

## READING WARM-UP

## Objectives

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

## Terms to Learn

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.

# 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.

You use muscles when you eat and breathe. Muscles, along with your skeleton, hold you upright and let you move. If all of your muscles rested at once, 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.

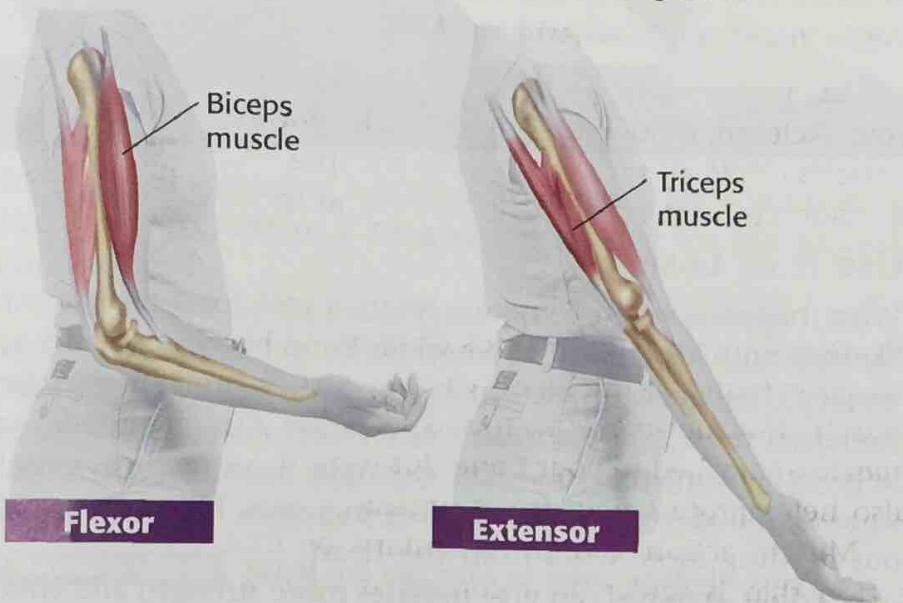
Muscle action can be voluntary or involuntary. Muscle action that is under your control is *voluntary*. Muscle action that is not under your control is *involuntary*. Smooth muscle and cardiac muscle are involuntary muscles. Skeletal muscles can be both voluntary and involuntary muscles. For example,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

**Figure 1** Three Kinds of Muscle



## Figure 2 A Pair of Muscles in the Arm

Skeletal muscles, such as the biceps and triceps muscles, work in pairs. When the biceps muscle contracts, the arm bends. When the triceps muscle contracts, the arm straightens.



### 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.)

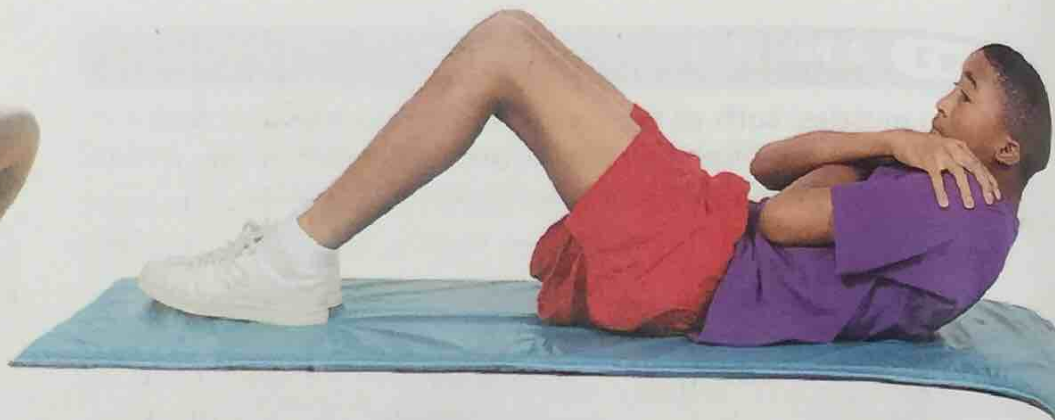
**muscular system** the organ system whose primary function is movement and flexibility

## SCHOOL to HOME

### Power in Pairs

Ask a parent 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?

## ACTIVITY



**Figure 3** This girl is strengthening her heart and improving her endurance by doing aerobic exercise. This boy is doing resistance exercise to build strong muscles.

### 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.

### CONNECTION TO Chemistry

**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 OYDZ). 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.

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

## SECTION Review

### Summary

- The three kinds of muscle tissue are smooth muscle, cardiac muscle, and skeletal muscle.
- Skeletal muscles work in pairs. Skeletal muscles contract to move bones.
- Resistance exercise improves muscle strength. Aerobic exercise improves heart strength and muscle endurance.
- 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?

## MATH PRACTICE

### Runner's Time

Jan has decided to enter a 5 km road race. She now runs 5 km in 30 min. She would like to decrease her time by 15% before the race. What will her time be when she reaches her goal?

### 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.

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Topic: Muscular System

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