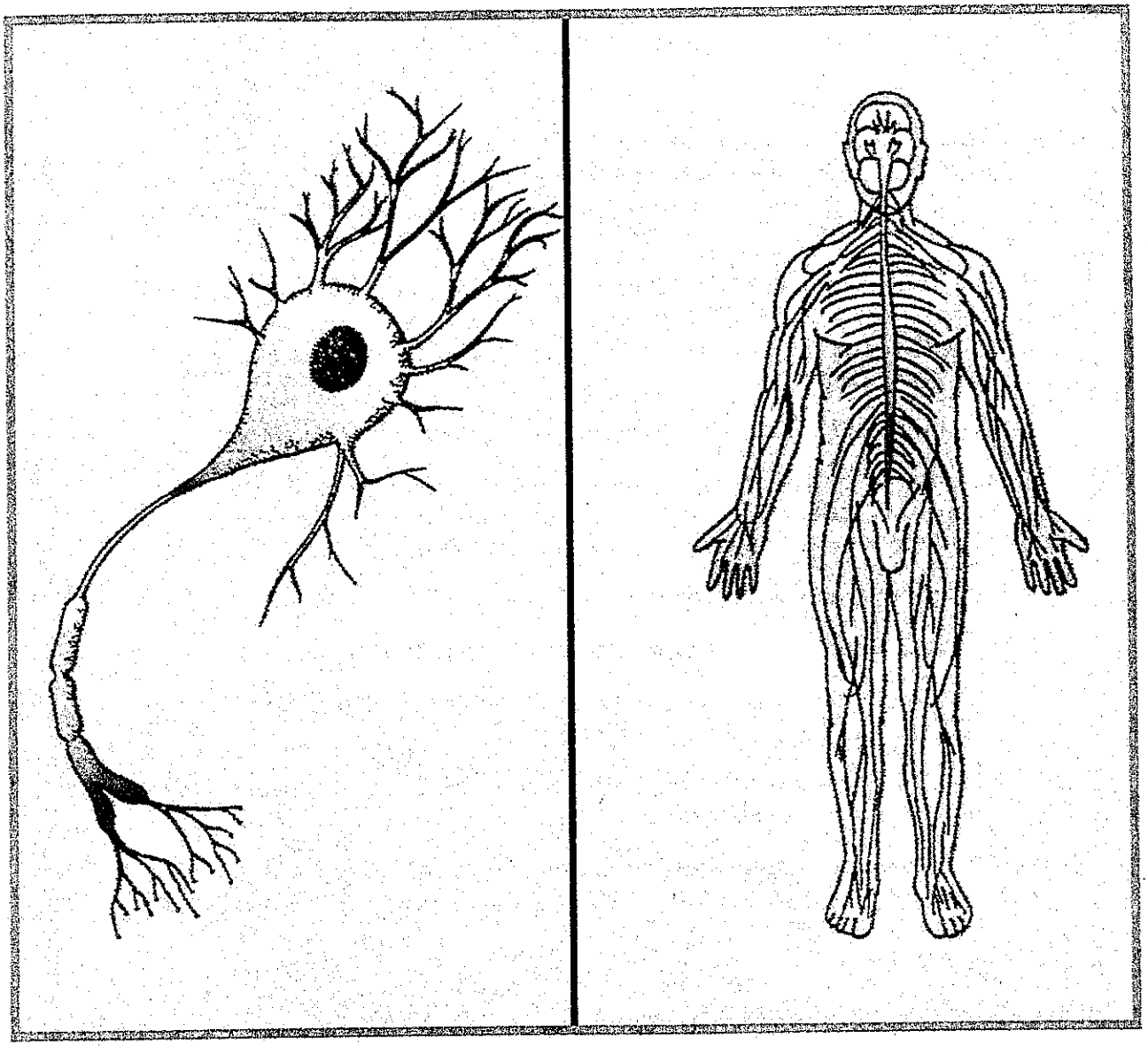
Lesson 20

What is the nervous system?



KEY TERMS

nervous system: body system made up of the brain, the spinal cord, and all the nerves that control body activities

neuron: nerve cell

LESSON 20 | What is the nervous system?

Every school has an office. It is a very important place. Messages come into the office. Messages go out. Most plans for the whole school are made in the office.

In your body, the job of receiving and sending messages is done by the **nervous system**. The nervous system controls all of your body's activities. The nervous system is made up of the brain, the spinal cord, and branching nerves.

The brain and spinal cord alone make up the central nervous system.

You have learned that the sense organs receive stimuli. But what happens to the stimuli after they are received? For example, how do you decide to answer the telephone, or raise your hand in class?

This is how the nervous system works:

- Stimuli from the sense organs change to electrical signals.
- These electrical signals do not stay in the sense organs. Nerves carry the signals to the brain and spinal cord.
- The brain decides what each stimulus is. The brain also decides how to respond to each stimulus.
- Nerves carry "what to do" messages away from the brain. The messages go to the part of the body that will answer or respond to the stimuli.

Most "what to do" messages go to muscles. Some, however, go to glands. Most responses are carried out by muscles.

Note: In some cases, the spinal cord, not the brain, receives and sends messages of how to respond to a stimulus. You will learn more about this in Lesson 22.

NERVE CELLS

The nerves of the nervous system are made up of nerve cells. Each nerve cell is called a **neuron** [NOOR-ahn].

Neurons are well suited to performing their job of carrying messages. A group of neurons looks like a string of space-age telephones.

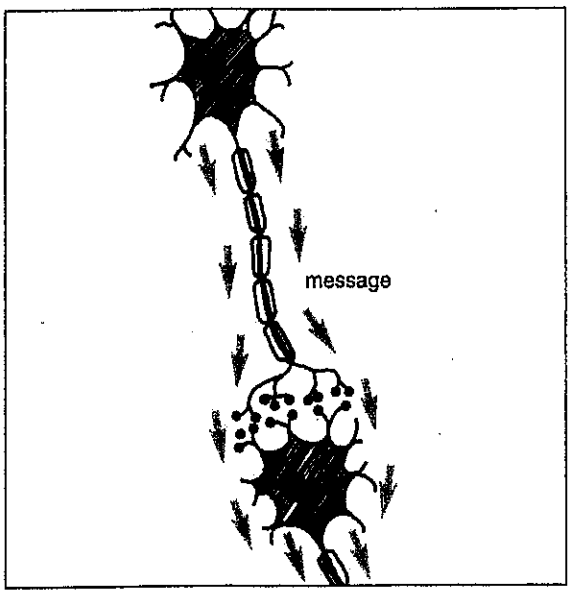


Figure A

Look at Figure A. It shows a message moving along two neurons.

Neurons form a pathway along which electrical signals travel. At one end of the pathway is a sense organ. At the other end is the muscle or gland that responds to the stimuli.

THE SPINAL CORD

Thirty-one pairs of nerves branch out from your spinal cord. These nerves are inside the spinal column (backbone). The backbone protects the nerves.

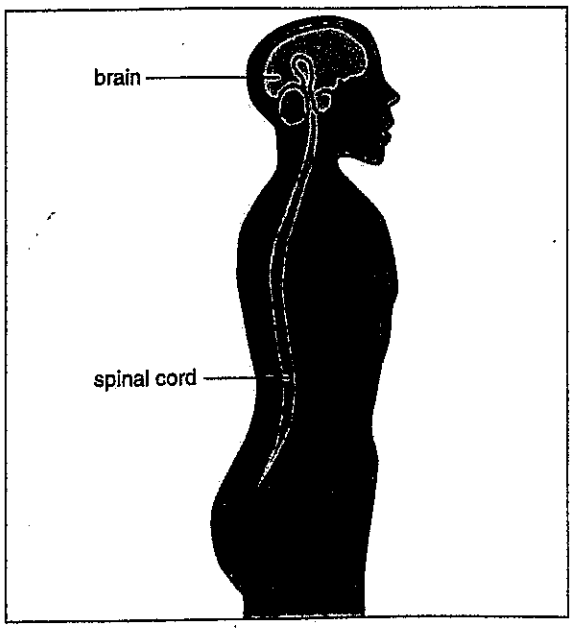


Figure B

Your spinal cord runs down the center of your back. It extends from the base of the brain to the tailbone.

Some emergency responses must happen extra fast. There is no time for the brain to decide how to respond. Delay can cause severe injury—or even death.

In these cases, the spinal cord—not the brain, sets up the response. The response takes place even before the message reaches the brain.

These emergency responses to stimuli are called reflexes. You will learn more about reflexes in Lesson 22.

NERVES CARRY MESSAGES IN ONE DIRECTION ONLY

- Some nerves carry messages to the brain and spinal cord.
- Other nerves carry messages away from the brain and spinal cord.

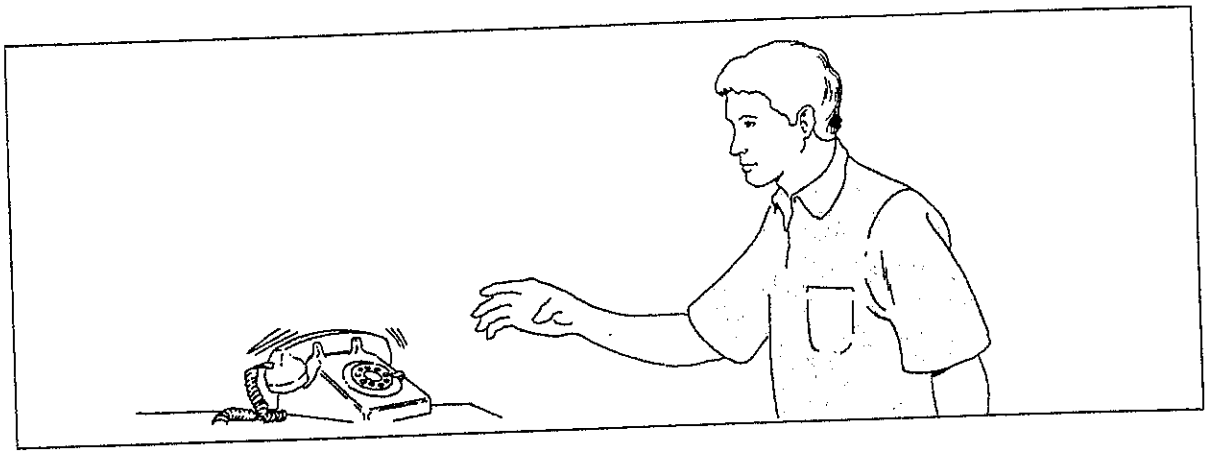


Figure C

1. Nerves that carry stimuli lead _____ the brain and spinal cord.
   to, away from
2. Nerves that carry messages for responses lead _____ the spinal cord.
   to, away from
3. In what energy form are nervous system signals? _____

FIND THE PARTS

Find the parts of the nervous system. Write their names on the correct lines. Choose from the parts listed below.

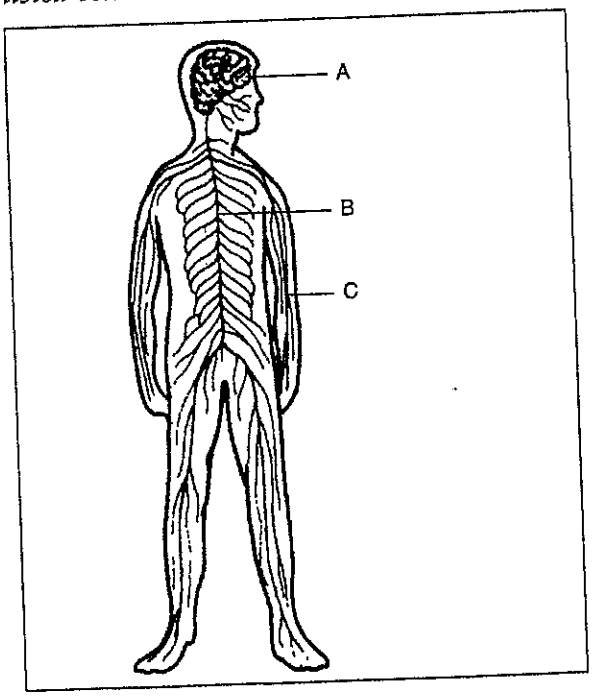


Figure D

spinal cord
branching nerves
brain

Name the parts that make up the central nervous system.

A._____

B._____

C._____

FILL IN THE BLANK

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided. Some words may be used more than once.

nerves	sends	muscles
one direction	spinal cord	to
receives	away from	brain
backbone	stimuli	response

1. The nervous system _____ and _____ messages.
2. The parts of the nervous system are: the _____, _____, and _____.
3. Nerves carry messages in only _____.
4. Some nerves carry messages _____ the brain and spinal cord. Some nerves carry messages _____ the brain and spinal cord.
5. _____ are carried to the brain and spinal cord by nerves.
6. Messages of _____ are carried away from the brain and spinal cord.
7. The _____ "decides" what to do about most stimuli.
8. Most messages of response are sent to _____.
9. Most responses are carried out by _____.
10. The spinal cord is protected by the _____.

MATCHING

Match each term in Column A with its description in Column B. Write the correct letter in the space provided.

	Column A	Column B
_____	1. parts of the nervous system	a) an action
_____	2. stimulus	b) brain, spinal cord, and nerves
_____	3. response	c) a signal to do something
_____	4. brain and spinal cord	d) carry messages
_____	5. nerves	e) central nervous system

Figure E

1. Name the sense organs.

   _____ _____

   _____ _____

   _____

2. Four of the sense organs send nerves right into the brain. Which organs are they? (Think of your own body.)

   _____ _____

   _____ _____

3. Most nerves of one of the sense organs go to the spinal cord before they go to the brain. Which organ is this? (Think of your own body.)

   _____

REACHING OUT

Responses that are planned are voluntary responses. Responses that are not planned are involuntary responses.

1. What was the last voluntary response you did?

   _____

   _____

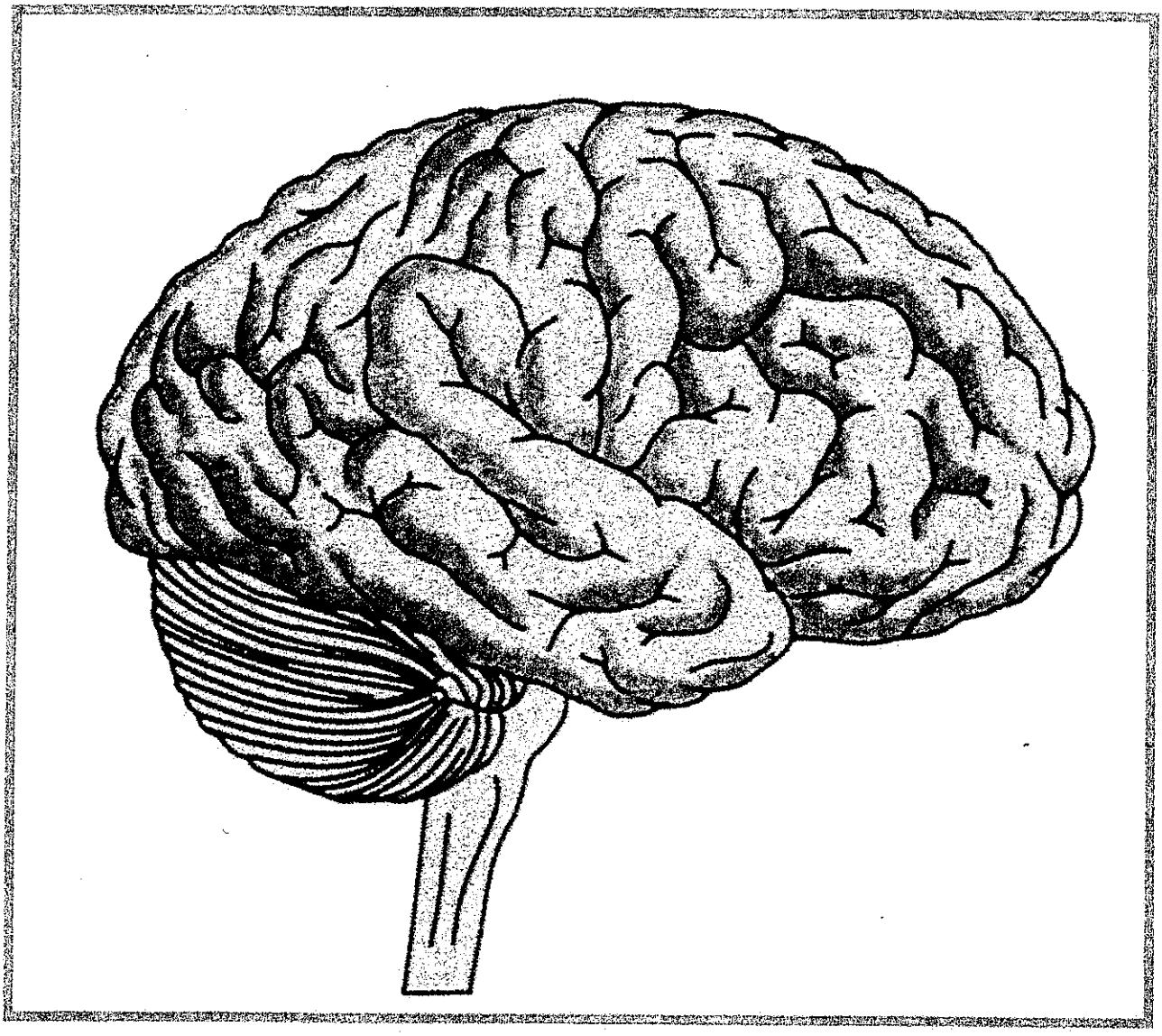
2. Can you name an involuntary response that you are probably doing right now?

   _____

   _____

Lesson 21

What are the parts of the brain?



KEY TERMS

cerebrum: large part of the brain that controls the senses and thinking

cerebellum: part of the brain that controls balance and body motion

medulla: part of the brain that controls many vital functions, such as heartbeat and breathing

The brain is the control center of your body. The brain is made up of a mass of nervous tissue. It is protected by your skull.

The main job of the brain is to receive messages and decide what to do. These messages may come from inside or outside your body. Your brain responds to the messages and then controls almost all of your body's activities.

The brain is made up of three main parts. They are the **cerebrum** [suh-REE-brum], the **cerebellum** [ser-uh-BELL-um], and the **medulla** [muh-dull-uh].

Different parts of the brain control different activities.

CEREBRUM The cerebrum is the largest part of the brain. It controls the senses, thought, memory, and learning. It also controls certain voluntary muscles. You use voluntary muscles for activities like walking, talking, and writing.

CEREBELLUM The cerebellum is located at the back of the brain. It works with the cerebrum to control voluntary muscles. The cerebellum controls body movements. The cerebellum also helps you keep your balance.

MEDULLA The medulla is the smallest part of the brain. It is a thick stalk at the base of the skull. The medulla connects the brain to the spinal cord. It controls many vital involuntary functions. For example, the medulla controls breathing, digestion, and heartbeat. It also controls sneezing and blinking.

Look at Figure A. It shows the parts of the cerebrum that control certain ... answer the questions below.

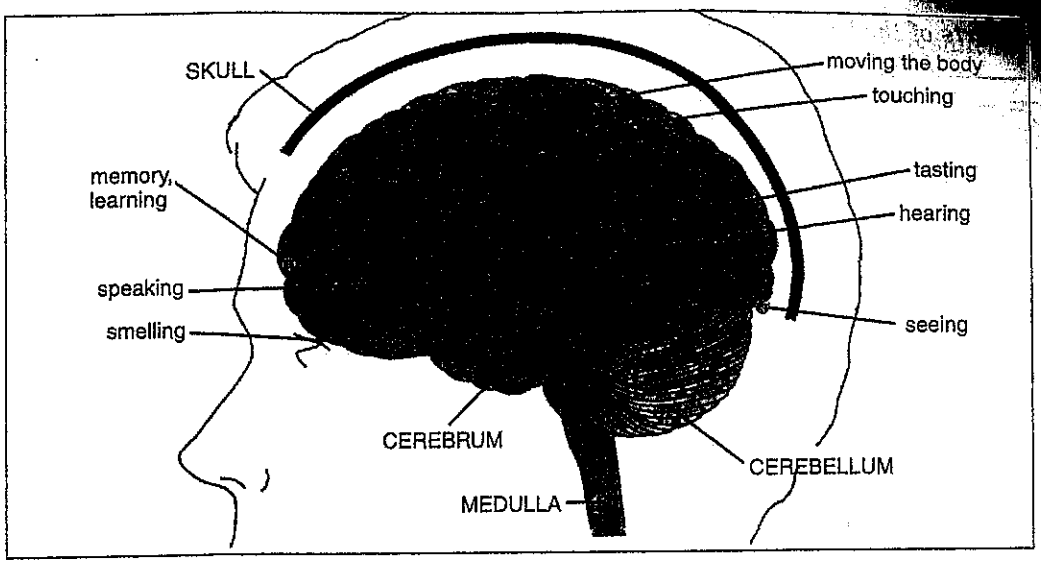


Figure A

1. What might happen if you were hit very hard on the back of your head? _____

   _____

2. What might happen if you were hit very hard on the front of your head? _____

   _____

3. What might happen if you were hit hard on the side of your head—towards the middle? _____

4. The brain is one of the most protected parts of your body.

   a) What protects your brain? _____

   b) Why does it protect so well? _____

   c) Of what is it made? _____

5. a) What is the largest part of the brain? _____

   b) What is the smallest part of the brain? _____

LABEL THE DIAGRAM

Label the main parts of the brain.

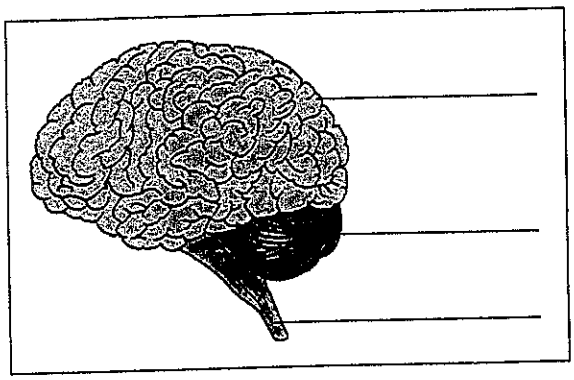


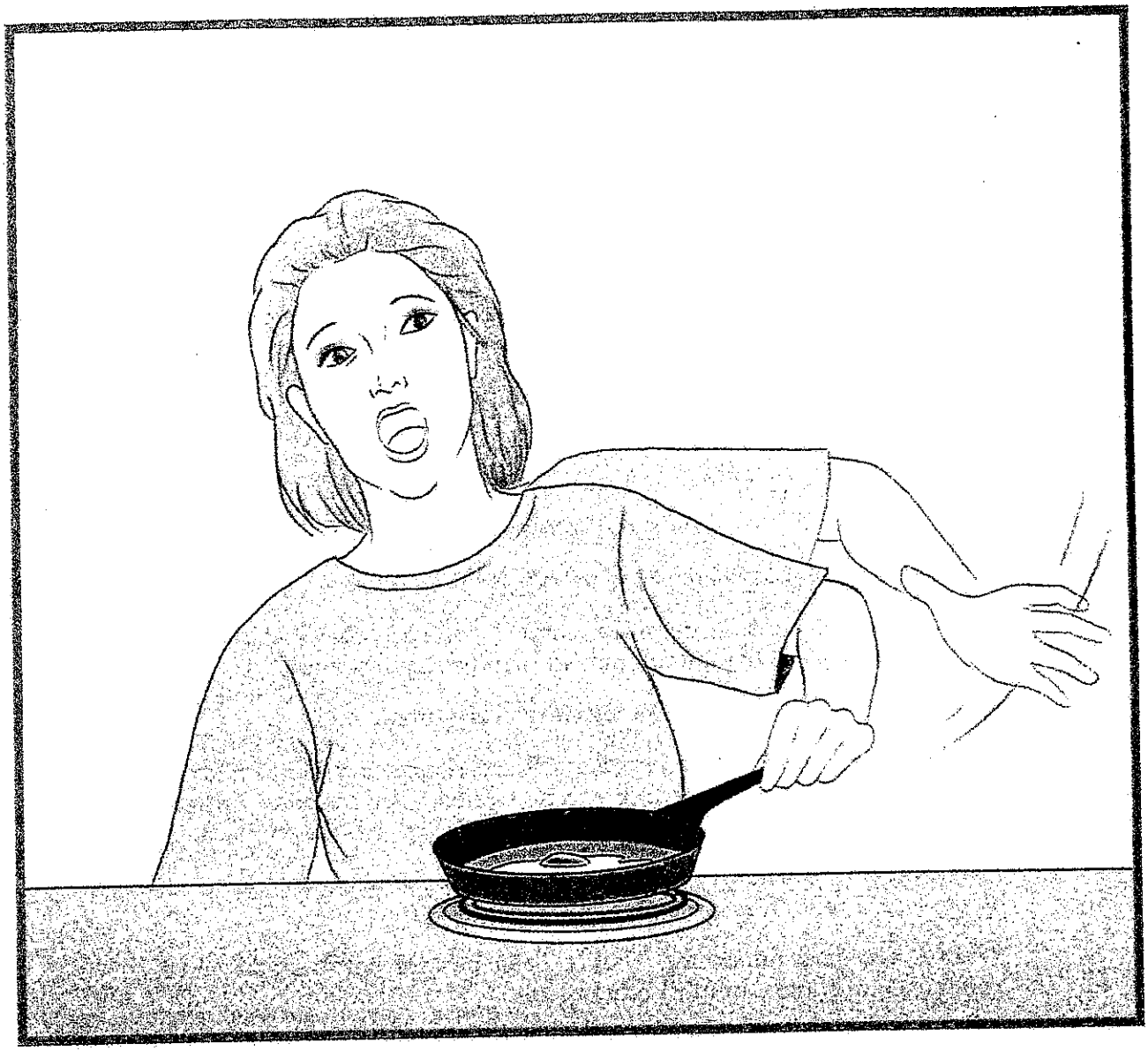
Figure B

COMPLETE THE CHART

Twelve actions are listed below. Each action is controlled by a different part of the brain. Place a check (✔) in the proper box (or boxes) for each action.

ACTION		CONTROLLED BY		
		cerebrum	**cerebellum**	**medulla**
1.	hearing			
2.	seeing			
3.	moving the body			
4.	heartbeat			
5.	tasting			
6.	balance			
7.	sneezing			
8.	learning			
9.	breathing			
10.	speaking			
11.	memory			
12.	blinking			

What is a reflex?



KEY TERM

reflex: automatic response to a stimulus

LESSON 22 | What is a reflex?

The moment you are born you do certain things by yourself. You cry, you yawn, your eyes blink, your lips search for food.

You were not taught how to do these things. You were born knowing how to do them.

These kinds of responses are called **reflexes**.

There are many kinds of reflexes. But they are all alike in certain ways.

- Reflexes are not learned. They are inborn.
- You do not control or think about reflexes. They happen by themselves. They are automatic and involuntary responses.
- A reflex is done exactly the same way every time.

In most cases, you do not know a reflex is happening. For example, jumping away from a speeding car is a reflex. You respond without thinking. You know about it only after the response has taken place.

The same is true when you touch a hot pot. You pull your hand away before your brain "feels" the pain.

Reflexes are very important. They protect us and help us stay alive. Reflexes control most of our body organs.

Most reflexes occur very quickly. This is because reflexes do not involve the brain. They are controlled by the spinal cord. Look at the example below to help you understand the path of a reflex.

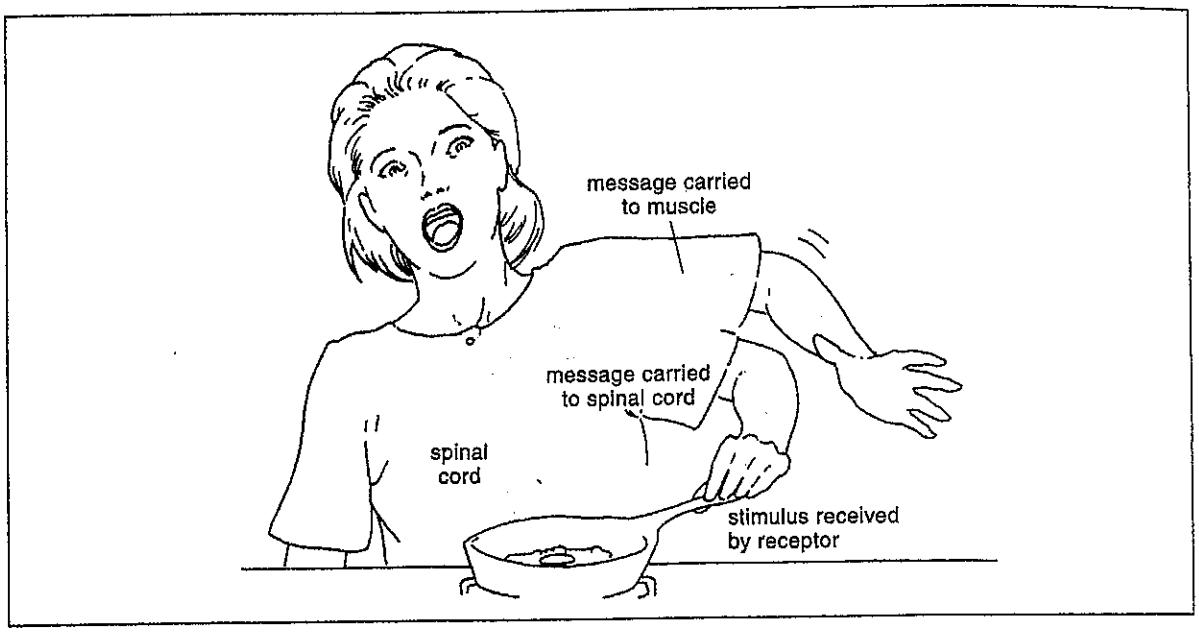


Figure A

The stimulus: touching a hot object.

The response: pulling the hand away.

- FIRST Cells in the skin detect heat. Nerves send the message of "heat" to the spinal cord. The spinal cord decides what to do.
- SECOND Nerves carry this message of "what to do" away from the spinal cord. It goes to the muscles of the hand.
- THIRD The message tells the muscles to "let go" of the hot object.

At this point, the brain does not know what is happening. However, while messages are moving along the reflex path, the spinal cord is sending messages to the brain. Once the brain receives these messages, it sends messages to your hand. Then, you feel pain. That is why a reflex action is usually followed by a loud "OUCH!"

Reflexes control important body organs.

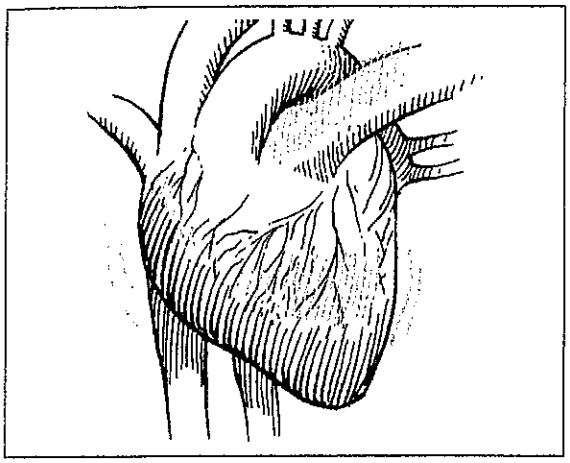


Figure B *Reflexes control your heartbeat.*

Figure C *Reflexes control your breathing.*

1. What happens to your heartbeat if you are excited?

_____

2. What happens to your heartbeat if you are asleep?

_____

Reflexes protect you from injury.

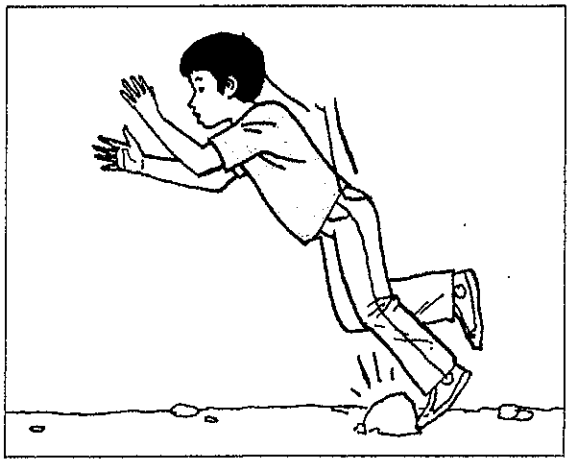


Figure D *When you trip, your hands move automatically to protect your face.*

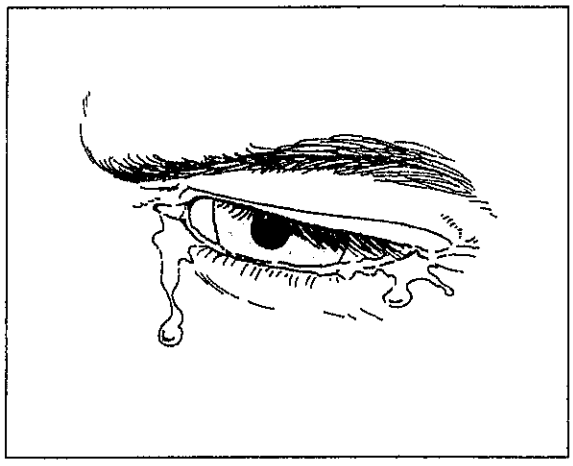


Figure E *When dust gets in your eyes you tear, and your eyelids flutter—automatically.*

3. What part of your body do you seem to protect first automatically?

_____

4. How does this reflex protect you?

_____

COMPLETING SENTENCES

Choose the correct word or term for each statement. Write your choice in the spaces provided.

1. Reflexes are _____ .
   learned, inborn
2. You _____ control reflexes.
   can, cannot
3. Reflexes _____ planned.
   are, are not
4. Reflexes _____ happen by themselves.
   do, do not
5. You _____ know that most reflexes are happening.
   do, do not
6. Reflex responses are carried out by _____ . (Careful, this one is tricky.)
   nerves, muscles
7. Most reflexes are very _____ .
   slow, fast
8. A reflex always happens _____ .
   the same way, in different ways
9. Reading _____ a reflex.
   is, is not
10. Blinking when something enters your eye _____ a reflex.
    is, is not

WORD SCRAMBLE

Below are several scrambled words you have used in this Lesson. Unscramble the words and write your answers in the spaces provided.

1. PONSESER _____
2. XERFEL _____
3. NAIP _____
4. NORBNI _____
5. SULUMITS _____

ABOUT INSTINCTS

An instinct [in-STINKT] is like a reflex. It is inborn and automatic. And it happens the same way, every time. BUT, an instinct is much more complex than a reflex.

There are many instincts. Animals depend on instincts more than humans. For example, a bird uses instinct to build its nest. A bird can build a nest even if it has never seen one built.

Nest-building is complicated. A bird must choose a nesting place. It must select nesting materials. Then it must put the nest together.

Scientists believe that an instinct is a series, or chain, of reflex responses. Each response leads to another. And, if one response in the "chain" is not done, the "instinct" will not be completed—or it will not be completed correctly.

For example, if a bird cannot put its nesting materials together correctly, the nest will not be built. Or if built, the nest will not be a good one.

Now, complete these sentences about instincts.

1. Instincts are _____ (learned, inborn).
2. Both reflexes and instincts are _____ (thought out, automatic).
3. Instincts are _____ (more, less) complex than reflexes.
4. An instinct is a series of inborn _____ (stimuli, responses).
5. For an instinct action to be completed, all steps leading to the action must be _____.

REACHING OUT

In what kind of jobs are very fast reflexes especially important?

_____

_____