SECTION

29.4 Central and Peripheral Nervous Systems

Teacher Notes and Answers

SECTION 4

Instant Replay

1. The central nervous system (CNS)
2. Cerebrum: interprets signals from your body.; Cerebellum: coordinates your movements.; Brain stem: controls the activities that are the most basic to life,
3. stressed, alert, ready for action with increased heart and breathing rate

Vocabulary Check

1. cerebral cortex
2. sympathetic nervous system
3. autonomic nervous system
4. cerebrum
5. cerebellum
6. somatic nervous system

The Big Picture

7. A message goes from the motor neurons to the spinal cord and directly back to the motor neurons; the message doesn't have to go to the brain.
8. Messages cannot move back and forth between the brain and the rest of the body.

SECTION

29.4 Central and Peripheral Nervous Systems

KEY CONCEPT The central nervous system interprets information, and the peripheral nervous system gathers and transmits information.

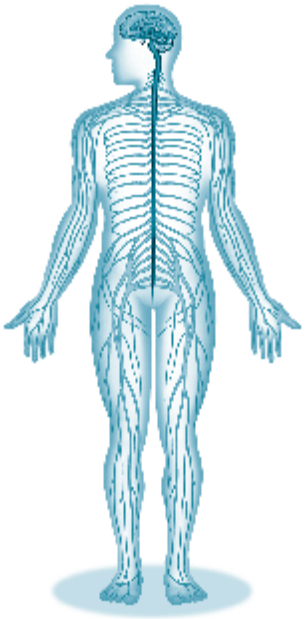
The nervous system's two parts work together.

You already know that the nervous system has two parts: the central nervous system (CNS) and the peripheral nervous system (PNS). The two parts of the nervous system are connected, and they work together.

- The central nervous system (CNS) includes the brain and spinal cord. It is made up of interneurons. These neurons receive information, interpret it, and send signals to the PNS.
- The peripheral nervous system (PNS) connects the CNS to all of your organs and organ systems. It reaches every part of your body. Sensory neurons in the PNS detect stimuli inside and outside your body and send signals to the CNS. Motor neurons carry messages from the CNS to target cells in your muscles or other organs.

INSTANT REPLAY

What part of the nervous system is made up of interneurons?



Your nervous system is your body's information superhighway. It connects your brain and spinal cord to the rest of your body.

The CNS processes information.

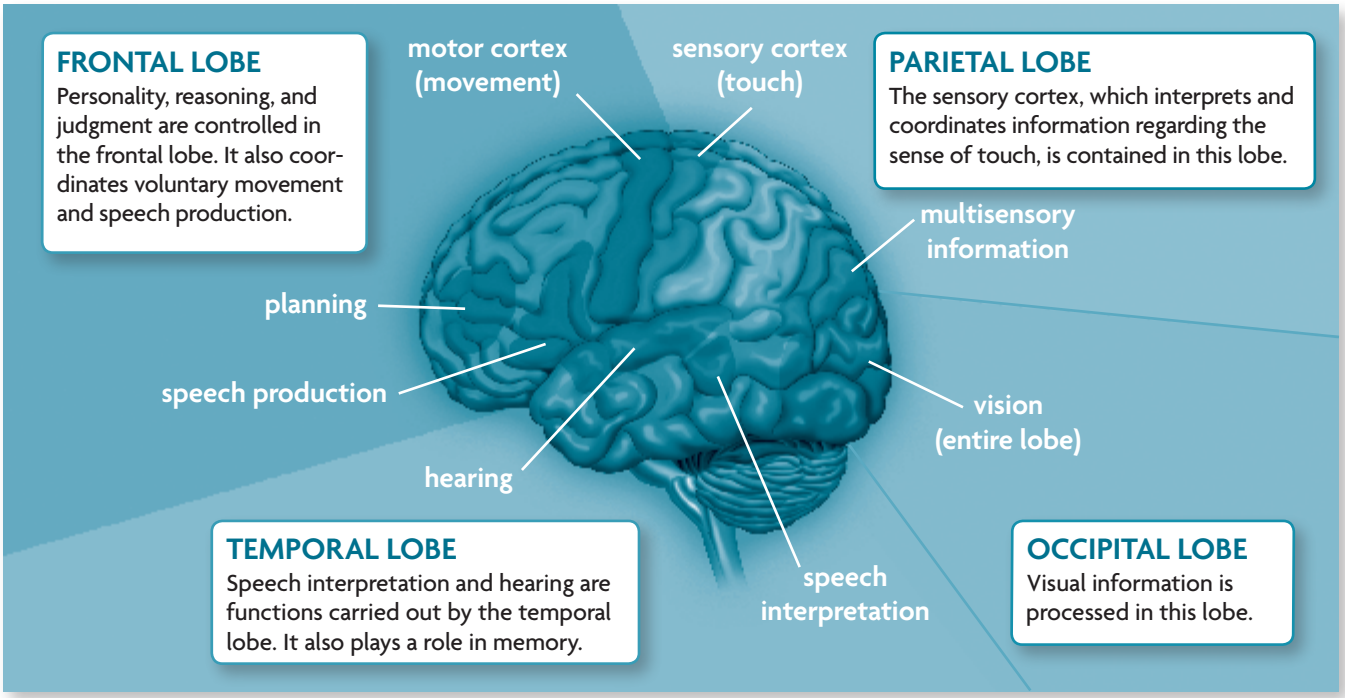
The interneurons in the brain and spinal cord are arranged in a special way. All the cell bodies are clustered together, and all the axons are clustered together. The cell bodies as a group have a dark gray color and are called gray matter. The axons are called white matter because their myelin sheaths appear white.

The Brain

Your brain contains more than 100 billion neurons. They are protected by three layers of tissue, called the meninges. Fluid between the layers cushions the brain, so it does not bang against the skull. The brain itself has three parts: the cerebrum, the cerebellum, and the brain stem.

Cerebrum The **cerebrum** interprets signals from your body. It forms responses such as hunger, thirst, emotions, motion, or pain. The two halves of the cerebrum are called hemispheres. The left hemisphere controls the right side of the body, while the right hemisphere controls the left.

The outer layer of the cerebrum is called the **cerebral cortex.** It interprets signals from your sensory organs. The cerebral cortex is about as thick as a pencil, but its folded surface area can hold more than 10 billion neurons. The neurons in the cerebral cortex are arranged in groups that perform different tasks. Each hemisphere of the cerebral cortex can be divided into four areas, called lobes.



Each hemisphere of the brain has four lobes.

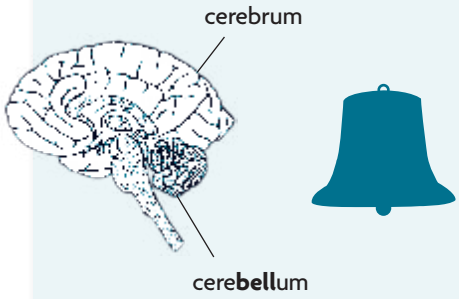
Underneath the cerebral cortex are many smaller groups of neurons. For example, the limbic system controls learning and emotions. The thalamus sorts out information from your sensory organs and passes signals between the spinal cord and other parts of the brain. The hypothalamus keeps track of temperature, hunger, and thirst.

Cerebellum The **cerebellum** is the part of the brain that coordinates your movements. It helps you keep your balance, to stand up straight, and to move smoothly.

Brain stem The brain is connected to the spinal cord by the **brain stem.** It controls the activities that are the most basic to life, such as breathing and heartbeat. The brain stem has three parts.

- The midbrain controls some reflexes.
- The pons controls breathing, and passes signals back and forth between the brain and the spinal cord.
- The medulla oblongata physically connects the brain and spinal cord. It controls your heart, and tasks such as vomiting, swallowing, and coughing.

VISUAL VOCAB



You can learn the location of the **cerebellum** by remembering that it hangs below the large part of the brain, just as a bell hangs from the ceiling.

The Spinal Cord

The interneurons of the spinal cord, like those of the brain, are protected by meninges and fluid. The spinal cord itself is a bundle of neurons about as wide as your thumb. It connects the brain to the nerves in the rest of the body. If the spinal cord is hurt, messages cannot flow back and forth between the brain and the rest of the body. This is why spinal cord injuries can cause paralysis.

However, not all nerve signals need to travel all the way up to the brain. Some travel along **reflex arcs.** These pathways allow interneurons in the spinal cord to receive and send messages to motor neurons. This is why you can pull your hand away from a hot stove before you get burned. You do not have to think about it first.

INSTANT REPLAY

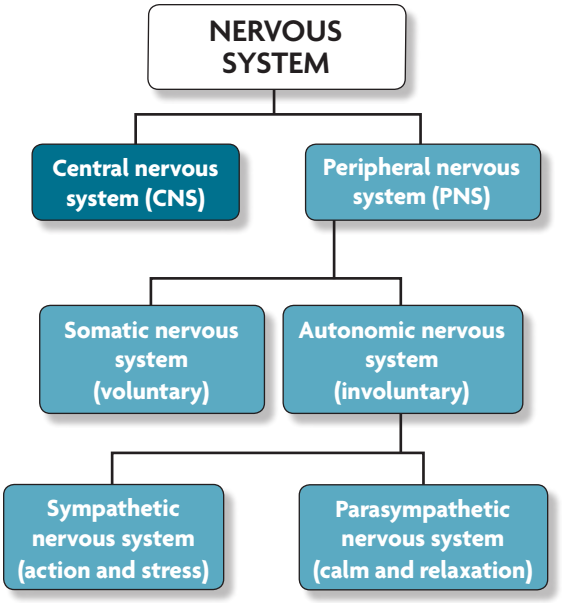
Underline the main function(s) of each of the three parts of the brain.

The PNS links the CNS to muscles and other organs.

The peripheral nervous system (PNS) includes all the nerves that are not part of the CNS. It includes 12 pairs of nerves in the head, such as the nerves in your face, nose, eyes, and ears. It also includes 31 pairs of spinal nerves.

The PNS includes sensory neurons and motor neurons. The sensory neurons collect information about the body and its environment. The motor neurons trigger responses to that information. Some of the responses are involuntary,* such as jerking your leg when a doctor taps your knee. Other responses are voluntary,* such as moving your hand to eat.

Your voluntary movements are controlled by the **somatic nervous system.** Your **autonomic nervous system** controls functions that happen automatically, such as breathing. The autonomic nervous system includes two systems: the sympathetic nervous system and the parasympathetic nervous system.



Each part of the nervous system has a different function.

* ACADEMIC VOCABULARY

involuntary something you have no choice about

voluntary something that you choose to do

Sympathetic nervous system Your body's response to stress is controlled by the **sympathetic nervous system.** When a sudden noise startles you, your sympathetic nervous system responds to your feelings of stress. It contracts certain blood vessels to reduce blood flow to your skin and internal organs. It increases the blood supply to your heart, brain, lungs, and muscles, so that you can think and act quickly.

Parasympathetic nervous system After the stress is over, your **parasympathetic nervous system** calms you. It lowers your heart rate and blood pressure. You relax, and your body conserves energy.

INSTANT REPLAY

How might you feel when your sympathetic nervous system is stimulated?

_____

29.4 Vocabulary Check

Mark It Up

Go back and highlight each sentence that has a vocabulary word in **bold.**

cerebrum	somatic nervous system
cerebral cortex	autonomic nervous system
brain stem	sympathetic nervous system
cerebellum	parasympathetic nervous system
reflex arc	

Choose the correct term from the list for each description.

1. layer of the cerebrum that interprets information from your sensory organs _____
2. helps the body prepare for stress _____
3. controls functions you do not have to think about _____
4. can be divided into two hemispheres _____
5. helps you keep your balance _____
6. controls your voluntary movements _____

29.4 The Big Picture

7. How does a reflex arc work? _____

_____

8. Why can some spinal cord injuries cause paralysis? _____

_____

_____