

UNIT OVERVIEW

We can sort animals into two large groups—vertebrates and invertebrates. The Vertebrates unit identifies common characteristics of vertebrates, including bone structure and major parts of the skeleton. The unit organizes vertebrates into five classes—mammals, birds, fish, reptiles, and amphibians—and explains how each class can be distinguished from the others by its common characteristics. These characteristics include body covering, body temperature, means of breathing, birth method, and other distinguishing features. Examples of animals in each class are provided.

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

All vertebrates, including humans, have skeletons that allow us to perform important activities. The skull protects our brain, which is the headquarters of all thinking, emotion, body functions, and decision making. The bones of our legs and feet allow us to walk, run, sit, and stand. The small bones of our hands allow us to use tools, write, and feed ourselves. And our spine provides a strong, flexible frame that holds the rest of the skeleton together. By learning about the importance of our skeleton, we are more likely to take better care of our body by eating well and by being careful to avoid bone breaks. Also, when we learn about other vertebrates, we may increase our concern for their protection and well-being.

Other topics

This unit also addresses topics such as: shark skeletons, animal skulls, fossils, and characteristics of reptiles.

SPARK

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

Materials

- Pencil and paper
- Chalkboard or whiteboard



Activity

Ask students to stand up and find a partner. Have them work in pairs to think about all the different places their body can bend (for example, at the elbow, wrist, knee, and neck). Each time they think of a place, they should list it on paper.

Once students have had time to make their lists, accumulate the responses in a class list on the board. Discuss which of the parts of their body can only bend back and forth (such as knees and knuckles) and which can move in circles (such as shoulders and hips). Challenge students to explain why they think certain parts move the way they do.

Now invite students to identify parts of their body that do not bend (for example, the skull and the middle of the forearm). Ask them to explain why they think certain places bend and other places do not.

Below are questions to spark discussion.

What is inside your body that allows you to bend in some places and not in others?

Why do some parts of your body only move in one direction, but other parts move in many directions?

If your body could bend in different ways than it does now, what would you be able to do?

Which parts of other animals' bodies can move, and which cannot? Which parts move in one direction, and which parts move in many directions? Why do you think their bodies are different from a person's body?

Use this activity to begin an introductory discussion about vertebrates. Explain that many (but not all) vertebrates have a skeleton made up of many bones. Having places where bones meet allows an animal to bend its parts and to move in many ways. Throughout the unit, students will learn more about vertebrates.

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 their understanding of what a vertebrate is and to identify any familiar vertebrates. Ask students whether they have heard of the categories, or classes, of vertebrates—mammals, birds, fish, reptiles, and amphibians—and encourage them to name examples from each class.



Probing Questions to Think About

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

- What is a skeleton?
- Why do animals need skeletons?
- What is a vertebrate?
- What are some kinds of vertebrates?
- What are some kinds of animals that do not have skeletons?
- How are the bones of a horse similar to the bones of a mouse? How are they different?
- What would your body be like if you didn't have any bones?
- Have you ever broken a bone? How did it feel? How long did it take to heal?
- What is a mammal? Bird? Fish? Reptile? Amphibian?

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 Vertebrates 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.

- amphibian** a cold-blooded vertebrate that generally spends some time in water and some time on land
- bird** a warm-blooded vertebrate with a beak, wings, and feathers

bone marrow	spongy material in the center of bones that produces blood cells
bones	hard parts of a body that give it shape
cartilage	a tough, rubbery tissue found in vertebrates that provides support to the skeleton
characteristic	a physical feature that helps identify a thing or group of things
classify	to put into a category
feature	a body part that helps identify a thing or group of things
fish	a vertebrate that lives in water, swims, has gills and fins and is usually covered with scales
invertebrate	an animal without a backbone
joint	a place where bones connect or join together
mammal	a warm-blooded vertebrate with hair or fur that nurses its young and has babies that are born live
reptile	a cold-blooded vertebrate that is covered with scales or horny plates
skeleton	the framework of bones and cartilage that supports and protects the body of a vertebrate
skull	the main bone structure of the head
spine	the backbone, or vertebral column
tissue	a group of cells in an organism that are similar in form and do a certain job
vertebra	one of the bones that make up the spine, or backbone
vertebrate	an animal with a backbone

Other Key Science Terms

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

cold-blooded	having a body temperature that changes according to the temperature of its surroundings
diaphragm	a sheet of muscle that allows the lungs to take in and release air
gills	the organs that fish and many other animals that live in water use for breathing
mammary glands	the glands in female mammals that produce milk to feed offspring

predator	an animal that hunts and eats other animals to survive
prey	an animal that is hunted and eaten by a predator
tadpole	a baby frog, toad, or other amphibian
warm-blooded	having a constant body temperature

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.

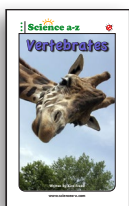
As students read, encourage them to create a science dictionary by recording new vocabulary terms and definitions in their *SAZ Journal*.

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 there more vertebrates than invertebrates in the world?*

A: No, and it's not even close. Some estimates say that about 98 percent of the world's animal species are invertebrates. Accordingly, the population of invertebrates is also much higher than that of vertebrates. Students may hold this misconception because vertebrate species tend to be depicted in books, movies, and music more often than invertebrates.



Q: *Are bones dry and dead?*

A: While an animal is alive, bones are not dry or dead, but are actually alive and growing. As a vertebrate ages, older bone tissue is replaced by fresh, new bone tissue. However, later in an animal's life, bone loss can occur, making the bones more susceptible to breaks. The bones of dead organisms do die and dry out.

Q: *Does every human have exactly 206 bones?*

A: Actually, no. As with many aspects of the body, there can be significant variation from one individual to the next. Some people have fewer than 206 bones, while others have more, and that number can change throughout one's lifetime. Human babies are born with more than 300 bones, but as they grow, many of these bones fuse together. For instance, 5 vertebrae near the base of the spine fuse to form the sacrum, and 4 vertebrae fuse to make the coccyx, or tailbone. Later in life, a single bone can break, and if the bone fragments heal separately, they can become separate bones. But 206 is widely accepted as a general guideline for the number of bones in the human body.

Q: *Do all vertebrates have the same number of bones?*

A: No, they do not. Many mammals have a similar number of bones as humans, while some long snakes have over 400 vertebrae alone! Students may predict that larger animals always have more bones than smaller ones. But vertebrates are likely to have a bone count similar to other animals in their vertebrate class (for example, fellow birds) rather than to other animals of the same size (for example, a small bird and a mouse).

Q: *Do all vertebrates have the same kinds of bones as each other?*

A: No, they do not. Each species has bones that are specially adapted to meet the animal's needs. For example, wolves and crocodiles have very strong jaws for crushing prey. Many birds have hollow, lightweight bones that allow them to fly. A human's spine and a snake's spine bend in quite different ways. Studying an animal's bones can teach us a lot about the animal's diet and activities.

Q: *Can studying bones help identify an animal?*

A: Yes, but it can be difficult to identify an animal by just an isolated bone or a part of a bone. Complete skeletons are much easier to identify. Identification can become even more challenging when studying very old bones, burnt bones, or bones of multiple species mixed together. Archaeologists and paleontologists often try to identify animal species from bones, which can help determine the diet of people who lived at the same time or can help in estimating when a species lived in a given area. In the case of humans, bones can even help forensic scientists identify a specific individual.

Q: *Is milk the only thing that's good for bones?*

A: Definitely not. Foods and drinks that are rich in vitamin D or calcium are good for bone health. This does include dairy products and also includes broccoli, fortified orange juice, soybeans, and many more foods. In fact, there is debate over whether dairy products help bones as much as once thought. In addition to consuming bone-friendly foods, exercise is another important way to preserve and strengthen bones.

Q: *If I break a bone, will it stick out of my skin?*

A: In rare cases, a broken bone does break the skin and must be reset in its normal position. Ouch! But, while still painful, most broken bones do not break the skin and do remain in their normal position. These breaks are usually visible on X-rays and will heal by themselves if immobilized, often within several weeks or months.

EXTENSION ACTIVITIES



Using the Internet

Most search engines will yield many results when the term *vertebrates* is entered. You can also search for information on a vertebrate species or a class of vertebrates. Be aware that some sites may not be educational or intended for the elementary classroom. More specific inquiries are recommended, such as:

- animal skeleton pictures and diagrams
- How many bones does an elephant have?
- compare reptiles and amphibians
- vertebrates for kids
- birds of Ireland
- list of Missouri fish species



Projects and Activities

- **Project:** Discuss familiar animal characters from comic strips, cartoons, and movies. Which are vertebrates and which are not? Which class of vertebrates seems to be used most often in fiction? Invite students to display their findings in a creative way.
- **Arts:** Have groups of five students work together to write a script for a skit related to vertebrates. Each actor should portray an animal from a different vertebrate class, and the dialogue should help the rest of the class learn something about the different classes of vertebrates.
- **Arts:** Have students clip pictures from magazines that show all five classes of vertebrates. They can glue these pictures onto posterboard to create a poster organized by vertebrate class. Or students can make a mobile with pictures on one side and explanations about each class of vertebrates on the other.

- **ELL/ESL:** Invite students to teach each other the names of familiar vertebrates in their first language. Make a class chart to display the name of each animal in as many languages as possible.
- **Field Trip or Guest:** Have an expert from a zoo, a wildlife sanctuary, or a local natural area explain to students some of the challenges facing various vertebrate species.
- **Community Service:** Provide students with opportunities to take part in an effort to protect endangered vertebrate species.
- **Home Connection:** Invite students to bring in stuffed animals and categorize them by their vertebrate class or by their other characteristics.
- **Research:** Help students conduct research to compare how different vertebrate species within one ecosystem are adapted to that environment (for example, a giraffe and a weaverbird in the Kalahari) or how the same type of animal adapts to living in two different environments (for example, foxes that live in the Arctic versus the desert).
- **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.

