Biology, Behavior, and Mind

Objective 2-1: Explain why psychologists are concerned with human biology.

1. In the most basic sense, every idea, mood, memory, and behavior that an individual has ever experienced is a

_____ phenomenon.

2. The theory that linked our mental abilities to

bumps on the skull was _____. Although its popularity faded, this theory

focused attention on the _____ of

3. Researchers who study the links between biology and behavior are working from the _____

4. We are made up of smaller and smaller

_____; we are also part of larger ______. Thus, we are ______systems.

STUDY TIP: Many students find the technical material in this chapter difficult to master. Not only are there many terms for you to remember, but you must also know the organization and function of the various divisions of the nervous system. Learning this material will require a great deal of active processing, testing yourself frequently to be sure you know and understand the many structures and their functions. Working the chapter review several times, drawing and labeling brain diagrams, making flash cards, and mentally defining the terms are all useful techniques for learning this type of material.

APPLICATIONS:

5. Someone working from the biological perspective would be more likely to study

- a. how you learn to express emotions.
- b. how to help people overcome emotional disorders.
- c. life-span changes in the expression of emotion.
- d. the chemical changes that accompany emotions.

6. Which of the following was a major problem with phrenology?

a. It was "ahead of its time" and no one believed it could be true.

b. The brain is not neatly organized into structures that correspond to our categories of behavior.

c. The brains of humans and animals are much less similar than the theory implied.

d. All of these were problems with phrenology.

7. Cite some possible areas a person working from the biological perspective would be likely to study.

Neural Communication

Objective 2-2: Describe the parts of a neuron, and explain how neurons transmit information. 8. Our body's neural system is built from billions of nerve cells, or ______. 9. The extensions of a neuron that receive messages from other neurons are the ______. The extension of a neuron that transmits information to other neurons is the ______. Some of these extensions are insulated by a fatty tissue called the _______, which helps speed the

neuron's impulses.

10. Identify the major parts of the neuron diagrammed below.



| 11. The neural impulse, or | 18. Neurotransmitters influence neurons either by |
|---|--|
| travels down a(n) | readiness to fire. Excess neurotransmitters are reabsorbed |
| 12. The fluid interior of a resting axon carries mostly | by the sending neuron in a process called |
| (nositively/negatively) charged ions, while the fluid | |
| outside has mostly (positively/negatively) charged ions. | Outline the sequence of reactions that occur when a neural |
| This polarization, called the | impulse is generated and transmitted from one neuron to |
| occurs because the cell membrane | another |
| is | |
| 13. An action potential occurs when the first part of the | |
| axon opens its gates and (positively/negatively) charged | |
| ions rush in. causing that part of the neuron to become | |
| . During the resting pause | |
| following an action potential, called the | |
| . the | |
| neuron pumps (positively/negatively) charged ions back | |
| outside the cell. | |
| 14. To trigger a neural impulse, | |
| signals minus signals must exceed | Objective 2-4: Describe how neurotransmitters influence |
| a certain intensity, called the | behavior, and explain how drugs and other chemicals affect |
| Increasing a stimulus above this level (will/ will not) | neurotransmission. |
| increase the neural impulse's intensity. This phenomenon | 19. A neurotransmitter that is important in muscle |
| is called an - | contraction is; it is also important |
| <u>-</u> | in learning and |
| response. | 20. Naturally occurring opiate-like neurotransmitters that |
| 15. The strength of a stimulus (does/ does not) affect the | are present in the brain are called |
| intensity of a neural impulse. A strong stimulus (can/ | When the brain is flooded with drugs such as |
| cannot) trigger more neurons to fire. | or, it may |
| Objective 2-3: Describe how nerve cells communicate with | stop producing these neurotransmitters. |
| other nerve cells. | 21. Drugs that produce their effects by mimicking |
| 16. The junction between two neurons is called a | neurotransmitters are called |
| , and the gap is called the | Drugs that block neurotransmitters' functioning by |
| . This | occupying their |
| discovery was made by . | |
| 17. The chemical messengers that convey information | are calledWhile certain |
| across the gaps between neurons are called | drugs create a temporary "high" |
| . These chemicals bind to receptor | by mimicking the endorphins, the poison |
| sites and unlock tiny channels, allowing electrically | produces paralysis by blocking the |
| charged to enter the neuron | activity of the neurotransmitter ACh. |
| to enter the neuron. | |

STUDY TIP: To understand the relationships among excitatory and inhibitory synapses, threshold, and the all-ornone response, you should think of the neuron as a simple switch that is always either "on" or "off." This "all-or-none" response is in contrast to the graded, "partially on" response of the more complex dimmer switch. Whether the all-or-none response occurs depends on whether the input to the neuron is sufficient to allow it to reach its threshold—much as a simple light switch requires a certain amount of force to operate. In the neuron's case, the "force" refers to the combination of excitatory inputs (which promote a response) and inhibitory inputs (which promote the neuron's remaining in its resting state).

APPLICATIONS:

22. Several shy neurons send an inhibitory message to neighboring neuron Joni. At the same time, a larger group of party-going neurons sends Joni excitatory messages. What will Joni do?

- a. fire, assuming that her threshold has been reached
- b. not fire, even if her threshold has been reached
- c. enter a refractory period
- d. become hyperpolarized

23. I am a relatively fast-acting chemical messenger that influences muscle action, learning, and memory. What am I?

- a. dopamine c. acetylcholine
- b. a hormone d. glutamate

24. Since Malcolm has been taking a drug prescribed by his doctor, he no longer enjoys the little pleasures of life, such as eating and drinking. His doctor explains that this is because the drug

- a. triggers release of dopamine.
- b. inhibits release of dopamine.
- c. triggers release of ACh.
- d. inhibits release of ACh.

25. Lolita is feeling depressed for no particular reason. It is possible that she has an undersupply of

26. Punjab had lunch at the local Chinese restaurant. Afterward, he suffered a migraine, most likely caused by an ______ of ______.

The Nervous System

Objective 2-5: Describe the functions of the nervous

system's main divisions, and identify the three main types

of neurons.

27. Taken altogether, the neurons of the body form the

28. The brain and spinal cord form the

_____ nervous system. The

neurons that link the brain and spinal cord to the

rest of the body form the _____

nervous system.

29. Axons are bundled into electrical cables called

_____, which link the CNS with muscles, glands, and sense organs. Information arriving in the brain and spinal cord from the body's tissues and sensory receptors travels in ______ neurons. Instructions from the brain and spinal cord are sent to the body's tissues via ______

neurons. The neurons that enable internal communication within the brain and spinal cord are called

30. The division of the peripheral nervous system that enables voluntary control of the skeletal muscles is the

_____ nervous system.

31. Involuntary, self-regulating responses—those of the glands and muscles of internal organs—are controlled by

the _____ nervous system.

32. The body is made ready for action by the

_____ division of the autonomic

nervous system.

33. The _____ division of the

autonomic nervous system produces relaxation. Describe and explain the sequence of physical reactions that occur in the body as an emergency is confronted and then passes.

34. The brain's neurons cluster into work groups called

35. Automatic responses to stimuli, called

_____, illustrate the work of the

_____. Simple pathways such as these

are involved in the ______-

_____ response and in the

_____ reflex.

Beginning with the sensory receptors in the skin, trace the course of a spinal reflex as a person reflexively jerks his or her hand away from an unexpectedly hot burner on a stove.

STUDY TIP: To keep the various functions of the peripheral nervous system (PNS) straight, remember that the PNS consists of two main divisions: somatic and autonomic. The somatic ("S") division primarily regulates "S functions," such as the *senses* and *skeletal* muscles. The autonomic "CA") division regulates *automatic* ("A") physical systems that do not require conscious attention. These include breathing, heart rate, and digestion, to name a few.

APPLICATIONS:

36. You are sitting at your desk at home, studying for an exam. No one else is home, but you hear creaking floorboards. You sneak downstairs, only to discover your parents have returned home early. Describe and explain the sequence of physical reactions that occurred in your body as you felt fear and then relief.

37. You are able to pull your hand quickly away from hot water before pain is felt because

a. movement of the hand is a reflex that involves intervention of the spinal cord only.

b. movement of the hand does not require intervention by the central nervous system.

c. the brain reacts quickly to prevent severe injury.

d. the autonomic division of the peripheral nervous

system intervenes to speed contraction of the muscles of the hand.

38. Following Jayshree's near-fatal car accident, her physician noticed that the pupillary reflex of her eyes was abnormal. This MAY indicate that Jayshree's

was damaged in the accident. 39. Your brother has been taking prescription medicine and experiencing a number of unpleasant side effects, including unusually rapid heartbeat and excessive perspiration. It is likely that the medicine is exaggerating activity in the

a. central nervous system.

- b. sympathetic nervous system.
- c. parasympathetic nervous system.
- d. somatic nervous system.

The Endocrine System

Objective 2-6: Describe the nature and functions of the endocrine system and its interaction with the nervous system.

40. The body's chemical communication network is called the _____

This system transmits information through chemical

messengers called ______ at a much

(faster/slower) rate than the nervous system, and its effects last (a longer time/ a shorter time).

41. In a moment of danger, the autonomic nervous system

orders the glands to release _____ and

_____. These hormones increase

_____, and

42. The most influential gland is the

_____, which, under the control of an

adjacent brain area called the _____,

helps regulate ______ and the release

of hormones by other endocrine glands. The hormone

_____ enables contractions associated

with birthing, milk flow during nursing, and orgasm. It also promotes

Write a paragraph describing the feedback system that links the nervous and endocrine systems.

APPLICATIONS:

43. I am a relatively slow-acting (but long-lasting) chemical messenger carried throughout the body by the bloodstream. What am I?

a. a hormone
b. a neurotransmitter
c. acetylcholine
d. dopamine
44. A bodybuilder friend suddenly seems to have grown
several inches in height. You suspect that your friend's
growth spurt has occurred because he has been using drugs
that affect the

- a. pituitary gland. c. a
- b. pancreas.

c. adrenal glands.

d. parathyroids.

The Brain

Objective 2-7: Describe several techniques for studying the brain's connections to behavior and mind.

45. Researchers sometimes study brain function by

producing _____ or by selectively

destroying brain cells. The oldest technique for studying the brain involves _____

_____ of patients with brain injuries or diseases.

46. The ______ is an amplified

recording of the waves of electrical activity that sweep across the brain's surface.

47. The technique depicting the level of activity of brain areas by measuring the brain's consumption of glucose is called the _____

Briefly explain the purpose of the PET scan.

thought to control the bodily activity being studied. Using this technique, researchers found that bloodflow to the back of the brain (increases/ decreases) when people view a scene because that is where _____

information is processed.

STUDY TIP/APPLICATIONS: To help keep the various research methods for studying the brain straight, think of the methods as falling into two categories: (1) those that measure ongoing electrical or metabolic brain activity in real time (EEG, PET scan, fMRI) and (2) those that merely provide a momentary picture of the brain's anatomical structure (MRI).
50. a. Which method would be most useful to a neurologist attempting to locate a tumor in a patient's brain?

b. Which method would be most useful to a researcher attempting to pinpoint the area of the brain that is most critical to speaking aloud?

c. What are some other instances when a researcher would be best advised to use methods that give a picture of the brain's structure?

d. What are some other instances when a researcher would be best advised to use methods that measure brain activity?

Objective 2-8: Describe the components of the brainstem, and summarize the functions of the brainstem, thalamus, and cerebellum.

51. The oldest and innermost region of the brain is the

52. At the base of the brainstem, where the spinal cord

enters the skull, lies the _____, which

controls ______ and

_____. Just above this part is the

_____ which helps coordinate

movements.

53. Nerves from each side of the brain cross over to connect with the body's opposite side in the

54. At the top of the brainstem sits the

_____, which serves as the brain's sensory switchboard, receiving information from all the senses except ______ and routing it to

48. A technique that produces clearer images of the brain (and other body parts) by using magnetic fields and radio waves is known as _____.

49. By comparing scans taken less than a second apart, the

detects oxygen-laden bloodflow to the part of the brain

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| the regions dealing with those senses. These egg-shaped | 61. Below the thalamus is the | |
|--|---|--|
| structures also receive replies from the higher regions, | (c), which regulates bodily maintenance behaviors such as | |
| which they direct to the and to | | |
| the | , and | |
| 55. The finger-shaped network of neurons, the | behavior. This area also | |
| , is | regulates behavior by secreting | |
| contained inside the brainstem and plays an important role | that enable it to control the | |
| in controlling Electrically | gland. Olds and Milner discovered that this region also | |
| stimulating this area will produce an | contains centers, which | |
| animal. Lesioning this area will | animals will work hard to have stimulated. | |
| cause an animal to lapse into a | 62. Some researchers believe that alcohol dependence, drug | |
| 56. At the rear of the brain stem lies the | abuse, binge eating, and other | |
| It influences one type of | disorders may stem from a genetic | |
| and | | |
| memory. It also helps us judge time, modulate our | in the natural brain systems for | |
| , and discriminate sounds and | pleasure and well-being. | |
| textures; and it coordinates voluntary movement and | Objective 2-10: Identify the various regions of the cerebral | |
| control. | cortex, and describe their functions. | |
| 57. The lower brain functions occur without effort, | 63. The most complex functions of human behavior are | |
| indicating that our brains process most information (inside/ | linked to the most developed part of the brain, the | |
| outside) of our awareness. | | |
| Objective 2-9: Describe the structures and functions of the | This thin layer of | |
| limbic system. | interconnected neural cells is the body's ultimate control | |
| 58. Between the brainstem and cerebral hemispheres is the | and - | |
| | center. | |
| system. One component | 64. Compared with the cortexes of lower mammals, the | |
| of this system that | human cortex has a (smoother/more wrinkled) surface. | |
| processes conscious | This (increases / decreases) the overall surface area of our | |
| memories is the | brains. | |
| | 65. The cells that support, protect, and nourish cortical | |
| (see a in drawing). | neurons are called | |
| 59. Aggression or fear will result from stimulation of | . These cells may also playa role | |
| different regions of the lima-bean-sized neural clusters, the | in and . | |
| (see b). | 66. Each hemisphere's cortex is subdivided into four lobes. | |
| 60. We must remember, however, that the brain (is/is not) | separated by prominent | |
| neatly organized into structures that correspond to our | folds. List the four lobes of the brain. | |
| categories of behavior. For example, aggressive behavior | a. C. | |
| (does/does not) involve neural activity in many brain levels. | | |
| | 0 u | |

| 67. Electrical stimulation | of one side of the | devoted to it. |
|---|--|--|
| | cortex, an arch-shaped region | 70. Visual information is received in the |
| at the back of the | lobe, will | lobes, whereas auditory |
| produce movement on th | e opposite side of the body. The | information is received in the |
| more precise the control needed, the (smaller/ greater) | | lobes. |
| amount of cortical space occupied. | | 71. Areas of the brain that don't receive sensory |
| 68. Researchers investigating | | information or direct movement but, rather, integrate and |
| | _ believe that one day mind- | interpret information received by other regions are known |
| reading computers may enable paralyzed people to control | | as |
| machines directly with their | | Approximately of the human |
| Clinical trials involving _ | | cortex is of this type. Such areas in the |
| 6 - | are | lobe are involved in judging, |
| now under way for peopl | e. For example, recording | planning, and processing of new memories and in some |
| electrodes implanted in th | ne | aspects of personality. In the |
| ····· | of a 25-year-old man's brain | lobe, these areas enable mathematical and spatial |
| have enabled him to men | tally control a TV draw shapes on | reasoning, and an area of the |
| a screen and play video | rames | lobe enables us to recognize faces. |
| 69 At the front of the pay | rietal lobes lies the | 72. Although the mind's subsystems are localized in |
| op. At the none of the pa | cortex which when stimulated | particular brain regions, the brain (does/does not) act as a |
| | Cortex, which, when summated, | unified whole |
| sensitive a body region, t | he greater the area of | |
| APPLICATION: | | |
| 73. In the diagrams t brain locations th each location wit behavior. | o lhe righl, lhe numbers refer lo al have been damaged. Malch h ils probable effect on | |
| Location | Behavioral Effect | 8 |
| 1 2. 3. 4. 5. 6. 7. 8. 9. | a. vision disorder b. insensitivity to touch c. motor paralysis d. hearing problem e. lack of coordination f. abrormal hunger g. split brain h. sleep/arousal disorder i. altered personality | |

When different words are shown in the left and right visual Objective 2-11: Discuss the brain's ability to reorganize itself, and define neurogenesis. fields, if the patient fixates on a point on the center line 74. The quality of the brain that makes it possible for between the fields, the patient will be able to say only the undamaged brain areas to take over the functions of word shown on the . Explain why a split-brain patient would be able to read damaged regions is known as _____ This quality is especially apparent in the brains of (young aloud the word *pencil* flashed to his or her right visual field, children/ adolescents/ adults). but would be unable to identify a *pencil* by touch using only the left hand. 75. Although severed neurons usually (will/will not) regenerate, some neural tissue can _____ in response to damage. The form of therapy aimed at helping to reprogram a damaged brain is called _____ therapy. New evidence suggests 79. When the "two minds" of a split brain are at odds, the that adult mice, birds, monkeys, and humans (can/cannot) _____ hemisphere tries to rationalize generate new brain cells through a process called what it doesn't understand. The _____ _____. Research also reveals the hemisphere often acts on autopilot. This phenomenon existence of master cells in the demonstrates that the _____ mind human embryo that can develop into any type of brain cell. (can/ cannot) control our behavior. Objective 2-12: Explain how split-brain research helps us 80. Deaf people use the _____ understand the functions of our two brain hemispheres. hemisphere to process sign language. 76. The brain's two sides serve differing functions, which is 81. Although the _____ hemisphere is referred to as hemispheric specialization, or better at making literal interpretations of language, the _____. Because damage to the _____ hemisphere will impair such _____ hemisphere excels in making important functions as reading, writing, speaking, inferences, modulating our orchestrating our sense of _______, and arithmetic reasoning, and understanding, the _____ hemisphere was thought to be a perceiving objects. 82. (Close-Up) In all cultures of the world, most of the subordinate or minor hemisphere. human population is (right/left)-handed. Genetic factors 77. In treating several patients with severe epilepsy, Philip Vogel and Joseph Bogen separated the two hemispheres of (play / do not play) a role in handedness. This handedness the brain by cutting the bias is unique to humans and to our nearest relatives. _____. When this structure is severed, the result is referred to as a _____ **APPLICATIONS:** 83. The part of the human brain that is most like that of a fish is the a. cortex. 78. In a split-brain patient, only the b. limbic system. c. brainstem. ____ hemisphere will be aware of an

d. right hemisphere.

unseen object held in the left hand. In this case, the person would not be able to ______ the object. 84. To pinpoint the location of a tumor, a neurosurgeon electrically stimulated parts of the patient's sensory cortex. If the patient was conscious during the procedure, which of the following was probably experienced?

- a. "hearing" faint sounds
- b. "seeing" random visual patterns
- c. movement of the arms or legs
- d. a sense of having the skin touched

85. If Dr. Rogers wishes to conduct an experiment on the effects of stimulating the reward centers of a rat's brain, he should insert an electrode into the

- a. thalamus.
- b. sensory cortex.
- c. hypothalamus.
- d. corpus callosum.

86. A split-brain patient has a picture of a knife flashed to her left hemisphere and that of a fork to her right hemisphere. She will be able to

- a. identify the fork using her left hand.
- b. identify a knife using her left hand.
- c. identify a knife using either hand.
- d. identify a fork using either hand.

87. Anton is applying for a technician's job with a neurosurgeon. In trying to impress his potential employer with his knowledge of the brain, he says, "After my father's stroke I knew immediately that the blood clot had affected his left cerebral hemisphere because he no longer recognized a picture of his friend." Should Anton be hired?

a. Yes. Anton obviously understands brain structure and function.

b. No. The right hemisphere, not the left, specializes in picture recognition.

c. Yes. Although blood clots never form in the left hemisphere, Anton should be rewarded for recognizing the left hemisphere's role in picture recognition.

d. No. Blood clots never form in the left hemisphere, and the right hemisphere is more involved than the left in recognizing pictures.

88. Dr. Johnson briefly flashed a picture of a key in the right visual field of a split-brain patient. The patient could probably

- a. verbally report that a key was seen.
- b. write the word key using the left hand.
- c. draw a picture of a key using the left hand.
- d. do none of these things.

89. In primitive vertebrate animals, the brain primarily regulates ; in lower mammals, the

brain enables

- a. emotion; memory
- b. memory; emotion
- c. survival functions; emotion
- d. reproduction; emotion

90. A scientist from another planet wishes to study the simplest brain mechanisms underlying emotion and memory. You recommend that the scientist study the

- a. brainstem of a frog.
- b. limbic system of a dog.
- c. cortex of a monkey.
- d. cortex of a human.

91. Dr. Frankenstein made a mistake during neurosurgery on his monster. After the operation, the monster "saw" with his ears and "heard" with his eyes. It is likely that Dr.

Frankenstein "rewired" neural connections in the monster's a. hypothalamus.

- b. cerebellum.
- c. amygdala.
- d. thalamus.

92. Raccoons have much more precise control of their paws than dogs. You would expect that raccoons have more cortical space dedicated to "paw control" in the of their brains.

- a. frontal lobes b. parietal lobes
- c. temporal lobes d. occipital lobes