood from the body to the gills to remove the carbon dioxide and absorb more oxygen. The anterior heart, located underneath the liver, pumps the newly oxygenated blood around the body.)*

## **F. Caecum and Stomach**

**1.** Is your squid's caecum large and full or flat? *(Answers will vary.)*

**2.** What does this tell you about your squid before it was caught? *(Students should recognize that a flat caecum indicates that the squid did not eat before it was caught. A full, large caecum indicates that the squid had a meal before it was caught.)*

**3.** Cut open the squid's stomach. Had your squid eaten recently? *(Answers will vary.)*

## **G. Ink Sac**

**1.** Why would a squid want to release black ink into the water? List as many reasons as you can think of. *(Answers will vary. This internal structure helps protect the squid if it ever feels threatened. The ink creates a dark cloud in the water that usually confuses potential predators. The release of ink provides an opportunity for the squid to escape a potential predator. It also tastes bad, making a predator think twice about eating the squid.)*

# Student Activity Sheet 2C

Name \_\_\_\_\_

## Squid Dissection Guide

### Directions

1. Always wear your gloves, lab apron, and safety goggles when handling the squid. You may use the hand lenses and dissection mat at any time to help in your observations. Remember, this was a once-living animal and should be treated with respect.
  2. Take turns using the tools so everyone has a chance to dissect if they choose.
  3. Cut off one of the arms, or tentacles, to better observe the sucker cups.
  4. Locate the mouth of the squid, which is in the middle of all the arms. Use the dissection scissors to cut from the top of the mouth, up the squid's head, and in between its two eyes. Stop before you begin to cut into the mantle.
  5. Open up the head. Locate a white, circular structure. This is called a **buccal bulb** (see dissection mat for help if you can't locate the buccal bulb). Gently use the forceps or your fingers to remove the buccal bulb.
  6. Answer the questions about the buccal bulb in Part A of Student Activity Sheet 2B: *Squid Dissection*.
  7. Move on to the **eye**. Carefully cut around one of the squid's eyes. You should observe an outer layer around the eye. Remove this layer and use the forceps to take out the eye.
  8. While you explore the squid's eye, answer the questions in Part B of Student Activity Sheet 2B.
  9. **STOP!** Wait for your teacher's permission to continue.
- 
10. Move away from the head and focus on the **mantle**. Use the dissection scissors to extend the cut that has already been started for you. Open up the mantle and observe the squid's insides. Does this look anything like the inside of a human?
  11. Determine whether your squid is male or female. Use the back of the dissection mat to help you. Record your answer in Part C of Student Activity Sheet 2B.
  12. Find a group with a squid with different reproductive organs than your squid and compare the insides of the two squids.
  13. Notice the brightly colored structures inside the squid. These have been specially dyed to help you better see its circulatory system. Notice the red, feathery **gills** on each side. Use the dissection scissors to remove them. Draw a picture of the gills in Part D of Student Activity Sheet 2B. Then, record a prediction of how the gills are used.
  14. A squid has **three hearts**. Two are small, but can be seen right now. They should be blue. Use your dissection mat to locate them, and then remove the two blue hearts. (The third heart is buried under some organs. You may find it later. It is red and triangular.)
  15. Answer the questions about the squid's hearts in Part E of the activity sheet.
  16. **STOP!** Wait for your teacher's permission to continue.

- 
- 17.** Use your dissection mat to locate a large structure near the fin called a caecum. This structure helps the squid digest food. The **stomach** is to the left of the caecum. Remove these structures from your squid.
- 18.** Answer the questions about the caecum and the stomach in Part F of the activity sheet.
- 19.** You should see a clear, plastic-like object in the flesh of the squid. This is called a gladius, or pen. This is the “skeleton” of the squid. Carefully remove this structure and set it on the tray.
- 20.** You will notice other organs in the squid’s body. For example, the squid has an intestine, a rectum, and an anus that allow it to remove waste from its body. Use your dissection mat to locate these structures and others that have not been mentioned.
- 21.** Locate the silver and black structure called the ink sac. Carefully cut into the ink sac. You should notice black ink. Squids have the ability to release this ink into the water around them.
- 22.** Complete Part G of the activity sheet.
- 23.** Listen carefully to your teacher’s directions for cleaning up your work area. Make sure your group disinfects the work area and that everyone washes their hands thoroughly after cleaning up.

# Summative Assessment

Name \_\_\_\_\_

Date \_\_\_\_\_

**1)** Which of the following could be considered an internal structure in an animal?

- A. Fur
- B. Heart
- C. Antlers
- D. Eyes

**2)** What do flowers help a plant do?

- A. Grow
- B. Make food
- C. Reproduce
- D. Survive

**3)** What are the five main senses?

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**4)** In the space below, draw a picture that shows how we are able to see objects around us.

**5)** Light must be \_\_\_\_\_ by an object in order for us to see it.

- A. reflected
- B. absorbed
- C. taken in
- D. removed



# Plant and Animal Structures

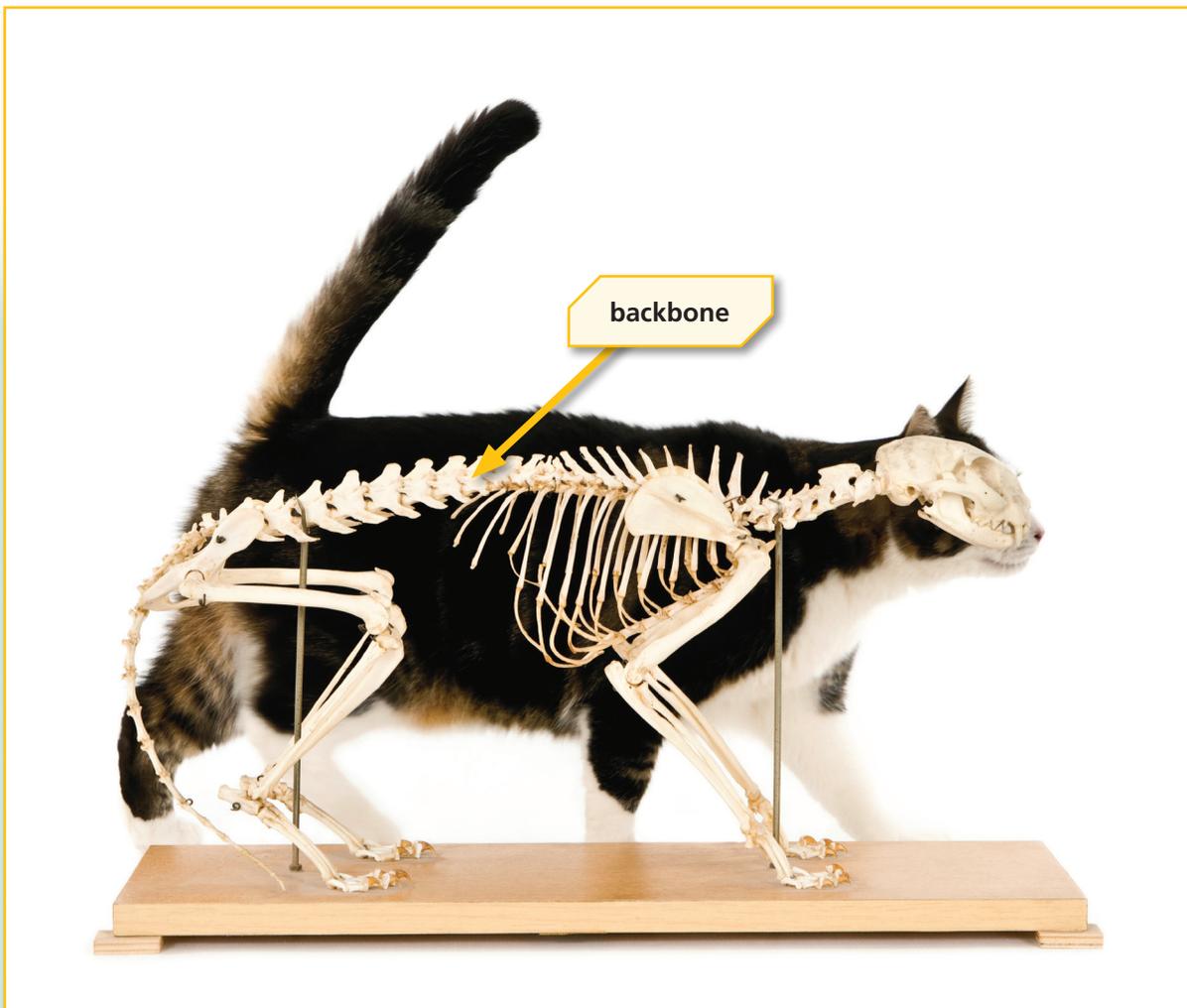


# Animal Structures

Scientists have identified more than a million species of animals! Each species has different structures. These structures help animals grow, survive, and reproduce.

## Structures That Support the Body

**Animals with Backbones** Animals can be placed into two groups: animals that have a backbone and animals that do not. Animals with backbones are called **vertebrates**. They have skeletons inside their bodies. An internal skeleton is called an **endoskeleton**. Mammals, birds, reptiles, and amphibians have skeletons made of bone. So do most fish.



A cat's skeleton supports its body.

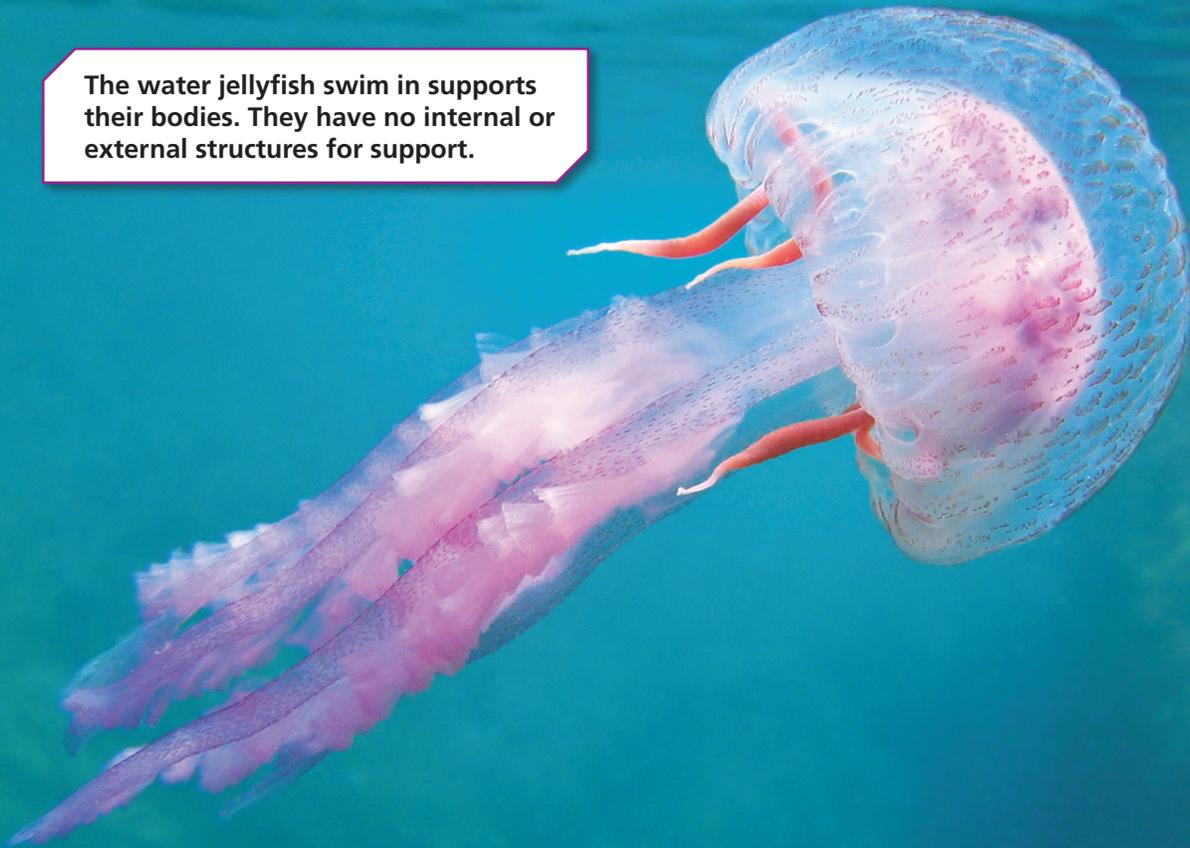
**Animals Without Backbones** **Invertebrates** are animals that do not have backbones. Their bodies are very soft. They have different kinds of structures that give their bodies support.

- Mollusks include snails, clams, and mussels. Snails have a hard outer shell. Bivalves have a shell made up of two halves. Clams and mussels are bivalves.
- Segmented worms have a liquid inside their bodies that gives them their shape.
- Echinoderms include sea urchins. Most of these ocean animals have spiny skins.
- Arthropods are the largest group of invertebrates. This group includes insects, spiders, and lobsters. These animals have a hard outer covering called an **exoskeleton**. They have segmented bodies and jointed legs.



A snail has a hard shell that protects its body.

The water jellyfish swim in supports their bodies. They have no internal or external structures for support.



# B

**Physical**

# B

**Life**

# S

**Earth & Space**

## Kindergarten

**Push, Pull, Go**  
K-PS2-1; K-PS2-2

**Living Things and Their Needs**  
K-LS1-1; K-ESS2-2;  
K-ESS3-1; K-ESS3-3

**Weather and Sky**  
K-PS3-1; K-PS3-2;  
K-ESS2-1; K-ESS3-2

## 1st Grade

**Light and Sound Waves**  
1-PS4-1; 1-PS4-2; 1-PS4-3;  
1-PS4-4

**Exploring Organisms**  
1-LS1-1; 1-LS1-2; 1-LS3-1

**Sky Watchers**  
1-ESS1-1; 1-ESS1-2

## 2nd Grade

**Matter**  
2-PS1-1; 2-PS1-2; 2-PS1-3;  
2-PS1-4

**Ecosystem Diversity**  
2-LS2-1; 2-LS2-2; 2-LS4-1

**Earth Materials**  
2-ESS1-1; 2-ESS2-1;  
2-ESS2-2; 2-ESS3-3

## 3rd Grade

**Forces and Interactions**  
3-PS2-1; 3-PS2-2; 3-PS2-3;  
3-PS2-4

**Life in Ecosystems**  
3-LS1-1; 3-LS2-1; 3-LS3-1;  
3-LS3-2; 3-LS4-1; 3-LS4-2;  
3-LS4-3; 3-LS4-4

**Weather and Climate Patterns**  
3-ESS2-1; 3-ESS2-2;  
3-ESS3-1

## 4th Grade

**Energy Works!**  
4-PS3-1; 4-PS3-2; 4-PS3-3;  
4-PS3-4; 4-PS4-1; 4-PS4-3;  
4-ESS3-1

**Plant and Animal Structures**  
4-LS1-1; 4-LS1-2; 4-PS4-2

**Changing Earth**  
4-ESS1-1; 4-ESS2-1;  
4-ESS2-2; 4-ESS3-2

## 5th Grade

**Structure and Properties of Matter**  
5-PS1-1; 5-PS1-2; 5-PS1-3;  
5-PS1-4

**Matter and Energy in Ecosystems**  
5-PS3-1; 5-LS1-1;  
5-LS2-1; 5-ESS2-1;  
5-ESS2-2; 5-ESS3-1

**Earth and Space Systems**  
5-PS2-1; 5-ESS1-1;  
5-ESS1-2

## Science

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