

# Nervous System and Senses

## Key Words

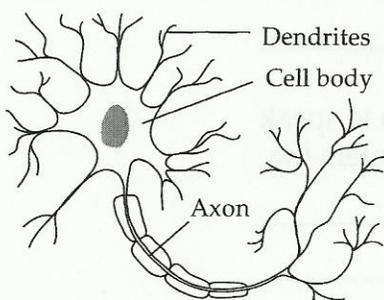
<b>neurons:</b>	nerve cells that carry messages throughout the body
<b>impulses:</b>	messages carried by neurons
<b>cerebrum:</b>	part of the brain that controls all voluntary activities of the body
<b>cerebellum:</b>	part of the brain that coordinates and balances the actions of the voluntary muscles
<b>medulla:</b>	part of the brain that controls involuntary actions
<b>spinal cord:</b>	long bundle of nerve fibers surrounded by the backbone that connects the brain with the rest of the nervous system

## KEY IDEAS

The nervous system receives and relays information about activities within the body. The nervous system also receives messages about the environment and responds to those messages. The nervous system is made up of the brain, the spinal cord, and all the nerves of the body.

At this very moment, you are responding to your environment. You are using your sense of sight to read this page. The nervous system controls your senses and their responses.

Fig. 46-1



**Neurons.** The nervous system receives and relays information about activities within the body. It also monitors and responds to internal and external changes. The nervous system contains billions of neurons. **Neurons** (NUHR-rahnz) are nerve cells that carry messages throughout the body. Fig. 46-1 shows the three parts of a neuron: the cell body, dendrites, and the axon. The nucleus of the neuron and most of the cytoplasm are in the cell body. Branching out from the cell body are threadlike structures called dendrites. Dendrites receive messages from other neurons and carry them to the cell body. The axon is a long, thin fiber that extends from the cell body. The axon carries messages away from the cell body.



1. What do neurons do? \_\_\_\_\_

**The Brain.** The messages carried by neurons are called **impulses** (IHM-pul-sehz). Impulses are carried from nerves to the brain or from the brain to nerves. The brain is called the control center of the body because it makes the body respond to all the impulses.

The brain has three main parts which are shown in Fig. 46-2. The large, upper part of the brain is the **cerebrum** (SEHR-uh-brum). The cerebrum controls all voluntary activities of the body. It controls movement, speech, memory, and emotions. The cerebrum also identifies the impulses it receives from the senses. The cerebrum controls activities such as learning, reasoning, problem solving, and decision making.

Near the back of the head, beneath the cerebrum, is the **cerebellum** (sehr-uh-BEHL-um). The cerebellum coordinates and balances the actions of the voluntary muscles. It makes your muscles move smoothly and helps you keep your balance.

Bundles of nerves from the cerebrum and cerebellum come together at the base of the brain. They form the brainstem. The lowest part of the brainstem is the **medulla** (mih-DUL-uh). The medulla controls involuntary actions such as breathing, heart rate, and digestion.

**The Spinal Cord.** The brainstem continues into the spinal cord. The spinal cord is a part of the nervous system. The **spinal cord** (SPY-nuhl KORD) is a long bundle of nerve fibers surrounded by the backbone. It connects the brain with the neurons in all parts of the body.

**The Senses.** The nervous system receives messages about the environment and then responds to the messages. Some of the messages go through the spinal cord to the brain. Other messages go only to and from the spinal cord. The brain and spinal cord get the messages from the sense organs. The sense organs are the eyes, ears, skin, tongue, and nose. Each sense organ is associated with a specific sense: vision, hearing, touch, taste, or smell. Special cells in the sense organs detect energy. The energy can be light, heat, sound, chemical, or even pressure. Fig. 46-3 shows which organ senses each kind of energy.

Fig. 46-2

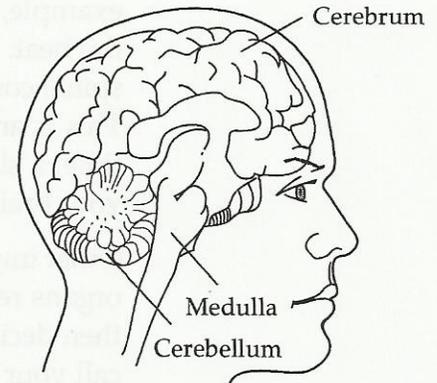


Fig. 46-3

Organ	Sense	Energy
	→ Sight	→ Light
	→ Hearing	→ Sound
	→ Touch	→ Heat, pressure
	→ Taste	→ Chemical
	→ Smell	→ Chemical

The sense organs and nervous system work together to help the body respond to its environment. When the cells sense energy, they send an impulse through neurons. Certain kinds of impulses require quick responses. These impulses travel only to the spinal cord. The spinal cord sends another impulse back to the neurons in the body part that needs to respond. For example, if you touch a very hot pan, nerves in the skin of your fingers sense the heat. The heat impulse travels through neurons to the spinal cord. The spinal cord instantly sends back an impulse that makes your hand pull back. This is an automatic response that takes less than one second. At the same time, a slower impulse travels to your brain. Soon after you've responded, your brain knows what happened.

Other impulses do not cause automatic responses. The neurons in your sense organs relay these impulses through the spinal cord to the brain. The brain then decides what the impulse means. For example, when you hear a friend call your name, neurons in your ears carry the sound impulse to your brain. The brain understands the meaning of the words and tells you who spoke.

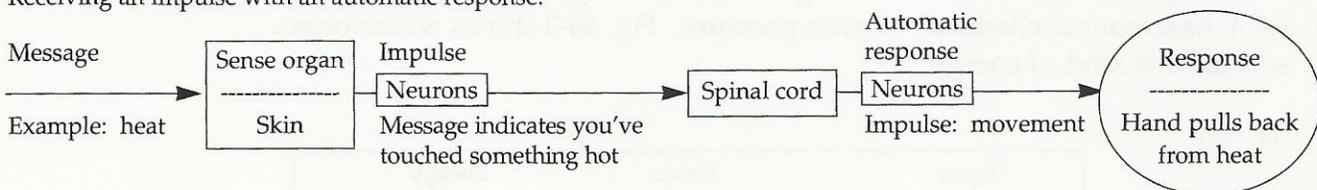
You can then decide if you want to respond. The brain sends an impulse through the spinal cord to the part of the body that you want to move. For example, you decide to turn your head toward your friend, and your neck moves. This response is not automatic. Instead, you respond consciously, or think about how to respond.

## TAKE ANOTHER LOOK

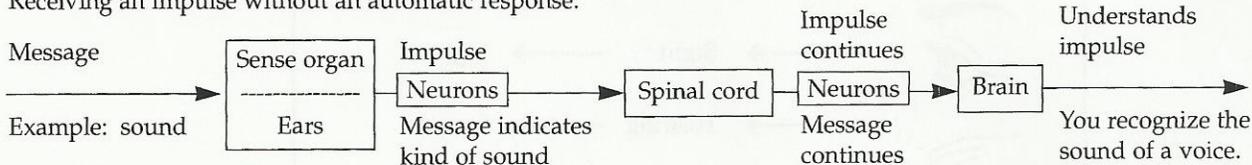
Fig. 46-4 shows how nerve impulses reach the brain and the different ways the body responds.

Fig. 46-4

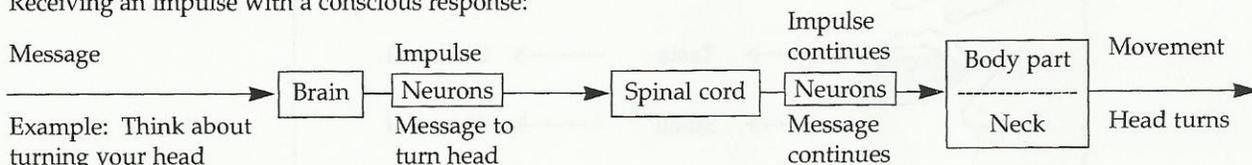
Receiving an impulse with an automatic response:



Receiving an impulse without an automatic response:



Receiving an impulse with a conscious response:



## Check Your Understanding

Complete the following paragraph with the correct terms.

The nervous system is made up of billions of (2)\_\_\_\_\_. Neurons carry (3)\_\_\_\_\_ throughout the body. (4)\_\_\_\_\_ organs send messages about the environment. The (5)\_\_\_\_\_ tells the body how to respond to these messages. The (6)\_\_\_\_\_ is the part of the brain that controls all voluntary activities. The (7)\_\_\_\_\_ coordinates and balances the actions of the voluntary muscles. Involuntary actions are controlled by the (8)\_\_\_\_\_.

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9. What does the nervous system do? \_\_\_\_\_

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10. How do dendrites differ from axons? \_\_\_\_\_

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11. Why is the brain called the control center of the body?

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12. What form of energy do the ears detect? \_\_\_\_\_

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13. How do sense organs relay information about the environment to the brain? \_\_\_\_\_

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