1–3 Studying Life

Deep in the skull of a British teenager, an invisible invader eats away at brain tissue until it resembles a sponge. In a Costa Rican rain forest, a chameleon crawls past a bright red tree frog whose blue legs look like a pair of blue jeans, while a toucan uses its rainbow-colored bill to slice into a wild avocado. These scenes all involve biology—the study of life. (The Greek word *bios* means "life," and *-logy* means "study of.") **Biology** is the science that employs the scientific method to study living things.

The scientific study of life has never been more exciting than it is today. Why? Think about headline news stories you may have heard about over the last couple of years—and even over the last couple of days. Hantavirus crops up in Southwestern states. Dengue fever threatens the Gulf Coast. Mice, sheep, and even dogs have been cloned. Genetically-engineered crop plants are designed to resist insect pests. The stories behind these and many other headlines come from the study of living things.

Characteristics of Living Things

Are the firefly and the fire in **Figure 1–14** alive? They are both giving off energy. Describing what makes something alive is not easy. No single characteristic is enough to describe a living thing. Also, some nonliving things share one or more traits with living things. Mechanical toys, automobiles, and clouds move around, for example, whereas mushrooms and trees live their lives in one spot. Other things, such as viruses, exist at the border between organisms and nonliving things.

Despite these difficulties, it is possible to describe what most living things have in common. **Living things share the following characteristics:**

- **Living things are made up of units called cells.**
- **Living things reproduce.**
- **Living things are based on a universal genetic code.**
- **Living things grow and develop.**
- **Living things obtain and use materials and energy.**
- **Living things respond to their environment.**
- **Living things maintain a stable internal environment.**
- **Taken as a group, living things change over time.**

Guide for Reading

Key Concepts

- What are some characteristics of living things?
- How can life be studied at different levels?

Vocabulary

biology
cell
homeostasis
sexual reproduction
asexual reproduction
metabolism
stimulus

Reading Strategy: Summarizing As you read, make a list of the properties of living things. Write one sentence describing each property.

Figure 1–14 A Colorado firefly beetle (top) has all of the characteristics of living things. Even though fire (bottom) uses materials and can grow as living things do, fire is not alive because it does not have other characteristics of living things.

Section 1–3

1 FOCUS

Objectives

1.3.1 ***Describe*** some characteristics of living things.
1.3.2 ***Explain*** how life can be studied at different levels.

Guide for Reading

Vocabulary Preview

Pronounce each of the Vocabulary words for the class, and have students repeat the pronunciation in unison. Note any words that English language learners have trouble pronouncing, and work with them to correct their problems.

Reading Strategy

Students should write one sentence describing each of the eight characteristics listed on page 15. You might have students rewrite the items in the list and revise their sentences as they read the section.

2 INSTRUCT

Characteristics of Living Things

Build Science Skills

Comparing and Contrasting Divide the class into small groups, and allow each group to examine two objects: a watch or clock with a working second hand and an active, living animal such as a fish or an insect. Ask groups to compare the two, noting similarities and differences. Have group members collaborate on writing a paragraph explaining what makes one object a living thing and the other object not. L2

TIME SAVER

SECTION RESOURCES

Print:

- ***Teaching Resources,*** Lesson Plan 1–3, Adapted Section Summary 1–3, Adapted Worksheets 1–3, Section Summary 1–3, Worksheets 1–3, Section Review 1–3
- ***Reading and Study Workbook A,*** Section 1–3
- ***Adapted Reading and Study Workbook B,*** Section 1–3

Technology:

- ***iText,*** Section 1–3
- ***Transparencies Plus,*** Section 1–3

1–3 (continued)

Build Science Skills

Comparing and Contrasting Ask students to compare the bear and the salamander shown in Figure 1–15. Ask students: **What characteristics of life do both of these organisms exhibit?** *(Both exhibit all the eight characteristics of life. Students should note that they are made of cells and that they both reproduce. Allow students to speculate about how each animal exhibits the other characteristics.)* **How are these two living things similar, and how are they different?** *(They are similar in that they are both animals. They are different in size, shape, structure, and habitat, among many other ways.)* L2

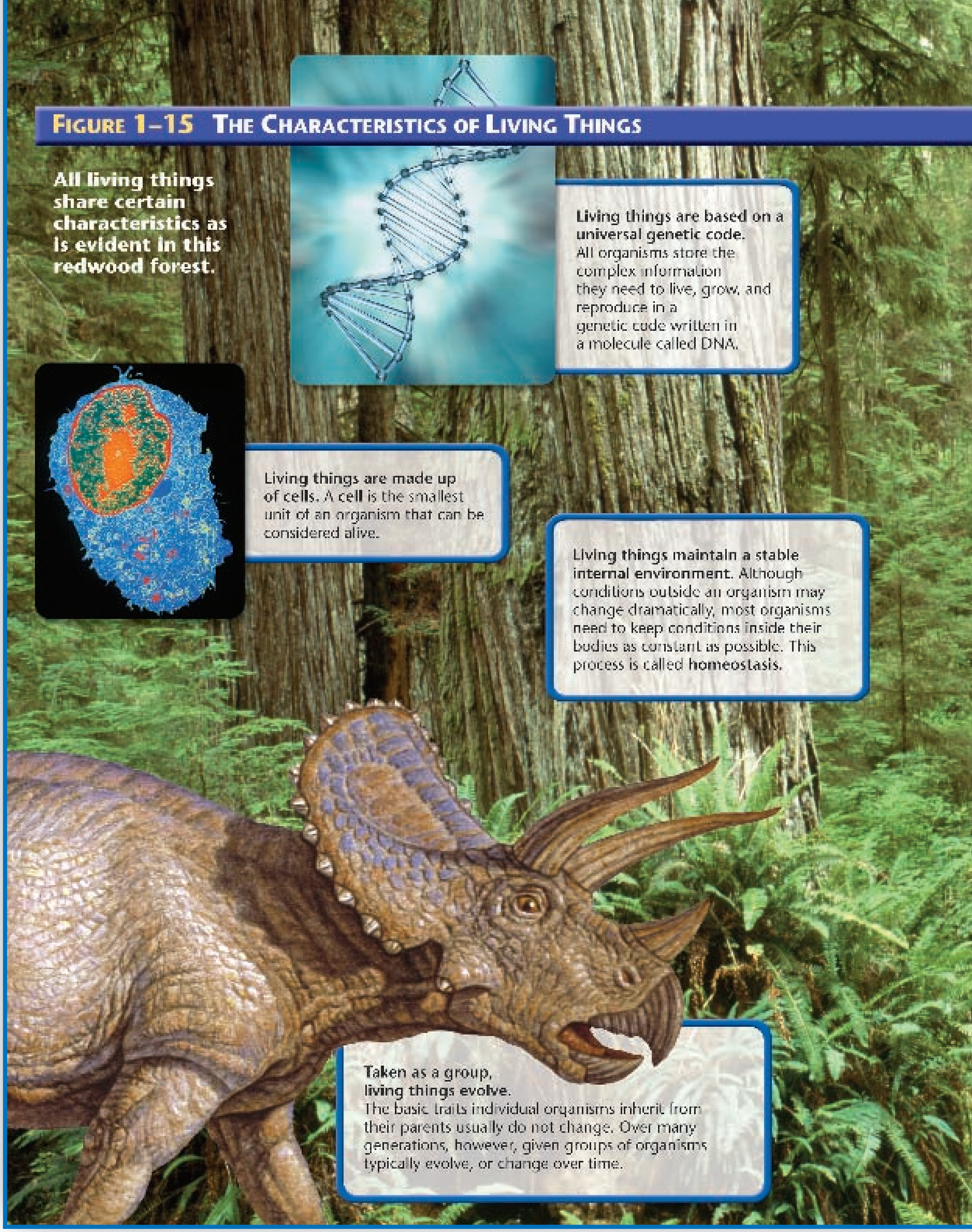


FIGURE 1–15 THE CHARACTERISTICS OF LIVING THINGS

UNIVERSAL ACCESS

Less Proficient Readers
Make sure students grasp the difference between sexual and asexual reproduction, because this distinction will be important in chapters to come. Point out that the prefix *a-* simply means "not," and thus *asexual reproduction* literally means "not sexual reproduction." To help students compare and contrast the two, have them make a Venn diagram that notes how the two processes are alike and different. L1

English Language Learners
Help students create a personal science glossary that can be added to as they learn new terms in reading each chapter of this text. Encourage these students to dedicate a small notebook for this purpose or to devise another way to keep an organized glossary. Students can keep an alphabetized list, or they might simply make a list for each chapter. For each term, students should write a definition and note its pronunciation. L1 L2

Build Science Skills

Comparing and Contrasting Emphasize to students the difference between growth in living and growth in nonliving things. A good comparison to make is the growth of a child compared with that of a garbage heap. Point out that as a child eats food—pasta, fruits, vegetables, meat—he or she grows. In contrast, if you were to throw the same foods into a pile, the garbage heap would also grow. Ask: **Based on the example given, how would you compare the growth of living and nonliving things?** *(Answers may include the concepts of assimilation and organization, development of specific structures, and/or organized growth rather than a "pile.")* **Do organisms always grow and develop at the same rate?** *(Most students will know that organisms don't.)* **When do organisms stop growing and developing?** *(The process goes on at different rates but does not completely stop until death.)* L1 L2

Use Visuals

Figure 1–15 Ask students: **How does the salamander obtain the energy it needs to live?** *(It eats other organisms for the energy stored in their bodies.)* **Where do the giant redwoods and other plants obtain the energy they need to live?** *(From the sun through the process of photosynthesis)* Point out that all the living things on Earth ultimately obtain the energy they need from the energy of sunlight, as students will learn in greater detail in subsequent chapters. L2

TEACHER TO TEACHER

To get students to think about the characteristics of life, I give them the following scenario:

You are a member of a local research laboratory. One afternoon, you receive a shoebox marked "Handle with care." In it, you find three gelatinous, orange-colored masses of material. Each mass is approximately 5 cm in diameter. You also find a message from a local resident: "I found these things along the roadside at the bridge near a creek. Can you tell me if they are alive and what I should do with them? They started showing up right after the spring rains this year and seem to be growing fast."

Have students answer the following questions: (1) As you observe the masses, what evidence would make you think they are living things? (2) List the questions that you would ask as you begin your investigation.

—*Debbie Richards*
Biology Teacher
Bryan High School
Bryan, TX

1–3 (continued)

Quick Lab

Objective Students will be able to infer some characteristics of living things. L2

Skill Focus **Formulating Hypotheses, Evaluating, Inferring**

Materials hand lens, dormant brine shrimp eggs, water, hatched brine shrimp eggs, bowls covered with fabric

Time 15 minutes

Advance Prep Obtain dormant brine shrimp eggs—also called "sea monkeys"—from a biological supply house. A day, or at least several hours, before the activity begins, put some of the dormant eggs in water so that students can observe live hatchlings in step 3.

Safety Make sure students wash their hands with soap and warm water after handling the dormant eggs or live shrimp.

Strategy Have the hatchlings in bowls covered with fabric and stationed around the classroom. After students have written their predictions, uncover the bowls and invite students to observe.

Expected Outcomes Students will recognize that the line between living and nonliving is not as clear as they might have thought.

Analyze and Conclude

1. Answers will depend on students' predictions. Most students will not have predicted that the objects they observed in step 1 would become live shrimp or anything else alive.

2. Students should recognize that the objects they observed in step 3 were alive and infer that the objects they observed in step 1 were also alive.

3. Accept any reasonable response, provided that the arguments are logical and based on observation.

Quick Lab

What are the characteristics of living things?

Materials hand lens, unknown objects (dry), same objects soaked in water

Procedure

1. Examine the dry unknown object your teacher provides. Record your observations.
2. **Predicting** In step 3, you will observe the same kind of object after it has been soaked in water. Write a prediction describing what you expect to see.
3. Examine one of the objects that has been soaking in water for a period of time. Record your observations. Wash your hands when you have finished.

Analyze and Conclude

1. **Evaluating** Was the prediction you made in step 2 correct? Explain your answer.
2. **Inferring** Were the objects you observed in step 1 living or nonliving? Were the objects you observed in step 3 living or nonliving? Use the observations you made as supporting evidence for your answers.
3. **Formulating Hypotheses** Suggest one or more ways to explain the differences between the dry and wet objects.

▼ **Figure 1–16** Over time, as life has evolved into many different forms, organisms have entered into a variety of relationships. Interactions between predators and prey (including those between insect-eating plants and insects) and between hosts and parasites often play important roles in regulating the sizes of both plant and animal populations.

Big Ideas in Biology

The units of this book seem to cover different subjects. But we'll let you in on a secret: That's not how biology works. All biological sciences are tied together by themes and methods of study that cut across disciplines. Some of these "big ideas" may sound familiar because they overlap with the characteristics of life or the nature of science. You will see that these big ideas themselves overlap and interlock with one another. All of them crop up again and again in the chapters that follow.

Science as a Way of Knowing Science is not a list of "facts," but "a way of knowing." The job of science is to use observations, questions, and experiments to explain the natural world in terms of natural forces and events. Successful scientific research reveals rules and patterns that can explain and predict at least some events in nature. Science therefore enables us to take actions that affect events in the world around us. Making certain that scientific knowledge is used for the benefit of society requires an understanding of the nature of science—its strengths, its limitations, and its interactions with our culture.

Interdependence in Nature All forms of life on Earth are connected together into a biosphere, which literally means "living planet." Within the biosphere, organisms are linked to one another and to the land, water, and air around them. The relationships between organisms and their environment depend on two processes—the flow of energy and the cycling of matter. Human life and the economies of human societies also require matter and energy, so human life depends directly on the economy of nature.

Matter and Energy Life's most basic requirements are matter that serves as nutrients to build body structures and energy to fuel the processes of life. Some organisms, such as plants, obtain energy from sunlight and take up the nutrients they need from air, water, and soil. Other organisms, including most animals, must eat plants or other animals to obtain both nutrients and energy. These requirements are the basis of the interdependence of all living things in the biosphere.

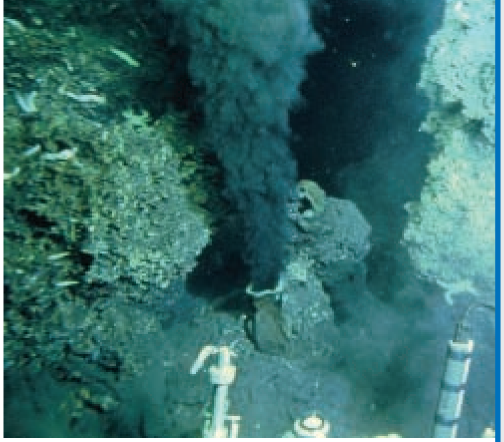
Cellular Basis of Life Organisms are composed of one or more cells, which are the smallest units that can be considered fully alive. Cells can grow, respond to their surroundings, and reproduce. Despite their small size, cells are complex and highly organized.

Many living things consist of only a single cell and are called unicellular organisms. The organisms you are most familiar with—for example, animals and plants—are multicellular. The cells in multicellular organisms are often remarkably diverse, existing in a variety of sizes and shapes. In some multicellular organisms, each type of cell is specialized to perform a different function. The human body, for example, contains at least 85 different cell types.

Information and Heredity Life's processes are directed by information carried in a genetic code that is common, with minor variations, to every organism on Earth. That information, carried in DNA, is copied and passed from parent to offspring. The information coded in DNA forms an unbroken chain that stretches back roughly three and a half billion years. Yet, the DNA inside your cells right now can influence your risk of getting cancer, the amount of cholesterol in your blood, and the color of your children's hair.

Unity and Diversity of Life The remarkable thing about the living world is that all living things are fundamentally alike at the molecular level, even though life takes an almost unbelievable variety of forms. All organisms are composed of a common set of carbon-based molecules, all use proteins to build their structures and carry out their functions, and all store information in a common genetic code. One great contribution of evolutionary theory is that it explains both this unity of life and its diversity.

Evolution In biology, evolution, or changes in living things through time, explains the inherited similarities as well as the diversity of life. Evolution is the unifying theme of biology. Evolutionary theory tells us that all forms of life on Earth are related because we all trace our ancestry back to a common origin more than 3.5 billion years ago. Evidence of this shared history is found in all aspects of living and fossil organisms, from physical features to structures of proteins to sequences of biological information found in DNA and RNA.



▲ **Figure 1–17** Certain types of sulphur-eating bacteria, which last shared common ancestors with humans more than 3.5 billion years ago, share surprising amounts of DNA with us. These unicellular organisms are poisoned by the oxygen we breathe, yet live in water that would boil us alive. They can literally "eat" sulphur but contain stretches of DNA that look remarkably like certain genes in our cells.

Big Ideas in Biology

Build Science Skills

Applying Concepts Explain to students that the "big ideas" in biology are themes, not facts, theories, or hypotheses. Although the big ideas are similar to the characteristics of life, they are more general, unifying concepts found in all sciences—biology, chemistry, earth science, and physics. The big ideas are the major ideas that link conceptual organization of the various scientific disciplines. The big ideas in this program include the following: science as a way of knowing; interdependence in nature; matter and energy; cellular basis of life; information and heredity; unity and diversity of life; evolution; structure and function; homeostasis; and science, technology and society.

BIO INSIGHTS

HISTORY OF SCIENCE

A constant "internal milieu"

In 1851, French physiologist Claude Bernard (1813–1878) discovered that nerves in an animal's body control the dilation and constriction of blood vessels. He observed that on hot days the blood vessels of the skin become dilated, whereas on cold days those same blood vessels become constricted. Bernard concluded that the function of these changes has to do with regulating the body's internal temperature. On hot days, dilated, blood-filled vessels radiate heat away from the body. On cold days, constricted, blood-depleted vessels conserve body heat. Thus, even when the external environment changes, an animal has a way of maintaining a constant "internal milieu." His concept of the maintenance of an internal balance within an animal is incorporated in the modern concept of homeostasis, which literally means "same condition."

1–3 (continued)

Branches of Biology

Build Science Skills

Asking Questions To introduce the topic of branches of biology to students, play a game of 20 questions with the class. Think of a familiar plant or animal, such as a dandelion, an ant, or a sparrow. Tell students that you are thinking of a certain organism and that they are allowed 20 yes-or-no questions to determine what this organism is. As the game progresses, you might suggest questions to the class; do not let them stray too far from the correct answer. Tell students that whether they realized it or not, they were conducting a scientific investigation. They were presented with a problem, and they needed to ask the right questions to reach a solution. Emphasize that in science, answers are often available—it's figuring out the right questions that is difficult. Explain that scientists from different branches of biology ask different questions-—approaching living things at different levels of organization. L1 L2

▲ **Figure 1–18** Despite the cold temperatures of this robin's environment, its body temperature remains fairly constant, partly because its feathers provide a layer of insulation and partly because of the body heat it produces.

Structure and Function The structures of wings enable birds and insects to fly. The structures of legs enable horses to gallop and kangaroos to hop. When organisms need to do anything—from capturing food to digesting it and from reproducing to breathing—they use some kind of structure that has evolved in ways that make a particular function possible. Each major group of organisms has evolved its own particular body part, or "tool kit," that evolves into different forms as various species adapt to the challenges of life in a wide range of environments.

Homeostasis All living organisms expend energy to keep conditions inside their cells within certain limits. An organism's ability to maintain a tolerable internal environment in the face of changing external conditions is vital to its survival. Any breakdown of that stability may have serious or even fatal consequences. The robin shown in **Figure 1–18** is maintaining homeostasis by puffing up its feathers to stay warm.

Science, Technology, and Society Science seeks to provide useful information. But many discoveries raise ethical questions. Just because we can use scientific information in a particular way, should we do so? How should we use genetic engineering? Should cloning of humans be banned? Should cloning of any animals and plants be prohibited? How can we use our growing understanding of how human activity affects our world? Should we take action to stop global warming? What's the best way to protect our food and water supplies? In our democracy, these questions can only be answered by a public that truly understands what science is and how it works.

Branches of Biology

Living things come in an astonishing variety of shapes, sizes, and habits. Living systems also range in size from groups of molecules that make up structures inside cells to the collections of organisms that make up the biosphere. No single biologist could study all this diversity, so biology is divided into different fields. Some fields are based on the types of organisms being studied. Zoologists study animals. Botanists study plants. Other fields study life from a particular perspective. For example, paleontologists study ancient life.

Some fields focus on the study of living systems at different levels of organization, as shown in **Figure 1–19.** **Some of the levels at which life can be studied include molecules, cells, organisms, populations of a single kind of organism, communities of different organisms in an area, and the biosphere. At all these levels, smaller living systems are found within larger systems.** Molecular biologists and cell biologists study some of the smallest living systems. Population biologists and ecologists study some of the largest systems in nature. Studies at all these levels make important contributions to the quality of human life.

BIO INSIGHTS **FACTS AND FIGURES**

Branches of biology

The branches of biology are too numerous to list. Zoologists, botanists, paleontologists, and ethologists are just a few of the great variety of biologists. Biochemists study the chemistry of living things. Geneticists study heredity and variation among organisms. Cytologists, or cell biologists, study the structure and function of cells. Ecologists study the interaction of organisms in ecosystems. Microbiologists study the structure and function of microorganisms. The list goes on, and those mentioned are just the biologists who pursue knowledge in what is sometimes called theoretical science. There are also many biologists who work in applied or practical science, including physicians, medical researchers, wildlife managers, foresters, and agricultural researchers, to name just a few.

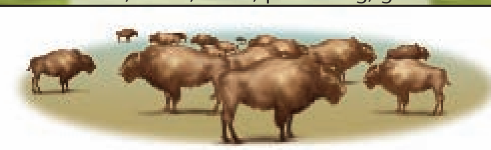
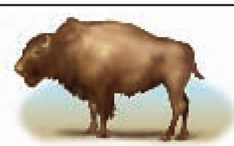
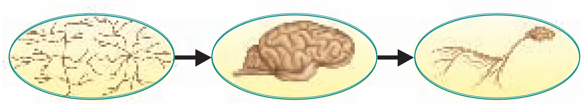
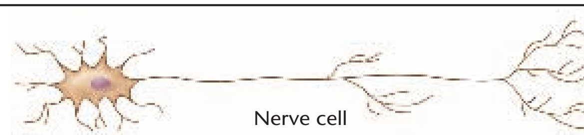
Levels of Organization		
Biosphere	The part of Earth that contains all ecosystems	 Biosphere
Ecosystem	Community and its nonliving surroundings	 Hawk, snake, bison, prairie dog, grass, stream, rocks, air
Community	Populations that live together in a defined area	 Hawk, snake, bison, prairie dog, grass
Population	Group of organisms of one type that live in the same area	 Bison herd
Organism	Individual living thing	 Bison
Groups of Cells	Tissues, organs, and organ systems	 Nervous tissue → Brain → Nervous system
Cells	Smallest functional unit of life	 Nerve cell
Molecules	Groups of atoms; smallest unit of most chemical compounds	 Water, DNA

Figure 1–19 **Living things may be studied on many different levels.** The largest and most complex level is the biosphere. The smallest level is the molecules that make up living things.

Use Visuals

Figure 1–19 Make sure students understand the hierarchy implied in the figure: molecular, cellular, multicellular, organism, population, community, ecosystem, and biosphere. Have students use a dictionary to clarify the meaning of these terms. Then, ask students to make a graphic organizer that could represent relationships among the terms, such as a series of larger and larger circles. L1 L2

Build Science Skills

Asking Questions Display the same pictures of natural environments that students examined for the Assess Prior Knowledge activity on page 2. Ask students again to choose one of the pictures to examine closely and to compile a list of 20 questions a biologist might ask about the organisms in the picture. Explain that these questions could concern anything from the molecular level to the biosphere level. Have students compare the 20 questions they wrote after having read these sections with the 20 questions they wrote previously. L2

1–3 (continued)

Biology in Everyday Life

Build Science Skills

Applying Concepts Ask students to choose a commercial product that they use every day, such as a certain soap, type of makeup, kind of chewing gum, or brand of deodorant. Ask them to explain in a paragraph how they could use what they have learned so far in this chapter to find out how the product affects their bodies and whether it could be harmful in some way. L2

3 ASSESS

Evaluate Understanding

Have students explain in writing how a living thing, such as the Venus' flytrap shown in Figure 1–16, exhibits all of the characteristics of living things.

Reteach

Point out a living thing and a nonliving thing in the classroom, such as a computer and a fish in an aquarium. Have students compare and contrast the two using the eight characteristics of living things.

Focus on the BIG Idea

Students could observe whether the object ingests or excretes materials, whether it increases in size over time, and whether it responds to stimuli from the environment.

iText Interactive Textbook

If your class subscribes to the iText, use it to review the Key Concepts in Section 1–3.

Answer to . . .

Figure 1–20 *A typical response might suggest that researchers will find cures for many diseases.*

▲ **Figure 1–20** Progress in biology has meant huge improvements in health not just for you and your family but, in some societies, for pets as well. **Predicting** *How do you expect advances in biology to change healthcare during your lifetime?*

Biology in Everyday Life

As you begin studying biology, you may be thinking of it as just another course, with a textbook to read plus labs, homework, and tests. It's also a *science* course, so you may worry that it will be too difficult. But you will see that more than any other area of study, biology touches your life every day. In fact, it's hard to think of anything you do that isn't affected by it. It helps you understand and appreciate every other form of life, from pets such as the dog in **Figure 1–20** to dinosaurs no longer present on Earth. It provides information about the food you need and the methods for sustaining the world's food supplies. It describes the conditions of good health and the behaviors and diseases that can harm you. It is used to diagnose and treat medical problems. It identifies environmental factors that might threaten you, such as disposal of wastes from human activities. More than any other science, biology helps you understand what affects the quality of your life.

Biologists do not make the decisions about most matters affecting human society or the natural world; citizens and governments do. In just a few years, you will be able to exercise the rights of a voting citizen, influencing public policy by the ballots you cast and the messages you send public officials. With others, you will make decisions based on many factors, including customs, values, ethical standards, and scientific knowledge. Biology can provide decision makers with useful information and analytical skills. It can help them envision the possible effects of their decisions. Biology can help people understand that humans are capable of predicting and trying to control their future and that of the planet.

1–3 Section Assessment

1. **Key Concept** Describe five characteristics of living things.
2. **Key Concept** What topics might biologists study at the community level of organization?
3. Compare sexual reproduction and asexual reproduction.
4. What biological process includes chemical reactions that break down materials?
5. What is homeostasis? Give an example of how it is maintained.
6. **Critical Thinking Applying Concepts** Suppose you feel hungry, so you reach for a peach you see in a fruit bowl. Explain how both external and internal stimuli are involved in your action.

Focus on the BIG Idea

Science as a Way of Knowing List some observations that could be made to determine whether an object that is not moving is living or nonliving. Refer to Section 1–1 to help yourself recall what an observation is.

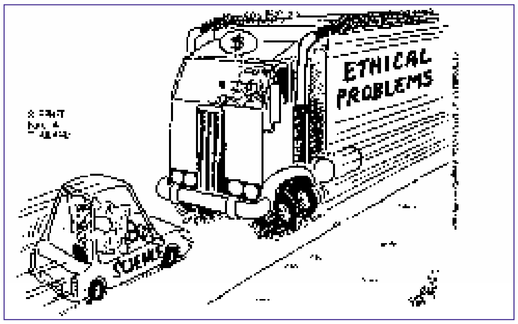
1–3 Section Assessment

1. Students should describe any five of the eight characteristics listed on page 15.
2. Students should describe topics about populations that live in an area, such as interactions among different populations and changes in size or habits.
3. In sexual reproduction, cells from two different parents unite to produce the first cell of a new organism. In asexual reproduction, the new organism has a single parent.
4. Metabolism
5. Homeostasis is the process by which organisms keep internal conditions fairly constant. Examples will vary, though most students will describe an internal feedback mechanism, such as temperature regulation.
6. External stimuli might include the sight and smell of the peach. Internal stimuli might include feeling hungry or the thought that this food would be good to eat.

ISSUES in Biology

When Scientists Have a Conflict of Interest

Scientists are expected to be completely honest about their investigations. Doctors are expected to place the welfare of their patients first. Yet, conflicts of interest can often threaten the credibility of a researcher. A conflict of interest exists when a person's work can be influenced by personal factors such as financial gain, fame, future work, or favoritism. For example, suppose scientists have received funds to test a potential anti-cancer drug. If experiments show that the drug is not very effective, the researchers may be tempted to conceal the results in order to avoid losing their funding.



The Viewpoints

Regulation Is Necessary

Some scientists argue that, because the public must be able to trust the work of science, some rules are essential for preserving scientific integrity. Every profession should regulate its members, and every science publication should have strict rules about avoiding conflicts of interest. In any published work, announcements of potential conflicts should be required. In some cases, scientists should avoid or be forbidden to do work that involves personal gain in addition to the usual payment for doing the work. Some form of government regulation may be needed.

Regulation Is Unnecessary

Other scientists insist that conflict-of-interest regulations are unnecessary for the majority of researchers, who are honest and objective about their work. It is unfair to assume that a researcher's discoveries would be different because of the nature of the financial support for the research. In fact, without the opportunity for scientists to get additional funding for successful work, many new drugs or new techniques would never have been developed. So it is important that scientists be allowed to investigate any topic, even those in which they have the opportunity for personal gain.

Research and Decide

1. **Analyzing the Viewpoints** To make an informed decision, learn more about this issue by consulting library or Internet sources. Then answer the following question: How might the views about a possible conflict of interest differ among a group of scientists, the company employing a scientist, and people seeking information from a scientist?
2. **Forming Your Opinion** How should this problem of possible conflicts of interest be decided? Include information or reasoning that answers people with the opposite view.
3. **Role-Playing** Suppose doctors who own a company developing a new medicine want their patients to help test the medicine. Let one person represent a doctor, a second person a patient, and a third person a medical reporter asking: Should the patients take part in the tests?

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BIO INSIGHTS

BACKGROUND

Reasons to be concerned
There are no sciencewide rules about reporting conflicts of interest, nor is there government regulation requiring biologists to do so. Various publications and professional organizations have their own code of ethics. In recent years, there has been a growing concern about how such conflicts might be affecting scientific research, especially the great amount of research done in universities. By 1997, U.S. companies were spending $1.7 billion a year on university-based science and engineering research. By the late 1990s, more than 90 percent of companies connected to the life sciences had some kind of relationship with university scientists. Yet, in a survey of science journals, 142 of 210 did not publish a single disclosure of conflict of interest in 1997. Some observers also worry about scientists' skewing their work toward government interests, because federal funding of research is common.

ISSUES in Biology

After students respond to question 3 in Research and Decide, have student volunteers role-play the situation for the class. Follow that by a class discussion of the issue. Then, ask each student to write a statement about his or her own assessment of such a conflict of interest.

Research and Decide

1. Students might find a variety of viewpoints about this issue in books, periodicals, or Internet sites about current affairs. Answers to the question will vary. A typical response might suggest that the group of scientists might be dedicated to pursuing scientific truth but also be intent on satisfying those who have funded the research. Additionally, the company employing the scientists might want both the truth and results that will help its profit. People seeking information from a scientist may simply want unbiased data, though they might not want results that somehow upset their view of the world.

2. A typical response might suggest that journals and professional organizations should adopt strict guidelines about conflicts of interest and that there should even be some government regulation. Students should back their positions with logical arguments.

3. Have students write a dialogue that includes viewpoints from the doctor and the patient, with the reporter questioning each. The reporter might press the doctor on whether owning the company is a conflict of interest that would invalidate the test. The reporter might ask the patient whether the doctor can be trusted and whether the test will be conducted in a safe way.

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Students can research conflicts of interest on the site developed by authors Ken Miller and Joe Levine.