The Nervous System  •  Review and Reinforce

How the Nervous System Works

Understanding Main Ideas

Answer the following questions on a separate sheet of paper.

1. What are three main functions of the nervous system? Give an example of each.

2. What are the three kinds of neurons? How do they work together to produce a response to an environmental stimulus? Use an example in your explanation.

3. How does a message travel across the gap at a synapse?

Building Vocabulary

Label the diagram below with the axon, axon tip, dendrite, and synapse.

Fill in the blank to complete each statement.

8. A(n) __________________ is what your body does in reaction to a stimulus.
9. A bundle of nerve fibers is called a(n) __________________.
10. The message that a neuron carries is called a(n) __________________.
11. Any change or signal in the environment that can make an organism react is a(n) __________________.
12. A cell that carries information through your nervous system is called a(n) __________________.
The Nervous System  •  Enrich

Polygraph Test

A polygraph, or lie detector, test is sometimes used to help determine whether a person is telling the truth. In such a test, the subject (the person being tested) is connected to a polygraph machine that records information about his or her body. This information includes such things as heart rate, blood pressure, breathing rate, and sweat gland activity. An examiner (the person giving the test) asks the subject a series of questions. As the subject answers, the machine records changes in the subject’s body. The examiner uses these changes to determine whether the subject has answered the questions truthfully.

The polygraph test relies upon responses of the subject’s nervous system. If the subject gives an untruthful answer, fear of being caught in a lie triggers several responses that are largely involuntary. For example, fear might cause the subject’s heart rate to increase or even skip a beat, and these changes would be recorded by the polygraph. However, there is disagreement among scientists about how reliable polygraphs are. Some studies have shown that conditions such as lack of sleep or the use of some types of drugs can affect the results of a polygraph test.

Answer the following questions on a separate sheet of paper.

1. Why do you think it is important that a polygraph measures responses that are largely involuntary instead of responses that are voluntary?
2. Sometimes subjects are given a “practice test” that will record their body’s response to telling a lie. In this test, the examiner tells the subject to think of a number between one and ten and to answer “no” to all questions. Then, the examiner asks “Is the number one?,” “Is the number two?,” and so on, until the examiner has asked the question for all the numbers from one to ten. Why is this a good practice test?
3. Name a voluntary response and an involuntary response of the nervous system during a polygraph test.
Divisions of the Nervous System

Understanding Main Ideas
For items 1–5, complete the following concept map.

Answer the following questions on a separate sheet of paper.

6. What is the function of the central nervous system?
7. What is the peripheral nervous system and what is its function?
8. What is the function of the somatic nervous system?
9. What is the function of the autonomic nervous system?

Building Vocabulary
Match each term with its definition by writing the letter of the correct definition in the right column on the line beside the term in the left column.

10. spinal cord
11. reflex
12. cerebellum
13. concussion
14. brain
15. brain stem
16. cerebrum

a. the part of the brain that controls the body’s involuntary activities
b. the part of the brain that interprets input from the senses, controls the movement of skeletal muscles, and carries out complex mental processes
c. a bruiselike injury of the brain
d. an automatic response that occurs very rapidly and without conscious control
e. the part of the central nervous system that controls most body functions
f. the part of the brain that coordinates the actions of your muscles and helps you keep your balance
g. a thick column of nerve tissue
Sleep and Your Brain

When you are sleeping, you are not aware of your surroundings. Yet your brain remains active. No one knows why sleep is necessary, but scientists have hypothesized that it is involved in learning and memory. To study the activity of a person’s brain during sleep, scientists use a device called an electroencephalogram (EEG). To make an EEG, wires are placed on a person’s head. These wires can transmit the electrical signals of nerve impulses in the brain. The electrical signals are converted to a wavelike pattern that is recorded on paper. This record is an EEG.

EEGs indicate that there are two types of sleep. One type of sleep is called slow-wave sleep. During slow-wave sleep, a person usually does not dream and frequently changes position. The second type of sleep is called paradoxical sleep. During this type of sleep, a person’s eyes move back and forth underneath their closed eyelids. Paradoxical sleep is also marked by dreaming and by a relaxation of the body’s muscles.

These two types of sleep alternate throughout a night. A person first goes through slow-wave sleep, then paradoxical sleep, back to slow-wave sleep, and so on. EEGs showing the brain’s activity while a person is awake and during the two types of sleep are shown at the right.

Answer the following questions on a separate sheet of paper.

1. How does the brain activity of a person in slow-wave sleep compare to that of a person who is awake? How does the brain activity of a person in paradoxical sleep compare to that of a person who is awake?
2. Can a person who is asleep still respond to stimuli? Explain.
3. Infants require much more sleep than older people. How does this fact support the hypothesis that sleep is connected to learning and memory?
4. A paradox is something that seems to be false, but is in fact true. In what way is paradoxical sleep a paradox?
5. How does an EEG demonstrate that nerve impulses travel through neurons in the form of electrical signals?
The Nervous System • Review and Reinforce

Sight and Hearing

Understanding Main Ideas
Answer the following questions on a separate sheet of paper.

1. How do we see? In your explanation, describe the parts of the eye and the path of light through the eye.
2. How do we hear? In your explanation, describe the parts of the ear and path of sounds through the ear.

Building Vocabulary
From the list below, label the diagram.

cornea  iris  retina
pupil  lens

3. ______
4. ______
5. ______
6. ______
7. ______

Fill in the blank to complete each sentence.

8. The ______________________ contains receptors that convert sound vibrations to impulses that are sent to the brain.
9. Vibrations pass from the eardrum to the ________________________.
10. The ________________________ sends electrical impulses from the rods and cones to the brain.
11. The ________________________ is a membrane in the ear that vibrates when sound waves strike it.
12. Each ________________________ in your inner ear helps you maintain your sense of balance.
Color Vision, Colorblindness

Receptor cells called cones enable you to see colors. The human eye has three different types of cones. People who are colorblind are missing at least one type of cone cell. Most people who are colorblind can see colors. They just can’t see as many colors as a person with all three types of cones. In addition, some colors may appear different to a person who is colorblind than to a person who has all three types of cones.

Because there are three types of cones, there are also three types of colorblindness. For example, people who do not have red cones cannot see red light. As a result, they cannot distinguish between the colors red and green. Those who do not have blue cones cannot see blue light; they cannot distinguish between the colors blue and yellow. People who lack green cones cannot see green light.

Everyone is colorblind during some part of their life. For example, you were born colorblind. Cone cells don’t start working until a person is about four months old. You also become colorblind in dim light. You may have noticed that when you first turn off your bedroom light at night, you can’t see anything at all. Then after a few minutes, the room seems to get lighter. The flowchart below shows why this happens.

Answer the following questions on a separate sheet of paper.

1. Why does a darkened room appear to get lighter after a few minutes?
2. One way scientists have learned about colorblindness is by studying people who are colorblind in one eye, but have full color vision in the other eye. Such people are able to describe how colors appear to a person who has colorblindness in both eyes. How do you think they are able to do this?
3. What problem might a person who lacked red cones have at a traffic light? What is a possible solution to this problem?
4. The taillights of some cars and motorcycles appear very dark brown to some people with colorblindness. Why could this be dangerous?
5. Suppose a person’s eyes had no cones at all. How would this affect his or her color vision?
The Nervous System • Review and Reinforce

Alcohol and Other Drugs

Understanding Main Ideas
For items 1–3, complete the following Venn diagram by writing the letter of each characteristic in the correct section.

- slow down the central nervous system
- can be abused
- include alcohol and heroin
- speed up body processes
- act on the nervous system
- include nicotine

Answer the following in the spaces provided.

4. What are some of the common effects of long-term abuse of alcohol?

________________________________________________________________________
________________________________________________________________________

Building Vocabulary
Write a definition for each of the following terms on the lines below.

5. drug abuse
________________________________________________________________________
________________________________________________________________________

6. alcoholism
________________________________________________________________________
________________________________________________________________________

7. tolerance
________________________________________________________________________
________________________________________________________________________

8. withdrawal
________________________________________________________________________
________________________________________________________________________

9. depressant
________________________________________________________________________
________________________________________________________________________
Alcohol-Related Traffic Deaths

Traffic accidents are the leading cause of death in the United States for children under age 15. Between 1985 and 1996, 35,547 children under age 15 were killed in traffic accidents. Alcohol was involved in 8,482 of these deaths. Of the children killed in alcohol-related crashes, 68 percent were passengers in a car, 22 percent were pedestrians, and 8 percent were bicyclists.

The table below shows the ages of people who died in traffic accidents caused by drunk drivers in 1997 and 2001.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>1997</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 16</td>
<td>670</td>
<td>584</td>
</tr>
<tr>
<td>16-20</td>
<td>2,096</td>
<td>2,366</td>
</tr>
<tr>
<td>21-24</td>
<td>2,053</td>
<td>2,421</td>
</tr>
<tr>
<td>25-34</td>
<td>4,031</td>
<td>3,800</td>
</tr>
<tr>
<td>35-44</td>
<td>3,356</td>
<td>3,709</td>
</tr>
<tr>
<td>45-54</td>
<td>1,862</td>
<td>2,382</td>
</tr>
<tr>
<td>55-64</td>
<td>905</td>
<td>1,039</td>
</tr>
<tr>
<td>65-74</td>
<td>604</td>
<td>558</td>
</tr>
<tr>
<td>Over 74</td>
<td>454</td>
<td>481</td>
</tr>
<tr>
<td>Total</td>
<td>16,031</td>
<td>17,338</td>
</tr>
</tbody>
</table>

Answer the following questions on a separate sheet of paper.

1. For which age group did the number of traffic deaths due to drunken drivers increase the most? How many more deaths were there in this age group in 2001 than 1997?
2. By about what percent did the total number of traffic deaths involving drunken drivers increase between 1997 and 2001?
3. About how many people died each day in 2001 due to traffic accidents involving drunken drivers?
4. How many people under age 16 were killed by drunken drivers in 1997 and 2001 combined?
5. What are three ways that the number of deaths due to drunken driving could be reduced?

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