SECTION 1

Introduction to Body Systems

Imagine jumping into a lake. At first, your body feels very cold. You may even shiver. But eventually you get used to the cold water. How does this happen?

Your body gets used to cold water because it returns to *homeostasis*. **Homeostasis** (HOH mee OH STAY sis) is the maintenance of a stable internal environment in the body. When you jump into a cold lake, homeostasis helps your body stay warm.

READING WARM-UP

Objectives

- Describe homeostasis and what happens when it is disrupted.
- Describe how tissues, organs, and organ systems are related.
- List 12 organ systems.
- Identify how organ systems work together to maintain homeostasis.

Terms to Learn

homeostasis
tissue
organ

READING STRATEGY

Reading Organizer As you read this section, make a concept map by using the terms above.

homeostasis the maintenance of a constant internal state in a changing environment

Staying in Balance

The environment around you is always changing. Your body has to adjust to these conditions. For example, generally, on a hot day, your body is able to react to maintain your body temperature and avoid overheating. As shown in **Figure 1**, all living organisms have to maintain homeostasis.

Maintaining homeostasis is not easy. Your body needs nutrients and oxygen. Your body needs wastes removed. And your body needs to defend itself against disease. A single cell cannot do all of these jobs for the entire body. Fortunately, your body has many kinds of cells. Some cells remove wastes. Other cells carry oxygen or defend your body against disease. Together, these cells help your internal environment stay stable.

Figure 1 *These penguins have adaptations that help them maintain homeostasis in the cold environment in which they live.*

Falling Out of Balance

Sometimes, your body cannot maintain homeostasis. For example, if you don't eat the right foods, your cells may not get the nutrients they need. Maybe your body systems can't fight off a disease caused by bacteria or viruses. So, homeostasis is disrupted. What happens when homeostasis is disrupted? Cells may be damaged or may die. When this happens, you can become sick, as shown in **Figure 2.** Sometimes, people die when homeostasis is disrupted.

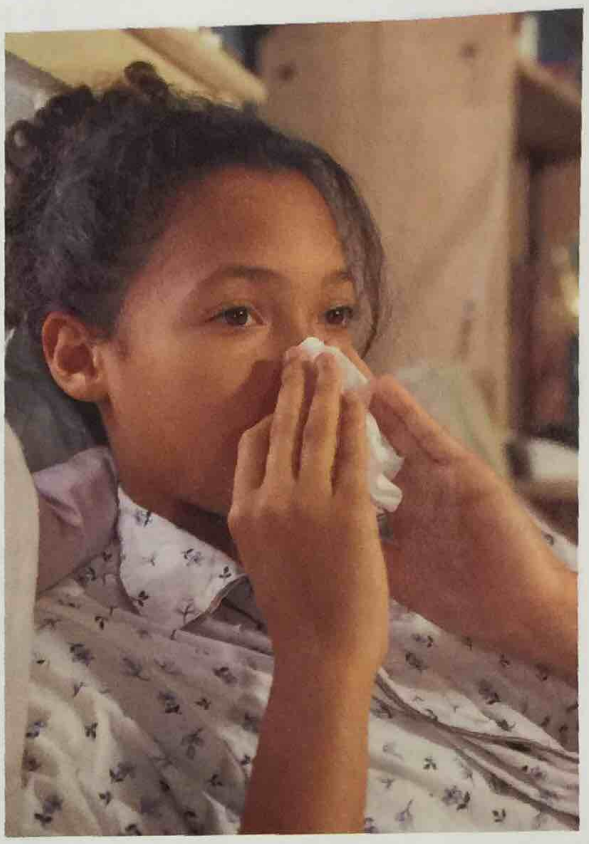


Figure 2 *When homeostasis is disrupted, a person can become sick.*

Temperature Regulation

When you are hot, your body gives off heat. You also sweat. When sweat evaporates from your skin, your body is cooled. Sweating is a process that helps your body maintain homeostasis. Sometimes, the body cannot cool down. This happens when cells do not get what they need, such as water for sweat. If the body gets too hot, cells may be damaged.

The body also has ways to keep you warm on cold days. When you are cold, you shiver, which helps you stay warm. Sometimes, the body cannot stay warm. Body temperature falls below normal in a condition called *hypothermia*.

Moving Materials

Your cells need nutrients for life processes. If nutrients are not delivered, the cells cannot complete their life processes. So, the cells will die. These life processes often make wastes, which must be removed from cells. Many wastes are toxic. If a cell cannot get rid of them, the wastes will damage the cell.

Reading Check **Explain the importance of moving materials into and out of cells.** (*See the Appendix for answers to Reading Checks.*)

CONNECTION TO Chemistry

WRITING SKILL **Adapting After Surgery** People can survive the removal of some parts of the body. For example, doctors may remove a patient's gall bladder, spleen, or large intestine because of disease or injury. However, the patient's body must make adjustments to maintain a stable internal environment. Examine how the body adjusts to the loss of a body part due to disease or injury. Identify how the body changes in order to maintain a stable internal environment. In your **science journal,** write a newspaper article about your findings.

Body Organization

As you may know, your body is made up of billions of cells. A cell is the basic unit of all living things. You have many kinds of cells. For example, you have muscle cells and nerve cells.

Cells Form Tissues

Various kinds of cells make up the parts of the body. These cells work together in much the same way that players on a soccer team do. Just as each person on a soccer team has a role during a game, each cell in your body has a job in maintaining homeostasis. For example, muscle cells are cells that can contract, or become shorter. They allow movement. Nerve cells receive and transmit electrical impulses, or messages.

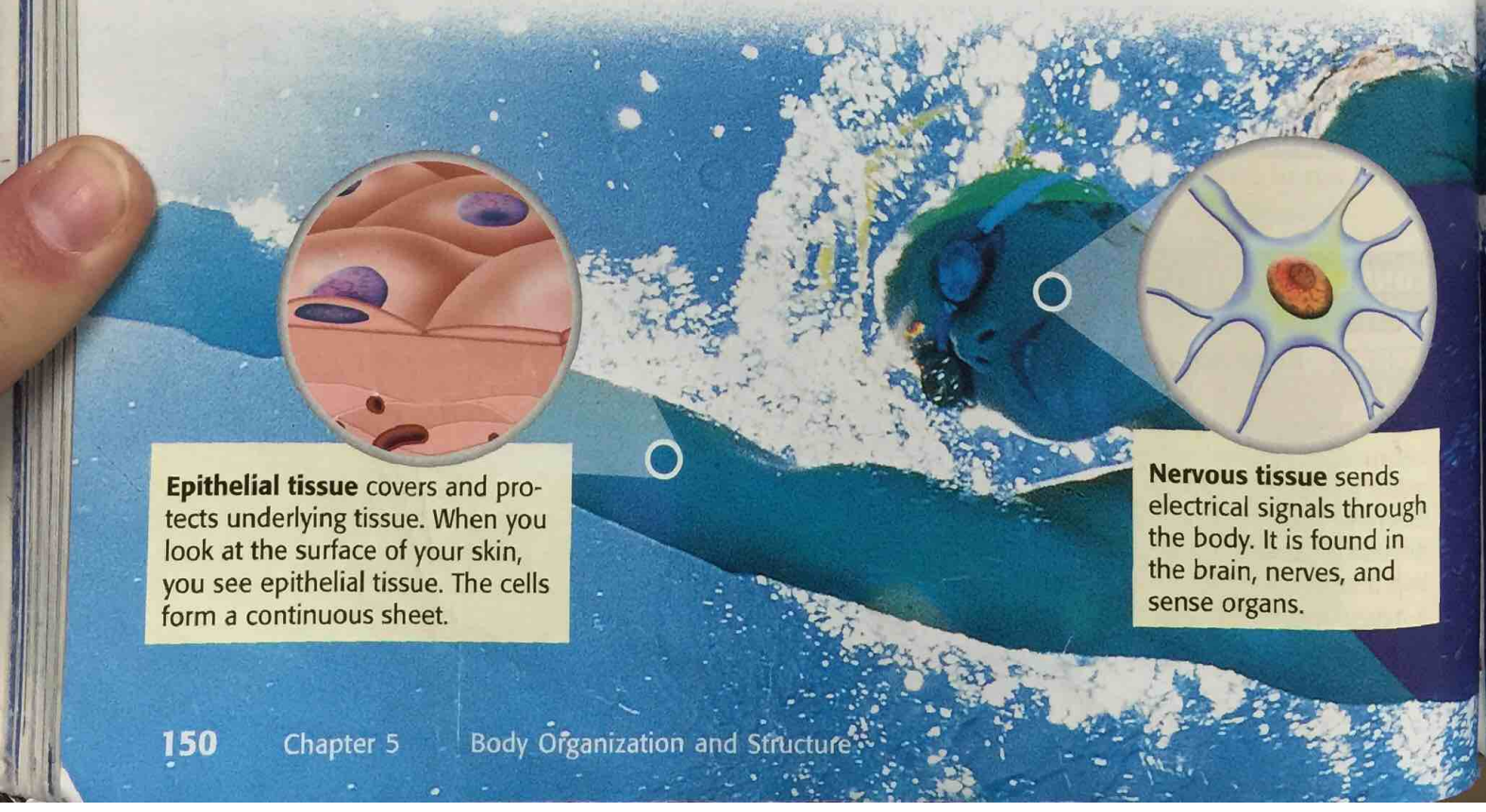
tissue a group of similar cells that perform a common function

A group of similar cells working together forms a **tissue**. Your body has four main kinds of tissue. The four kinds of tissue are shown in **Figure 3.** Each kind of tissue is made up of its own kind of cells. For example, muscle cells make up muscle tissue, and nerve cells make up nervous tissue.

Each kind of tissue may have variations based on the specific function of the tissue. For example, both bone and blood are kinds of connective tissue. However, the tissues differ. The connective tissue of bones supports the body and protects organs, so it is a solid. The connective tissue of blood moves throughout the body, so it is a liquid.

Reading Check **How are cells and tissues related?**

Figure 3 **Four Kinds of Tissue**

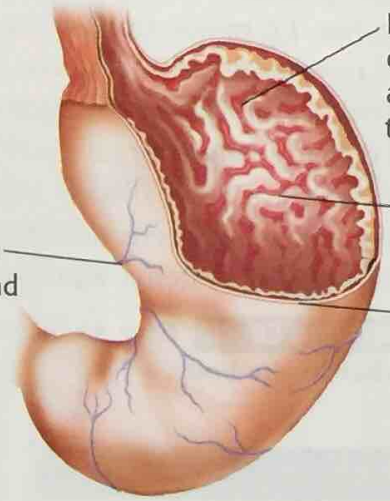


Epithelial tissue covers and protects underlying tissue. When you look at the surface of your skin, you see epithelial tissue. The cells form a continuous sheet.

Nervous tissue sends electrical signals through the body. It is found in the brain, nerves, and sense organs.

Figure 4 **Organization of the Stomach**

The stomach is an organ. The four kinds of tissue work together so that the stomach can carry out digestion.



Nervous tissue in the stomach partly controls the production of acids that aid in the digestion of food. Nervous tissue signals when the stomach is full.

Epithelial tissue lines the stomach.

Blood and another **connective tissue** called *collagen* are found in the wall of the stomach.

Layers of **muscle tissue** break up and mix stomach contents.

Tissues Form Organs

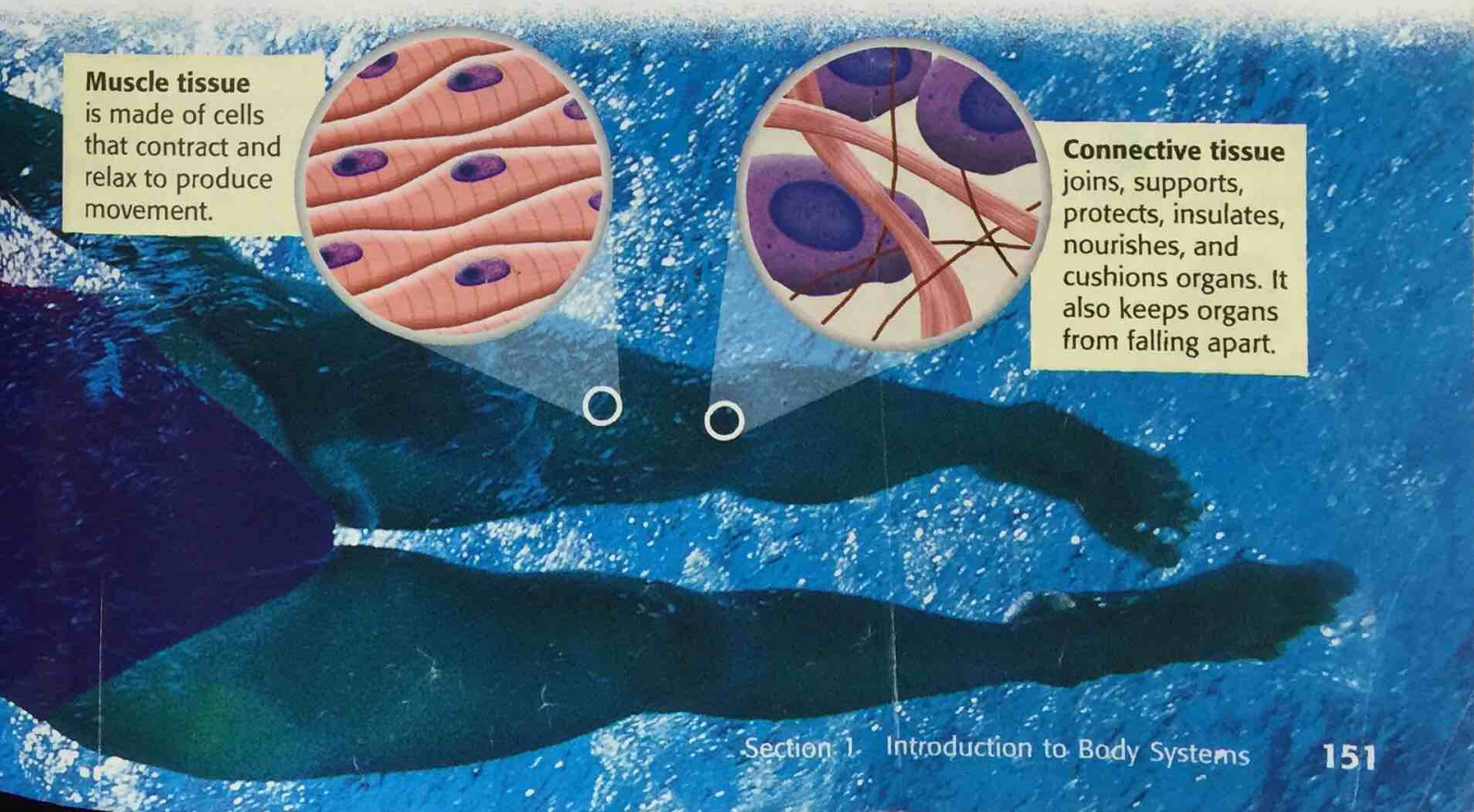
One kind of tissue alone cannot do all of the things that several kinds of tissue working together can do. Two or more tissues working together form an **organ.** Your stomach, shown in **Figure 4,** uses all four kinds of tissue to carry out digestion.

organ a collection of tissues that carry out a specialized function of the body

Organs Form Systems

Your stomach does a lot to help you digest your food. But the stomach doesn't do it all. Your stomach works with other organs, such as the small and large intestines, to digest your food. Organs that work together make up an *organ system.*

Reading Check **How is the stomach part of an organ system?**



Working Together

Organ systems work together to maintain homeostasis. Your body has 12 major organ systems, as shown in **Figure 5.** The circulatory and cardiovascular systems are shown together. The cardiovascular system includes your heart and blood vessels. Additionally, these organs are part of the circulatory system, which also includes blood. Together, these two systems deliver the materials your cells need to survive. This is just one example of how organ systems work together to keep you healthy.

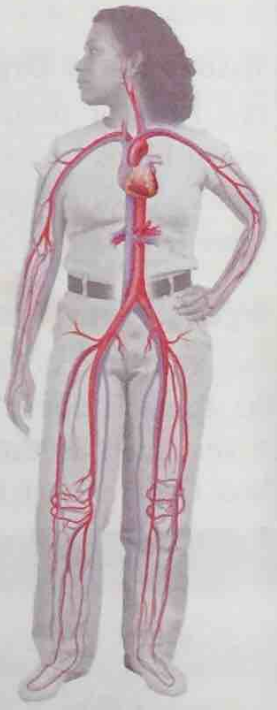
Reading Check **Give an example of how organ systems work together in the body.**

Figure 5 **Organ Systems**

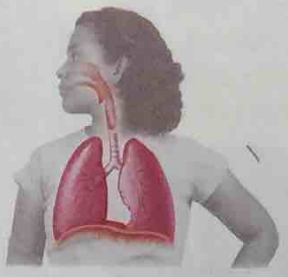
Integumentary System Your skin protects you from disease and regulates body temperature.

Muscular System Your muscular system works with the skeletal system to help you move.

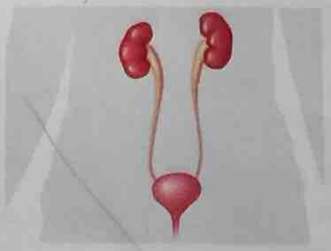
Skeletal System Your bones provide a frame to support and protect your body parts.



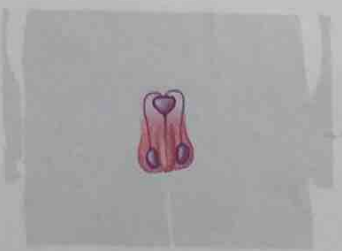
Cardiovascular and Circulatory Systems Your heart pumps blood through all of your blood vessels.



Respiratory System Your lungs absorb oxygen and release carbon dioxide.



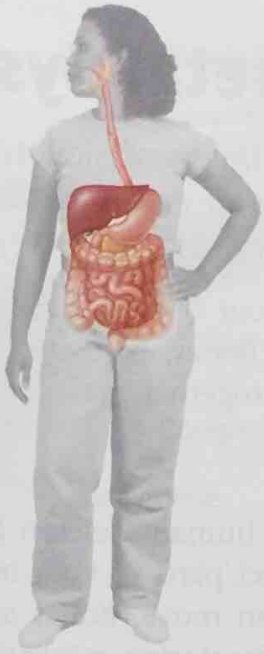
Urinary System Your urinary system removes wastes from the blood and regulates your body's fluids.



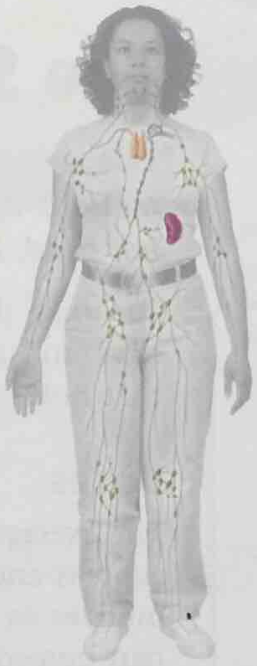
Male Reproductive System The male reproductive system produces and delivers sperm.

Female Reproductive System The female reproductive system produces eggs and nourishes and protects the fetus.

Nervous System Your nervous system receives and sends electrical messages throughout your body.



Digestive System Your digestive system breaks down the food you eat into nutrients that your body can absorb.



Lymphatic System The lymphatic system returns leaked fluids to blood vessels and helps defend against disease.

Endocrine System Your glands send out chemical messages, which control body functions.

SECTION Review

Summary

- Homeostasis is the maintenance of a stable internal environment.
- A group of cells that work together is a tissue. Tissues form organs. Organs that work together form organ systems.
- There are 12 major organ systems in the human body.
- Organ systems work together to help the body maintain homeostasis.

Using Key Terms

1. In your own words, write a definition for the term *homeostasis*.

Understanding Key Ideas

2. Which of the following statements describes how tissues, organs, and organ systems are related?
   - **a.** Organs form tissues, which form organ systems.
   - **b.** Organ systems form organs, which form tissues.
   - **c.** Tissues form organs, which form organ systems.
   - **d.** None of the above
3. List the 12 organ systems.

Math Skills

4. The human skeleton has 206 bones. The human skull has 22 bones. What percentage of human bones are skull bones?

Critical Thinking

5. **Applying Concepts** The circulatory system delivers nutrients to cells in the body. What might happen to homeostasis if this system were disrupted? Explain your answer.
6. **Predicting Consequences** Predict what might happen if the human body did not have specialized cells, tissues, organs, and organ systems to maintain homeostasis.