

## UNIT OVERVIEW

Animals are categorized as either vertebrates or invertebrates. Vertebrates have a spine, while invertebrates do not. Invertebrates are extremely diverse and represent over 95 percent of all animals on Earth. Spiders, snails, beetles, octopuses, worms, and sea sponges are some of the many types of invertebrates. The Invertebrates unit explores six groups of invertebrates—poriferans (sponges), cnidarians (such as sea jellies and corals), echinoderms (such as sea urchins and sea stars), mollusks (such as octopuses, snails, and clams), annelids (worms), and arthropods (such as insects, spiders, and lobsters). The unit addresses the traits that all invertebrates share and explores differences between invertebrate groups.

Certain reading resources are provided at three reading levels within the unit to support differentiated instruction. Other resources are provided as a set, with different titles offered at each reading level. Dots on student resources indicate the reading level as follows:

- low reading level
- middle reading level
- high reading level

## THE BIG IDEA

Understanding invertebrates helps students appreciate the rich variety of animal life on Earth. Invertebrates are everywhere, far surpassing vertebrates in both number of species and total mass. Despite their sometimes unusual or frightening appearance, these creatures are animals, just as puppies, dolphins, and parakeets are. Each type of invertebrate has specific body parts and abilities that enable it to survive. Invertebrate species are integral parts of the ecosystems in which they live. They are important as members of food webs, as decomposers, and as pollinators. As we learn about invertebrates and recognize them as important living things, we may change how we interact with them. We may even take action to protect them and ensure their survival.

### Other topics

This unit also addresses topics such as: special characteristics of certain invertebrates, how invertebrate animals grow and change, similarities and differences among common invertebrates, and factors that can influence the behavior of invertebrates.

## SPARK

The spark is designed to get students thinking about the unit's topics and to generate curiosity and discussion.



### Materials

- photographs of several types of animals, including both invertebrates and vertebrates

### Activity

Place students in small groups. Give each group a set of photographs of various types of animals, including a mix of invertebrates and vertebrates. Ask students to look at the photographs and then attempt to categorize the animals on the basis of shared characteristics. During their first classification, allow students to group the animals in any way, such as by color, size, or texture. Invite a volunteer from each group to share how they sorted their animals.

Now ask groups to categorize their animals again, this time considering features such as body structure, body covering, appendages, sensory organs, and whether the animal has bones. Instruct groups to organize their pictures into categories, and then invite volunteers to share how their group sorted their animals this time.

Below are questions to spark discussion.

*How did you decide how to sort animals into groups?*

*Could you have sorted the same animals into groups in a different way? If so, how would that have affected the results?*

*Think about one of the groups you made. Could you sort those animals into even smaller groups? Explain.*

*Why is it important for scientists to sort animals into groups?*

Use this activity to begin an introductory discussion about invertebrates. Explain to students that an important way to sort animals into groups is by identifying them as either vertebrates or invertebrates. Invertebrates are animals without a spine. Explain that invertebrates are important animals that represent a huge percentage of all the animals on Earth. Help students understand that invertebrates are all around them—on the playground, in the garden, in oceans and lakes, in their school, in their home, and sometimes even on their dinner plate. Throughout the unit, students will learn more about invertebrates.

Many of the unit's vocabulary terms are related to the spark activity and can be introduced during the spark. For vocabulary work, see the Vocabulary section in this *Unit Guide*.

**PRIOR KNOWLEDGE**

Invite students to explain what a spine, or backbone, is. Ask them to brainstorm animals that they think do and do not have a spine.

**Probing Questions to Think About**

Use the following questions to have students begin thinking of what they know about invertebrates.

- Do all animals have bones?
- What is an invertebrate?
- What are some kinds of invertebrates?
- What are some ways invertebrates differ from vertebrates?
- How is a cricket similar to a squid? How are they different?
- How is a centipede similar to an earthworm? How are they different?
- Why are invertebrates important?

Tell students they will learn more about these topics soon.

**UNIT MATERIALS**

Each unit provides a wide variety of resources related to the unit topic. Students may read books and other passages, work in groups to complete hands-on experiments and investigations, discuss science ideas as a class, watch videos, complete writing tasks, and take assessments.

Resources are available for printing or projecting, and many student resources are also available for students to access digitally on [Kids A-Z](#).

Selected unit resources are available in more than one language.

For a complete list of materials provided with the unit, see the Invertebrates unit page on the Science A–Z website.

**VOCABULARY**

Use the terms below for vocabulary development throughout the unit. They can be found in boldface in the *Nonfiction Book*, the *Quick Reads*, and/or other unit resources. These terms and definitions are available on *Vocabulary Cards* for student practice. Additional vocabulary lists are provided in the teaching tips for *Investigation Packs* and *FOCUS Books*.

**Core Science Terms**

These terms are crucial to understanding the unit.

- |                    |  |
|--------------------|--|
| <b>arachnids</b>   | a group of arthropods that have two body segments and eight legs; includes spiders and scorpions                                     |
| <b>arthropods</b>  | a group of invertebrates that have a segmented body, an exoskeleton, and jointed limbs; includes insects, arachnids, and crustaceans |
| <b>crustaceans</b> | a group of mostly aquatic arthropods that have a segmented body and several pairs of legs; includes crabs and shrimp                 |

<b>diversity</b>	a wide variety of many things
<b>exoskeleton</b>	a hard external skeleton that covers the body of some invertebrates
<b>insects</b>	a group of small arthropods that have six legs, three body parts, and usually two sets of wings; includes bees, beetles, and ants
<b>invertebrates</b>	animals that have no backbone
<b>mollusks</b>	a group of invertebrates that have a soft, unsegmented body, and most have one or two shells; includes snails and octopuses
<b>spine</b>	a column of bones that provides the main support for a vertebrate's body; the backbone, or vertebral column
<b>sponges</b>	a group of primitive marine invertebrates with a porous body that permanently attaches to a solid surface as an adult
<b>symmetry</b>	the property of having the same size and shape across a dividing line, or having one half identical to the other half
<b>vertebrates</b>	animals that have a backbone

### Other Key Science Terms

The following vocabulary is not essential for comprehending the unit but may enrich students' vocabulary.

<b>abdomen</b>	the rear part of an insect's body, which contains the reproductive and digestive organs
<b>backbone</b>	the column of bones along the back of vertebrates
<b>bivalves</b>	a group of marine mollusks with a pair of shells connected by a hinge
<b>camouflage</b>	the ability to blend into the background or hide by using colors, patterns, or shapes
<b>classify</b>	to sort; to assign to a category
<b>cold-blooded</b>	having an internal body temperature that changes with the temperature of the surroundings
<b>common name</b>	the name by which a living thing is known to the general public and is called in everyday speech
<b>filtering</b>	straining material from a liquid, such as gathering food from water
<b>gills</b>	the organs that fish and many other aquatic animals use for breathing

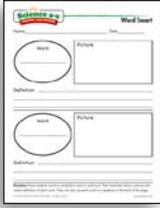
<b>larva</b>	an immature form of an animal that goes through major body changes before it looks like the adult form
<b>molting</b>	the process of shedding an outer covering, such as skin, hair, feathers, or a shell and replacing it with a new layer
<b>nerve net</b>	a simple nervous system, found in the bodies of cnidarians and echinoderms
<b>predator</b>	an animal that hunts and eats other animals to survive
<b>prey</b>	an animal that is hunted and eaten by a predator
<b>reproduce</b>	to make offspring that are similar to the original living thing
<b>scientific name</b>	the formal name that scientists use for a living thing, composed of its Latin names
<b>symbiotic</b>	describes a relationship between two different types of living things that benefits both
<b>tentacles</b>	thin, flexible limbs on an animal, especially an invertebrate
<b>trait</b>	a feature or quality that makes an animal, plant, or group unique
<b>tube feet</b>	tube-shaped structures on the bodies of most echinoderms that are used for locomotion and grasping
<b>venom</b>	a poisonous fluid that some animals use to kill prey and defend themselves; usually delivered by biting or stinging
<b>vertebrae</b>	the bones that make up the spine, or backbone; plural of <i>vertebra</i>

### Vocabulary Activities

You may choose to introduce all the terms that will be encountered in the unit before assigning any of the reading components. *Vocabulary Cards* with the key science terms and definitions are provided. Dots on the cards indicate the reading levels of the *Nonfiction Book* or the *Quick Reads* in which each term can be found. If all level dots appear, the term may come from another resource in the unit. Students can use these cards to review and practice the terms in small groups or pairs. The cards can also be used for center activity games such as Concentration.

The *Word Work* activity sheets offer fun puzzles and practice with key vocabulary terms from the unit. For further vocabulary practice and reinforcement, you can choose from the vocabulary *Graphic Organizers*. To build customized vocabulary lessons with terms related to the topic, see [Vocabulary A-Z](#).





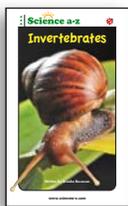
Students can use the *Word Smart* vocabulary *Graphic Organizer* to organize information on the science terms. You may want to assign each student one to three words to share his or her *Word Smart* knowledge with classmates. Students who have the same word should first compare their *Word Smart* sheets with each other and then report to the larger group.

The science terms can be used in oral practice. Have students use each term in a spoken sentence.

As students read, encourage them to create a science dictionary by recording new vocabulary terms and definitions in their *SAZ Journal*.

## BACKGROUND AND MISCONCEPTIONS

Use this section as a resource for more background knowledge on unit content and to clarify the content for students if misconceptions arise. Refer to Using the Internet below for more ways to extend the learning.



**Q:** *Are invertebrates animals?*

**A:** Yes. The animal kingdom is divided into two main groups—vertebrates and invertebrates. Invertebrates may seem foreign and strange to some people, but they share many characteristics with more familiar animals such as dogs and cats. In fact, humans and spiders both belong to the animal kingdom!

**Q:** *Are all invertebrates the same?*

**A:** No. Actually, the invertebrate group is far more diverse than the vertebrate group. Invertebrates come in a huge variety of shapes and sizes. They differ in their behavior, diet, body parts, and habitat. Scientists have described about sixty thousand vertebrate species but have identified well over one million different species of invertebrates.

**Q:** *How can I tell if an animal is an invertebrate?*

**A:** Vertebrates are animals with a spine and bones. Mammals, birds, fish, reptiles, and amphibians are all vertebrates. Animals without bones are invertebrates. Flies, bees, lobsters, worms, snails, clams, sea cucumbers, and octopuses are all invertebrates.

**Q:** *If invertebrates do not have a spine or bones, what supports their body?*

**A:** Invertebrates have various ways of supporting their body. Some have an exoskeleton, which is a rigid outer casing that covers the body of arthropods. The exoskeleton protects the internal organs, and joints within it help the animal move. Many mollusks have shells that provide structure and protection. Echinoderms have an internal skeleton-like framework made of calcium carbonate. Soft-bodied invertebrates, such as earthworms and sea anemones, have a hydrostatic skeleton. Their bodies have cavities filled with fluid surrounding the muscles. The hydrostatic skeleton gives shape to these animals and, along with the muscles, makes it possible for the animals to move.

**Q:** *Are all invertebrates bugs?*

**A:** No. People mistakenly use the word *bug* for anything considered a “creepy-crawly,” such as a spider, worm, tick, fly, or slug. Others use the word *bug* to mean any sort of pest. In reality, a bug is a specific type of insect within the arthropod group. Scientists often refer to these insects as true bugs to distinguish them from the commonly used term. True bugs include aphids, cicadas, and stinkbugs.

**Q:** *Do invertebrates want to attack people?*

**A:** People are sometimes afraid of invertebrates that can bite or sting. They may feel that these animals are purposefully attacking them. In some fiction stories, invertebrates seem to work together to destroy human communities. In reality, however, invertebrates that have venom or poison use it to defend themselves against predators or to capture and eat a meal. These are natural functions of survival for these creatures. While some invertebrates do occasionally sting or bite, they are not known to do so with malice. Humans have devised many ways to protect themselves from invertebrates, including protective clothing, chemical barriers, and traps.

**Q:** *Is it okay to use insecticides to kill invertebrates in my yard?*

**A:** While it may be uncomfortable and a nuisance to have insects and other invertebrates in your yard, few of the invertebrates we encounter are threats of any kind. In fact, many are beneficial and play important roles in our environment. Bees and butterflies pollinate flowers; earthworms, snails, and millipedes recycle dead plant material, adding nutrients to the soil; and spiders reduce the population of pest insects by eating them. Many people do choose to extinguish nuisance invertebrates, but others tolerate them. The use of chemicals can also pose threats to humans and pets, prompting some people to avoid their use.

## EXTENSION ACTIVITIES



© Jupiterimages Corporation

### Using the Internet

Most search engines will yield many results when the term *invertebrate* is entered. You can also perform a more specific search on a particular group of invertebrates, such as *arthropod*, *mollusk*, or *echinoderm*. Be aware that some sites may not be educational or intended for the elementary classroom. More specific inquiries are recommended, such as:

- vertebrates and invertebrates
- invertebrates classification
- bilateral vs. radial symmetry
- insect pollinators
- body structure of a cricket
- arachnids in the desert
- invertebrates in gardens
- endangered arthropods
- local insect collections
- sea slug photographs

Below are some links with excellent resources for students and/or teachers.

The National Geographic website contains photos, videos, and informational articles about invertebrates.

<http://animals.nationalgeographic.com/animals/invertebrates>

BioKIDS is a resource produced by the University of Michigan. It is designed for children and includes information about invertebrates, including articles, specimen diagrams, photos, and classification charts.

[www.biokids.umich.edu/critters](http://www.biokids.umich.edu/critters)

The Neuroscience for Kids website from the University of Washington is designed for children and has information about how various invertebrates use their nervous system to sense and respond to the world around them. <http://faculty.washington.edu/chudler/invert.html>

The Kentucky Bug Connection, published by the University of Kentucky, contains useful tips on how teachers can use insects in the classroom. It also includes ideas for further exploration of insects.

[www.uky.edu/Ag/CritterFiles/casefile/bugconnection/teaching/sixscience.htm](http://www.uky.edu/Ag/CritterFiles/casefile/bugconnection/teaching/sixscience.htm)



### Projects and Activities

- **Project/Home Connection:** Have students conduct a survey of invertebrates in their yard or neighborhood. Students can write a list of all the invertebrates they encounter and then try to categorize them by their invertebrate group.
- **Arts:** Have students invent and draw their own imaginary invertebrate. Ask them to incorporate invertebrate features they learned about in this unit, such as symmetry type, body covering, mode of feeding, means of moving, type of limbs, and sensory appendages such as antennae or sensory hairs.
- **Writing:** Instruct students to write a story about what it would be like to live as an invertebrate. Ask them to choose a specific invertebrate species and incorporate features of that animal, such as how it moves and what it eats. Have them write the story as a first-person narrative. For extensive writing instruction, including how to write a personal narrative, visit [Writing A-Z](#).
- **Guest:** Invite an expert on invertebrates from a zoo, museum, or university to discuss how invertebrates are important to ecosystems.
- **Field Trip:** Visit a zoo, aquarium, or nature center that has a collection of diverse invertebrates. Ask students to record observations and sketches in a science journal.
- **Community Service:** Invite students to design and plant a community or school garden containing plants that attract insect pollinators.

- **Research:** Challenge students to choose two habitat types and conduct research on the invertebrates that live there. Ask students to focus on features (adaptations) that make animals well suited for particular environments. For example, a tarantula in the desert has much different body traits and behaviors than do ice worms in a glacier or sea urchins in a tide pool.
- **Research/Home Connection:** Students can conduct research as a family/home project or in the library/media center to extend the learning about a topic in one of the *Quick Reads* or other unit resources.

