

CHAPTER 40—THE NERVOUS SYSTEM AND THE EFFECTS OF DRUGS

MULTIPLE CHOICE

- Which of the following are activities of drugs in the nervous system?
 - increased neurotransmitter activity at a synapse
 - decreased neurotransmitter activity at a synapse
 - alteration of pain or mood
 - all of theseANS: D DIF: B OBJ: 40-5
- What is any drug that inhibits transmission of sensory impulses at a synapse called?
 - depressant
 - stimulant
 - hallucinogen
 - neurotransmitterANS: A DIF: B OBJ: 40-5
- A(n) _____ is any drug that speeds up the activities of the nervous system.
 - depressant
 - addictive drug
 - antibiotic
 - stimulantANS: D DIF: B OBJ: 40-5
- Which part of the brain controls conscious activities, memory, language, and the senses?
 - medulla oblongata
 - cerebrum
 - cerebellum
 - thalamusANS: B DIF: B OBJ: 40-2
- The _____ is the area of the brain that controls activities related to homeostasis, such as body temperature, hunger, thirst, and sleep.
 - cerebrum
 - cerebellum
 - medulla oblongata
 - hypothalamusANS: C DIF: B OBJ: 40-2
- Alcohol may act on the brain by _____.
 - dissolving through the membranes of neurons
 - speeding up the movement of sodium and calcium ions
 - increasing anxiety
 - increasing oxygen contentANS: A DIF: B OBJ: 40-6

40-1

- Cocaine is a stimulant because it _____.
 - causes blood pressure to drop
 - causes heart rate to slow down
 - relieves anxiety
 - causes levels of neurotransmitters in the brain to increaseANS: D DIF: B OBJ: 40-6
- A person who is addicted to a drug is experiencing withdrawal when he or she _____.
 - needs more of the drug to achieve the same effect
 - becomes ill after stopping its use
 - needs to take the drug more often
 - feels better when stopping its useANS: B DIF: B OBJ: 40-6
- You can see the colors in a picture because you are aided by the _____.
 - rods of the retina
 - right visual field
 - cones of the retina
 - left visual fieldANS: C DIF: B OBJ: 40-4
- Which controls involuntary activities of the body such as breathing and heart rate?
 - cerebrum
 - cerebellum
 - medulla oblongata
 - none of theseANS: C DIF: B OBJ: 40-2
- A nerve impulse travels from one cell to another by passing from _____.
 - one axon to another axon
 - one dendrite to an axon
 - one axon to a dendrite
 - one dendrite to another dendriteANS: C DIF: B OBJ: 40-1
- Sensory neurons can _____.
 - process incoming impulses and pass them on to motor neurons
 - carry impulses from outside and inside the body to the brain and spinal cord
 - carry response impulses away from the brain and spinal cord
 - carry impulses across synapsesANS: B DIF: B OBJ: 40-2

40-2

COMPLETION

1. Drugs may cause increased or decreased neurotransmitter activity at a(n) _____.
ANS: synapse DIF: B OBJ: 40-1
2. The skin contains _____ that detect changes in temperature, touch, pressure, and pain.
ANS: sensory receptors DIF: B OBJ: 40-1

3. When chemicals acting on the hairlike nerve endings located in your nose initiate impulses in the olfactory nerve, the response is called _____.
ANS: chemoreception DIF: B OBJ: 40-3

MATCHING

Match each item with the correct statement below. Write the answer in the space provided.

- | | |
|------------------------|----------------------|
| a. tolerance | h. depressant |
| b. reflex | i. hallucinogen |
| c. neurotransmitters | j. medulla oblongata |
| d. synapse | k. cochlea |
| e. addiction | l. axon |
| f. semicircular canals | m. rods |
| g. narcotic | n. retina |
1. _____
Chemicals that diffuse across the synapse and stimulate polarity changes in a neuron
 2. _____
Drug that affects the CNS, altering moods, thoughts, and sensory perceptions
 3. _____
Fluid-filled, snail-shaped structure in the inner ear
 4. _____
Tiny space between the axon of one neuron and the dendrites of another neuron over which nerve impulses must travel
 5. _____
Controls involuntary activities such as breathing and heart rate
 6. _____
Structure in the inner ear that helps maintain balance
 7. _____
Light receptors adapted for vision in dim light
 8. _____
Layer of nerve tissue made up of sensory neurons that respond to light
 9. _____
Occurs when a person needs larger and/or more frequent doses of a drug to achieve the same effect
 10. _____
Single extension of a neuron that carries impulses away from the cell body
 11. _____
Automatic response to a stimuli
 12. _____
Psychological and physical dependence on drugs
 13. _____
Any drug that slows down the activities of the CNS
 14. _____
Medicine that relieves pain and causes sleep
- | | | |
|---------------|--------|-----------|
| 1. ANS: _____ | DIF: B | OBJ: 40-1 |
| 2. ANS: _____ | DIF: B | OBJ: 40-6 |
| 3. ANS: _____ | DIF: B | OBJ: 40-3 |
| 4. ANS: _____ | DIF: B | OBJ: 40-1 |
| 5. ANS: _____ | DIF: B | OBJ: 40-2 |

- | | | |
|------------|--------|-----------|
| 6. ANS: f | DIF: B | OBJ: 40-3 |
| 7. ANS: m | DIF: B | OBJ: 40-4 |
| 8. ANS: n | DIF: B | OBJ: 40-4 |
| 9. ANS: a | DIF: B | OBJ: 40-6 |
| 10. ANS: l | DIF: B | OBJ: 40-1 |
| 11. ANS: b | DIF: B | OBJ: 40-2 |
| 12. ANS: e | DIF: B | OBJ: 40-6 |
| 13. ANS: h | DIF: B | OBJ: 40-5 |
| 14. ANS: g | DIF: B | OBJ: 40-5 |

SHORT ANSWER

1. Why does a person find it difficult to speak after being given a local anesthetic to kill the pain in a tooth that is being drilled?
ANS: The anesthetic affects motor nerves that control the muscles of the tongue.
DIF: A OBJ: 40-5
2. What causes the chemoreceptors of smell and taste to be active?
ANS: Dissolved molecules come into contact with the nerve endings of these two kinds of chemoreceptors. Depending on the molecule, different messages are sent to the brain. These messages include intensity and kind of taste.
DIF: A OBJ: 40-3
3. Describe how a wave of depolarization moves down an axon.
ANS: When a neuron is excited, its membrane becomes permeable to sodium ions. Positive sodium ions build up inside the neuron as the impulse travels down the axon. The membrane repolarizes immediately behind the impulse.
DIF: A OBJ: 40-1
4. Describe the function of the peripheral nervous system.
ANS: The peripheral nervous system carries messages to and from the central nervous system.
DIF: A OBJ: 40-2
5. What is the role of the somatic nervous system in your body?
ANS: Sensory nerves of the somatic nervous system relay information mainly from your skin to the CNS, which relays a response through motor neurons of the somatic system to the skeletal muscles. Reflexes, which are automatic, unconscious responses to stimuli, also occur through the somatic system.
DIF: B OBJ: 40-2

6. How do the semicircular canals help you to keep your balance?

ANS: The semicircular canals are filled with thick fluid and lined with hair cells. The mechanical movements of the hairs stimulate the neurons to carry an impulse to the cerebellum and the cerebrum. Motor neurons in the brain then stimulate muscles in the head and neck to readjust the position of your head so you maintain your balance.

DIF: B OBJ: 40-3

7. How is the eye adapted for vision in a dimly lit place?

ANS: The eye has special light receptors called rods, which are adapted for vision in dim light. The rods help the viewer to detect the shape and movement of objects in near darkness.

DIF: B OBJ: 40-4

8. How does a nerve impulse pass from neuron to neuron?

ANS: As an impulse reaches the end of an axon, the changing charges open calcium channels, allowing calcium to enter the end of the axon. The calcium causes neurotransmitters to diffuse across the synapse to the dendrite of the next neuron to be stimulated.

DIF: B OBJ: 40-1

9. How is a nerve impulse transmitted through a neuron?

ANS: When a stimulus excites a neuron, sodium channels in the membrane open up, allowing sodium ions to rush inside. The inside of the neuron becomes more positively charged than the outside, a condition that sets up a wave of changing charges down the length of the axon as the nerve impulse moves along it.

DIF: B OBJ: 40-1

10. The utricle and saccule are organs in the inner ear. Each of these structures contains a patch of epithelium called the macula. The macula of the utricle is oriented parallel to the base of the skull. The macula of the saccule is perpendicular to the base of the skull. Hair cells in the maculae are embedded in a gelatinous mass. Each hair is weighted by a small mineral grain. The force with which a mineral grain presses against a hair cell depends on the pull of gravity. In terms of the utricle and saccule, why might an astronaut in zero gravity experience space sickness?

ANS: Without gravity acting on the hair cells of the utricle and saccule, the astronaut's brain has to learn to adjust. In the meantime, he or she would experience the headaches and dizziness characteristic of space sickness.

DIF: A OBJ: 40-3

40-5

PROBLEM

If you enter a darkened room from a lighted area, you cannot see anything. The retina of the eye is lacking sufficient light-sensitive rhodopsin in the rods for adequate vision. However, the concentration of rhodopsin builds up quickly, as you can see from the graph in Figure 40-1 showing dark and light adaptation.

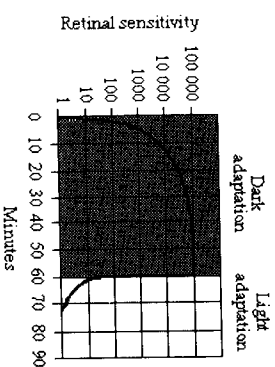


Figure 40-1

1. Based on Figure 40-1, on entering a bright room after being in the dark, what happens to the sensitivity of the retina?

ANS: It falls to a sensitivity of 1.

DIF: B OBJ: 40-4

2. How is the response of the retina to changes in light an adaptation? Refer to Figure 40-1.

ANS: Answers may include that the rods make only as much rhodopsin as is needed, but when there is need, they have the ability to produce large quantities of the substance in a reasonable amount of time.

DIF: A OBJ: 40-4

3. Using Figure 40-1, in how many minutes does the retina have a sensitivity of 100 000 units?

ANS: after about 60 minutes

DIF: B OBJ: 40-4

4. How long does it take for the sensitivity of the retina to improve from 1 to 10 000 arbitrary units? Refer to Figure 40-1.

ANS: about 12 minutes

DIF: B OBJ: 40-4

40-6