Section 2

Divisions of the Nervous System

Objectives

After this lesson, students will be able to

D.6.2.1 Describe the structures and functions of the central nervous system.

D.6.2.2 Describe the structures and functions of the peripheral nervous system.

D.6.2.3 Explain what a reflex is.

D.6.2.4 Identify two ways in which the nervous system can be injured.

Target Reading Skill

Building Vocabulary Explain that knowing the definitions of key vocabulary terms helps students understand what they need.

Answers

Sample answers:

central nervous system: division of nervous system made up of brain and spinal cord

peripheral nervous system: division of nervous system made up of all nerves outside the central nervous system

brain: part of central nervous system that is located in the skull and that controls most functions in the body

Preteach

Build Background Knowledge

L2

Nervous System Responses

Ask: **What happens if you accidentally touch a hot frying pan handle?** *(You quickly move your hand.)* **Is that response automatic or do you have to think about?** *(Automatic)* Tell students that they will learn how the body controls this and other automatic responses.

Section 2

Divisions of the Nervous System

Reading Preview

Key Concepts

- What are the structures and functions of the central nervous system?
- What are the structures and functions of the peripheral nervous system?
- What is a reflex?
- What are two ways in which the nervous system can be injured?

Key Terms

- central nervous system
- peripheral nervous system
- brain • spinal cord
- cerebrum • cerebellum
- brain stem
- somatic nervous system
- autonomic nervous system
- reflex • concussion

Target Reading Skill

Building Vocabulary After you read this section, reread the paragraphs that contain definitions of Key Terms. Use all the information you have learned to write a definition of each Key Term in your own words.

Lab zone Discover Activity

How Does Your Knee React?

1. Sit on a table or counter so that your legs dangle freely. Make sure that your partner is not directly in front of your legs.
2. Have your partner use the side of his or her hand to tap one of your knees gently just below the kneecap. Observe what happens to your leg. Note whether you have any control over your reaction.
3. Change places with your partner. Repeat Steps 1 and 2.

Think It Over

Inferring When might it be an advantage for your body to react very quickly and without your conscious control?

You are standing at a busy street corner, waiting to cross the street. A traffic cop blows his whistle and waves his arms energetically. For the heavy traffic to move smoothly, there needs to be a traffic cop and responsive drivers. The traffic cop coordinates the movements of the drivers, and they maneuver the cars safely through the intersection.

Similarly, your nervous system has two divisions that work together. The **central nervous system** consists of the brain and spinal cord. The **peripheral nervous system** (puh RIF uh rul) includes all the nerves located outside of the central nervous system. The central nervous system is like a traffic cop. The peripheral nervous system is like the drivers and pedestrians.

The traffic cop keeps everybody moving.

Lab zone Discover Activity

Skills Focus Inferring

Materials none

Time 10 minutes

Tips **CAUTION:** *Make sure students do not engage in horseplay or roughhousing while carrying out the activity. Remind them that serious damage can be done if they strike one another too hard on the kneecap.*

L1

Expected Outcome Students' legs will swing forward.

Think It Over It might be an advantage in situations that could cause injury, such as touching a hot stove.

Central Nervous System

You can see the central and peripheral nervous systems in Figure 5. **The central nervous system is the control center of the body. It includes the brain and spinal cord.** All information about what is happening in the world inside or outside your body is brought to the central nervous system. The **brain,** located in the skull, is the part of the central nervous system that controls most functions in the body. The **spinal cord** is the thick column of nervous tissue that links the brain to most of the nerves in the peripheral nervous system.

Most impulses from the peripheral nervous system travel through the spinal cord to get to the brain. Your brain then directs a response. The response usually travels from the brain, through the spinal cord, and then to the peripheral nervous system.

For example, here is what happens when you reach under the sofa to find a lost quarter. Your fingers move over the floor, searching for the quarter. When your fingers finally touch the quarter, the stimulus of the touch triggers nerve impulses in sensory neurons in your fingers. These impulses travel through nerves of the peripheral nervous system to your spinal cord. Then the impulses race up to your brain. Your brain interprets the impulses, telling you that you've found the quarter. Your brain starts nerve impulses that move down the spinal cord. From the spinal cord, the impulses travel through motor neurons in your arm and hand. The impulses in the motor neurons cause your fingers to grasp the quarter.

Reading Checkpoint **What are the parts of the central nervous system?**

Go Online active art

For: Nervous System activity
Visit: PHSchool.com
Web Code: cep-4062

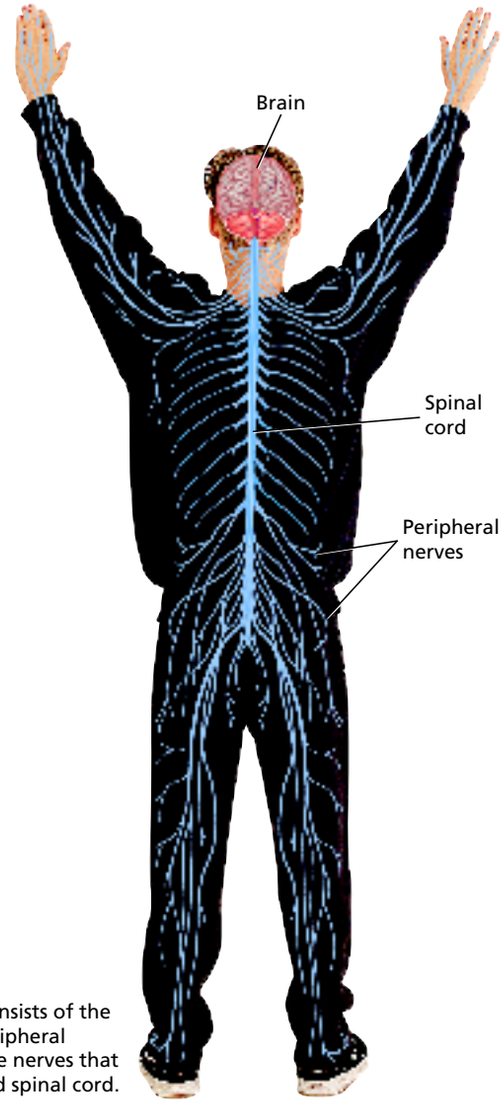


FIGURE 5
The Nervous System
The central nervous system consists of the brain and spinal cord. The peripheral nervous system includes all the nerves that branch out from the brain and spinal cord.

Differentiated Instruction

Special Needs L1

Demonstrating Nerve Pathways

Review the path of a nerve impulse using Figure 3 in the previous section. Then read the last paragraph on this page aloud. Read the paragraph again, but this time, role-play the action by reaching under a desk, for example, to retrieve a real quarter. Trace the pathways the nerve impulses would follow by running your finger along your fingers, arm, upper back, neck, and head. Give students another situation and have them demonstrate the pathway as you did. **learning modality: kinesthetic**

Instruct

Central Nervous System

Teach Key Concepts L2

Central Nervous System Function

Focus Remind students that sensory neurons transmit impulses to interneurons in the brain or spinal cord.

Teach Ask: **Why must impulses from sensory neurons be routed to the brain or spinal cord?** *(The brain and spinal cord control the functions of the body. They direct a response to be sent back to the peripheral nervous system.)* Ask students to look at Figure 5 and trace the path of the nerve impulses that begin in the hands of the figure. Ask: **What direction does the nerve impulse move?** *(From the hand to the brain)*

Apply Invite students to think of examples that illustrate an impulse originating from the body, such as hunger, and examples that illustrate an impulse originating from the environment, such as a pesky fly. Then have them describe the pathway the impulses would take in the body. **learning modality: verbal**

All in One Teaching Resources

- Transparency D51

Independent Practice L2

All in One Teaching Resources

- Guided Reading and Study Worksheet: *Divisions of the Nervous System*

Student Edition on Audio CD

Go Online active art

For: Nervous system activity
Visit: PHSchool.com
Web Code: cep-4062

Students can interact online with art of the nervous system.

Monitor Progress L2

Answer

Reading Checkpoint The spinal cord and the brain

The Brain and Spinal Cord

Teach Key Concepts L2

Functions of the Brain

Focus Remind students that the brain and spinal cord make up the central nervous system.

Teach Explain that the brain has three main regions that receive and process information. Have students locate these regions in Figure 6. Ask students to make lists in which they answer the following questions: **What are the activities controlled by the cerebrum?** *(Sample answers: Learning, creativity, speech, the senses)* **What are the functions of the cerebellum?** *(Coordinating muscle actions and helping you keep your balance)* **Which part of the brain controls involuntary actions?** *(Brain stem)*

Apply Ask: **Which part of the brain do gymnasts continually rely on as they perform? Explain your answer.** *(The cerebellum; it is responsible for the coordination of muscles and helps maintain balance, both of which are important to gymnasts.)* **learning modality: verbal**

Help Students Read L1

Identifying Main Ideas Read aloud the passage under the subheading "Cerebrum." Have students volunteer their ideas about which sentences express the main concepts. You can also approach this as a written exercise by having students circle sentences on a copy of the chosen paragraph.

The Brain and Spinal Cord

Your brain contains about 100 billion neurons, all of which are interneurons. Each of those neurons may receive messages from up to 10,000 other neurons and may send messages to about 1,000 more! Three layers of connective tissue cover the brain. The space between the middle layer and innermost layer is filled with a watery fluid. The skull, the layers of connective tissue, and the fluid all help protect the brain from injury.

There are three main regions of the brain that receive and process information. These are the cerebrum, the cerebellum, and the brain stem. Find each in Figure 6.

Cerebrum The largest part of the brain is called the cerebrum. The **cerebrum** (suh REE brum) interprets input from the senses, controls movement, and carries out complex mental processes such as learning and remembering. Because of your cerebrum, you can locate your favorite comic strip in the newspaper, read it, and laugh at its funny characters.

The cerebrum is divided into a right and a left half. The right half sends impulses to skeletal muscles on the left side of the body. In contrast, the left half controls the right side of the body. When you reach with your right hand for a pencil, the messages that tell you to do so come from the left half of the cerebrum. In addition, each half of the cerebrum controls slightly different kinds of mental activity. The right half is usually associated with creativity and artistic ability. The left half is usually associated with mathematical skills and logical thinking.

As you can see in Figure 6, certain areas of the cerebrum are associated with smell, touch, taste, hearing, and vision. Other areas control movement, speech, written language, and abstract thought.

Cerebellum and Brain Stem The second largest part of your brain is called the cerebellum. The **cerebellum** (sehr uh BEL um) coordinates the actions of your muscles and helps you keep your balance. When you walk, the impulses that tell your feet to move start in your cerebrum. However, your cerebellum gives you the muscular coordination and sense of balance that keep you from falling down.

The **brain stem,** which lies between the cerebellum and spinal cord, controls your body's involuntary actions—those that occur automatically. For example, neurons in the brain stem regulate your breathing and help control your heartbeat.

Reading Checkpoint **What actions does the brain stem control?**

Lab zone Skills Activity

Controlling Variables

Are people better able to memorize a list of words in a quiet room or in a room where soft music is playing?

1. Write a hypothesis that addresses this question.
2. Design an experiment to test your hypothesis. Make sure that all variables are controlled except the one you are testing—music versus quiet.
3. Check your procedure with your teacher. Then perform your experiment.

Did your results support your hypothesis?

Lab zone Skills Activity

Skills Focus Controlling variables L2

Materials tape player, cassette tape of soft music

Time 30 minutes

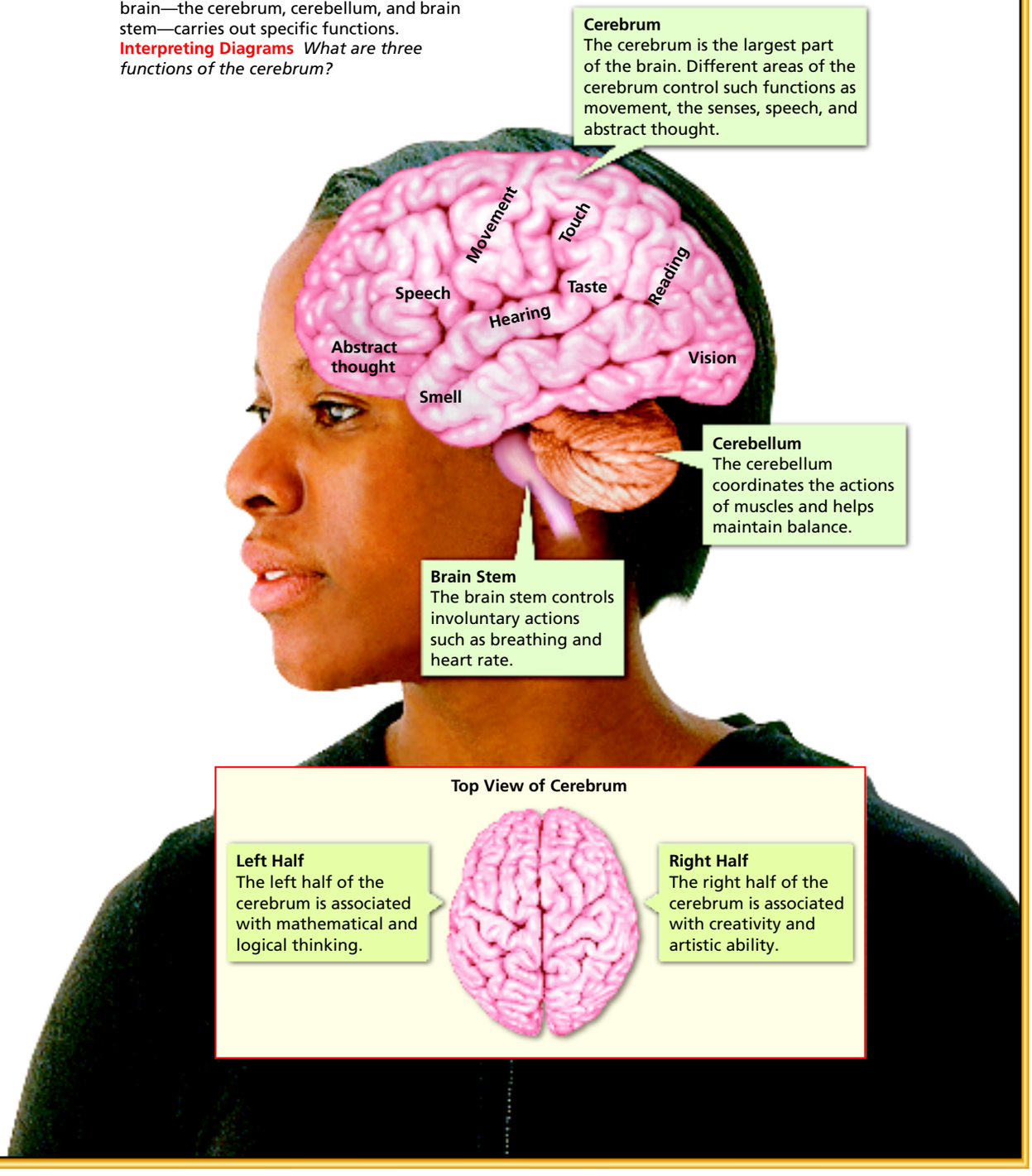
Tips Advise students to test three or four people, first in a quiet room, then with music playing softly. Make sure the person looks at a different list each time you test him or her.

Expected Outcome Sample hypothesis: Soft music increases the rate of learning. Sample experiment: Make up two lists of words with the same number of words, same word lengths, and same degree of familiarity. **learning modality: logical/mathematical**

FIGURE 6

The Brain

Each of the three main parts of the human brain—the cerebrum, cerebellum, and brain stem—carries out specific functions.
Interpreting Diagrams *What are three functions of the cerebrum?*



Use Visuals: Figure 6 L1

Parts of the Brain

Focus Refer students to Figure 6.

Teach Direct students to study the relative locations of the cerebrum, the brain stem, and the cerebellum in the illustration. Ask: **How are the structures of the cerebrum and cerebellum different?** *(The cerebrum is larger than the cerebellum, and the cerebrum's surface is creased by deep folds.)* Point out that folds increase the surface area of the cerebrum, allowing it to be compacted into a small space.

Apply With eyes closed, have students point to their own spinal cord near the base of their skull and to their brain stem, cerebellum, and cerebrum as they visualize the illustration of the brain's regions. **learning modality: visual**

All in One Teaching Resources

- Transparency D52

Lab zone Build Inquiry L2

Making Models of the Brain

Materials modeling clay of different colors

Time 20 minutes

Focus Remind students that different functions are controlled by different parts of the brain.

Teach Invite students to make model brains and label each part with a description of the processes it controls.

Apply Have each student think of an action or process, such as looking up something on the Internet, playing a team sport, or sitting down to a meal. Ask them to write a brief description of how the different parts of the brain work together to help the person accomplish the task. **learning modality: kinesthetic**

Monitor Progress L2

Writing Have students write a job description for each part of the brain.

Answer

Figure 6 The cerebrum interprets input from the senses, controls the movement of skeletal muscles, and carries out complex mental processes.

Peripheral Nervous System

Teach Key Concepts L2

How the Peripheral Nervous System Works

Focus Point out to students the spinal nerves and related structures in Figure 7.

Teach Explain that the spinal nerves in the neck and shoulder region of the spinal cord connect with peripheral nerves of the arms and hands, while those on lower portions of the spinal cord connect with peripheral nerves of the legs. Ask: **How do spinal nerves function differently from other nerves that we have studied?** *(Impulses travel in two directions—both to and from the spinal cord.)* **How does a spinal nerve's structure help it to function in this way?** *(It contains both sensory and motor neurons.)*

Apply Ask: **What might you assume about a person who is in an accident and cannot feel or move his or her legs afterward?** *(The person damaged a portion of the spinal cord containing spinal nerves that connect with the neurons of legs.)* **learning modality: visual**

Lab zone Build Inquiry L1

Classifying Somatic and Autonomic Functions

Materials none

Time 15 minutes

Focus Brainstorm with the class examples of voluntary and involuntary actions.

Teach Divide the class into small groups. Challenge each group to think of a task a person might do that involves voluntary and involuntary actions, then act out a skit without speaking. An example is eating a meal (students might point to their stomach after they pretend to take a bite to show involuntary action.) Have the class classify each action as somatic or autonomic.

Apply Challenge students to think of a situation where all functions of the body are under autonomic control. *(While a person is unconscious or asleep)* **learning modality: kinesthetic**

The Spinal Cord Run your fingers down the center of your back to feel the bones of the vertebral column. The vertebral column surrounds and protects the spinal cord. **The spinal cord is the link between your brain and the peripheral nervous system.** The layers of connective tissue that surround and protect the brain also cover the spinal cord. In addition, like the brain, the spinal cord is further protected by a watery fluid.

Peripheral Nervous System

The second division of the nervous system is the peripheral nervous system. **The peripheral nervous system consists of a network of nerves that branch out from the central nervous system and connect it to the rest of the body. The peripheral nervous system is involved in both involuntary and voluntary actions.**

A total of 43 pairs of nerves make up the peripheral nervous system. Twelve pairs originate in the brain. The other 31 pairs—the spinal nerves—begin in the spinal cord. One nerve in each pair goes to the left side of the body, and the other goes to the right. As you can see in Figure 7, spinal nerves leave the spinal cord through spaces between the vertebrae.

How Spinal Nerves Function A spinal nerve is like a two-lane highway. Impulses travel on a spinal nerve in two directions—both to and from the central nervous system. Each spinal nerve contains axons of both sensory and motor neurons. The sensory neurons carry impulses from the body to the central nervous system. The motor neurons carry impulses in the opposite direction—from the central nervous system to the body.

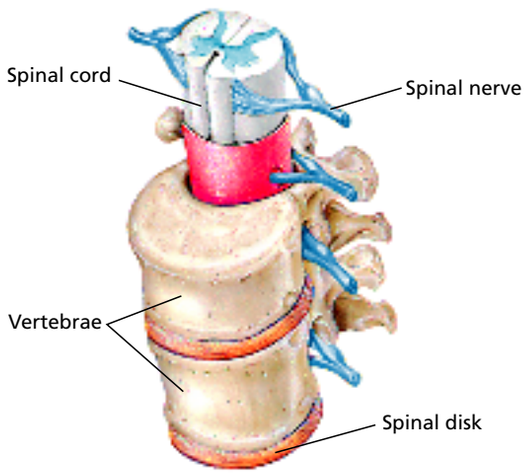


FIGURE 7
The Spinal Nerves
The spinal nerves, which connect to the spinal cord, emerge from spaces between the vertebrae. Each spinal nerve consists of both sensory and motor neurons.

Differentiated Instruction

English Learners/Beginning L1
Vocabulary: Word Analysis Help students remember the meaning of peripheral by explaining that *peri-* means "around," and *-phery* comes from the Greek word meaning "to carry." Ask: **How does the peripheral nervous system carry impulses around the body?** *(It connects the rest of the body to the central nervous system.)* **learning modality: verbal**

English Learners/Intermediate L2
Vocabulary: Word Analysis Explain that somatic comes from a Greek word meaning "body." The prefix *-auto* comes from a Greek word meaning "self." (Compare with automobile and author.) Have students speak or write sentences using *somatic* and *autonomic*. **learning modality: verbal**

Actions Controlled by the Somatic Nervous System
- Hands shape the clay.
- Foot turns the wheel.
- Mouth smiles.

Actions Controlled by the Autonomic Nervous System
- Heartbeat is regulated.
- Breathing rate is kept steady.
- Body temperature remains constant.

FIGURE 8
Somatic and Autonomic Nervous Systems
The somatic nervous system controls voluntary actions. The autonomic nervous system controls involuntary actions. **Classifying** *Which system helps regulate the artist's heartbeat?*

Somatic and Autonomic Systems The nerves of the peripheral nervous system can be divided into two groups, the somatic (soh MAT ik) and autonomic (awt uh NAHM ik) nervous systems. The nerves of the **somatic nervous system** control voluntary actions such as using a fork or tying your shoes. In contrast, nerves of the **autonomic nervous system** control involuntary actions. For example, the autonomic nervous system regulates the contractions of the smooth muscles that adjust the diameter of blood vessels.

Reading Checkpoint **What kinds of actions are controlled by the autonomic nervous system?**

Reflexes

Imagine that you are watching an adventure movie. The movie is so thrilling that you don't notice a fly circling above your head. When the fly zooms right in front of your eyes, however, your eyelids immediately blink shut. You didn't decide to close your eyes. The blink, which is a **reflex,** is a response that happened automatically. **A reflex is an automatic response that occurs very rapidly and without conscious control. Reflexes help to protect the body.** If you did the Discover activity on page 182, you saw another example of a reflex.

Lab zone **Try This Activity**

You Blinked!

Can you make yourself *not* blink? To answer this question, try the following activity.

1. Put on safety goggles.
2. Have your partner stand across from you and gently toss ten cotton balls toward your goggles. Your partner should not give you any warning before tossing the cotton balls.
3. Count the number of times you blink and the number of times you are able to keep from blinking.

Interpreting Data Compare the two numbers. Why is blinking considered a reflex?

Lab zone **Try This Activity**

Skills Focus Interpreting data L2

Materials goggles, cotton balls

Time 15 minutes

Tips Have partners stand approximately at arm's length from one another. Limit the time for each trial to 1–2 minutes. Suggest that students vary the pattern in which they toss the cotton balls.

Expected Outcome Without warning, most students will automatically blink when a cotton ball is tossed. Students will resist blinking when they concentrate. Blinking is an automatic response to prevent eye injury, but it can be controlled by the brain. **learning modality: kinesthetic**

Reflexes

Teach Key Concepts L2

Reflex Action

Focus Ask: **What are some examples of reflexes?** *(Sample answers: "Jumping" when startled, blinking, jerking a hand away from a hot object)*

Teach Explain that a reflex action by the nervous system allows for a quick response because it does not require interpretation by the brain. Ask: **What happens during a reflex?** *(Impulses requiring reflex actions travel quickly to the spinal cord, which directs the pathway of the impulse in two different directions. The impulse is sent to motor neurons, which enable a quick response, while the impulse is also sent to the brain—making the person aware of pain or what just happened.)* Clarify that awareness comes after the response has taken place.

Apply Ask: **Why is it important that the brain be notified of events requiring a reflex action?** *(Sample answers: It helps a person recognize possible danger, learn to avoid certain circumstances, or understand why an injury occurred.)* **learning modality: verbal**

Monitor Progress L2

Drawing
Have students illustrate how the impulses for a voluntary action and an involuntary action travel through the nervous system. Students can save their drawings in their portfolios. Portfolio

Answers
Figure 8 The autonomic nervous system

Reading Checkpoint Involuntary actions such as contractions of smooth muscle, heartbeat, breathing

Use Visuals: Figure 9 L1

Reflex Action Pathways

Focus Remind students that the brain is not part of the reflex reaction.

Teach Direct students to trace the path of the impulse in the figure from the stimulus to its response.

Apply Ask: **How does it benefit people that the spinal cord is able to send an impulse to motor neurons in response to a stimulus without involving the brain?** *(It allows people to respond more quickly to danger than if the nerve impulses traveled all the way to and from the brain.)* **learning modality: visual**

All in One Teaching Resources

Transparency D53

Nervous System Injuries

Teach Key Concepts L1

Protecting Against Nervous System Injuries

Focus Ask: **What protection does your body provide the brain and spinal cord against injuries?** *(Skull and backbone)*

Teach Point out that bones cannot protect the nervous system from all injuries. Ask students to describe what happens during a concussion. *(The soft tissue of the brain bumps into the skull.)* Ask: **What can happen to the spinal cord if it is injured?** *(It can be cut or crushed.)* **What two precautions are suggested for preventing these injuries?** *(Wear a helmet during activities in which you risk bumping your head. Wear a seatbelt when traveling in a car.)*

Apply Have students brainstorm situations in sports and other physical activities in which wearing a helmet is important. *(Possible answers: Football, in-line skating, riding a bike)* **learning modality: verbal**

A Reflex Pathway As you have learned, the contraction of skeletal muscles is usually controlled by the brain. However, in some reflex actions, skeletal muscles contract with the involvement of the spinal cord only—not the brain.

Figure 9 shows the reflex action that occurs when you touch a sharp object. When your finger touches the object, sensory neurons send impulses to the spinal cord. The impulses may then pass to interneurons in the spinal cord. From there the impulses pass directly to motor neurons in your arm and hand. The muscles then contract, and your hand jerks up and away from the sharp object. By removing your hand quickly, this reflex protects you from getting badly cut.

Signaling the Brain At the same time that some nerve impulses make your arm muscles contract, other nerve impulses travel up your spinal cord to your brain. When these impulses reach your brain, your brain interprets them. You then feel a sharp pain in your finger.

It takes longer for the pain impulses to get to the brain and be interpreted than it does for the reflex action to occur. By the time you feel the pain, you have already moved your hand away.

Reading Checkpoint **What is an example of a reflex?**

FIGURE 9
A Reflex Action
If you touch a sharp object, your hand immediately jerks away. This action, which is known as a reflex, happens automatically. Follow the numbered steps to understand how a reflex happens.
Sequencing *Do you pull your hand away before or after you feel the pain? Explain.*

1. Sensory neurons in your fingertip detect a pain stimulus.
2. Nerve impulses travel to your spinal cord.
3. Nerve impulses return to motor neurons in your hand, and you pull your hand away.
4. As you pull your hand away, nerve impulses travel to your brain. You feel the pain.

Nervous System Injuries

The nervous system can suffer injuries that interfere with its functioning. **Concussions and spinal cord injuries are two ways in which the central nervous system can be damaged.**

Concussions A **concussion** is a bruiselike injury of the brain. A concussion occurs when the soft tissue of the brain collides against the skull. Concussions can happen when you bump your head in a hard fall, an automobile accident, or a contact sport such as football.

With most concussions, you may have a headache for a short time, but the injured tissue heals by itself. However, with more serious concussions, you may lose consciousness, experience confusion, or feel drowsy after the injury. To decrease your chances of getting a brain injury, wear a helmet during activities in which you risk bumping your head.

Spinal Cord Injuries Spinal cord injuries occur when the spinal cord is cut or crushed. As a result, axons in the injured region are damaged, so impulses cannot pass through them. This type of injury usually results in paralysis, which is the loss of movement in some part of the body. Car crashes are the most common cause of spinal cord injuries.

Reading Checkpoint **What is paralysis?**

FIGURE 10
Protecting the Nervous System
You can help protect yourself from a spinal cord injury by wearing a seatbelt when you travel in a car.

Section 2 Assessment

Target Reading Skill Building Vocabulary
Use your definitions to help you answer the questions below.

Reviewing Key Concepts

1. a. Listing What two structures are part of the central nervous system?
   b. Describing Describe the functions of the three main regions of the brain.
   c. Relating Cause and Effect What symptoms might indicate that a person's cerebellum has been injured?
2. a. Identifying What are the two groups of nerves into which the peripheral nervous system is divided?
   b. Comparing and Contrasting How do the functions of the two groups of peripheral nerves differ?
3. a. Defining What is a reflex?
   b. Sequencing Trace the pathway of a reflex in the nervous system.
   c. Inferring How do reflexes help protect the body from injury?
4. a. Reviewing What is a concussion?
   b. Applying Concepts How can you reduce your risk of concussion?

Writing in Science

Comparison Paragraph Write a paragraph in which you compare the functions of the left and right halves of the cerebrum. Discuss what kinds of mental activities each half controls as well as which side of the body it controls.

Monitor Progress L2

Answers

Figure 9 In a reflex action, you respond before you feel pain. This quick response offers greater protection than would a response controlled by the brain.

Reading Checkpoint Sample answer: Blinking

Reading Checkpoint The loss of movement in some part of the body

Assess

Reviewing Key Concepts

1. a. The brain and the spinal cord **b.** Cerebrum: interprets sensory input, controls movement, and carries out complex processes; cerebellum: coordinates muscle action and helps maintain balance; brain stem: controls involuntary, or automatic, actions. **c.** Loss of balance; poor muscle coordination

2. a. The somatic and the autonomic nervous systems **b.** The somatic nervous system controls voluntary actions. The autonomic nervous system controls involuntary actions.

3. a. An automatic response that occurs rapidly and without conscious control **b.** Impulses travel from the sensory neurons to interneurons in the spinal cord, and then pass directly to motor neurons. **c.** Reflexes allow the body to respond quickly to danger.

4. a. A bruiselike injury of the brain **b.** Wear a helmet during actions in which you risk bumping your head.

Reteach L1

Provide students with copies of a diagram of the parts of the brain without the labels, and have them label each part.

Performance Assessment L2

Skills Check Have students make concept maps that identify the parts of the central nervous system and the peripheral nervous system.

All in One Teaching Resources

- Section Summary: *Divisions of the Nervous System*
- Review and Reinforce: *Divisions of the Nervous System*
- Enrich: *Divisions of the Nervous System*

Lab zone Chapter Project

Keep Students on Track Check that students have chosen one or more illusions by this time. Advise them to write their plans, listing questions they will ask the subjects. Check the plans for safety. Note that illusions do not necessarily affect all people the same way. Have students try out their illusions on a partner to refine their questions before the actual experiment.

Writing in Science

Writing Mode Description

Scoring Rubric

4 Includes all the functions for both sides of the brain and types of activities; goes beyond requirements, such as providing detailed examples
3 Includes all criteria, but does not go beyond requirements
2 Includes only brief description
1 Includes inaccurate description

Science and Society

Should People Be Required to Wear Bicycle Helmets?

Key Concept

Helmets are known to help prevent brain damage from accidents while biking. The question facing communities is whether to require bicyclists to wear helmets.

Build Background Knowledge

Recalling the Effects of Concussions

Help students recall the temporary and sometimes long-term effects of brain injury. Ask: **What is a concussion?** *(A bruiselike injury to the brain)* **What are the effects of a concussion?** *(Headache for a short time; serious concussion may cause you to black out, experience confusion, or feel drowsy.)*

Introduce the Debate

Remind students that wearing a helmet can help decrease the chances of concussion. Also make students aware that many communities have laws that require bicyclists to wear helmets.

Facilitate the Debate

- Divide students into four groups: (1) a group to represent state lawmakers, (2) a group to argue for the passage of a bicycle helmet law, (3) a group to argue against a bicycle helmet law, but for an education program paid for with taxes, and (4) a group to argue against any government regulation or tax-supported education programs.
- Tell the first group to work out rules and an agenda for a committee hearing on a proposed helmet law. Students in each of the other groups can work together to prepare a presentation to the committee during the hearing. Then hold the hearing, using the rules and agenda worked out by the committee members. Encourage students to act the way they think citizens would act in a real public hearing of this kind.

Should People Be Required to Wear Bicycle Helmets?

Bicycling is an enjoyable activity. Unfortunately, many bicyclists are injured while riding. Each year, more than 500,000 people in the United States are treated in hospitals for bicycling injuries. Many of those people suffer head injuries. Head injuries can affect everything your brain does—thinking, remembering, seeing, and being able to move.

Depending on the age group and geographic location, helmet use ranges from less than 10 percent to about 80 percent of bicyclists. What is the best way to get bicyclists to protect themselves from head injury?

The Issues

Should Laws Require the Use of Bicycle Helmets?

Experts estimate that bicycle helmets could reduce the risk of bicycle-related head injuries by as much as 85 percent. Today, about 19 states have passed laws requiring bicycle riders to wear helmets. Most of these statewide laws, however, apply only to children.

Some supporters of helmet laws want to see the laws extended to all riders. They claim that laws are the most effective way to increase helmet use.

Background

Facts and Figures Even if people do wear bicycle helmets, they may not be protected from head injury if they do not wear the helmets properly. Therefore, educational programs that teach people about the advantages of helmets often emphasize how to wear a helmet properly. The front edge of the helmet should be positioned 2 to 3 cm above the rider's eyebrows, and the helmet and the chin strap should be snug, but not uncomfortable. The helmet should be straight and not tilted forward or backward on the head. Communities can also help reduce bicycle head injuries by creating safer environments for bike riders, such as setting aside special lanes on roads or making biking trails through parks.

What Are the Drawbacks of Helmet Laws?

Opponents of helmet laws believe it is up to the individual to decide whether or not to wear a helmet. They say it is not the role of government to stop people from taking risks. They argue that, rather than making people pay fines if they don't wear bicycle helmets, governments should educate people about the benefits of helmets. Car drivers should also be educated about safe driving procedures near bicycles.

Are There Alternatives to Helmet Laws?

Instead of laws requiring people to wear helmets, some communities and organizations have set up educational programs that teach about the advantages of helmets. Effective programs teach about the dangers of head injuries and the protection that helmets provide. Effective education programs, though, can be expensive. They also need to reach a wide audience, including children, teens, and adults.

You Decide

1. Identify the Problem
In your own words, explain the issues concerning laws requiring people to wear bicycle helmets.

2. Analyze the Options
List two different plans for increasing helmet use by bicycle riders. List at least one advantage and one drawback of each plan.

3. Find a Solution
You are a member of the city government hoping to increase helmet use. Write a speech outlining your position for either a helmet law or an alternative plan. Support your position.

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You Decide

1. Sample answer: Helmets protect against injury. Passing laws and having education programs can be expensive. People have a right to make their own decisions regarding helmet use.
2. Sample answer: Plan 1. Fine people for not wearing helmets; advantage—may cause more people to wear helmets; drawback—may cause public resentment. Plan 2. Educate people about helmet use; advantage—people have "buy-in" on the issue; drawback—people may not wear helmets unless educated, and education is expensive.
3. Sample answer: I propose passage of a helmet law for people of all ages. Many states have laws for children 16 and under, but it is important to protect adults—the parents of the children—too. Helmets are a small price to pay for an 88 percent decrease in bike-related head injuries.

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Students can research this issue online.

Extend

Challenge students to find out whether your state or local government has passed a helmet law and, if so, whether it applies only to children or to bicycle riders of all ages. Suggest that students contact a member of a local law enforcement agency to ask what the penalties are for breaking such a law.