

## 1.3 Studying Life

### Lesson Objectives

- List the characteristics of living things.
- Identify the central themes of biology.
- Explain how life can be studied at different levels.
- Discuss the importance of a universal system of measurement.

### Lesson Summary

**Characteristics of Living Things** **Biology** is the study of life. Living things share these characteristics: They are made of cells and have a universal genetic code; they obtain and use materials and energy to grow and develop; they reproduce; they respond to signals in their environment (**stimuli**) and maintain a stable internal environment; they change over time.

**Big Ideas in Biology** The study of biology revolves around several interlocking big ideas:

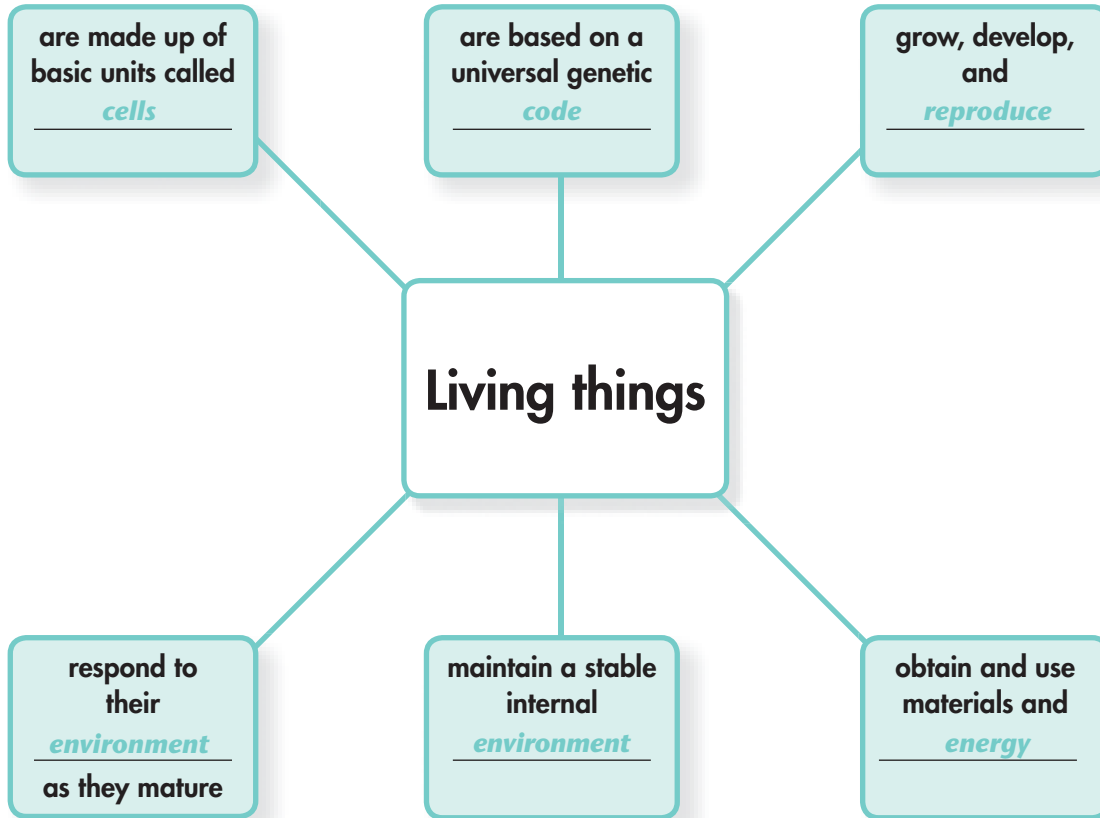
- ▶ **Cellular basis of life.** Living things are made of cells.
- ▶ **Information and heredity.** Living things are based on a universal genetic code written in a molecule called **DNA**.
- ▶ **Matter and energy.** Life requires matter that provides raw material, nutrients, and energy. The combination of chemical reactions through which an organism builds up or breaks down materials is called **metabolism**.
- ▶ **Growth, development, and reproduction.** All living things reproduce. In **sexual reproduction**, cells from two parents unite to form the first cell of a new organism. In **asexual reproduction**, a single organism produces offspring identical to itself. Organisms grow and develop as they mature.
- ▶ **Homeostasis.** Living things maintain a relatively stable internal environment.
- ▶ **Evolution.** Taken as a group, living things evolve, linked to a common origin.
- ▶ **Structure and function.** Each major group of organisms has evolved structures that make particular functions possible.
- ▶ **Unity and diversity of life.** All living things are fundamentally similar at the molecular level.
- ▶ **Interdependence in nature.** All forms of life on Earth are connected into a **biosphere**—a living planet.
- ▶ **Science as a way of knowing.** Science is not a list of facts but “a way of knowing.”

**Fields of Biology** Biology includes many overlapping fields that use different tools to study life. These include biotechnology, global ecology, and molecular biology.

**Performing Biological Investigations** Most scientists use the metric system as a way to share quantitative data. They are trained in safe laboratory procedures. To remain safe when you are doing investigations, the most important rule is to follow your teacher’s instructions.

## Characteristics of Living Things

1. Complete the graphic organizer to show the characteristics living things share.



- The genetic molecule common to all living things is DNA.
- The internal process of homeostasis enables living things to survive changing conditions.
- Living things are capable of responding to different types of stimuli.
- Living things have a long history of evolutionary change.  
asexual
- The continuation of life depends on both reproduction and sexual reproduction.
- The combination of chemical reactions that make up an organism's metabolism help to organize raw materials into living matter.

## Big Ideas in Biology

8. Complete the table of Big Ideas in Biology. The first row is filled in for you.

Big Idea	Description
Cellular basis of life	Living things are made of cells.
Information and heredity	<i>Living things are based on a universal genetic code written in a molecule called DNA.</i>
<b>Matter and energy</b>	Life requires matter that provides raw materials, nutrients, and energy.
Growth, development, and reproduction	<i>All living things reproduce. In sexual reproduction, cells from two parents unite to form the first cell of a new organism. In asexual reproduction, a single organism produces offspring identical to itself.</i>
<b>Homeostasis</b>	Living things maintain a relatively stable internal environment.
Evolution	<i>Taken as a group, living things evolve. Evolutionary change links all forms of life to a common origin more than 3.5 billion years ago.</i>
<b>Structure and function</b>	Each major group of organisms has evolved structures that make particular functions possible.
<b>Unity and diversity of life</b>	All living things are fundamentally similar at the molecular level.
<b>Interdependence in nature</b>	All forms of life on Earth are connected into a biosphere—a living planet.
Science as a way of knowing	<i>Science is not a list of facts, but “a way of knowing.” Scientists use observations, questions, and experiments to explain the natural world.</i>

9. Pick two of the big ideas from the chart and describe how the ideas interlock.

*Examples could show how the cellular basis of life links to a shared genetic code or growth, development, and reproduction; how homeostasis links to structure and function; how unity and diversity of life links to evolution.*

## Fields of Biology

10. Biology is made up of many overlapping fields, each of which uses different tools to gather information about living things. Fill out the table below with information about two fields of biology—one that appeals to you, and one that does not. Include a description of each field and the tools scientists in the field use, as well as your impressions of each.

Field of Biology	Description of Field	Why It Does or Does Not Appeal to Me
	<i>Answers will vary.</i>	

## Performing Biological Investigations

11. Describe the system of measurement most scientists use when collecting data and doing experiments.

*Most scientists use the metric system, which is a decimal system of measurement with units based on certain physical standards and scaled to multiples of 10.*

12. Why do scientists need a common system of measurement?

*Researchers need to replicate one another's experiments, and most experiments involve measurements.*

13. What is the most important safety rule for you to follow in the laboratory?

*Always follow your teacher's instructions.*

### Apply the Big idea

14. Your teacher is doing a long-term experiment by having you and your classmates grow plants at home. You are testing the hypothesis that plant growth is affected by the amount of water a plant receives. All the data will be compiled in three weeks. Why isn't it a good idea to use the 8-ounce measuring cup from your kitchen or the 12-inch ruler you have on your desk?

*It's important that all students use the same system of measurement so results can be compared. If someone uses liquid ounces and inches, they will need to convert these to the metric system, which may introduce errors. Also, the measurement may be less precise since those measures use fractions and not decimals for partial units.*

## Chapter Vocabulary Review

For Questions 1–8, complete each statement by writing the correct word.

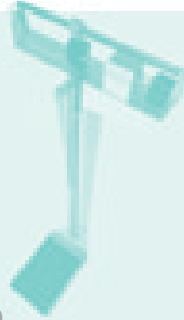
- The act of noticing and describing events or processes in a careful, orderly way is called observation.
- The information gathered during an experiment is called data.
- A(n) inference is a logical interpretation based on what scientists already know.
- A(n) hypothesis is a scientific explanation for a set of observations that can be tested in ways that support or reject it.
- A(n) theory is a well-tested explanation that unifies a broad range of observations and hypotheses.
- In asexual reproduction, the new organism has a single parent.
- A(n) stimulus is a signal to which an organism responds.
- Science is an organized way of gathering and analyzing evidence about the natural world.

For Questions 9–17, write the letter of the definition that best matches each term on the line provided.

Term	Definition
<u>B</u> 9. biology	A. in an experiment, the group exposed to the same conditions as the experimental group except for one independent variable
<u>E</u> 10. bias	B. the study of life
<u>C</u> 11. homeostasis	C. living things maintaining a relatively stable internal environment
<u>G</u> 12. metabolism	D. a molecule containing the universal genetic code
<u>D</u> 13. DNA	E. a point of view that is personal rather than scientific
<u>A</u> 14. control group	F. a living planet
<u>H</u> 15. independent variable	G. the combination of chemical reactions through which an organism builds up or breaks down materials
<u>I</u> 16. dependent variable	H. in an experiment, the variable that is manipulated
<u>F</u> 17. biosphere	I. in an experiment, the responding variable

## CHAPTER MYSTERY

### HEIGHT BY PRESCRIPTION



In the Chapter Mystery, you read about parents who had their healthy son injected with HGH hormones in the hope the treatment would increase his height. You also read that there is no evidence that treatment will make a child grow taller.

21st Century Learning

## Should Pharmaceuticals Be Advertised on Television?

Today, medical consumers often make the final decision about their or their child's treatment. It was not always like that. Not that long ago, patients were far more accepting of treatments prescribed by their doctor. They listened to the doctor's advice and did not demand a particular treatment. Why have the roles of doctor and patient changed today? One reason has to do with pharmaceutical advertising on television and in magazines. Drug ads are aimed at consumers, not doctors. Is it a good idea to advertise prescription drugs on television? Two viewpoints are presented below.

### Want some fries with that?

By: *The Opinionator*

I was watching TV last night, and I counted 14 ads for drugs. That's right, 14! I think things have gotten a bit out of hand. I mean, I'm all in favor of informed consumers, but I think this goes far beyond that.

I did some research this morning. Turns out that of all the people who go to their doctor and say, "Please write me a prescription for Drug X," 80% of them get it! Apparently, the doctor is just following the patients' orders.

Here's the thing. All drugs, all medicines, can be dangerous under certain circumstances. Doctors know if a patient should be taking a particular drug or not, and how much the patient should take. Doctors, not patients, should be making the decisions about medical treatments and what drug a patient should take.

### Responses to "Want some fries with that?"

Posted at 9:17 by Dragonfly

Believe it or not, this humble blogger still reads newspapers. I read an OpEd piece in the paper this morning that was all about how dangerous TV ads for drugs are. Here's a [link](#) to it. I couldn't find one point in the OpEd that I agreed with. What's wrong with letting people know what's out there? Nothing. Doctors are still the gatekeepers. They still have to write the prescription. If a drug is dangerous for people who have kidney problems, and you have kidney problems, your doctor won't write the prescription. But you probably wouldn't ask for it because you heard that little voice at the end of the ad say, "Do not take Drug X if you have kidney problems." Doctors can't possibly keep up with all the medical journals and stuff they get. TV advertising lets doctors know about new medications, too. So when it comes to drug ads, I say bring 'em on.

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## 21st Century Themes Science and Civic Literacy

Answer the following questions.

1. What is the main point made by the first blogger?

*Doctors, not patients, should be making the decisions about medical treatments.*

2. How does the second blogger address the first blogger's point of view?

*The second blogger says that doctors do make the decisions because they decide whether or not to write the prescription.*

3. What argument does second blogger use to support his or her viewpoint?

*TV ads let both patients and doctors know about possible treatments.*

4. Which blogger do you agree with? Give reasons for your answer.

*SAMPLE ANSWER: I agree with the first blogger because sometimes patients are so demanding that the doctor feels too pressured and just writes the prescription.*

*SAMPLE ANSWER: I agree with the second blogger because I think people have the right to know about all treatments available to them.*

5. More than 200 medical school teachers, as well as 39 medical and senior citizens' groups, have supported an end to all medical advertising aimed at consumers. They want to ban these ads on television, on the radio, in newspapers and magazines, and online. Does this change the opinion you expressed in the previous answer? Why or why not?

*Students who agreed with the first blogger may say that the new information reinforces their opinion. Some students who agreed with the second blogger may say the new information caused them to change their minds because the instructors and groups are experts.*

## 21st Century Skills Evaluating Sources of Information

The skills used in this activity include **social responsibility, critical thinking and systems thinking, information and media literacy, and communication skills.**

Use Internet resources to find additional arguments in favor of and against advertising pharmaceuticals to consumers. "DTCA" (which stands for "direct to consumer advertising") might be a helpful keyword to use in your search. Make two lists, one containing arguments that support DTCA for drugs and one containing reasons for opposing drug DTCA. Then, for each source, evaluate the accuracy of the Web site and the usefulness of the information. HINT: Sites with URLs that end in ".gov" or ".edu" are usually fairly reliable. Sites put up by organizations or individuals who have a financial interest in the issue may be biased.

*Evaluate students' work based on their having an adequate number of arguments for both points of view, they used reliable online sources for each argument, and their blog entry clearly presents their viewpoint, with supporting arguments.*