



PROJECT 1

Time for a Change

Surrounded by spectacular scenery, the hikers slowly climb to the top of the mountain. Hiking is good exercise—it helps keep your heart, lungs, bones, and muscles in good shape. Other healthful behaviors include eating a balanced diet and getting about eight hours of sleep each night. Behaviors such as these, if performed over and over, become good health habits.

Unfortunately, some habits can harm your health. But bad habits can be changed. One way to change a bad health habit is to replace it with a healthful behavior. For example, if you sit and watch television every day after school, try going for a bike ride with a friend instead.

Your Goal To identify a health habit you want to change, and to carry out a plan to change that habit.

To complete this project successfully, you must

- ◆ choose an unhealthy habit you want to change
- ◆ design a plan to change the unwanted habit—a plan that is realistic and has step-by-step goals
- ◆ keep a daily log to record your progress
- ◆ follow the safety guidelines in Appendix A

Get Started Preview the chapter to identify some habits that can harm your health. Choose one and identify a positive health behavior you could substitute. Begin to think about an overall goal and a realistic plan to achieve your goal.

Check Your Progress You'll be working on this project as you study this chapter. To keep your project on track, look for Check Your Progress boxes at the following points.

Section 1 Review, page 21: Choose the behavior that you want to change, and make a plan.

Section 2 Review, page 27: Keep a log of your progress.

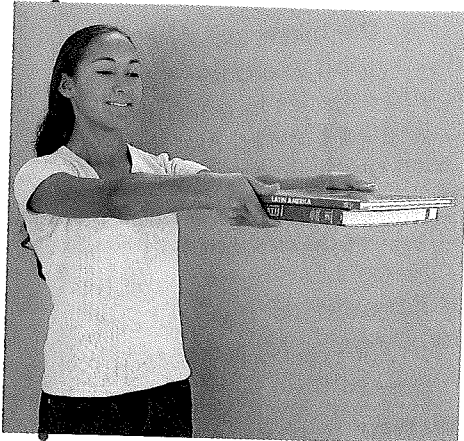
Wrap Up At the end of the chapter (page 35), you will reflect on your successes and setbacks, and identify your next steps.

Hiking is a fun activity that is good for your health.

SECTION 1

How the Body Is Organized

DISCOVER



How Do You Lift Books?

1. Stack one book on top of another one.
2. Lift the two stacked books in front of you so the lowest book is about level with your shoulders. Hold the books in this position for 30 seconds. While you are performing this activity, note how your body responds. For example, how do your arms feel at the beginning and toward the end of the 30 seconds?
3. Balance one book on the top of your head. Walk a few steps with the book on your head.

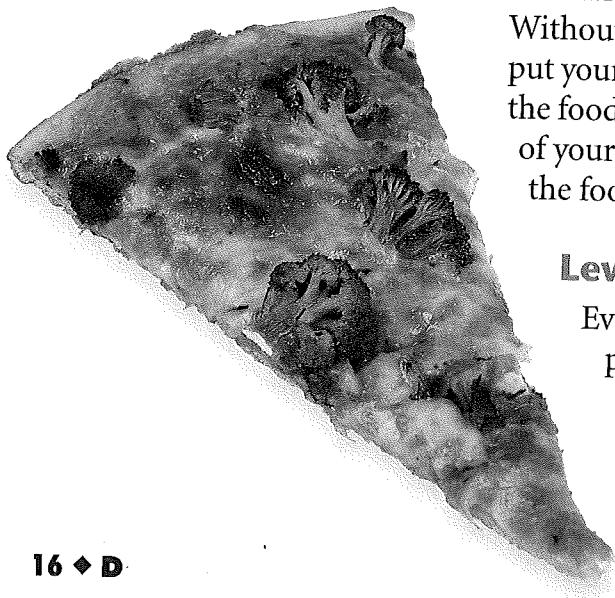
Think It Over

Inferring List all the parts of your body that worked together as you performed the activities in Steps 1 through 3.

GUIDE FOR READING

- ◆ What are the levels of organization in the body?
- ◆ What are the four basic types of tissue in the human body?

Reading Tip Before you read, preview *Exploring Levels of Organization in the Body*. Write down any unfamiliar words. Then, as you read, write their definitions.



The bell rings—lunchtime at last! You hurry down the noisy halls toward the cafeteria. The unmistakable aroma of hot pizza makes your mouth water. At last, after waiting in line, you pick up a plate with a slice of pizza and some salad. When you get to the cashier, you dig in your pocket for lunch money. Then, carefully balancing your tray, you scan the crowded cafeteria for your friends. You spot them, walk to their table, sit down, and begin to eat.

Think for a minute about how many parts of your body were involved in the simple act of getting and eating your lunch. You heard the bell with your ears and smelled the pizza with your nose. Bones and muscles worked together as you walked to the cafeteria, picked up your food, and sat down at the table. Without your brain, you couldn't have remembered where you put your lunch money. Once you began to eat, your teeth chewed the food and your throat muscles swallowed it. Then other parts of your digestive system, such as your stomach, began to process the food for your body to use.

Levels of Organization

Every minute of the day, whether you are eating, studying, playing basketball, or even sleeping, your body is busily at work. Each part of the body has a specific job to do, and all the different parts work together. This smooth functioning is due partly to the way in which the

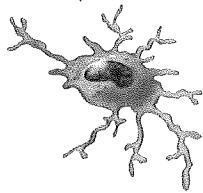
ACTIVITY

human body is organized. **The levels of organization in the human body consist of cells, tissues, organs, and organ systems.** The smallest unit is the cell, and the largest is the organ system. As you read about each level of organization, refer to *Exploring Levels of Organization in the Body*, which shows how your skeletal system is organized.

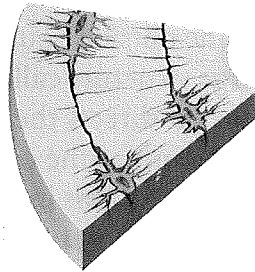
✓ **Checkpoint** What is the largest level of organization in the human body?

EXPLORING *Levels of Organization in the Body*

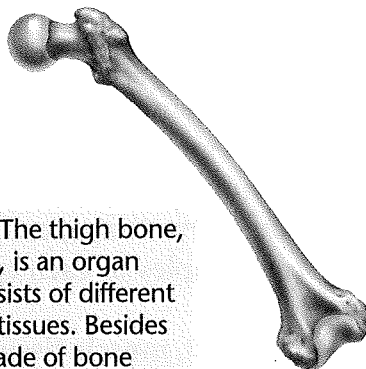
The skeletal system supports your body and gives it shape. Like all other organ systems in your body, it consists of organs made up of tissues and tissues made up of cells.



- ① **Cell** Bone cells are responsible for bone growth and repair. Each bone cell has thin extensions that project into the nonliving material around it, which the cells produce.



- ② **Tissue** Bone tissue consists of living cells that are widely separated from one another by hard, nonliving material. This hard material gives bones their strength.



- ③ **Organ** The thigh bone, or femur, is an organ that consists of different kinds of tissues. Besides tissue made of bone cells, a bone contains blood and nerve tissue.

- ④ **Organ System** The skeletal system is made up of over 200 bones. In addition, it includes cartilage, the tough tissue that gives shape to your nose and ears. The ligaments that hold bones together are also part of the skeletal system.

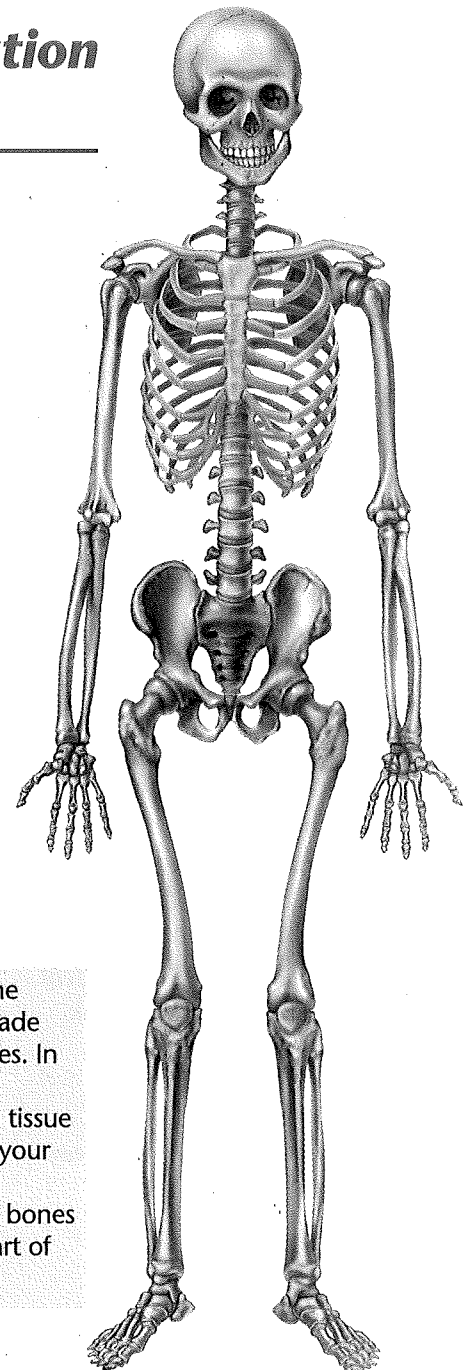
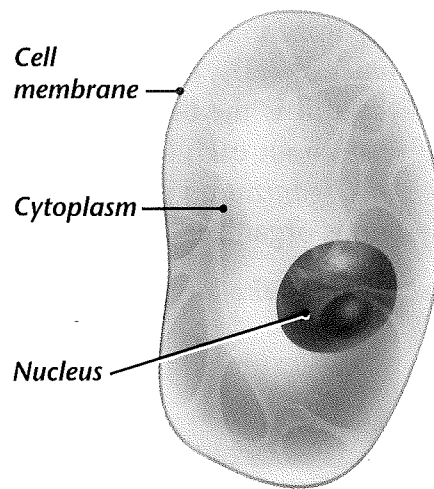


Figure 1 The cells in your body are surrounded by a cell membrane, and most have a nucleus. The cytoplasm is the area between the cell membrane and the nucleus.



TRY THIS

How Is a Book Organized?

ACTIVITY

In this activity, you will analyze the levels of organization in a book.

1. Examine this textbook to see how it is subdivided—into chapters, sections, and so on.
2. Make a concept map that shows this pattern of organization. Place the largest subdivision at the top of the map and the smallest at the bottom.
3. Compare the levels of organization in this book to those in the human body.

Making Models Which level of organization in the book represents cells? Which represent tissues, organs, and organ systems?

Cells

A **cell** is the basic unit of structure and function in a living thing. Complex organisms are composed of many cells in the same way a building is composed of many bricks. The human body contains about 100 trillion cells. Cells are quite tiny, and most cannot be seen without a microscope.

Most animal cells, including those in the human body, have a structure similar to the cell in Figure 1. The **cell membrane** forms the outside boundary of the cell. Inside the cell membrane is a large structure called the **nucleus**. The nucleus is the control center that directs the cell's activities and contains information that determines the cell's characteristics. When the cell divides, or reproduces, this information is passed onto the newly formed cells. The area between the cell membrane and the nucleus is called the **cytoplasm**. The cytoplasm contains a clear, jellylike substance in which many important cell structures are found.

Cells carry on the processes that keep organisms alive. Inside cells, for example, molecules from digested food undergo chemical reactions that provide energy for the body's activities.

Checkpoint What is the function of the nucleus?

Tissues

The cell is the smallest unit of organization in your body; the next level is a tissue. A **tissue** is a group of similar cells that perform the same function. **The human body contains four basic types of tissue: muscle tissue, nerve tissue, connective tissue, and epithelial tissue.** To see examples of each of these tissues, look at Figure 2.

Like the muscle cells that form it, **muscle tissue** can contract, or shorten. By doing this, muscle tissue makes parts of your body move. When you turn the pages of this book or focus your eyes on this page, you are using muscle tissue.

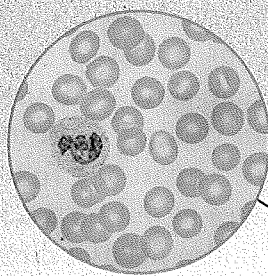
While muscle tissue carries out movement, nerve tissue directs and controls it. **Nerve tissue** carries messages back and forth between the brain and every other part of the body. Your brain is made up mostly of nerve tissue.

Connective tissue provides support for your body and connects all its parts. Bone is one kind of connective tissue; its strength and hardness support your body and protect its delicate structures. Fat, which pads parts of your body, provides insulation from cold, and stores energy, is also a connective tissue. So is blood, which travels to all parts of your body.

Epithelial tissue (ep uh THEE lee ul) covers the surfaces of your body, inside and out. Some epithelial tissue, such as the outermost layer of your skin, protects the delicate structures that lie

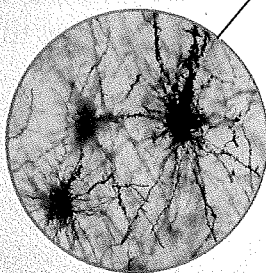
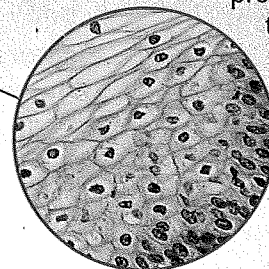
Connective tissue

Parts of the body are connected and supported by connective tissue, such as the blood cells shown here. Blood carries substances throughout your body. Fat, cartilage, bones, and the tendons that attach muscles to bones are all connective tissues.



Epithelial tissue

Epithelial tissue covers the surfaces of your body and the outside of your internal organs. This tissue also lines the inside of organs such as the small intestine. The skin cells shown here form a protective barrier against the environment outside the body.



Nerve tissue

Nerve tissue, such as the brain cells shown here, enables you to see, hear, and think. Your brain, spinal cord, and nerves consist of nerve tissue.

Muscle tissue

Every movement you make depends on muscle tissue. One kind of muscle tissue allows the body to move—as when a skater glides across the ice. Other kinds of muscle tissue move blood through the heart and move food through the digestive system.

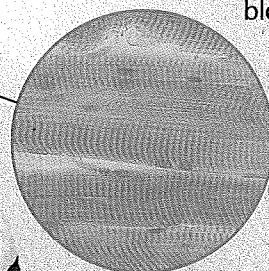


Figure 2 Your body contains four different kinds of tissues. An example of each kind is shown here.
Comparing and Contrasting How is the function of nerve tissue different from that of epithelial tissue?

beneath it. Other kinds of epithelial tissue absorb or release substances. The lining of your digestive system consists of epithelial tissue. Some of the cells in this tissue release chemicals used in digestion, while others absorb digested food.

Organs and Organ Systems

Your stomach, heart, brain, and lungs are all organs. An **organ** is a structure that is composed of different kinds of tissue. Like a tissue, an organ performs a specific job. The job of an organ, however, is generally more complex than that of a tissue. The heart, for example, pumps blood throughout your body, over and over again. The heart contains all four kinds of tissue—muscle, nerve, connective, and epithelial. Each tissue type contributes to the overall job of pumping blood.

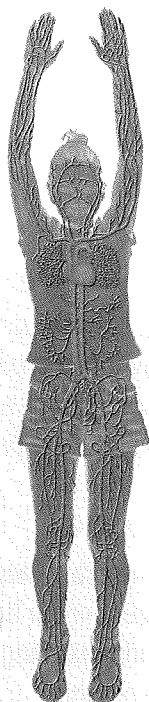
Each organ in your body is part of an **organ system**, a group of organs that work together to perform a major function. Your heart is part of your circulatory system, which carries oxygen and other materials throughout the body. Besides the heart, blood vessels are organs in the circulatory system. Figure 4 describes the major organ systems in the human body.

The different organ systems work together and depend on one another. You can compare the functioning of the human body to the work it takes to put on a school play. A play needs actors, of course, but it also needs a director, someone to make the costumes, and people to sell tickets. Similarly, when you ride a bike, you use your muscular and skeletal systems to steer and push the pedals. But you also need your nervous system to direct your arms and legs to move. Your respiratory, digestive, and circulatory systems work together to fuel your muscles with the energy they need. And your excretory system removes the wastes produced while your muscles are hard at work.

Figure 3 Each musician in the band contributes to the overall sound of the music. In the same way, each organ system in your body works with the other organ systems to keep you alive and healthy.



Organ Systems in the Human Body



▲ **Circulatory** Carries needed materials to the body cells; carries wastes away from body cells; helps fight disease.

Digestive Takes food into the body, breaks food down, and absorbs the digested materials.

Endocrine Controls many body processes—such as intake of sugar by cells—by means of chemicals.

Excretory Removes wastes.

Immune Fights disease.

Muscular Enables the body to move; moves food through the digestive system; keeps the heart beating.

Nervous Detects and interprets information from the environment outside the body and from within the body; controls most body functions.

Reproductive Produces sex cells that can unite with other sex cells to create offspring; controls male and female characteristics.

Respiratory Takes oxygen into the body and eliminates carbon dioxide.

Skeletal Supports the body, protects it, and works with muscles to allow movement; makes blood cells and stores some materials.

Skin Protects the body, keeps water inside the body, and helps regulate body temperature.

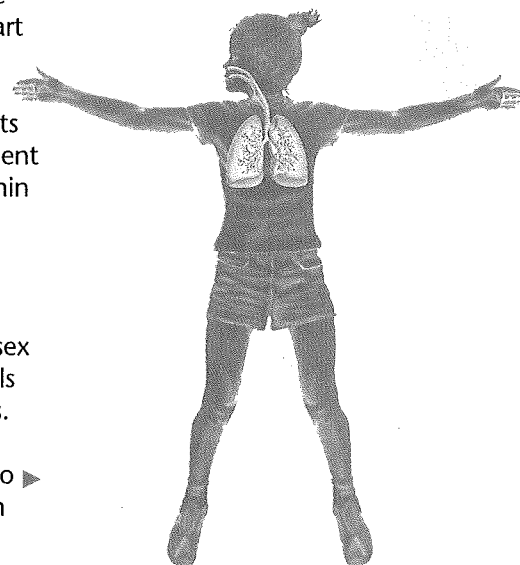


Figure 4 The human body is made up of eleven organ systems. *Interpreting Charts* Which two systems work together to get oxygen to your cells?



Section 1 Review

1. List the four levels of organization in the human body. Give an example of each level.
2. What are the four types of tissue found in the human body? What is the general function of each type?
3. Describe the structure of an animal cell.
4. **Thinking Critically Applying Concepts** What systems of the body are involved when you prepare a sandwich and then eat it?

Check Your Progress

Once you have chosen a behavior that you want to change, make a day-by-day plan. Get your teacher's approval for the plan. Then set up a log in which you will record your progress. Start now to work toward your first goal. (*Hint:* Your plan will be more successful if you set realistic intermediate goals along the way. For example, if you want to get more exercise, begin by exercising three times a week for a short period. Over time, you can gradually increase your exercise time and frequency.)

CHAPTER
PROJECT
1

A Body of Knowledge

In this lab, you will discover how much you already know about the human body.

Problem

Where are some important organs in the human body located?

Skills Focus

observing, inferring, posing questions

Materials

outline of the human body colored pencils

Procedure

1. Obtain an outline of the human body and five colored pencils. Notice that the outline shows a front view of the body, and that the right and left sides of the body are labeled.
2. Use one color to draw in the heart at the size and shape that you think it is. Draw the heart in the approximate place in the body where you think it is located. Label the heart on your drawing.
3. Select three different colors to represent the brain, lungs, and stomach. Draw each of these organs, showing its general size and shape and where you think it is located. Label each organ.

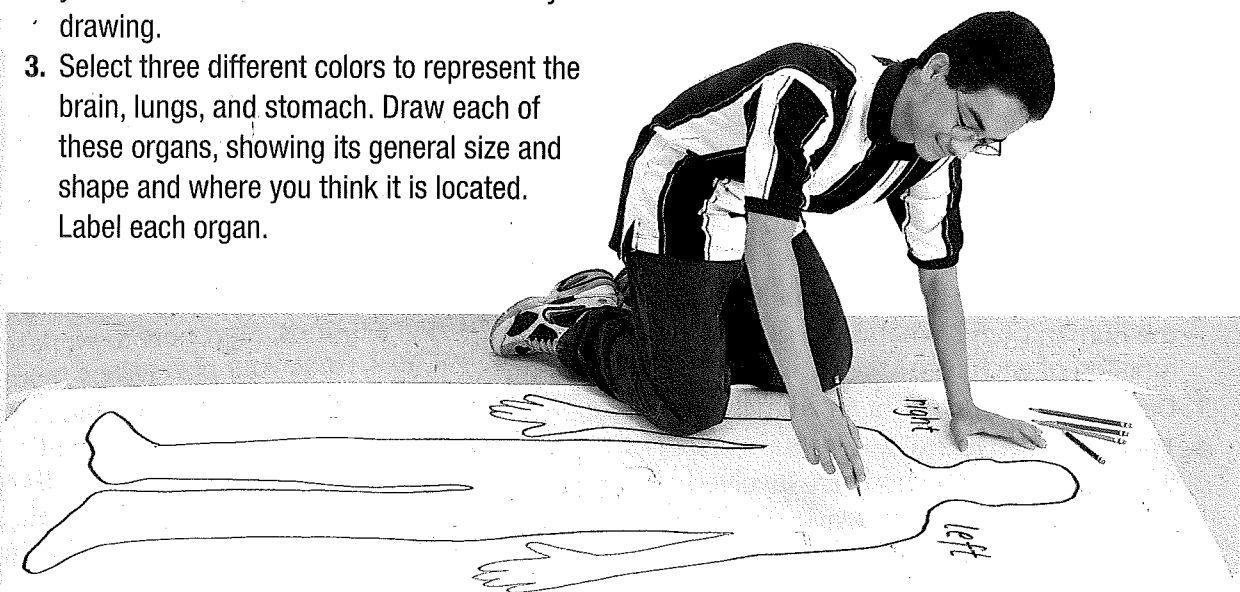
4. Choose one of the organs you just drew, and think of other organs that may be part of the same organ system. Draw those organs and label them. If the organs are part of a pathway, draw arrows to show the path.

Analyze and Conclude

1. Create a chart that lists the brain, heart, lungs, and stomach in the first column. In the second column, describe your understanding of the function of each of those organs.
2. Describe the role of the organ system you drew. How does it function in the body?
3. **Apply** For each organ in your chart, write one question you would like to have answered. Then write one question about the organ system you drew.

More to Explore

Find illustrations in this book that show the correct location of the organs you drew. Use a new body outline to make more accurate drawings of the organs and organ system.



SECTION
1**How the Body Is Organized****Key Ideas**

- ◆ The levels of organization in the human body consist of cells, tissues, organs, and organ systems.
- ◆ The cell is the basic unit of structure and function in living things. The human body contains about 100 trillion cells.
- ◆ A tissue is a group of cells that perform the same function. The human body contains four basic types of tissue—muscle, nerve, connective, and epithelial.
- ◆ Organs, which are composed of different kinds of tissue, perform complex functions. An organ system is a group of organs that work together to perform a major function.

Key Terms

cell	nerve tissue
cell membrane	connective tissue
nucleus	epithelial tissue
cytoplasm	organ
tissue	organ system
muscle tissue	

SECTION
2**Keeping the Body in Balance****Key Ideas**

- ◆ Homeostasis is the process by which an organism's internal environment is kept stable in spite of changes in the external environment.
- ◆ Stress disturbs homeostasis. When under stress, the body releases adrenaline, which causes many changes in the body. The changes prepare the body to take quick action.
- ◆ Exercise and relaxing activities can help relieve stress.

Key Terms

homeostasis	stress	adrenaline
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SECTION
3**Wellness**

INTEGRATING HEALTH

Key Ideas

- ◆ Wellness is being at the best possible level of health. The three components of wellness are physical health, mental health, and social health.
- ◆ Physical health consists of how well the body functions. Mental health consists of how you feel about yourself and how well you handle the demands of your life. Social health is how well you get along with other people.
- ◆ A person's overall level of wellness can range from very poor health to excellent health. Most people fall somewhere between those two points. Behavior can affect wellness, either by harming it or improving it.
- ◆ To make a health-related decision, you should consider both the benefits and the risks of any action.

Key Terms

wellness	social health
physical health	peer pressure
mental health	continuum

**USING THE INTERNET**

ACTIVITY

www.science-explorer.phschool.com

Reviewing Content



For more review of key concepts, see the Interactive Student Tutorial CD-ROM.

Multiple Choice

Choose the letter of the best answer.

1. A group of similar cells that perform a similar function is called a(n)
 - a. cell.
 - b. organ.
 - c. tissue.
 - d. organ system.
2. The control center of the cell is the
 - a. cell membrane.
 - b. cell fluid.
 - c. cytoplasm.
 - d. nucleus.
3. Which type of tissue is blood?
 - a. muscle tissue
 - b. epithelial tissue
 - c. connective tissue
 - d. nerve tissue
4. The term most closely associated with homeostasis is
 - a. growth.
 - b. stability.
 - c. temperature.
 - d. energy.
5. Which of the following is *not* a way to protect your social health?
 - a. getting enough sleep
 - b. making friends
 - c. respecting the rights of others
 - d. accepting help

True or False

If the statement is true, write true. If it is false, change the underlined word or words to make the statement true.

6. Epithelial tissue makes parts of your body move.
7. The circulatory system carries needed materials to the body cells.
8. The brain is an example of an organ.
9. The fight-or-flight response is part of the body's reaction to peer pressure.
10. Feeling good about yourself is one aspect of social health.

Checking Concepts

11. Explain the relationship between cells, tissues, organs, and organ systems.
12. What is the function of the respiratory system?
13. How does hunger help your body maintain homeostasis?
14. Think of a situation that might cause long-term stress. Identify some ways in which a person might deal with that stress.
15. List two possible health hazards in the environment, and explain how you might protect yourself from them.

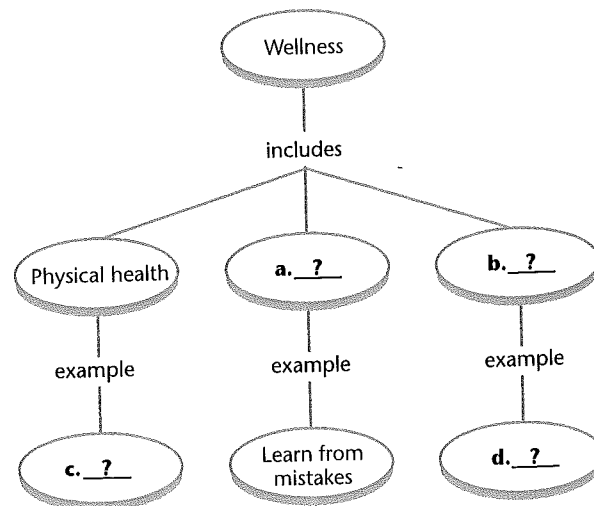
16. Writing to Learn Imagine that you write a newspaper advice column called Ask Dr. Wellness. You receive the following letter:
Dear Dr. Wellness: I am under a great deal of stress because I will soon be trying out for a major part in the school play. I want the part badly. How can I deal with this stress?

Aspiring Actor

Write an answer to this letter that gives Aspiring Actor some specific suggestions.

Thinking Visually

- 17. Concept Map** The concept map below diagrams the three components of wellness. Copy the map and complete it. (For more on concept maps, see the Skills Handbook.)



A Look Beneath the Skin

In this lab, you will learn about your own skeletal muscles by observing the “arm” muscles of a chicken.

Problem

What are some characteristics of skeletal muscles? How do skeletal muscles work?

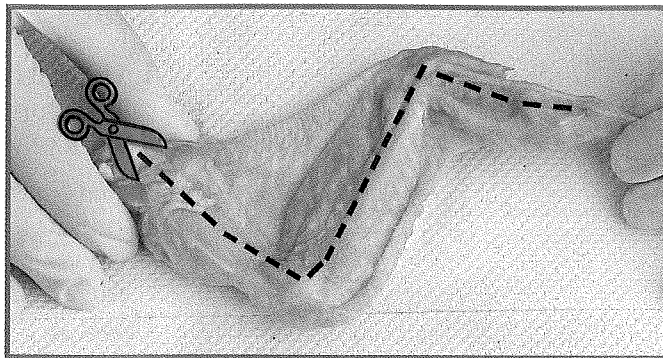
Materials

protective gloves	water
paper towels	dissection tray
scissors	uncooked chicken wing, treated with bleach

Procedure



1. Put on protective gloves. **CAUTION:** *Wear gloves whenever you handle the chicken.*
2. Your teacher will give you a chicken wing. Rinse it well with water, dry it with paper towels, and place it in a dissecting tray.
3. Carefully extend the wing to find out how many major parts it has. Draw a diagram of the external structure. Label the upper arm, elbow, lower arm, and hand (wing tip).
4. Use scissors to remove the skin. Cut along the cut line as shown in the photo. Only cut through the skin. **CAUTION:** *Cut away from your body and your classmates.*
5. Examine the muscles, the bundles of pink tissue around the bones. Find the two groups of muscles in the upper arm. Hold the arm down at the shoulder, and alternately pull on each muscle group. Observe what happens.
6. Find the two groups of muscles in the lower arm. Hold down the arm at the elbow, and alternately pull on each muscle group. Then make a diagram of the wing's muscles.



7. Find the tendons—shiny white tissue at the ends of the muscles. Notice what parts the tendons connect. Add the tendons to your diagram.
8. Remove the muscles and tendons. Find the ligaments, the whitish ribbonlike structures between bones. Add them to your diagram.
9. Dispose of the chicken parts according to your teacher's instructions. Wash your hands.

Analyze and Conclude

1. How does a chicken wing move at the elbow? How does the motion compare to how your elbow moves? What type of joint is involved?
2. What happened when you pulled on one of the arm muscles? What muscle action does the pulling represent?
3. Classify the muscles you observed as smooth, cardiac, or skeletal.
4. **Think About It** Why is it valuable to record your observations with accurate diagrams?

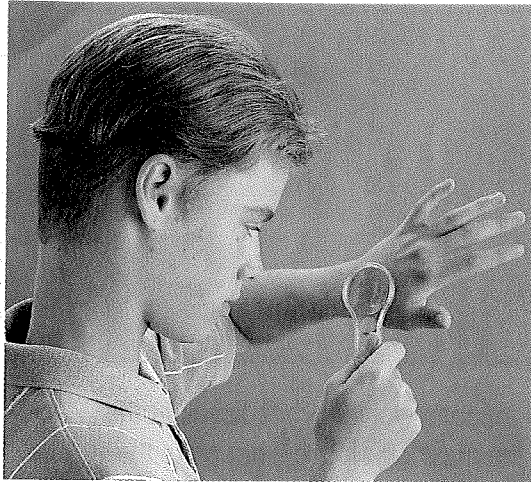
More to Explore

Use the procedures from this lab to examine an uncooked chicken thigh and leg. Compare how the chicken leg and a human leg move.

SECTION 4

The Skin

DISCOVER



What Can You Observe About Skin?

1. Using a hand lens, examine the skin on your hand. Look for pores and hairs on both the palm and back of your hand.
2. Place a plastic glove on your hand. After five minutes, remove the glove. Then examine the skin on your hand with the hand lens.

Think It Over

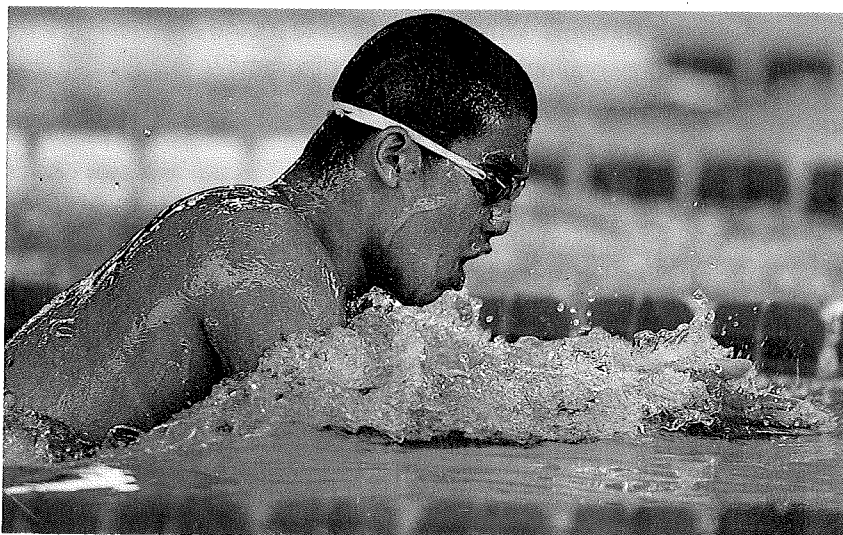
Inferring Compare your hand before and after wearing the glove. What happened to the skin when you wore the glove? Why did this happen?

GUIDE FOR READING

- ◆ What are the functions of skin?
- ◆ What habits can help keep your skin healthy?

Reading Tip As you read, create a table that shows the two major layers of skin. Include columns to record the location, structures, and functions of each layer.

Figure 13 The skin forms a barrier that protects the inside of the body from substances such as the chlorine in pool water.



Here's a question for you: What's the largest organ in the human body? If your answer is the skin, you are right! If an adult's skin were stretched out flat, it would cover an area larger than 1.5 square meters—about the size of a mattress on a twin bed. You may think of the skin as nothing more than a covering that separates the inside of the body from the outside environment. You may be surprised to learn about the many important roles that the skin plays.

The Body's Tough Covering

The skin performs several major functions in the body. **The skin covers the body and prevents the loss of water. It protects the body from injury and infection. The skin also helps to regulate body temperature, eliminate wastes, gather information about the environment, and produce vitamin D.**

The skin protects the body by forming a barrier that keeps disease-causing microorganisms and harmful substances outside the body. In addition, the skin helps keep important substances inside the body. Like plastic wrap that keeps food from drying out, the skin prevents the loss of important fluids such as water.

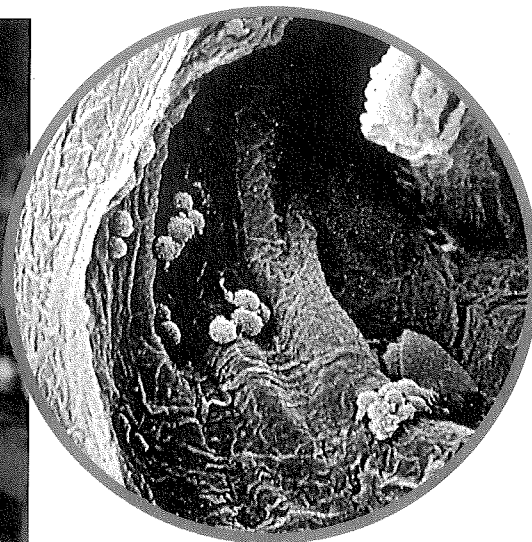


Figure 14 When you exercise, your body becomes warmer. Sweat glands in the skin produce perspiration, which leaves the body through pores like the one you see here.

Relating Cause and Effect How does perspiration help cool your body?

Another function of the skin is to help the body maintain a steady temperature. Many blood vessels run through skin. When you become too warm, these blood vessels enlarge to increase the amount of blood that flows through them. This allows heat to move from your body into the outside environment. In addition, sweat glands in the skin respond to excess heat by producing perspiration. As perspiration evaporates from your skin, heat moves into the air. Because perspiration contains some dissolved waste materials, your skin also helps to eliminate wastes.

The skin also gathers information about the environment. To understand how the skin does this, place your fingertips on the skin of your arm and press down firmly. Then lightly pinch yourself. You have just tested some of the nerves in your skin. The nerves in skin provide information about such things as pressure, pain, and temperature. Pain messages are important because they warn you that something in your surroundings may have injured you.

Lastly, some skin cells produce vitamin D in the presence of sunlight. Vitamin D is important for healthy bones. This is because Vitamin D helps the cells in your digestive system to absorb the calcium in your food. Your skin cells need only a few minutes of sunlight to produce all the vitamin D you need in a day.

Checkpoint How does your skin help eliminate waste materials from your body?

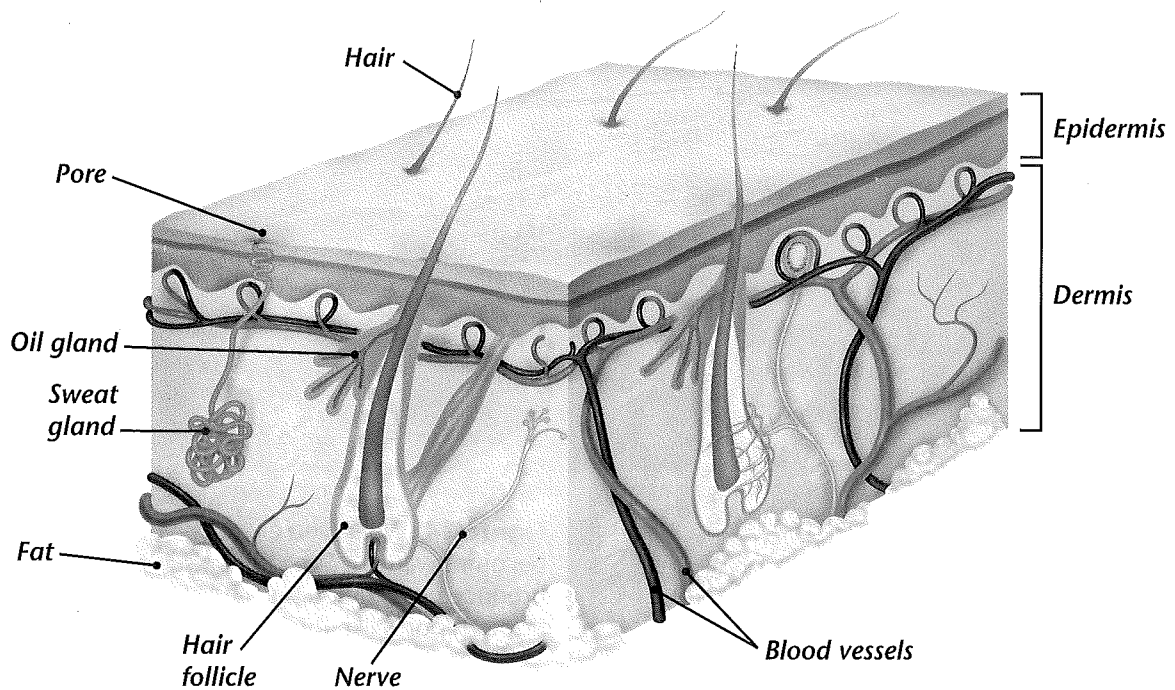


Figure 15 The skin is made of two main layers. The top layer is called the epidermis. The bottom layer is called the dermis.
Interpreting Diagrams In which layer of the skin do you find blood vessels?

The Epidermis

The skin is organized into two main layers, the epidermis and the dermis. You can see these layers in Figure 15. The **epidermis** is the outermost layer of the skin. In most places, the epidermis is thinner than the dermis. The epidermis does not have nerves or blood vessels. This is why you usually don't feel pain from very shallow scratches and why shallow scratches do not bleed.

Dead or Alive? The cells in the epidermis have a definite life cycle. Each epidermal cell begins life deep in the epidermis, where cells divide to form new cells. The new cells gradually mature and move upward in the epidermis as new cells form beneath them. After about two weeks, the cells die and become part of the surface layer of the epidermis. Under a microscope, this surface layer of dead cells resembles flat bags laid on top of each other. Cells remain in this layer for about two weeks. Then they are shed and replaced by the dead cells below.

Protecting the Body In some ways, the cells of the epidermis are more valuable to the body dead than alive. Most of the protection provided by the skin is due to the layer of dead cells on the surface. The thick layer of dead cells on your fingertips, for example, protects and cushions your fingertips. The shedding of dead cells also helps to protect the body. As the cells fall away, they carry with them bacteria and other substances that settle on the skin. Every time you rub your hands together, you lose hundreds, even thousands, of dead skin cells.

Some cells in the inner layer of the epidermis help to protect the body, too. On your fingers, for example, some cells produce hard nails, which protect the fingertips from injury and help you scratch and pick up objects.

Other cells deep in the epidermis produce **melanin**, a pigment, or colored substance, that gives skin its color. The more melanin in your skin, the darker it is. Exposure to sunlight stimulates the skin to make more melanin. Melanin production helps to protect the skin from burning.

✓ *Checkpoint* How do dead skin cells help to protect the body?

The Dermis

The **dermis** is the lower layer of the skin. Find the dermis in Figure 15. Notice that it is located below the epidermis and above a layer of fat. This fat layer pads the internal organs and helps keep heat in the body.

The dermis contains nerves and blood vessels. The dermis also contains other structures as well—sweat glands, hairs, and oil glands. Sweat glands produce perspiration, which reaches the surface through openings called **pores**. Strands of hair grow within the dermis in structures called **follicles** (FAHL ih kulz). The hair that you see above the skin's surface is made up of dead cells. Oil produced in glands around the hair follicles waterproofs the hair. In addition, oil that reaches the surface helps to keep the skin moist.

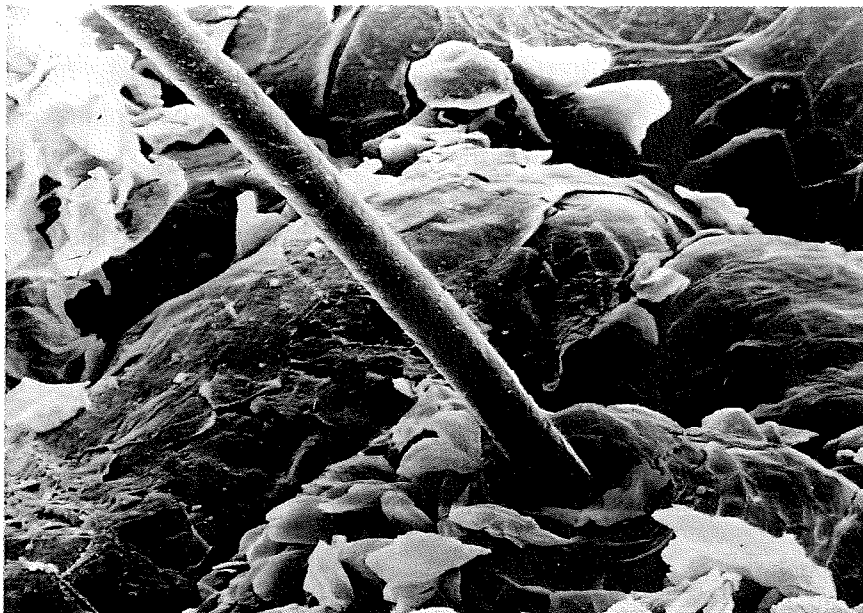


Figure 16 Hairs grow from follicles in the dermis of the skin. Hair is made of dead cells.

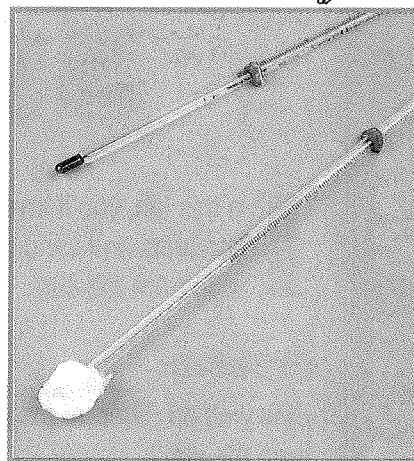
TRY THIS

Sweaty Skin

This activity illustrates one of the skin's important functions.

ACTIVITY

1. Put on your safety goggles. Wrap a wet cotton ball around the bulb of one thermometer. Place a second thermometer next to the first one.



2. After two minutes, record the temperature reading on each thermometer.
3. Using a piece of cardboard, fan both thermometers for several minutes. The cardboard should be at least 10 cm from the thermometers. Then record the temperatures.

Measuring Which of the two thermometers had a lower temperature after Step 3? How does this activity relate to the role of skin in regulating body temperature?

Caring for Your Skin

Because your skin has so many important functions, it is important to take care of it. **Four simple habits can help you keep your skin healthy. Eat properly. Drink enough water. Limit your exposure to the sun. Keep your skin clean and dry.**

Eating Properly Your skin is always active. The cells in the epidermis are replaced, hair strands and nails grow, and oil is produced. These activities require energy—and a well-balanced diet provides the energy needed for these processes. You will learn more about healthy diets in Chapter 3.

You and Your Environment

Sun Safety

In this lab, you'll investigate how sunscreen products and various fabrics protect your skin from the sun.

Problem

How well do different materials protect the skin from the sun?

Skills Focus

predicting, observing, drawing conclusions

Materials

scissors	pencil
3 different fabrics	plastic knife
photosensitive paper	metric ruler
white construction paper	stapler
resealable plastic bag	staple remover
2 sunscreens with SPF ratings of 4 and 30	

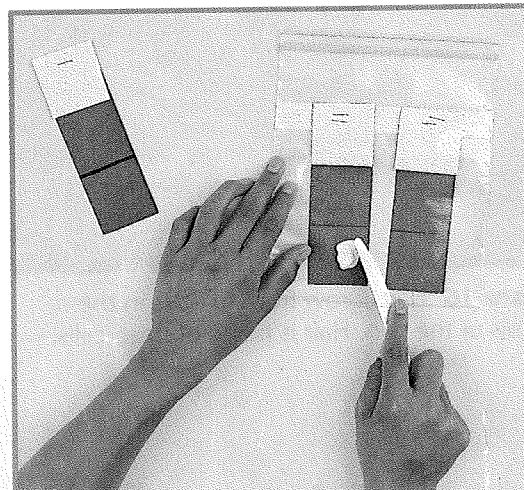
Procedure

1. Read over the procedure. Then write a prediction about how well each of the sunscreens and fabrics will protect against the sun.

2. Use scissors to cut five strips of photo-sensitive paper that measure 5 cm by 15 cm.
3. Divide each strip into thirds by drawing lines across the strips as shown in the photo.
4. Cover one third of each strip with a square of white construction paper. Staple each square down.

Part 1 Investigating Sunscreens

5. Use a pencil to write the lower SPF (sun protection factor) rating on the back of the first strip. Write the other SPF rating on the back of a second strip.
6. Place the two strips side by side in a plastic bag. Seal the bag, then staple through the white squares to hold the strips in place.



Drinking Water To keep your skin healthy, it is also important to drink plenty of water. When you participate in strenuous activities, such as playing soccer, you can perspire up to 10 liters of liquid a day. You need to replace the water lost in perspiration by drinking water or other beverages and by eating foods, such as fruits, that contain water.

Limiting Sun Exposure You can also take actions to protect your skin from cancer and early aging. **Cancer** is a disease in which some body cells divide uncontrollably. Repeated exposure to sunlight can damage skin cells and cause them to become

7. With a plastic knife, spread a thin layer of each sunscreen on the bag over the last square of each strip. Make certain each layer has the same depth. Be sure not to spread sunscreen over the middle squares.
8. Place the bag in direct sunlight with the sunscreen side up. Leave it there until the middle squares turn white.
9. Remove the strips from the bag, and take off the construction paper. Rinse the strips for one minute in cold water. Then dry them flat.
10. Observe all the squares. Record your observations.

Part 2 Investigating Fabrics

11. Obtain three fabrics of different thicknesses. Staple a square of each fabric over the last square of a photosensitive strip. Write a description of the fabric on the back of the strip.
12. Expose the strips to the sun, fabric-side up, until the middle square turns white. Then follow Steps 9 and 10.

Analyze and Conclude

1. Did the sunscreens protect against sun exposure? How do you know?
2. Which sunscreen provided more protection? Was your prediction correct?



3. Did the fabrics protect against sun exposure? How do you know?
4. Which fabric provided the most protection? The least protection? How did your results compare with your predictions?
5. **Apply** What advice would you give people about protecting their skin from the sun?

Design an Experiment

Design an experiment to find out whether ordinary window glass protects skin against sun exposure. Obtain your teacher's approval before carrying out this experiment.



Figure 17 This person is taking precautions to protect her skin from the sun.
Applying Concepts What other behaviors can provide protection from the sun?

cancerous. In addition, exposure to the sun can cause the skin to become leathery and wrinkled.

There are many things you can do to protect your skin from damage by the sun. When you are outdoors, wear a hat and sunglasses and use a sunscreen on exposed skin. The clothing you wear can also protect you. Choose clothing made of tightly woven fabrics for the greatest protection. In addition, avoid exposure to the sun between the hours of 10 A.M. and 2 P.M. That is the time when sunlight is the strongest.

Keeping Skin Clean When you wash your skin with mild soap, you get rid of dirt and harmful bacteria. Good washing habits are particularly important during the teenage years when oil glands are more active. When oil glands become clogged with oil, bacterial infections can occur.

One bacterial infection of the skin that can be difficult to control is known as **acne**. If you develop acne, your doctor may prescribe an antibiotic to help control the infection. When you wash, you help to control oiliness and keep your skin from becoming infected with more bacteria.

Other organisms, called fungi, can also live on and infect the skin. Fungi grow best in warm, moist surroundings. Athlete's foot is a very common fungal infection that occurs on the feet, especially between the toes. You can prevent athlete's foot by keeping your feet, especially the spaces between your toes, clean and dry.



Section 4 Review

1. Describe the functions of the skin.
2. List three things you can do to keep your skin healthy.
3. Describe the structure of the two layers of skin.
4. **Thinking Critically Making Judgments**
 Do you think it is possible to wash your skin too much and damage it as a result? Why or why not?

Science at Home

With a family member, look for products in your home that provide protection from the sun. You may also want to visit a store that sells these products. Make a list of the products and place them in categories such as sunblocks, clothing, eye protectors, and other products. Explain to your family member why it is important to use such products.

Reviewing Content



For more review of key concepts, see the Interactive Student Tutorial CD-ROM.

Multiple Choice

Choose the letter of the best answer.

1. Blood cells are produced in
 - a. compact bone.
 - b. marrow.
 - c. cartilage.
 - d. ligaments.
2. Joints that allow only forward or backward movement are
 - a. pivot joints.
 - b. ball and socket joints.
 - c. hinge joints.
 - d. gliding joints.
3. An injury in which the ligaments are overstretched and tear is called
 - a. a fracture.
 - b. a sprain.
 - c. a dislocation.
 - d. tendinitis.
4. Muscles that help the skeleton move are
 - a. cardiac muscles.
 - b. smooth muscles.
 - c. skeletal muscles.
 - d. involuntary muscles.
5. Which structures help to maintain body temperature?
 - a. oil glands
 - b. follicles
 - c. sweat glands
 - d. ligaments

True or False

If the statement is true, write true. If it is false, change the underlined word or words to make the statement true.

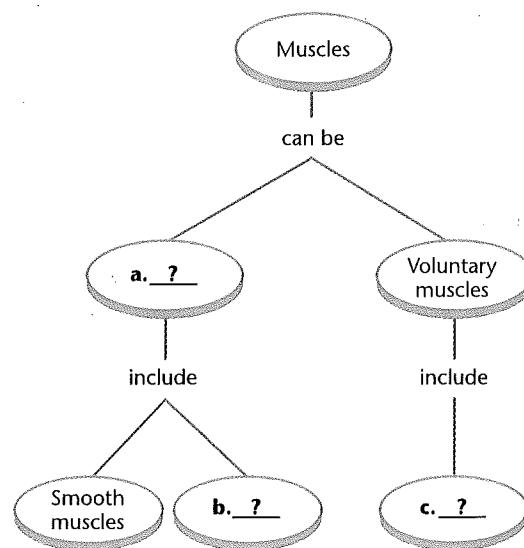
6. Spongy bone is filled with cartilage.
7. The connective tissue that connects the bones in a movable joint is called a tendon.
8. An X-ray is commonly used to diagnose soft tissue injuries.
9. Skeletal muscle is sometimes called striated muscle.
10. The epidermis contains nerve endings and blood vessels.

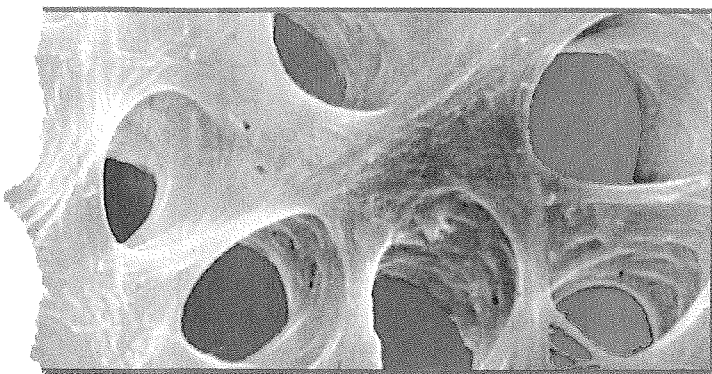
Checking Concepts

11. Describe the structure of a bone.
12. List the four kinds of movable joints. Describe how each kind of joint functions.
13. Why do X-ray images show bones but not muscles or other soft tissues?
14. How does the appearance of smooth muscle differ from that of skeletal muscle when viewed with a microscope?
15. Explain how skeletal muscles work in pairs to move a body part.
16. Why are smooth muscles called involuntary muscles?
17. Describe the life cycle of an epidermal cell.
18. Why is it important to limit your exposure to the sun?
19. **Writing to Learn** Write an article for your school newspaper about preventing skeletal and muscular injuries. The article should focus on ways in which athletes can decrease the risk of injuries during sports.

Thinking Visually

20. **Concept Map** Copy the concept map about muscles onto a separate sheet of paper. Then complete it and add a title. (For more information on concept maps, see the Skills Handbook.)





SECTION 1

The Skeletal System**Key Ideas**

- ◆ The skeleton provides shape and support, enables movement, protects internal organs, produces blood cells, and stores materials.
- ◆ Movable joints allow the body to make a wide range of motions. Movable joints include gliding joints, hinge joints, pivot joints, and ball-and-socket joints.
- ◆ A combination of a balanced diet and regular exercise helps keep bones healthy.

Key Terms

vertebra	cartilage	ligament
marrow	joint	osteoporosis

SECTION 2

Diagnosing Bone and Joint Injuries

INTEGRATING TECHNOLOGY

Key Ideas

- ◆ X-rays are used to take images of bones. The waves of energy pass through the skin and other tissues and strike the photographic film underneath the area being observed.
- ◆ In magnetic resonance imaging (MRI), magnetic energy is used to produce an image of soft tissues.
- ◆ Skeletal injuries can be prevented by warming up, wearing protective equipment, and exercising in safe places.

Key Terms

fracture	X-ray
sprain	magnetic resonance
dislocation	imaging

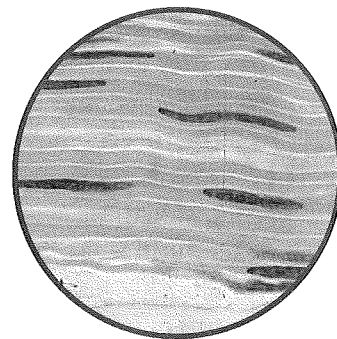
SECTION 3

The Muscular System**Key Ideas**

- ◆ Skeletal muscles are voluntary muscles that are attached to the bones of the skeleton. Smooth muscles, which are involuntary muscles, line the walls of many internal organs and blood vessels. Cardiac muscles are involuntary muscles found only in the heart.
- ◆ Because muscles can only contract and not expand, skeletal muscles work in pairs. When one muscle contracts, the other muscle in the pair returns to its original length.

Key Terms

involuntary muscle
tendon
voluntary muscle
smooth muscle
skeletal muscle
cardiac muscle



SECTION 4

The Skin**Key Ideas**

- ◆ Skin covers and protects the body from injury and infection. It also helps to regulate body temperature, get rid of wastes, gather information about the environment, and produce vitamin D.
- ◆ The epidermis is the top layer of the skin. The dermis is the lower layer of the skin.
- ◆ For healthy skin, eat a well-balanced diet and drink enough water. Also limit your exposure to the sun and keep your skin clean.

Key Terms

epidermis	pore	cancer
melanin	follicle	acne
dermis		

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ACTIVITY