LESSON 25.1

Getting Started

Objectives

25.1.1 List the characteristics that all animals share.

25.1.2 Differentiate between invertebrates and chordates.

25.1.3 List and discuss the essential functions that animals perform in order to survive.

Student Resources

Study Workbooks A and B, 25.1 Worksheets

Spanish Study Workbook, 25.1 Worksheets

BIOLOGY.com Lesson Overview • Lesson Notes • Activity: InterActive Art • Assessment: Self-Test, Lesson Assessment

For corresponding lesson in the **Foundation Edition**, see pages 606–610.

Build Background

Have students offer examples of animals and explain why they would classify each as an animal. *(Answers will vary.)* As students read **Characteristics of Animals,** draw a **Cluster Diagram** on the board, with four circles branching separately from a center circle. Write the word *Animals* in the center circle, and then ask students to supply the four characteristics of animals to complete the diagram *(heterotrophic, multicellular, eukaryotic, cells lack cell walls).*

Study Wkbks A/B, Appendix S19, Cluster Diagram.
Transparencies, GO2.

NATIONAL SCIENCE EDUCATION STANDARDS

UNIFYING CONCEPTS AND PROCESSES

I, II, IV, V

CONTENT

C.1.f, C.3.d, C.3.e, C.5.d, C.6.a, C.6.b

INQUIRY

A.1.a, A.1.b

25.1 What Is an Animal?

Key Questions

- *What characteristics do all animals share?*
- *What characteristics distinguish invertebrates and chordates?*
- *What essential functions must animals perform to survive?*

Vocabulary

invertebrate
chordate
notochord
pharyngeal pouch
vertebrate
feedback inhibition

Taking Notes

Outline As you read, make an outline about the features of animals.

For more on the diversity of animals, go to the Visual Guide.
DOL•30–DOL•64

THINK ABOUT IT An osprey circles a salt marsh searching for prey. Suddenly, it dives, extending razor-sharp talons. With a triumphant whistle, it carries a struggling fish back to its young. On the bottom of the bay, worms burrow beneath rocks carpeted with orange sponges. In the air above, mosquitoes swarm, searching for a blood meal. All these different inhabitants of the Atlantic coast are animals.

Characteristics of Animals

What characteristics do all animals share?

All members of the animal kingdom share certain characteristics. Animals are all heterotrophs; they obtain nutrients and energy by eating other organisms. Animals are also multicellular; their bodies are composed of many cells. The cells that make up animal bodies are eukaryotic, containing a nucleus and membrane-bound organelles. Unlike the cells of algae, fungi, and plants, animal cells lack cell walls. **Animals, which are members of the kingdom Animalia, are multicellular, heterotrophic, eukaryotic organisms whose cells lack cell walls.**

Types of Animals

What characteristics distinguish invertebrates and chordates?

Animal diversity is so vast and differences among animals so great that we need to divide these organisms into groups to even begin talking about them. Animals are often classified into two broad categories: invertebrates and chordates.

Invertebrates More than 95 percent of animal species are informally called **invertebrates.** **Invertebrates include all animals that lack a backbone, or vertebral column.** Because this category lumps together organisms that *lack* a characteristic, rather than those that *share* a characteristic, "invertebrates" do not form a clade or any other kind of true category in the system of biological classification. Invertebrates include at least 33 phyla, which are the largest taxonomic groups of animals. Invertebrates include sea stars, worms, jellyfishes, and in sects. They range in size from dust mites to colossal squid more than 14 meters long.
DOL•31–DOL•45.

UbD Teach for Understanding

ENDURING UNDERSTANDING Animals have evolved diverse ways to carry out basic life processes and maintain homeostasis.

GUIDING QUESTION What is an animal?

EVIDENCE OF UNDERSTANDING *After completing the lesson, assign the following assessment to determine if students understand the characteristics of an animal.* Divide the class into pairs, and assign an organism to each pair. (Include unfamiliar organisms, some of which are not animals.) Tell students their task is to decide whether their assigned organism is an animal and to justify their conclusion based on the four main characteristics of animals and the essential functions animals must carry out to survive. Give students time to research their assigned organism. Then, have pairs present their results to the class.

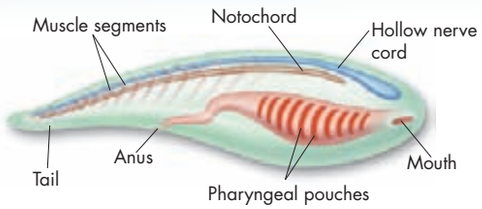


FIGURE 25–1 Characteristics of Chordates All chordates have a dorsal, hollow, nerve cord; a notochord; pharyngeal pouches; and a tail that extends beyond the anus. Some chordates possess all these traits as adults; others possess them only as embryos.

Chordates Fewer than 5 percent of animal species are **chordates,** members of the clade commonly known as Phylum Chordata. **All chordates exhibit four characteristics during at least one stage of life: a dorsal, hollow nerve cord; a notochord; a tail that extends beyond the anus; and pharyngeal** (fuh RIN jee ul) **pouches.** As you see in **Figure 25–1,** the hollow nerve cord runs along the dorsal (back) part of the body. Nerves branch from this cord at intervals. The **notochord** is a long supporting rod that runs through the body just below the nerve cord. Most chordates have a notochord only when they are embryos. At some point in their lives, all chordates have a tail that extends beyond the anus. **Pharyngeal pouches** are paired structures in the throat region, which is also called the pharynx. In some chordates, such as fishes, slits develop that connect pharyngeal pouches to the outside of the body. Pharyngeal pouches may develop into gills used for gas exchange.

Phylum Chordata includes some odd aquatic animals known as nonvertebrate chordates, which lack vertebrae. Most chordates, however, develop a backbone, or vertebral column, constructed of bones called vertebrae (singular: vertebra). Chordates with backbones are called **vertebrates.** Vertebrates include fishes, amphibians, reptiles, birds, and mammals. DOL•46–DOL•64

MYSTERY CLUE

Scientists verified that the organisms were young animals that had a stiff rod running along the tail. What does this suggest about the slimy critters?

FIGURE 25–2 Invertebrates and Chordates Both of these animals have fuzzy bodies with wings and both can fly, but the similarities end there. Butterflies are insects, which are invertebrates, and bats are mammals, which are chordates. **Classify** ***Bats have backbones. In which of the two major groups of chordates would you classify bats?***

Quick Facts

SO MANY ANIMALS

Animals are tremendously diverse and are found in almost all habitats, although most animal phyla inhabit Earth's seas. There are about 35 animal phyla, encompassing about 1.8 million named species—almost a million of which are insects! In contrast, only about 300,000 plant species have been formally described. Scientists think that there could be between 10–30 million unclassified species, most living in the rain forest. In general, animals tend to be very mobile—they move about in an interesting variety of ways and expend energy to acquire the foods they need to live. The great variety of animals is, in part, a consequence of the adaptations made to the variety of foods they eat and the variety of habitats they live in—from deep ocean vents to the skies above us! The diversity of animals and of their habitats, however, is easily dwarfed by those of the single-celled organisms. Earth is, and will probably always be, in "the age of bacteria."

Teach

Lead a Discussion

Have students read **Types of Animals.** Ask how they would distinguish invertebrates from chordates. Then, use **Figure 25–1** to call attention to the four characteristics shared by chordates: a dorsal, hollow nerve cord; a notochord; a tail that extends beyond the anus; and pharyngeal pouches.

DIFFERENTIATED INSTRUCTION

LPR **Less Proficient Readers** Students might have difficulty with the large number of unfamiliar terms on the page. Have pairs of students work together to complete a **Vocabulary Word Map** for each new term, with characteristics and examples or attributes in the boxes under the term.

Study Wkbks A/B, Appendix S32, Vocabulary Word Map. **Transparencies,** GO17.

ELL Focus on ELL: Access Content

ALL SPEAKERS Pair beginning and intermediate speakers with advanced and advanced high speakers. Have each pair use a **Main Idea and Details Chart** to learn the descriptions of the four characteristics of chordates. Help students with vocabulary terms as needed.

Study Wkbks A/B, Appendix S28, Main Idea and Details Chart. **Transparencies,** GO13.

MYSTERY CLUE From the clue about the organisms having a stiff rod running along the tail (a notochord), students should suspect that the organism is a chordate. Students can go online to Biology.com to gather their evidence.

BIOLOGY.com Students can use **InterActive Art: Structure of a Sponge** to observe the basic anatomy and functions of a sponge.

Answers

FIGURE 25–2 Bats are vertebrates.

Teach continued

Lead a Discussion

Write the term *homeostasis* on the board, and ask students to define it in their own words. *(Sample answer: Homeostasis refers to all of the ways or systems an organism has evolved for maintaining its internal environment as its external environment changes.)* Discuss why feedback inhibition is an important adaptation for animals. Explain that animals often cope with changing external conditions through feedback processes.

Ask How does your body respond when you feel cold? *(Sample answer: It shivers.)*

Ask What does a dog do when it gets hot? *(It pants with its tongue hanging out.)*

Explain that these are ways that feedback helps maintain body systems at a temperature range in which they work most efficiently.

DIFFERENTIATED INSTRUCTION

L1 **Struggling Students** Have students use a **Cycle Diagram** to help them think about what takes place when feedback inhibition restores homeostasis. Provide small groups with a blank cycle diagram they can use to show how feedback inhibition works when a person's body temperature rises.

Study Wkbks A/B, Appendix S23, Cycle Diagram. **Transparencies,** GO6.

ELL **English Language Learners** Have students skim the first paragraph of **What Animals Do to Survive.** Ask them to list words in the paragraph they do not understand. *(Sample answers: survive, bewildering, diversity, feedback inhibition)* Then, have them work with fluent English speakers to define these words and quiz one another on their meanings.

Quick Lab GUIDED INQUIRY

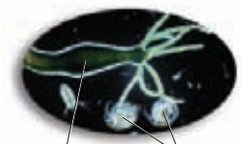
How Hydra Feed

1. Your teacher will provide you with hydra and *Daphnia,* small aquatic invertebrates. Using a dropper pipette, gently place one hydra onto a well slide.
2. Let the hydra adjust to its surroundings for 5 to 10 minutes.
3. Using your dropper, add one *Daphnia* to the slide.
4. Observe the hydra under a microscope.

Analyze and Conclude

1. Observe What happens when the *Daphnia* is added to the same slide as the hydra?

2. Draw Conclusions How do the hydra's tentacles help it to maintain homeostasis?



3. Pose Questions Formulate two questions about how the hydra survives in its environment.

What Animals Do to Survive

What essential functions must animals perform to survive?

Animals display a bewildering variety of body shapes, sizes, and colors. The best way to study and understand this diversity is not to memorize all the body parts of these animals, but to understand how the structures function and why. No matter their appearance, all animals must perform similar functions to stay alive. **Like all organisms, animals must maintain homeostasis by gathering and responding to information, obtaining and distributing oxygen and nutrients, and collecting and eliminating carbon dioxide and other wastes. They also reproduce.** The body systems that perform these functions are closely linked to one another. Over time, members of different animal phyla have evolved very different body structures that perform these essential functions. You will study these structures in more detail in Chapters 27 and 28.

Maintaining Homeostasis Recall that all organisms must keep their internal environment relatively stable, a process known as maintaining homeostasis. In animals, maintaining homeostasis is the most important function of all body systems. For example, most reptiles, birds, and mammals cannot excrete excess salt very well. Those that hunt or feed in salt water, such as the marine iguana in **Figure 25–3,** have adaptations that allow them to remove salt from their bodies.

Often, homeostasis is maintained by feedback inhibition. **Feedback inhibition,** or negative feedback, is a system in which the product or result of a process limits the process itself. If your house gets too cold, for example, the thermostat turns on the heat. As heat warms the house, the thermostat turns the heater off. Your body's thermostat works the same way. If you get too cold, you shiver, using muscle activity to generate heat. If you get too hot, you sweat, which helps you lose heat.

In this unit, you will learn about body systems in various animal groups. You will see how different groups have evolved different ways of ensuring their body systems stay in balance.

FIGURE 25–3 Homeostasis Marine iguanas are reptiles that feed in salt water. Reptile excretory systems are not adapted to process salt water. So these reptiles maintain homeostasis by sneezing a combination of salt and nasal mucus you might call "snalt." Snalt sometimes coats their bumpy heads and spiny necks, as you can see in this photo.

Quick Lab

PURPOSE Students will observe how hydra are adapted to obtain nutrients.

MATERIALS live hydra and *Daphnia* cultures, microscope, dropper pipette, depression slides

SAFETY Tell students to treat the animals with care to avoid injury to them. Caution students to handle breakable materials, such as glass slides, carefully and not to touch broken glass.

PLANNING Provide a container into which used hydra and remaining *Daphnia* can be collected.

ANALYZE AND CONCLUDE

1. The hydra extend their tentacles to capture the *Daphnia.*
2. Hydra tentacles help maintain homeostasis by capturing food and delivering it to the hydra's mouth.
3. Sample answer: What adaptations help hydra survive? How do tentacles help hydra feed?

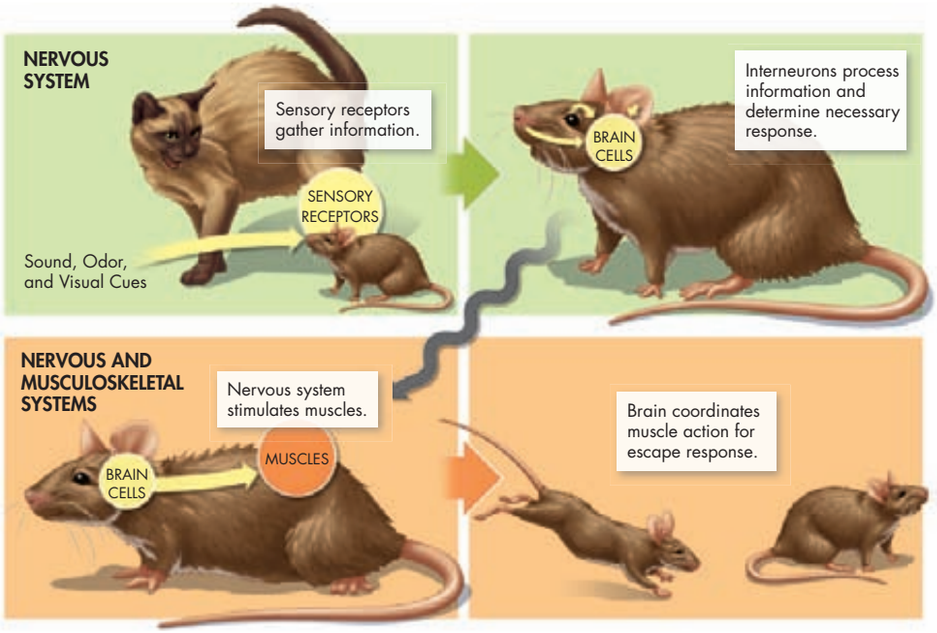


FIGURE 25–4 Gathering and Responding to Information The nervous and muscular systems work together to produce a response. **Predict** *Would an animal with a malfunctioning nervous system be likely to produce an appropriate muscular response to a predator? Explain.*

Gathering and Responding to Information Complex animals, such as mammals, use several linked body systems to respond to events in their environment, as shown in **Figure 25–4.** The nervous system gathers information using cells called receptors that respond to sound, light, chemicals, and other stimuli. Other nerve cells collect and process that information and determine how to respond. Some invertebrates have only a loose network of nerve cells, with no real center. Other invertebrates and most chordates have large numbers of nerve cells concentrated into a brain.

Animals often respond to the information processed in their nervous system by moving around. Muscle tissue generates force by becoming shorter when stimulated by the nervous system. Muscles work together with some kind of supporting structure called a skeleton to make up the musculoskeletal system. Skeletons vary widely from phylum to phylum. Some invertebrates, such as earthworms, have skeletons that are flexible and function through the use of fluid pressure. Insects and some other invertebrates have external skeletons. The bones of vertebrates form an internal skeleton. For example, the hard shell of a lobster is an external skeleton, while your bones are part of your internal skeleton.

In Your Notebook *Construct a flowchart showing the events in* ***Figure 25–4*** *in chronological order.*

Use Visuals

Have students examine **Figure 25–4.** Then, ask them to describe the events from the rat's point of view.

Ask Where are the sensory receptors located that come into play when the rat first notices the cat? *(in the rat's eyes, nose, and ears)*

Ask What do you think is going on in the interaction between the rat's nervous system and its musculoskeletal system? *(Sample answer: Nerve cells cause muscles to contract, and movement occurs.)*

DIFFERENTIATED INSTRUCTION

L1 Struggling Students If some students have trouble understanding **Figure 25–4,** cover the bottom of the figure and ask students to describe what the rat senses.

Ask How did the rat gather information? *(Its senses detected the cat.)*

Then, cover the top of the figure, and ask what message the brain is sending to the muscles.

Ask How did the rat respond to this information? *(Its muscles contracted, and it escaped.)*

Biology In-Depth

BODY TALK

To maintain homeostasis, the body must have internal communication. Both the endocrine and nervous systems fulfill this role in humans and in many other animals. Endocrine communication depends on the release of chemicals that travel though the body in blood. Hours, or even days, may elapse (as in the case of the menstrual cycle) between the release of a chemical by an endocrine gland and the response by the specific cells (target tissue) that are sensitive to the chemical. Nervous system communication, in contrast, is very rapid and depends on the transmission of impulses along nerve pathways. Depending on the type and size of nerve fiber, nerve impulses can relay information from an event in one part of the body to the brain or another organ (in the case of a reflex) at speeds from 1m/s to over 100 m/s.

Answers

FIGURE 25–4 Sample answer: I predict that an organism with a malfunctioning nervous system would be in danger of producing an inappropriate response to a predator for several reasons. If the organism has faulty sensory receptors, it might not be aware of the predator and its nervous system would not signal its muscles that it needs to run away. If its brain cells are faulty, the nervous system might misinterpret information about the predator.

IN YOUR NOTEBOOK Check that students' flowcharts reflect stimulus-response activities in the sequence shown in **Figure 25–4.**

Teach continued

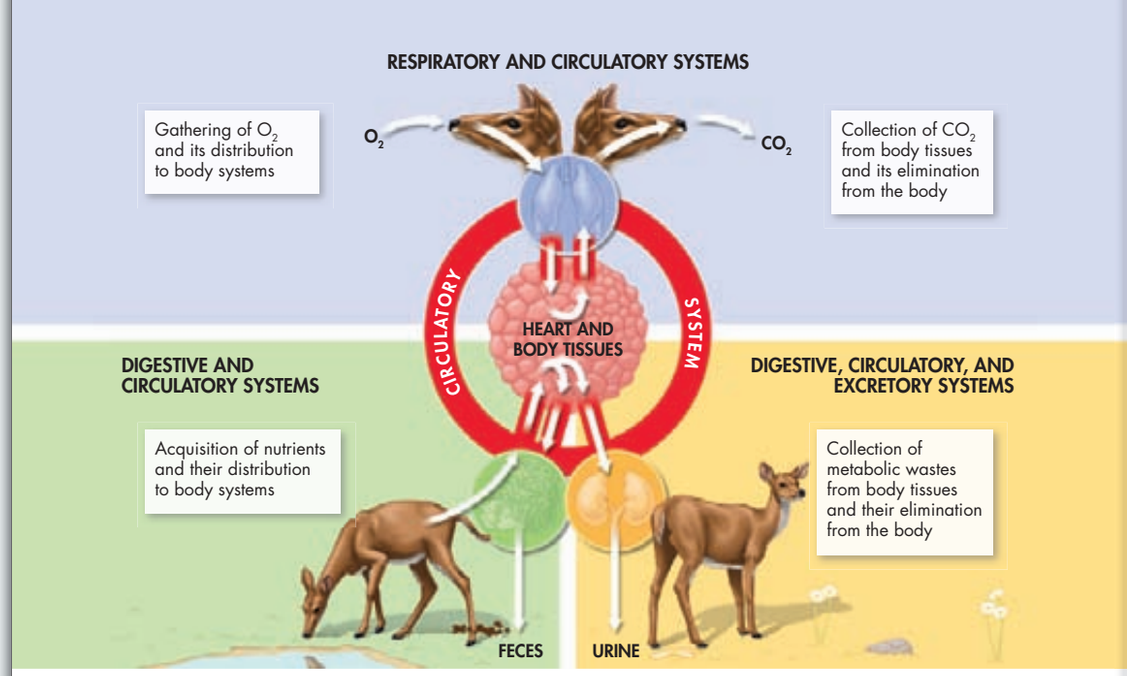
VISUAL SUMMARY

Have students examine **Figure 25–5** to understand how body systems function and are connected via the circulatory system. Have students work in small groups to write three questions—one for each section of the diagram—which, when answered, will help them understand how each set of systems specifically helps maintain homeostasis. Use the groups' questions to check student understanding.

DIFFERENTIATED INSTRUCTION

L1 **Special Needs** If **Figure 25–5** confuses some students, cover all but one part of the figure. Then, working in small groups, have students discuss each part. For example, for the top part, students might discuss how the respiratory and circulatory systems work together to take in oxygen and deliver it to body cells. Then, repeat the exercise with another part of the diagram.

L3 **Advanced Students** Challenge students to write a paragraph comparing a circulatory system to a city's highway system. Ask them how traffic flow would be affected if there were an accident on the highway at rush hour. How would the city be affected? Have students describe this in terms of a breakdown in homeostasis.



VISUAL SUMMARY

MOVING MATERIALS IN, AROUND, AND OUT OF THE BODY

FIGURE 25–5 The structures of an animal's respiratory, digestive, and excretory systems must work together with those of its circulatory system.

Obtaining and Distributing Oxygen and Nutrients All animals must breathe to obtain oxygen. Small animals that live in water or in wet places can "breathe" by allowing oxygen to diffuse across their skin. Larger animals use a respiratory system based on one of many different kinds of gills, lungs, or air passages. In addition, all animals must eat to obtain nutrients. Most animals have a digestive system that acquires food and breaks it down into forms cells can use.

After acquiring oxygen and nutrients, animals must transport them to cells throughout their bodies. For many animals, this task of transporting oxygen and nutrients requires some kind of circulatory system. Therefore, the structures and functions of respiratory and digestive systems must work together with circulatory systems, as shown in **Figure 25–5.** Among vertebrates, including humans, the circulatory system is especially important in supplying oxygen and nutrients. In humans, for example, brain tissue begins to die within moments if its blood supply is interrupted by a stroke.

Collecting and Eliminating CO_2 and Other Wastes Animals' metabolic processes generate carbon dioxide and other waste products. Some of those waste products contain nitrogen, often in the form of ammonia. Both carbon dioxide and ammonia are toxic in high concentrations. So these wastes must be excreted, or eliminated from the body.

UbD Check for Understanding

ONE-MINUTE RESPONSE

Give students about a minute to write a response to the following prompt.

- Describe the importance of the circulatory system to other systems in maintaining homeostasis. *(Answers should include that the circulatory system supplies nutrients from the digestive system and oxygen from the lungs to the cells of the body. It also transports wastes from cells to the excretory system and carbon dioxide from the cells to the lungs, helping the body maintain homeostasis.)*

ADJUST INSTRUCTION

If responses are incorrect or incomplete, have students review the Visual Summary and edit their original responses. Then, have each student share his or her edited response with a partner.

Many animals eliminate carbon dioxide by simply using their respiratory systems. However, most complex animals have a specialized organ system—the excretory system—for eliminating other wastes, such as ammonia. The excretory system concentrates or processes these wastes and either expels them immediately or stores them before eliminating them.

Before waste products can be discharged from the body, they must first be collected from cells throughout body tissues and then delivered to the respiratory or excretory system. Some sort of circulatory system is often necessary to perform these functions. So the collection and elimination of wastes requires close interactions between the structures and functions of three body systems, as shown in **Figure 25–5** on the previous page.

Reproducing Most animals reproduce sexually by producing haploid gametes. Sexual reproduction helps create and maintain genetic diversity, which increases a species' ability to evolve and adapt as their environment changes. Many invertebrates and a few vertebrates can also reproduce asexually. Asexual reproduction usually produces offspring that are genetically identical to the parent. It allows animals to increase their numbers rapidly but does not generate genetic diversity.

FIGURE 25–6 Reproduction Like many vertebrates, this pygmy marsupial frog is caring for her young while they develop. Unlike most animals, she is carrying her eggs on her back!

25.1 Assessment

Review Key Concepts

1. a. Review Which characteristics do all animals share?

b. Classify A classmate is looking at a unicellular organism under a microscope. She asks you if it is an animal. What would you say, and why?

2. a. Review What is the defining characteristic of invertebrates? What are four characteristics of chordates?

b. Explain Why would you be unlikely to find a notochord in an adult chordate?

c. Compare and Contrast How do vertebrates differ from other chordates?

3. a. Review Describe the essential functions performed by all animals.

b. Explain Why must waste products produced by metabolic processes be eliminated from an animal's body?

c. Sequence Which body system delivers waste products to the respiratory and excretory systems?

VISUAL THINKING

4. Make a two-column chart that lists the ways that animals gather and respond to information. In the first column, list each function. In the second column, include a drawing, photograph, or clipping of a structure that performs that function.

BIOLOGY.com Search Lesson 25.1 GO • Self-Test • Lesson Assessment

LESSON 25.1

Assess and Remediate

EVALUATE UNDERSTANDING

Ask a student to name an essential function animals perform to survive. Then, have a second student describe how that function contributes to homeostasis. Continue until all essential functions have been discussed. Then, have students complete the 25.1 Assessment.

REMEDIATION SUGGESTIONS

LPR **Less Proficient Readers** If students have trouble answering **Question 3b,** rephrase the question in simpler terms. For example, you could ask them why eliminating waste is an important animal function. Have pairs discuss the simplified question and write a response.

BIOLOGY.com Students can check their understanding of lesson concepts with the **Self-Test** assessment. They can then take an online version of the **Lesson Assessment.**

Assessment Answers

1a. All are heterotrophs, are multicellular, and have eukaryotic cells without cell walls.

1b. Sample answer: It is not an animal, because one of the characteristics shared by all animals is that they are multicellular.

2a. Invertebrates lack a notochord and backbone. Chordates have a hollow nerve cord, a notochord, a tail that extends beyond the anus, and pharyngeal pouches at some point in their development.

2b. Most chordates have a notochord only when they are embryos.

2c. Vertebrates are chordates that have a backbone made up of vertebrae. A few aquatic chordates lack vertebrae.

3a. maintaining homeostasis, gathering and responding to information, obtaining and distributing oxygen and nutrients, collecting and eliminating CO_2 and other wastes, reproducing

3b. Metabolic wastes, such as CO_2 and ammonia, are toxic in high concentrations and must be eliminated.

3c. the circulatory system

VISUAL THINKING

4. Answers will vary. Column one might list:

- Hearing sounds
- Detecting chemicals
- Seeing movement, light, or color

Accept all entries that students have correctly illustrated.

Teach

Lead a Discussion

Ask students what they think Dr. Henderson means in her statement, "Stop and take a look at the world around you. Biology is exciting! There are many unanswered questions . . . and many waiting to be asked."

DIFFERENTIATED INSTRUCTION

L1 **Struggling Students** For students who have difficulty appreciating the great variety of organisms an invertebrate biologist might study, collect photographs of different types of invertebrates and display them around the classroom. You may also display field guides of invertebrates. Have students select one organism and explain why it is an invertebrate and why an invertebrate biologist might find it interesting.

Answers

WRITING

Sample answers: How can one animal infest another animal? How did you learn about these animals to begin with? Does all of your research take place outside? Each question should be accompanied by the student's reason for asking the question.

NATIONAL SCIENCE EDUCATION STANDARDS

CONTENT G.1

INQUIRY A.2.a, A.2.b

Careers & BIOLOGY

Are you interested in a career with animals? If so, you might be interested in one of the careers below.

ZOO CURATOR

When you think of a zoo worker, you likely picture a keeper feeding animals, right? Zookeepers are not the only people working in zoos, however! Zoo curators are responsible for overseeing a specific part of a zoo's work. There are many different kinds of curators, including research curators, animal curators, and conservation curators. Each contributes to the zoo's mission of wildlife protection and preservation.

BEEKEEPER

More than one quarter of the American diet comes from food plants that are pollinated by bees. Beekeepers maintain beehives and are therefore a vital part of the agriculture business. Bees are rented to farmers for pollination of crops such as almonds, apples, peaches, soybeans, and many types of berries. Beekeepers may also use their hives to produce beeswax and honey.

INVERTEBRATE BIOLOGIST

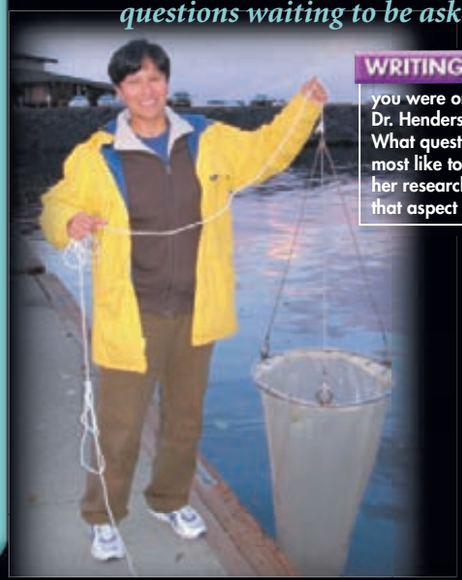
More than 95 percent of animals lack a backbone. From corals to spiders, earthworms to sea stars, the variety is amazing! Biologists may study invertebrate behavior, evolution, ecology, or anatomy. With so many species to choose from, the research is as varied as the animals themselves.

CAREER CLOSE-UP:

Dr. Scottie Yvette Henderson, Invertebrate Biologist

The strange and diverse creatures of the ocean inspire Dr. Scottie Henderson, an instructor of biology at the University of Puget Sound in Tacoma, Washington. Her current research focuses on tiny, potentially parasitic crabs that infest a clam called *Nuttallia obscurata*. Dr. Henderson and her colleagues are looking at the interactions of the clam and crab to better understand the nature of their symbiotic relationship. Some evidence points to parasitism, but the relationship may be commensal. Nothing, however, is as important to Dr. Henderson as getting her students interested in and excited about science.

"Stop and take a look at the world around you. Biology is exciting! There are many unanswered questions . . . and many questions waiting to be asked."



WRITING Suppose you were one of Dr. Henderson's students. What question would you most like to ask her about her research? Explain why that aspect interests you.

Quick Facts

WORKING WITH INVERTEBRATES

A biological curator cares for a specific collection of preserved or living organisms at a zoo or museum. Curators also help select items to add to the collection. Large zoos may have separate curators for insects, birds, large animals, and other special interests. Curators generally have at least a bachelor's degree in their area of interest.

A beekeeper should have a thorough understanding of types of bees, their care, and uses. Training can be through a beekeepers' association or a county extension service.

Becoming an invertebrate zoologist like Dr. Henderson requires at least a bachelor's degree in biology. It usually also requires graduate study and research in a specialized area of zoology, such as invertebrate ecology, behavior, or physiology.