Lance Armstrong has won the Tour de France several times. These victories are especially remarkable because he was diagnosed with cancer in 1996. But with medicine and hard work, he grew strong enough to win one of the toughest events in all of sports.
Too Cold for Comfort

Your nervous system sends you messages about your body. For example, if someone steps on your toe, your nervous system sends you a message. The pain you feel is a message that tells you to move your toe to safety. Try this exercise to watch your nervous system in action.

Procedure

1. Hold a few pieces of ice in one hand. Allow the melting water to drip into a dish. Hold the ice until the cold is uncomfortable. Then, release the ice into the dish.
2. Compare the hand that held the ice with your other hand. Describe the changes you see.

Analysis

1. What message did you receive from your nervous system while you held the ice?
2. How quickly did the cold hand return to normal?
3. What organ systems do you think helped restore your hand to normal?
4. Think of a time when your nervous system sent you a message, such as an uncomfortable feeling of heat, cold, or pain. How did your body react?
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?

Your body gets used to cold water because it returns to homeostasis. Homeostasis is the maintenance of a stable internal environment in the body. When you jump into a lake, homeostasis helps your body adapt to the cold water.

**Cells, Tissues, and Organs**

Maintaining homeostasis is not easy. Your internal environment is always changing. Your cells need nutrients and oxygen to survive. Your cells need wastes removed. If homeostasis is disrupted, cells may not get the materials they need. So, cells may be damaged or may die.

**Cells Form Tissues**

Your cells must do many jobs to maintain homeostasis. But, each of your cells does not have to do all of those jobs. 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. Your cells are organized into groups. 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 1*. 

---

**Homeostasis** the maintenance of a constant internal state in a changing environment

**Tissue** a group of similar cells that perform a common function

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*Figure 1* 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.
**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 2, uses all four kinds of tissue to carry out digestion.

**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?

(See the Appendix for answers to Reading Checks.)
Working Together

Your body’s 11 major organ systems, shown in Figure 3, work together to maintain homeostasis. For example, the cardiovascular system, which includes the heart, blood, and blood vessels, works with the respiratory system, which includes the lungs. The cardiovascular system picks up oxygen from the lungs and carries the oxygen to cells in the body. These cells produce carbon dioxide, which the cardiovascular system returns to the respiratory system. The respiratory system expels the carbon dioxide.

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

**Figure 3 Organ Systems**

**Integumentary System**
Your skin, hair, and nails protect the tissue that lies beneath them.

**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 System**
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.
**Summary**

- A group of cells that work together is a tissue. Tissues form organs. Organs that work together form organ systems.
- There are four kinds of tissue in the human body.
- There are 11 major organ systems in the human body.
- Organ systems work together to help the body maintain homeostasis.

**Using Key Terms**

1. Use the following terms in the same sentence: homeostasis, tissue, and organ.

**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 11 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 Tanya went to a restaurant and ate a hamburger. Describe how Tanya used five organ systems to eat and digest her hamburger.

6. Predicting Consequences Predict what might happen if the human body did not have specialized cells, tissues, organs, and organ systems to maintain homeostasis.
The Skeletal System

When you hear the word *skeleton*, you may think of the remains of something that has died. But your skeleton is not dead. It is very much alive.

You may think your bones are dry and brittle. But they are alive and active. Bones, cartilage, and the connective tissue that holds bones together make up your **skeletal system**.

**Bones**

The average adult human skeleton has 206 bones. Bones help support and protect parts of your body. They work with your muscles so you can move. Bones also help your body maintain homeostasis by storing minerals and making blood cells. **Figure 1** shows the functions of your skeleton.

**Protection** Your heart and lungs are protected by ribs, your spinal cord is protected by vertebrae, and your brain is protected by the skull.

**Storage** Bones store minerals that help your nerves and muscles function properly. Long bones store fat that can be used for energy.

**Movement** Skeletal muscles pull on bones to produce movement. Without bones, you would not be able to sit, stand, walk, or run.

**Blood Cell Formation** Some of your bones are filled with a special material that makes blood cells. This material is called *marrow*.
Bone Structure

A bone may seem lifeless. But a bone is a living organ made of several different tissues. Bone is made of connective tissue and minerals. These minerals are deposited by living cells called osteoblasts (AHS tee oh BLASTS).

If you look inside a bone, you will notice two kinds of bone tissue. If the bone tissue does not have any visible open spaces, it is called compact bone. Compact bone is rigid and dense. Tiny canals within compact bone contain small blood vessels. Bone tissue that has many open spaces is called spongy bone. Spongy bone provides most of the strength and support for a bone.

Bones contain a soft tissue called marrow. There are two types of marrow. Red marrow produces both red and white blood cells. Yellow marrow, found in the central cavity of long bones, stores fat. Figure 2 shows a cross section of a long bone, the femur.

Bone Growth

Did you know that most of your skeleton used to be soft and rubbery? Most bones start out as a flexible tissue called cartilage. When you were born, you didn’t have much true bone. But as you grew, most of the cartilage was replaced by bone. During childhood, most bones still have growth plates of cartilage. These growth plates provide a place for bones to continue to grow.

Feel the end of your nose. Or bend the top of your ear. These areas are two places where cartilage is never replaced by bone. These areas stay flexible.

Reading Check How do bones grow? (See the Appendix for answers to Reading Checks.)

Quick Lab

Pickled Bones

1. Place a clean chicken bone in a jar of vinegar.
2. After 1 week, remove the bone and rinse it with water.
3. Describe the changes that you can see or feel.
4. How has the bone’s strength changed?
5. What did the vinegar remove?
A place where two or more bones meet is called a **joint**. Your joints allow your body to move when your muscles contract. Some joints, such as fixed joints, allow little or no movement. Many of the joints in the skull are fixed joints. Other joints, such as your shoulder, allow a lot of movement. Joints can be classified based on how the bones in a joint move. For example, your shoulder is a ball-and-socket joint. Three joints are shown in **Figure 3**.

Joints are held together by *ligaments* (LIG uh muhnts). Ligaments are strong elastic bands of connective tissue. They connect the bones in a joint. Also, cartilage covers the ends of many bones. Cartilage helps cushion the area in a joint where bones meet.

**Joints**

**Gliding Joint**
Gliding joints allow bones in the hand and wrist to glide over one another and give some flexibility to the area.

**Ball-and-Socket Joint**
As a video-game joystick lets you move your character all around, the shoulder lets your arm move freely in all directions.

**Hinge Joint**
As a hinge allows a door to open and close, the knee enables you to flex and extend your lower leg.

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**Reading Check**
Describe the basic structure of joints.

---

**Connection to Environmental Science**

**Bones from the Ocean**
Sometimes, a bone or joint may become so damaged that it needs to be repaired or replaced with surgery. Often, replacement parts are made from a metal, such as titanium. However, some scientists have discovered that coral skeletons from coral reefs in the ocean can be used to replace human bone. Research bone surgery. Identify why doctors use metals such as titanium. Then, identify the advantages that coral may offer. Write a report discussing your findings.
**Skeletal System Injuries and Diseases**

Sometimes, parts of the skeletal system are injured. As shown in **Figure 4**, bones may be fractured, or broken. Joints can also be injured. A dislocated joint is a joint in which one or more bones have been moved out of place. Another joint injury, called a *sprain*, happens if a ligament is stretched too far or torn.

There are also diseases of the skeletal system. *Osteoporosis* (ohh puh ROH sis) is a disease that causes bones to become less dense. Bones become weak and break more easily. Age and poor eating habits can make it more likely for people to develop osteoporosis. Other bone diseases affect the marrow or make bones soft. A disease that affects the joints is called *arthritis* (ahr THRIET is). Arthritis is painful. Joints may swell or stiffen. As they get older, some people are more likely to have some types of arthritis.

**Figure 4**  *This X ray shows that the two bones of the forearm have been fractured, or broken.*
The Muscular System

Have you ever tried to sit still, without moving any muscles at all, for one minute? It’s impossible! Somewhere in your body, muscles are always working.

Your heart is a muscle. Muscles make you breathe. And muscles hold you upright. If all of your muscles rested at the same time, you would collapse. The **muscular system** is made up of the muscles that let you move.

**Kinds of Muscle**

*Figure 1* shows the three kinds of muscle in your body. *Smooth muscle* is found in the digestive tract and in the walls of blood vessels. *Cardiac muscle* is found only in your heart. *Skeletal muscle* is attached to your bones for movement. Skeletal muscle also helps protect your inner organs.

Muscle action can be voluntary or involuntary. Muscle action that is under your control is *voluntary*. Muscle action that is not under your control is *involuntary*. Smooth muscle and cardiac muscle are involuntary muscles. Skeletal muscles can be both voluntary and involuntary muscles. For example, you can blink your eyes anytime you want to. But your eyes will also blink automatically.

---

**What You Will Learn**

- List three kinds of muscle tissue.
- Describe how skeletal muscles move bones.
- Compare aerobic exercise with resistance exercise.
- Describe two muscular system injuries.

**Vocabulary**

muscular system

**Reading Strategy**

Discussion Read this section silently. Write down questions that you have about this section. Discuss your questions in a small group.

---

**Figure 1 Three Kinds of Muscle**

- **Skeletal muscle** enables bones to move.
- **Smooth muscle** moves food through the digestive system.
- **Cardiac muscle** pumps blood around the body.
Movement
Skeletal muscles can make hundreds of movements. You can see many of these movements by watching a dancer, a swimmer, or even someone smiling or frowning. When you want to move, signals travel from your brain to your skeletal muscle cells. The muscle cells then contract, or get shorter.

Muscles Attach to Bones
Strands of tough connective tissue connect your skeletal muscles to your bones. These strands are called tendons. When a muscle that connects two bones gets shorter, the bones are pulled closer to each other. For example, tendons attach the biceps muscle to a bone in your shoulder and to a bone in your forearm. When the biceps muscle contracts, your forearm bends toward your shoulder.

Muscles Work in Pairs
Your skeletal muscles often work in pairs. Usually, one muscle in the pair bends part of the body. The other muscle straightens part of the body. A muscle that bends part of your body is called a flexor (FLEKS uhr). A muscle that straightens part of your body is an extensor (ek STEN suhr). As shown in Figure 2, the biceps muscle of the arm is a flexor. The triceps muscle of the arm is an extensor.

✓ Reading Check Describe how muscles work in pairs. (See the Appendix for answers to Reading Checks.)

School to Home
Power in Pairs
Ask a parent or guardian to sit in a chair and place a hand palm up under the edge of a table. Tell your parent to apply gentle upward pressure. Feel the front and back of your parent’s upper arm. Next, ask your parent to push down on top of the table. Feel your parent’s arm again. What did you notice about the muscles in your parent’s arm when he or she was pressing up? pushing down?
Use It or Lose It

What happens when someone wears a cast for a broken arm? Skeletal muscles around the broken bone become smaller and weaker. The muscles weaken because they are not exercised. Exercised muscles are stronger and larger. Strong muscles can help other organs, too. For example, contracting muscles squeeze blood vessels. This action increases blood flow without needing more work from the heart.

Certain exercises can give muscles more strength and endurance. More endurance lets muscles work longer without getting tired. Two kinds of exercise can increase muscle strength and endurance. They are resistance exercise and aerobic exercise. You can see an example of each kind in Figure 3.

Resistance Exercise

Resistance exercise is a great way to strengthen skeletal muscles. During resistance exercise, people work against the resistance, or weight, of an object. Some resistance exercises, such as curl-ups, use your own weight for resistance.

Aerobic Exercise

Steady, moderately intense activity is called aerobic exercise. Jogging, cycling, skating, swimming, and walking are aerobic exercises. This kind of exercise can increase muscle strength. However, aerobic exercise mostly strengthens the heart and increases endurance.

Muscle Function

Body chemistry is very important for healthy muscle function. Spasms or cramps happen if too much sweating, poor diet, or illness causes a chemical imbalance in muscles. Identify three chemicals that the body needs for muscles to work properly. Make a poster explaining how people can make sure that they have enough of each chemical.
**Muscle Injury**

Any exercise program should be started slowly. Starting slowly means you are less likely to get hurt. You should also warm up for exercise. A *strain* is an injury in which a muscle or tendon is overstretched or torn. Strains often happen because a muscle has not been warmed up. Strains also happen when muscles are worked too hard.

People who exercise too much can hurt their tendons. The body can’t repair an injured tendon before the next exercise session. So, the tendon becomes inflamed. This condition is called *tendinitis*. Often, a long rest is needed for the injured tendon to heal.

Some people try to make their muscles stronger by taking drugs. These drugs are called *anabolic steroids* (a nuh BAH lik STER OIDZ). They can cause long-term health problems. Anabolic steroids can damage the heart, liver, and kidneys. They can also cause high blood pressure. If taken before the skeleton is mature, anabolic steroids can cause bones to stop growing.

 выбранный текст в этой картинке

**Summary**

1. The three kinds of muscle tissue are smooth muscle, cardiac muscle, and skeletal muscle.
2. Skeletal muscles work in pairs. Skeletal muscles contract to move bones.
4. Strains are injuries that affect muscles and tendons. Tendinitis affects tendons.

**Using Key Terms**

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

**Understanding Key Ideas**

2. Muscles
   - a. work in pairs.
   - b. move bones by relaxing.
   - c. get smaller when exercised.
   - d. All of the above
3. Describe three kinds of muscle.
4. List two kinds of exercise. Give an example of each.
5. Describe two muscular system injuries.

**Math Skills**

6. If Trey can do one curl-up every 2.5 s, about how long will it take him to do 35 curl-ups?

**Critical Thinking**

7. Applying Concepts  Describe some of the muscle action needed to pick up a book. Include flexors and extensors in your description.
8. Predicting Consequences  If aerobic exercise improves heart strength, what likely happens to heart rate as the heart gets stronger? Explain your answer.

**Reading Check**  What are the risks of using anabolic steroids?
The Integumentary System

What part of your body has to be partly dead to keep you alive? Here are some clues: It comes in many colors, it is the largest organ in the body, and it is showing right now!

Did you guess your skin? If you did, you guessed correctly. Your skin, hair, and nails make up your **integumentary system** (in TEG yoo MEN tuhr ee SIS tuhm). The integumentary system covers your body and helps you maintain homeostasis.

**Functions of Skin**

Why do you need skin? Here are four good reasons:

- Skin protects you by keeping water in your body and foreign particles out of your body.
- Skin keeps you in touch with the outside world. Nerve endings in your skin let you feel things around you.
- Skin helps regulate your body temperature. Small organs in the skin called **sweat glands** make sweat. Sweat is a salty liquid that flows to the surface of the skin. As sweat evaporates, the skin cools.
- Skin helps get rid of wastes. Several kinds of waste chemicals can be removed in sweat.

As shown in **Figure 1**, skin comes in many colors. Skin color is determined by a chemical called **melanin**. If a lot of melanin is present, skin is very dark. If little melanin is present, skin is very light. Melanin absorbs ultraviolet light from the sun. So, melanin reduces damage that can lead to skin cancer. However, all skin, even dark skin, is vulnerable to cancer. Skin should be protected from sunlight whenever possible.
Layers of Skin

Skin is the largest organ of your body. In fact, the skin of an adult covers an area of about 2 m²! However, there is more to skin than meets the eye. Skin has two main layers: the epidermis (ep uh DUHR mis) and the dermis. The epidermis is the outermost layer of skin. You see the epidermis when you look at your skin. The thicker layer of skin that lies beneath the epidermis is the dermis.

Epidermis

The epidermis is made of epithelial tissue. Even though the epidermis has many layers of cells, it is as thick as only two sheets of paper over most of the body. It is thicker on the palms of your hands and on the soles of your feet. Most cells in the epidermis are dead. These cells are filled with a protein called keratin. Keratin helps make the skin tough.

Dermis

The dermis lies beneath the epidermis. The dermis has many fibers made of a protein called collagen. These fibers provide strength. They also let skin bend without tearing. The dermis contains many small structures, as shown in Figure 2.
Hair and Nails

Hair and nails are important parts of the integumentary system. Like skin, hair and nails are made of living and dead cells. Figure 3 shows hair and nails.

A hair forms at the bottom of a tiny sac called a hair follicle. The hair grows as new cells are added at the hair follicle. Older cells get pushed upward. The only living cells in a hair are in the hair follicle. Like skin, hair gets its color from melanin.

Hair helps protect skin from ultraviolet light. Hair also keeps particles, such as dust and insects, out of your eyes and nose. In most mammals, hair helps regulate body temperature. A tiny muscle attached to the hair follicle contracts. If the follicle contains a hair, the hair stands up. The lifted hairs work like a sweater. They trap warm air around the body.

A nail grows from living cells in the nail root at the base of the nail. As new cells form, the nail grows longer. Nails protect the tips of your fingers and toes. So, your fingers and toes can be soft and sensitive for a keen sense of touch.

Skin Injuries

Skin is often damaged. Fortunately, your skin can repair itself, as shown in Figure 4. Some damage to skin is very serious. Damage to the genetic material in skin cells can cause skin cancer. Skin may also be affected by hormones that cause oil glands in skin to make too much oil. This oil combines with dead skin cells and bacteria to clog hair follicles. The result is acne. Proper cleansing can help but often cannot prevent this problem.
Using Key Terms

1. In your own words, write a definition for each of the following terms: integumentary system, epidermis, and dermis.

Understanding Key Ideas

2. Which of the following is NOT a function of skin?
   a. to regulate body temperature
   b. to keep water in the body
   c. to move your body
   d. to get rid of wastes

3. Describe the two layers of skin.

4. How do hair and nails develop?

5. Describe how a cut heals.

Math Skills

6. On average, hair grows 0.3 mm per day. How many millimeters does hair grow in 30 days? in a year?

Critical Thinking

7. Making Inferences Why do you feel pain when you pull on your hair or nails, but not when you cut them?

8. Analyzing Ideas The epidermis on the palms of your hands and on the soles of your feet is thicker than it is anywhere else on your body. Why might this skin need to be thicker?
**Seeing Is Believing**

Like your hair and skin, fingernails are part of your body’s integumentary system. Nails, shown in the figure below, are a modification of the outer layer of the skin. Nails grow from the nail bed and will grow continuously throughout your life. In this activity, you will measure the rate at which fingernails grow.

**Procedure**

1. Use a permanent marker to mark the center of the nail bed on your right index finger, as shown in the figure below. **Caution:** Do not get ink on your clothing.

2. Measure from the mark to the base of your nail. Record the measurement, and label the measurement “Day 1.”

3. Repeat steps 1 and 2 for your left index finger.

4. Let your fingernails grow for 2 days. Normal daily activity will not wash away the mark completely, but you may need to freshen the mark.

5. Measure the distance from the mark on your nail to the base of your nail. Record this distance, and label the measurement “Day 3.”

**OBJECTIVES**

- Measure nail growth over time.
- Draw a graph of nail growth.

**MATERIALS**

- graph paper (optional)
- metric ruler
- permanent marker

**SAFETY**
6 Continue measuring and recording the growth of your nails every other day for 2 weeks. Refresh the mark as necessary. You may continue to file or trim your nails as usual throughout the course of the lab.

7 After you have completed your measurements, use them to create a graph similar to the graph below.

### Fingernail Growth

<table>
<thead>
<tr>
<th>Day</th>
<th>Growth (mm)</th>
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<tbody>
<tr>
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<td>10</td>
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<td>11</td>
<td></td>
</tr>
</tbody>
</table>

Left index finger
Right index finger

**Draw Conclusions**

3 **Making Predictions** If one nail grew more quickly than the other nail, what might explain the difference in growth?

4 **Analyzing Graphs** Compare your graph with the graphs of your classmates. Do you notice any differences in the graphs based on gender or physical characteristics, such as height? If so, describe the difference.

**Apply Your Data**

Do additional research to find out how nails are important to you. Also, identify how nails can be used to indicate a person’s health or nutrition. Based on what you learn, describe how your nail growth indicates your health or nutrition.

**Analyze the Results**

1 **Describing Events** Did the nail on one hand grow faster than the nail on the other hand?

2 **Examining Data** Did your nails grow at a constant rate, or did your nails grow more quickly at certain times?
Complete each of the following sentences by choosing the correct term from the word bank.

homeostasis organ joint skeletal system tissue muscular system epidermis dermis integumentary system

1. A(n) ___ is a place where two or more bones meet.
2. ___ is the maintenance of a stable internal environment.
3. The outermost layer of skin is the ___.
4. The organ system that includes skin, hair, and nails is the ___.
5. A(n) ___ is made up of two or more tissues working together.
6. The ___ supports and protects the body, stores minerals, and allows movement.

Which muscle tissue can be both voluntary and involuntary?

a. smooth muscle  
b. cardiac muscle  
c. skeletal muscle  
d. All of the above

The integumentary system

a. helps regulate body temperature.  
b. helps the body move.  
c. stores minerals.  
d. None of the above

Muscles

a. work in pairs.  
b. can be voluntary or involuntary.  
c. become stronger if exercised.  
d. All of the above

How do muscles move bones?

Describe the skeletal system, and list four functions of bones.

Give an example of how organ systems work together.

List three injuries and two diseases that affect the skeletal system.
15 Compare aerobic exercise and resistance exercise.

16 What are two kinds of damage that may affect skin?

CRITICAL THINKING

17 Concept Mapping Use the following terms to create a concept map: tissues, muscle tissue, connective tissue, cells, organ systems, organs, epithelial tissue, and nervous tissue.

18 Making Comparisons Compare the shapes of the bones of the human skull with the shapes of the bones of the human leg. How do the shapes differ? Why are the shapes important?

19 Making Inferences Compare your elbows and fingertips in terms of the texture and sensitivity of the skin on these parts of your body. Why might the skin on these body parts differ?

20 Making Inferences Imagine that you are building a robot. Your robot will have a skeleton similar to a human skeleton. If the robot needs to be able to move a limb in all directions, what kind of joint would be needed? Explain your answer.

21 Analyzing Ideas Human bones are dense and are often filled with marrow. But many bones of birds are hollow. Why might birds have hollow bones?

22 Identifying Relationships Why might some muscles fail to work properly if a bone is broken?

INTERPRETING GRAPHICS

Use the cross section of skin below to answer the questions that follow.

23 What is d called? What substance is most abundant in this layer?

24 What is the name and function of a?

25 What is the name and function of b?

26 Which letter corresponds to the part of the skin that is made up of epithelial tissue that contains dead cells?

27 Which letter corresponds to the part of the skin from which hair grows? What is this part called?
Passage 1  Sometimes, doctors perform a skin graft to transfer some of a person’s healthy skin to an area where skin has been damaged. Doctors perform skin grafts because skin is often the best “bandage” for a wound. Like cloth or plastic bandages, skin protects the wound. Skin allows the wound to breathe. Unlike cloth or plastic bandages, skin can regenerate itself as it covers a wound. But sometimes a person’s skin is so severely damaged (by burns, for example) that the person doesn’t have enough skin to spare.

1. Based on the passage, what can skin do that manufactured bandages can’t do?
   A Skin can protect a wound.
   B Skin can stop more skin from being damaged.
   C Skin can regenerate itself.
   D Skin can prevent burns.

2. In the passage, what does the term skin graft most likely mean?
   F a piece of skin transplanted from one part of the body to another
   G a piece of skin made of plastic
   H a piece of damaged skin that has been removed from the body
   I burned skin

3. Based on the passage, why might a severe burn victim not receive a skin graft?
   A Manufactured bandages are better.
   B He or she doesn’t have enough healthy skin.
   C There isn’t enough damaged skin to repair.
   D Skin is the best bandage for a wound.

Passage 2  Making sure that your body maintains homeostasis is not an easy task. The task is difficult because your internal environment is always changing. Your body must do many different jobs to maintain homeostasis. Each cell in your body has a specific job in maintaining homeostasis. Your cells are organized into groups. A group of similar cells working together forms a tissue. Your body has four main kinds of tissue—epithelial tissue, connective tissue, muscle tissue, and nervous tissue. These tissues work together to form organs, which help maintain homeostasis.

1. Based on the passage, which of the following statements about tissues is true?
   A Tissues do not help maintain homeostasis.
   B Tissues form organ systems.
   C Tissues are changing because the body’s internal environment is always changing.
   D There are four kinds of tissue.

2. According to the passage, which of the following statements about homeostasis is true?
   F It is easy for the body to maintain homeostasis.
   G The body must do different jobs to maintain homeostasis.
   H Your internal environment rarely changes.
   I Organs and organ systems do not help maintain homeostasis.

3. Which of the following statements about cells is false?
   A Cells are organized into different groups.
   B Cells form tissues.
   C Cells work together.
   D Cells don’t maintain homeostasis.
The line graph below shows hair growth over time. Use the graph to answer the questions that follow.

1. How long was the hair on day 60?
   A 20.0 cm  
   B 21.0 cm  
   C 22.5 cm  
   D 23.0 cm

2. On which day was hair length 23 cm?
   F day 60  
   G day 90  
   H day 120  
   I day 150

3. From day 0 to day 150, what is the average amount that hair grows every 30 days?
   A 0.5 cm  
   B 1.2 cm  
   C 1.5 cm  
   D 2.0 cm

4. Based on the average amount of hair growth per 30-day period, how long would it take the hair to grow another 3.6 cm?
   F 30 days  
   G 60 days  
   H 90 days  
   I 120 days

5. Stephen wants to run a 10 K race. Right now, he can run 5 K. What is the percentage increase from 5 K to 10 K?
   A 50%  
   B 100%  
   C 200%  
   D 500%
Weird Science

**Engineered Skin**

Your skin is your first line of defense against the outside world. Your skin keeps you safe from dehydration and infection, helps regulate body temperature, and helps remove some wastes. But what happens if a large portion of skin is damaged? Skin may not be able to function properly. For someone who has a serious burn, a doctor often uses skin from an undamaged part of the person’s body to repair the damaged skin. But some burn victims don’t have enough undamaged skin to spare. Doctors have discovered ways to engineer skin that can be used in place of human skin.

**Math Activity**

A doctor repaired 0.35 m² of an adult patient’s skin with engineered skin. If an adult has about 2 m² of skin, what percentage of the patient’s skin was repaired?

**Science, Technology, and Society**

**Beating the Odds**

Sometimes, people are born without limbs or lose limbs in accidents. Many of these people have prostheses (prahs THEE SEEZ), or human-made replacements for the body parts. Until recently, many of these prostheses made it more difficult for many people to participate in physical activities, such as sports. But new designs have led to lighter, more comfortable prostheses that move the way that a human limb does. These new designs have allowed athletes with physical disabilities to compete at higher levels.

**Social Studies Activity**

Research the use of prostheses throughout history. Create a timeline showing major advances in prosthesis use and design.
Zahra Beheshti

Physical Therapist  A physical therapist is a licensed professional who helps people recover from injuries by using hands-on treatment instead of medicines. Dr. Zahra Beheshti is a physical therapist at the Princeton Physical Therapy Center in New Jersey. She often helps athletes who suffer from sports injuries.

After an injury, a person may go through a process called rehabilitation to regain the use of the injured body part. The most common mistake made by athletes is that they play sports before completely recovering from injuries. Dr. Beheshti explains, “Going back to their usual pre-injury routine could result in another injury.”

Dr. Beheshti also teaches patients about preventing future sports injuries. “Most injuries happen when an individual engages in strenuous activities without a proper warm-up or cool-down period.” Being a physical therapist is rewarding work. Dr. Beheshti says, “I get a lot of satisfaction when treating patients and see them regain their function and independence and return to their normal life.”

Language Arts Activity

Interview a physical therapist who works in or near your community. Write a newspaper article about your interview.

Current Science

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