# *Invitation to Psychology 8th edition Wade Test Bank*

SKU: 9780134999210-TEST-BANK

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# TOTAL ASSESSMENT GUIDE

## Chapter 2

## THE BRAIN AND THE NERVOUS SYSTEM

| Topic/ Learning Objective | | Remember the Facts | Understand the Concepts | Apply What You Know | Analyze It |
|---|---|---|---|---|---|
| **POP QUIZ 1** | Multiple Choice | 1,3, 4, 6-9 | 5, 10 | 2 | |
| **POP QUIZ 2** | Multiple Choice | 2,4,5,7-10 | 1 | 3,6 | 21 |
| **The Nervous System: A Basic Blueprint** 2.1.A – Describe the primary functions of the central nervous system, and name its two main structures. 2.1.B – List the major structures and major divisions of the peripheral nervous system, and describe their primary functions. | Multiple Choice | 1-6,9,10,12-15, 17-20 | 7 | 8,11,16,22-26 | |
| | True/False | 1-10,12-17 | 11 | | |
| | Short Answer | | 1,3,4 | | 2 |
| | Essay | | | | 1,2 |
| | Integrative Essay | | | | |
| **Communication in the Nervous System** 2.2.A – Compare the functions of neurons and glial cells. 2.2.B – Describe each of the three main parts of a neuron, and explain their functions. 2.2.C – Explain how stem cells contribute to the process of neurogenesis. 2.2.D – Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters. 2.2.E – Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior. | Multiple Choice | 27-44,47-49,51, 53-54,56-57, 59-61, 64, 67,70,74-79, 81-82,84-105,107 | 50, 63, 65,66,68, 69,71,72, 73,106 | 45,46,52, 83 | 55, 58, 62, 80 |
| | True/False | 18-59 | | | |
| | Short Answer | 5-8,10,11 | | 9,12 | |
| | Essay | | | 3,4,6 | 5 |
| | Integrative Essay | | | | 1 |
| **Mapping The Brain** 2.3.A – Describe techniques researchers use for manipulating the brain and observing the behavior that results. 2.3.B – Describe techniques researchers use for manipulating behavior and observing the effects on the brain. | Multiple Choice | 108, 110-111,113,114, 117,118,120-121 | 123 | 112,115,116,119 | 109, 122 |
| | True/False | 60-69 | | | |
| | Short Answer | 15 | 13,14 | | |
| | Essay | | | 7 | |
| | Integrative Essay | | | | |

**(Continued on next page)**



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| Topic/ Learning Objective | | Remember the Facts | Understand the Concepts | Apply What You Know | Analyze It |
|---|---|---|---|---|---|
| **A Tour Through The Brain** 2.4.A – List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum. 2.4.B – Describe the location and function of the thalamus. 2.4.C – Describe the location and function of the hypothalamus and pituitary gland. 2.4.D – Describe the location and function of the amygdala. 2.4.E – Describe the location and function of the hippocampus. 2.4.F – Describe the function of the cerebrum and corpus callosum. 2.4.G – Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex. | Multiple Choice | 124-130,132,135, 136,138,139,141, 142, 144-152,154-160,162, 164-171,173-177 | 137,140, 163, 172 | 131,133,134, 153, 171, 178 | 143, 161, 170 |
| | True/False | 70-99,101-104 | | 100 | |
| | Short Answer | 16-19,23, 24 | 20,21,22 | | |
| | Essay | | | 8,10 | 9 |
| | Integrative Essay | | | | |
| | | | | | |
| **The Two Hemispheres of the Brain** 2.5.A – Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres. 2.5.B – Describe why the two hemispheres of the brain are allies rather than opposites. | Multiple Choice | 180-182,184,186-188 | 183,185,189 | | 179 |
| | True/False | 105-112 | | | |
| | Short Answer | 25-27 | | | |
| | Essay | | | | |
| | Integrative Essay | 2 | | | |
| **The Flexible Brain** 2.6.A – Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences. 2.6.B – Discuss the relationship between cultural forces and brain function. 2.6.C – Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior. | Multiple Choice | 191 | 194 | | 190,192,193 |
| | True/False | 113-119 | 120 | | |
| | Short Answer | | 28 | | |
| | Essay | 11 | | | |
| | Integrative Essay | | | | |
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**Name _____**

**Chapter 2 – Pop Quiz 1**

1. A collection of neurons and supportive tissue running from the base of the brain down the center of the back, protected by a column of bones, is called the _____.
   a. spinal cord
   b. cerebellum
   c. somatic nervous system
   d. amygdala

2. Shayla blinks as she steps off the school bus and walks into a gust of wind. This automatic reaction is regulated by the _____.
   a. spinal cord
   b. lower part of her brain
   c. hormonal activity in her body
   d. hippocampus

3. The somatic nervous system is also called the _____.
   a. sympathetic nervous system
   b. parasympathetic nervous system
   c. central nervous system
   d. skeletal nervous system

4. A cell that conducts electrochemical signals and is the basic unit of the nervous system is called a _____.
   a. glial cell
   b. neuron
   c. neurotransmitter
   d. nerve

5. New research suggests that glial cells make up around _____ of the brain's cells.
   a. 10 percent
   b. 25 percent
   c. 50 percent
   d. 90 percent

6. Which part of the neuron transmits messages to other neurons, muscles, or gland cells?
   a. the cell body
   b. dendrites
   c. the axon
   d. glial cells

7. Which of the following neurotransmitters affects neurons involved in muscle action, arousal, vigilance, memory, and emotion?
   a. serotonin
   b. GABA
   c. acetylcholine
   d. norepinephrine

8. In _____, brain cells are stimulated using a powerful magnetic field produced by a wire coil placed on a person's head that temporarily stimulates or inactivates neural circuits.
   a. positron-emission tomography
   b. functional magnetic resonance imaging



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c. transcranial direct current stimulation
d. transcranial magnetic stimulation

9. The _____ is a structure in the brain stem that is involved in activities like sleeping, waking, and dreaming.
a. medulla
b. pons
c. thalamus
d. cerebellum

10. Researchers took photographs of different faces, cut them down the middle vertically, and pasted different halves together to form composite faces. The reconstructed photographs were flashed quickly to split-brain patients. It was found that the split-brain patients would _____.
a. name the person in the left part of the image and point with the right hand to the left image
b. name the person in the right part of the image and point with the left hand to the left image
c. name the person in the right part of the image and point with the right hand to the left image
d. name the person in the left part of the image and point with the left hand to the right image


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**Chapter 2 – Pop Quiz 1**
**Answer Key**

1. a Rationale: The spinal cord is a collection of neurons and supportive tissue running from the base of the brain down the center of the back, protected by a column of bones. The spinal cord is located within the vertebral column. (Remember the Facts, Easy, LO 2.1.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

2. b Rationale: Reflexes that occur above the neck are controlled by the lower parts of the brain. (Apply What You Know, Difficult, LO 2.1.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena)

3. d Rationale: The somatic nervous system is also called the skeletal nervous system. (Remember the Facts, Moderate, LO 2.1.B, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

4. b Rationale: The neuron is the basic unit of nervous system function. It uses electrochemical signals to communicate with other cells. (Remember the Facts, Easy, LO 2.2.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

5. c Rationale: An adult brain contains about 171 billion cells, about evenly divided between neurons and glia. (Remember the Facts, Moderate, LO 2.2.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

6. c Rationale: The axon transmits information to other neurons, to skeletal muscle, and to gland cells. (Remember the Facts, Easy, LO 2.2.B, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

7. c Rationale: Acetylcholine affects neurons involved in muscle action, arousal, vigilance, memory, and emotion. (Remember the Facts, Easy, LO 2.2.E, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

8. d Rationale: Transcranial magnetic stimulation is a method of stimulating brain cells, using a powerful magnetic field produced by a wire coil placed on a person's head, that can be used by researchers to temporarily stimulate or inactivate neural circuits. (Remember the Facts, Easy, LO 2.2.E, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

9. b Rationale: The pons is involved in (among other things) sleeping, waking, and dreaming. (Remember the Facts, Easy, LO 2.4.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

10. b Rationale: In the split-brain patient, each hemisphere perceives information in the opposite half of the visual field. Thus, they can verbally describe only what they see in the right half of the visual field, though they can indicate, with their left hand, what they saw in the left half of the visual field. (Understand the Concepts, Difficult, LO 2.5.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains, 2.1 Use scientific reasoning to interpret psychological phenomena)


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**Name _____**

**Chapter 2 – Pop Quiz 2**

1. Which of the following is true of spinal reflexes?
   a. They are not automatic and require conscious effort.
   b. Spinal reflexes control such responses as withdrawing from a painful stimulus, sneezing, and blinking.
   c. They involve sending sensory messages to the spinal cord that immediately trigger a motor response.
   d. They require sensory information to be sent to the brain and then back down to the spinal cord.

2. _____ carry orders from the central nervous system to muscles, glands, and internal organs.
   a. Motor nerves
   b. Sensory nerves
   c. Dendrites
   d. Glial cells

3. On a hike through the hills, Tony feels a bug crawling up his leg under his pants. Which system is necessary for Tony to be aware of the bug?
   a. sympathetic nervous system
   b. endocrine system
   c. somatic nervous system
   d. autonomic nervous system

4. _____ are the brain's communication specialists, transmitting information to, from, and within the central nervous system.
   a. Neurotransmitters
   b. Neurons
   c. Glial cells
   d. Hormones

5. Which part of a neuron acts like an antenna to receive messages from other neurons and transmit these messages toward the cell body?
   a. neurotransmitters
   b. dendrites
   c. axons
   d. glial cells

6. Emily is told by her physician that her symptoms are caused by the loss of myelin. Her diagnosis is most likely to be _____.
   a. Parkinson's disease
   b. Alzheimer's disease
   c. multiple sclerosis
   d. epilepsy

7. Which of the following neurotransmitters functions as the major inhibitory neurotransmitter in the brain?
   a. glutamate
   b. GABA
   c. acetylcholine
   d. norepinephrine

8. A PET scan _____.
   a. records brain waves through electrodes taped to the scalp
   b. records biochemical changes in the brain as they are happening
   c. stimulates the brain by producing a magnetic field through a wire coil
   d. uses radio frequencies and a magnetic field to produce images of the brain


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9. The _____ is involved in classical conditioning and remembering simple skills.
   a. pons
   b. medulla
   c. reticular activating system
   d. cerebellum

10. Linguistic and analytic skills are typically handled by the _____.
   a. right half of your brain
   b. left half of your brain
   c. top half of your brain
   d. back half of your brain


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**Chapter 2 – Pop Quiz 2**
**Answer Key**

1. c Rationale: Spinal reflexes are automatic responses that occur without conscious effort. In fact, spinal reflexes do not even require the brain to occur. Reflexes above the neck, such as sneezing and blinking, are not spinal reflexes because they involve the lower part of the brain rather than the spinal cord. (Understand the Concepts, Moderate, LO 2.1.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains)

2. a Rationale: Motor nerves carry orders from the central nervous system to muscles, glands, and internal organs. (Remember the Facts, Easy, LO 2.1.B, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

3. c Rationale: Sensory information from the skin is carried to the spinal cord by sensory nerves, a part of the somatic nervous system. (Apply What You Know, Moderate, LO 2.1.B, APA 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena)

4. b Rationale: Neurons are the brain's communication specialists, transmitting information to, from, and within the central nervous system. (Remember the Facts, Easy, LO 2.2.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

5. b Rationale: Dendrites receive information from other neurons and transmit these messages toward the cell body. (Remember the Facts, Easy, LO 2.2.B, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

6. c Rationale: Multiple sclerosis is a disorder involving the loss of myelin in the brain. (Apply What You Know, Moderate, LO 2.2.B, APA 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena)

7. b Rationale: GABA (gamma-aminobutyric acid) is the most common inhibitory neurotransmitter in the brain. (Remember the Facts, Easy, LO 2.2.E, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

8. b Rationale: In a PET scan, a radioactively labeled substance such as glucose is injected. The most active cells absorb the most glucose. Therefore, it is possible to scan the brain to see which cells are active in a particular task. (Remember the Facts, Easy, LO 2.3.B, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

9. d Rationale: In addition to being involved in motor coordination, posture, and balance, the cerebellum is involved in classical conditioning and remembering simple skills. (Remember the Facts, Moderate, LO 2.4.A, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)

10. b Rationale: For most people, analytic skills and language are primarily left hemisphere functions, while the right hemisphere is more important for processing spatial information, including recognizing faces. (Remember the Facts, Easy, LO 2.5.B, APA 1.1 Describe key concepts, principles, and overarching themes in psychology)


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**Multiple Choice Questions**

1. The function of the _____ is to gather and process information, produce responses to stimuli, and coordinate the workings of different cells.
   a. cardiovascular system
   b. respiratory system
   c. nervous system
   d. lymphatic system
   Answer: c
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
   Rationale: Nervous systems are specialized to receive information from the environment and from the body, analyze that information, and then command the body to make appropriate responses.

2. The nervous system is divided into two main parts, _____.
   a. the central nervous system and the peripheral nervous system
   b. the brain and the spinal cord
   c. the autonomic nervous system and the somatic nervous system
   d. the brain and the nerves
   Answer: a
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Moderate
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
   Rationale: The two divisions of the nervous system are the central nervous system and the peripheral nervous system.

3. The _____ receives, processes, interprets, and stores incoming information from the senses and also sends out messages destined for muscles, glands, and internal organs.
   a. cardiovascular system
   b. central nervous system
   c. endocrine system
   d. lymphatic system
   Answer: b
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
   Rationale: The function of the central nervous system as a whole is to receive and analyze information, store information for later use, determine appropriate responses, and send out commands to enact those responses.

4. The central nervous system consists of the _____.
   a. parasympathetic and sympathetic divisions
   b. brain and the spinal cord
   c. muscles and glands


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d. sense organs and sensory neurons
Answer: b
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The central nervous system is the portion of the nervous system consisting of the brain and spinal cord.

5. An important role of the spinal cord is the _____.
a. processing and storing of incoming sensory information
b. control of reflexes above the neck
c. monitoring of the activity of the internal organs
d. control of automatic reflexes below the neck
Answer: d
Topic: The Nervous System: A Basic Blueprint
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains
Rationale: One function of the spinal cord is the control of basic reflexes. The other functions listed are the responsibility of the brain.

6. A collection of neurons and supportive tissue running from the base of the brain down the center of the back, protected by a column of bones is called the _____.
a. spinal cord
b. cerebellum
c. somatic nervous system
d. amygdala
Answer: a
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The spinal cord is a collection of neurons and supportive tissue running from the base of the brain down the center of the back, protected by a column of bones. The spinal cord is located within the vertebral column.

7. Which statement is true of spinal reflexes?
a. They are not automatic and require conscious effort.
b. Spinal reflexes control such responses as withdrawing from a painful stimulus, sneezing, and blinking.
c. They involve sending sensory messages to the spinal cord that immediately trigger a motor response.
d. They require sensory information to be sent to the brain and then back down to the spinal cord.
Answer: c
Topic: The Nervous System: A Basic Blueprint
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Spinal reflexes are automatic responses that occur without conscious effort. In fact, spinal reflexes do not even require the brain to occur. Reflexes above the neck, such as sneezing and blinking, are not spinal reflexes because they involve the lower part of the brain rather than the spinal cord.

8. Eduardo is camping with friends when he accidentally steps in the campfire and recoils his foot instantaneously. What produced this speedy foot-saving action?
   a. the direct operation of the spinal cord
   b. the complex interplay of brain and spinal signals
   c. a signal relayed from the foot to the brain to the spinal cord back to the foot
   d. a pain signal sent from the brain to the foot
   Answer: a
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Apply What You Know
   Difficulty Level: Moderate
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
   Rationale: The withdrawal reflex described here is an example of a spinal reflex. Spinal reflexes do not require the help of the brain, so they can occur very quickly.

9. Reflexes above the neck, such as sneezing and blinking, are controlled by the _____.
   a. spinal cord
   b. sympathetic nervous system
   c. brain
   d. parasympathetic nervous system
   Answer: c
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
   Rationale: Reflexes above the neck are controlled by the lower part of the brain, whereas the spinal cord controls reflexes in the rest of the body.

10. Reflexes below the neck, such as yanking a hand back from a scalding stream of water, are controlled by the _____.
   a. spinal cord
   b. sympathetic nervous system
   c. brain
   d. parasympathetic nervous system
   Answer: a
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
   Rationale: Reflexes above the neck are controlled by the brain stem, while the spinal cord controls reflexes in the rest of the body.


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11. Shayla blinks as she steps off the school bus and walks into a gust of wind. This automatic reaction is regulated by the _____.
    a. spinal cord
    b. lower part of her brain
    c. hormonal activity in her body
    d. hippocampus
    Answer: b
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Apply What You Know
    Difficulty Level: Difficult
    Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
    Rationale: Reflexes that occur above the neck are controlled by the lower part of the brain.

12. The input and output of the central nervous system is handled by the _____.
    a. lymphatic system
    b. endocrine system
    c. cardiovascular system
    d. peripheral nervous system
    Answer: d
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Remember the Facts
    Difficulty Level: Easy
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.2 Develop a working knowledge of psychology's content domains, 2.1 Use scientific reasoning to interpret psychological phenomena
    Rationale: The peripheral nervous system refers to the parts of the nervous system that are outside of the brain and spinal cord. It includes sensory and motor nerves, which send information to the central nervous system and carry it away, respectively.

13. _____ carry orders from the central nervous system to muscles, glands, and internal organs.
    a. Motor nerves
    b. Sensory nerves
    c. Dendrites
    d. Glial cells
    Answer: a
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Remember the Facts
    Difficulty Level: Easy
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
    Rationale: Motor nerves carry orders from the central nervous system to muscles, glands, and internal organs.

14. In the peripheral nervous system, _____ enable us to move, and cause glands to contract and to secrete hormones.
    a. motor nerves
    b. glial cells
    c. dendrites
    d. sensory nerves
    Answer: a
    Topic: The Nervous System: A Basic Blueprint


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Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Motor nerves carry commands from the central nervous system to skeletal muscles and glands.

15. In the peripheral nervous system, _____ carry messages from special receptors in the skin, muscles, and other internal and external sense organs to the spinal cord, which sends them along to the brain.
    a. hormones
    b. motor nerves
    c. neuromodulators
    d. sensory nerves
    Answer: d
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Remember the Facts
    Difficulty Level: Easy
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
    Rationale: Sensory nerves carry information from sense organs to the spinal cord and brain.

16. Lexie returns from a day at the beach to find she has a severe sunburn all over her back. Which nerves are sending the messages from her burned skin to her central nervous system, informing her of the pain from the burn?
    a. sensory nerves
    b. motor nerves
    c. synaptic nerves
    d. association nerves
    Answer: a
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Apply What You Know
    Difficulty Level: Easy
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
    Rationale: Sensory nerves carry information from sense organs to the spinal cord and brain.

17. Which structure is a part of the peripheral nervous system?
    a. the brain
    b. the spinal cord
    c. the somatic nervous system
    d. the endocrine system
    Answer: c
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Remember the Facts
    Difficulty Level: Easy
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
    Rationale: The somatic nervous system is a subdivision of the peripheral nervous system.


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18. The subdivision of the peripheral nervous system that connects to sensory receptors and to skeletal muscles is called the _____.
    a. sympathetic nervous system
    b. parasympathetic nervous system
    c. somatic nervous system
    d. central nervous system
    Answer: c
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Remember the Facts
    Difficulty Level: Easy
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
    Rationale: The somatic nervous system carries sensory information to the brain and motor commands to skeletal muscle.

19. The somatic nervous system is sometimes also called the _____.
    a. sympathetic nervous system
    b. parasympathetic nervous system
    c. central nervous system
    d. skeletal nervous system
    Answer: d
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Remember the Facts
    Difficulty Level: Moderate
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
    Rationale: The somatic nervous system is also called the skeletal nervous system.

20. The functioning of blood vessels, glands, and internal organs is regulated by the _____.
    a. autonomic nervous system
    b. somatic nervous system
    c. hippocampus
    d. lymphatic system
    Answer: a
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Remember the Facts
    Difficulty Level: Easy
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
    Rationale: The autonomic nervous system regulates the function of internal organs, glands, and blood vessels.

21. Which statement about the nervous system is true?
    a. The autonomic nervous system collects sensory input and sends commands to skeletal muscles.
    b. The autonomic nervous system consists of the sympathetic and parasympathetic nervous systems.
    c. The sympathetic nervous system enables the body to conserve and store energy.
    d. The parasympathetic nervous system mobilizes the body for action.
    Answer: b
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Analyze It
    Difficulty Level: Moderate
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The autonomic nervous system consists of the sympathetic nervous system, which mobilizes the body for action, and the parasympathetic nervous system, which enables the body to conserve and store energy.

22. On a hike through the hills, Tony feels a bug crawling up his leg under his pants. Which system is necessary for Tony to be aware of the bug?
    a. sympathetic nervous system
    b. endocrine system
    c. somatic nervous system
    d. autonomic nervous system
    Answer: c
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Apply What You Know
    Difficulty Level: Moderate
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
    Rationale: Sensory information from the skin is carried to the spinal cord by sensory nerves, a part of the somatic nervous system.

23. As she walks out of the living room, Gale turns off the light. In this example, which system is necessary for Gale to perform this action?
    a. sympathetic nervous system
    b. parasympathetic nervous system
    c. endocrine system
    d. somatic nervous system
    Answer: d
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Apply What You Know
    Difficulty Level: Moderate
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
    Rationale: The motor nerves, controlling skeletal muscles, are part of the somatic nervous system.

24. Autumn spots the boy that she has a crush on sitting with his friends. Her heart begins to pound, her hands get sweaty, and her cheeks feel hot. Autumn's _____ has been activated.
    a. autonomic nervous system
    b. somatic nervous system
    c. spinal reflex system
    d. skeletal nervous system
    Answer: a
    Topic: The Nervous System: A Basic Blueprint
    Skill Level: Apply What You Know
    Difficulty Level: Moderate
    Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
    Rationale: The sympathetic nervous system, a part of the autonomic nervous system, controls arousal.


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25. As Yulya walked through a dark alley at night, she heard a bottle break, a weird wheezing noise, and something rustling behind a dumpster. Her heart beat faster, she started to sweat, and she began to breathe more deeply. The physiological reactions were produced by Yulya's _____.
a. somatic system
b. central nervous system
c. parasympathetic nervous system
d. sympathetic nervous system
Answer: d
Topic: The Nervous System: A Basic Blueprint
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Yulya's body is preparing to fight or flee a potential stressor.

26. As Yulya continued walking down a darkened alley she saw a mangy, asthmatic cat emerge from behind a dumpster. The cat yawned and hobbled away, as Yulya's heartbeat slowed and her breathing returned to normal. These physiological reactions were produced by Yulya's _____.
a. skeletal nervous system
b. central nervous system
c. parasympathetic nervous system
d. sympathetic nervous system
Answer: c
Topic: The Nervous System: A Basic Blueprint
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: This division of the nervous system would produce these effects.

27. A neuron is also called a _____.
a. glial cell
b. precursor cell
c. nerve cell
d. neurotransmitter
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Neurons are also known as nerve cells.

28. _____ are the brain's communication specialists, transmitting information to, from, and within the central nervous system.
a. Endocrines
b. Neurons
c. Glial cells
d. Hormones
Answer: b
Topic: Communication in the Nervous System


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Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Neurons are the brain's communication specialists and are considered the building blocks of the nervous system.

29. A cell that conducts electrochemical signals and is the basic unit of the nervous system is called a _____.
a. glial cell
b. neuron
c. neurotransmitter
d. nerve
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The neuron is the basic unit of nervous system function. It uses electrochemical signals to communicate with other cells.

30. The name "glia" is derived from the Greek word for "glue." It is an appropriate name because one function of glial cells is to _____.
a. keep the axon from detaching from the cell body
b. hold neurons in place
c. fuse neurotransmitters to receptor sites
d. fuse sodium ions to potassium ions
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.2 Develop a working knowledge of psychology's content domains
Rationale: One of the functions of glial cells is to hold neurons in place.

31. New research suggests that glial cells make up around _____ of the brain's cells.
a. 10 percent
b. 25 percent
c. 50 percent
d. 90 percent
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: An adult brain contains about 171 billion cells, about evenly divided between neurons and glia.

32. An adult brain contains about 171 _____ cells.
a. thousand
b. million
c. billion


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d. trillion
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: An adult brain contains about 171 billion cells, about evenly divided between neurons and glia.

33. The part of neurons that receive messages from nerve cells and look like the branches of a tree are called _____.
a. axons
b. neurotransmitters
c. dendrites
d. cell bodies
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The dendrites have many branches like a tree and receive messages from other neurons like antennas.

34. Which part of a neuron acts like an antenna to receive messages from other neurons and transmit these messages toward the cell body?
a. neurotransmitters
b. dendrites
c. axons
d. glial cells
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Dendrites receive information from other neurons and transmit these messages toward the cell body.

35. Which structure includes the nucleus of the neuron, which contains genetic information, and is shaped roughly like a sphere or a pyramid?
a. the axon
b. the cell body
c. dendrites
d. glial cells
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The cell body is shaped roughly like a sphere or a pyramid; it includes the cell's nucleus, which contains genetic information and controls the cell's growth and reproduction.

36. Which part of the neuron contains the biochemical machinery for keeping the neuron alive?
a. the cell body


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b. glial cells
c. the axon
d. dendrites
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The cell body contains the biochemical machinery for keeping the neuron alive.

37. Which structures transmit messages away from cell bodies to neurons, muscles, or gland cells?
a. axons
b. neurotransmitters
c. dendrites
d. glial cells
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The axon transmits information to other neurons, to skeletal muscle, and to gland cells.

38. Outgoing neural signals pass along the _____ of a neuron to terminal branches.
a. receptor site
b. axon
c. glial cell
d. dendrites
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The axon transmits information to other neurons, to skeletal muscle, and to gland cells.

39. Which part of the neuron transmits messages to other neurons, muscles, or gland cells?
a. the cell body
b. dendrites
c. the axon
d. glial cells
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The axon transmits information to other neurons, to skeletal muscle, and to gland cells.

40. Many axons, especially the larger ones, are insulated by a surrounding layer of fatty material called the _____.


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a. neuromodulator
b. myelin sheath
c. dendrite
d. glia
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Large axons are insulated by a surrounding layer of fatty material called the myelin sheath.

41. The myelin sheath in the central nervous system is made up of _____.
a. neurotransmitters
b. GABA
c. dendrites
d. glial cells
Answer: d
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Many axons, especially the larger ones, are insulated by a surrounding layer of fatty material called the myelin sheath, which in the central nervous system is made up of glial cells.

42. Constrictions that divide the myelin sheath into segments are called _____.
a. dendrites
b. glia
c. nodes
d. sclerosis
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Constrictions in the myelin sheath called nodes divide it into segments, making it look a little like a string of link sausages.

43. One purpose of the _____ is to prevent signals in adjacent cells from interfering with each other.
a. cell body
b. myelin sheath
c. dendrites
d. axon
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: One purpose of the myelin sheath is to prevent signals in adjacent cells from interfering with each other. Another purpose is to speed up the conduction of neural impulses.

44. One purpose of the _____ is to speed up the conduction of neural impulses.
a. dendrites


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b. axon terminal
c. myelin sheath
d. synaptic vesicle
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The myelin sheath insulates axons and increases the speed of neural conduction.

45. Emily is told by her physician that her lack of coordination, partial paralysis, loss of sensation, and vision problems are caused by the loss of myelin. Her diagnosis is most likely to be _____.
a. Parkinson's disease
b. Alzheimer's disease
c. multiple sclerosis
d. epilepsy
Answer: c
Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Multiple sclerosis is a disorder involving the loss of myelin in the brain.

46. Judy is told by her physician that her symptoms are caused by a loss of myelin. Her symptoms would be most likely to include _____.
a. burning fever
b. problems with vision
c. hallucinations
d. psychosis
Answer: b
Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: In individuals with multiple sclerosis, loss of myelin causes erratic nerve signals, leading to loss of sensation, weakness or paralysis, lack of coordination, or vision problems.

47. A nerve is a bundle of _____.
a. neurotransmitters in the central nervous system
b. glial cells in the brain
c. axons, and occasionally dendrites, in the peripheral nervous system
d. cell bodies in the brain
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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Rationale: A nerve is a bundle of axons, and sometimes dendrites, in the peripheral nervous system.

48. The human body has _____ pairs of peripheral nerves, one nerve from each pair on the left side of the body and the other on the right.
a. 43
b. 12
c. 31
d. 52
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy
Rationale: The human body has 43 pairs of peripheral nerves, one nerve from each pair is on the left side of the body and the other is on the right.

49. The human body has _____ pairs of cranial nerves in the head, connecting directly to the brain.
a. 43
b. 12
c. 31
d. 52
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Most of the peripheral nerves enter or leave the spinal cord, but 12 pairs in the head, the cranial nerves, connect directly to the brain.

50. Research by contemporary neuroscientists has shown that _____.
a. no new central nervous system cells are produced after infancy
b. extended immobility can regrow severed spinal-cord axons in animals
c. it is impossible to regrow spinal-cord axons after damage
d. severed spinal-cord axons in an animal regrow if treated with certain nervous system chemicals
Answer: d
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy
Rationale: In research labs, it has been shown that severed spinal cord axons may regrow in animals when treated with certain nervous system chemicals. Neurons can be regenerated from immature stem cells.

51. The process of neurogenesis occurs when _____.
a. neurons convert themselves to stem cells
b. neurons divide to create two new neurons
c. immature stem cells give birth to new neurons
d. neurons convert themselves to glial cells
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy


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Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Neurogenesis refers to the production of new neurons from immature stem cells.

52. "Grrrr…." harrumphed Valdo. "Errrggghhhhh……" "What in the world are you doing there, sweating and straining and turning red in the face?!" cried Leticia. "I'm trying….to….generate….new neurons….in my brain," gasped Umberto, as he attempted to squeeze out a few more. Although his specific approach seems destined to fail, what do scientists know about the process of neurogenesis?
a. the production of stem cells occurs only during the first few months of pregnancy
b. neurogenesis is abundant until the age of 1 year, after which it ceases to occur
c. stem cell production increases in twice-yearly waves until puberty is reached
d. many stem cells, especially those related to learning and memory, continue to divide and mature throughout adulthood
Answer: d
Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Research suggests that stem cells may divide and mature throughout adulthood.

53. Neuroscientists have found that _____ can inhibit the process of neurogenesis.
a. enriched environments
b. stress
c. physical exercise
d. effortful mental activity
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Aging and stress can inhibit neurogenesis.

54. Neuroscientists have found that _____ can kill the new neurons that have been produced through neurogenesis.
a. physical exercise
b. effortful mental activity
c. melanin
d. nicotine
Answer: d
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Drugs like nicotine can kill newly produced neurons.

55. Which statement is true regarding neurogenesis?
a. Injured or damaged neurons in the central nervous system can never regenerate.
b. No new neurons are produced in the central nervous system after infancy.
c. Neurogenesis occurs in the spinal cord but not in the brain.


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d. Recent research suggests that stem cells in the brain may be able to generate new neurons throughout life.
Answer: d
Topic: Communication in the Nervous System
Skill Level: Analyze It
Difficulty Level: Difficult
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Research suggests that stem cells in the brain may divide and mature into neurons throughout adulthood.

56. Stem-cell research is one of the hottest areas in biology and neuroscience because stem cells _____.
a. have the capacity to develop into many different types of cells
b. are not affected by the process of neurogenesis
c. are readily available in nature for research
d. are immune to most common ailments
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy
Rationale: Stem-cell research is one of the hottest areas in biology and neuroscience because embryonic stem cells can generate many types of specialist cells, from neurons to kidney cells. Therefore, stem cells may be useful for treating damaged tissues.

57. The minuscule space where the axon terminal of one neuron nearly touches a dendrite or the cell body of another is called the _____.
a. receptor site
b. dendrite
c. synaptic cleft
d. synaptic vesicle
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Neurons do not directly touch each other, end to end. Instead, they are separated by a minuscule space called the synaptic cleft.

58. Manolo was bragging to Lia. “Man, I’m smart!” he crowed. “My brain cells are stitched so tightly together that there’s no space between them. Information travels from neuron to neuron without a break!” “You can’t be that smart,” muttered Lia, “if you don’t even understand how misinformed you are.” Why is Lia correct?
a. Neurons don’t touch one another; there’s a small gap between them called a synapse.
b. Axons touch other axons, and dendrites touch other dendrites; the neuron itself doesn’t matter.
c. Every neuron produces an inhibitory synapse, which must be matched by an excitatory synapse in order for any neural communication to take place.
d. Myelin stimulates an action potential, and this sends a signal through a dendrite; the strength of the signal is more important than the connection.
Answer: a


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Topic: Communication in the Nervous System
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: This is what happens when electrochemical transmission takes place.

59. The inside and outside of a neuron contain _____.
a. only positively charged ions
b. only negatively charged ions
c. a mix of positive and negatively charged ions
d. no charged particles
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The inside and outside of a neuron contain positively and negatively charged ions (electrically charged atoms).

60. When a neuron is stimulated, sodium moves into the cell, causing the inside of the neuron to _____.
a. become less negative relative to the outside
b. become more negative relative to the outside
c. remain neutral in charge
d. become less positive relative to the outside
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy
Rationale: At rest, the neuron has a negative charge relative to the outside. But when it is stimulated, special "gates" in the cell's membrane open, allowing positively charged sodium ions to move from the outside to the inside, making the neuron less negative.

61. A brief change in the electrical voltage that occurs in response to stimulation that travels down an axon is called _____.
a. an inhibitory response
b. an action potential
c. neurogenesis
d. transcranial direct current stimulation
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: An action potential is a brief change in electrical voltage that occurs between the inside and the outside of an axon when a neuron is stimulated, producing an electrical impulse.

62. "Argh!" cried Richie. "I can feel sodium and potassium ions moving across the cell membranes of my neurons! It's so distracting!" Two conclusions are correct regarding Richie's statements. First, he can't really feel ions moving across his cell membranes. Second, if he could, he'd be describing:
a. an action potential
b. channelization
c. reuptake
d. a resting potential
Answer: a
Topic: Communication in the Nervous System
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: An action potential is a brief change in electrical voltage that occurs between the inside and the outside of an axon when a neuron is stimulated, producing an electrical impulse.

63. Action potentials travel swiftly down _____.
a. axons with myelin and more slowly in axons without myelin
b. axons without myelin and more slowly in axons with myelin
c. dendrites with myelin and more slowly in dendrites without myelin
d. dendrites without myelin and more slowly in dendrites with myelin
Answer: a
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Myelin increases the speed of conduction of the action potential in the axon.

64. Nerve impulses travel more slowly in babies than in older children and adults because _____.
a. an infant does not have as many synaptic connections as an adult has
b. dendrites and axons take time to develop in infants
c. neurons are much shorter in infants than in adults
d. the myelin sheaths on axons are not yet fully developed in infants
Answer: d
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Myelin increases the speed of conduction of the action potential in the axon and infants do not yet have much myelin.

65. When a neural impulse reaches the end of the axon terminal _____.
a. the action potential "hops" directly across the synaptic cleft
b. it electrically activates the receptor sites
c. it causes synaptic vesicles to release neurotransmitters
d. it reverses direction


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Answer: c
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: When a neural impulse reaches the axon terminal's button-like tip, it must get its message across the synaptic cleft to another cell. At this point, synaptic vesicles, tiny sacs in the tip of the axon terminal, open and release a few thousand molecules of a chemical substance called a neurotransmitter.

66. Which entity is a chemical messenger?
a. synaptic vesicles
b. receptor sites
c. neurotransmitters
d. potassium ions
Answer: c
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Neurotransmitters and hormones are chemicals that carry messages to other cells.

67. Receptor sites on the membrane of a neuron's dendrites receive _____.
a. neurotransmitters
b. synaptic vesicles
c. action potentials
d. negative potassium ions
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Neurotransmitter molecules bind briefly with receptor sites, special molecules in the membrane of the receiving neuron's dendrites.

68. When a neurotransmitter binds to a receptor site, it can cause _____.
a. the receptor to fire an action potential
b. an excitatory effect, but it cannot cause an inhibitory effect
c. an inhibitory effect, but it cannot cause an excitatory effect
d. either an excitatory effect or an inhibitory effect
Answer: d
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena


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Rationale: When neurotransmitters bind to receptor sites, some neurotransmitters will cause a decrease in the negative charge, causing an excitatory effect. Other neurotransmitters will cause an increase in the negative charge, leading to an inhibitory effect.

69. In the process of getting a message across the synaptic cleft to another cell, _____ open and release molecules of a chemical substance to diffuse across the synaptic cleft.
a. synaptic vesicles
b. receptor sites
c. axon terminals
d. dendrites
Answer: a
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: When a neural impulse reaches the axon terminal's button-like tip, it must get its message across the synaptic cleft to another cell. At this point, synaptic vesicles, tiny sacs in the tip of the axon terminal, open and release a few thousand molecules of a chemical substance called a neurotransmitter. These molecules then diffuse across the synaptic cleft.

70. _____ are special molecules in the membrane of a receiving neuron's dendrites with which neurotransmitter molecules bind.
a. Synapses
b. Glia
c. Neuromodulators
d. Receptor sites
Answer: d
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Receptor sites are special places on the membrane of dendrites where neurotransmitters can attach.

71. When a neurotransmitter molecule binds briefly with a receptor site, changes occur in the receiving neuron's charge. If the neurotransmitter causes a decrease in the negative charge, then the effect is _____.
a. a decreased probability that the receiving neuron will fire
b. an excitatory effect
c. an inhibitory effect
d. a decreased probability that the neurons are densely connected
Answer: b
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Some neurotransmitters cause a decrease in the negative charge. When the charge reaches a critical level, the neuron fires—which called an excitatory effect.


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72. When a neurotransmitter molecule binds briefly with a receptor site, changes occur in the receiving neuron's charge. If the neurotransmitter causes an increase in the negative charge, then the effect is _____, and so the probability that the receiving neuron will fire _____..
a. inhibitory; decreases
b. excitatory; increases
c. inhibitory; increases
d. excitatory; decreases
Answer: a
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy
Rationale: Neurotransmitters that cause an increase in the negative charge will make the neuron less likely to fire. This is called an inhibitory effect.

73. Neurotransmitters make it possible for _____.
a. adult neurogenesis to occur
b. unmyelinated cells to grow myelin
c. one neuron to influence another
d. glands to influence the function of various organs throughout the body
Answer: c
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Neurotransmitters are chemicals released from the axon terminal that can have either excitatory or inhibitory effects on the activity of the receiving cell.

74. Which neurotransmitter affects neurons involved in sleep, appetite, sensory perception, temperature regulation, pain suppression, and mood?
a. serotonin
b. dopamine
c. acetylcholine
d. norepinephrine
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Serotonin is involved in many systems in the brain and has effects on sleep, appetite, perception, temperature regulation, pain, and mood.

75. Which neurotransmitter affects neurons involved in voluntary movement, learning, memory, pleasure and reward, and possibly responses to novelty?
a. serotonin


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b. dopamine
c. GABA
d. norepinephrine
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Dopamine in the brain is involved in the control of voluntary movement, learning, memory, pleasure and reward, and response to novelty.

76. Which neurotransmitter affects neurons involved in muscle action, arousal, vigilance, memory, and emotion?
a. serotonin
b. GABA
c. acetylcholine
d. norepinephrine
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Acetylcholine affects neurons involved in muscle action, arousal, vigilance, memory, and emotion.

77. Which neurotransmitter affects neurons involved in learning, dreaming, and waking from sleep?
a. serotonin
b. dopamine
c. norepinephrine
d. acetylcholine
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Norepinephrine affects neurons involved in learning, memory, dreaming, waking from sleep, and emotion, and those involved in the increased heart rate and the slowing of intestinal activity during stress.

78. Which neurotransmitter affects neurons involved in increased heart rate and the slowing of intestinal activity during stress?
a. serotonin
b. dopamine
c. acetylcholine
d. norepinephrine
Answer: d
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy


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Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Norepinephrine affects neurons involved in learning, memory, dreaming, waking from sleep, and emotion, and those involved in the increased heart rate and the slowing of intestinal activity during stress.

79. Which neurotransmitter functions as the major inhibitory neurotransmitter in the brain?
a. glutamate
b. GABA
c. acetylcholine
d. norepinephrine
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: GABA (gamma-aminobutyric acid) is the most common inhibitory neurotransmitter in the brain.

80. Glutamate is to _____ as GABA is to _____.
a. now; later
b. go; stop
c. how; why
d. left; right
Answer: b
Topic: Communication in the Nervous System
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Glutamate and GABA are the major excitatory and inhibitory neurotransmitters in the brain.

81. Glutamate functions as the _____.
a. neurotransmitter most involved in voluntary movements
b. major inhibitory neurotransmitter in the brain
c. neurotransmitter most responsible for the slowing of intestinal activity during stress
d. major excitatory neurotransmitter in the brain
Answer: d
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Glutamate is the major excitatory neurotransmitter in the brain; it is released by about 90 percent of the brain's neurons.

82. In Parkinson's disease, a loss of cells that produce _____ is responsible for tremors and muscle rigidity.
a. acetylcholine


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b. dopamine
c. GABA
d. glutamate
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: A loss of cells that produce dopamine is responsible for the tremors and rigidity of Parkinson's disease.

83. Actor Michael J. Fox has long been an advocate for people who, like himself, have been diagnosed with Parkinson's disease. A primary cause of this disorder is a(n) _____.
a. loss of dopamine
b. loss of acetylcholine
c. overproduction of dopamine
d. overproduction of acetylcholine
Answer: a
Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy
Rationale: A loss of cells that produce dopamine is responsible for the tremors and rigidity of Parkinson's disease.

84. The levels of the neurotransmitter _____ will decrease in the human body after having a protein-rich meal.
a. acetylcholine
b. dopamine
c. serotonin
d. GABA
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Serotonin levels will decrease after a protein-rich meal and increase after a high-carbohydrate, no-protein meal.

85. Most recreational drugs produce their effects by _____.
a. blocking or enhancing the actions of neurotransmitters
b. killing GABA neurons
c. causing glial cells to produce excess myelin
d. blocking glial cells from producing myelin
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy


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Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Most recreational drugs produce their effects by blocking or enhancing the actions of neurotransmitters.

86. Which substance in the nervous system is considered a neurotransmitter?
a. glutamate
b. melatonin
c. testosterone
d. progesterone
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Glutamate is a neurotransmitter; the other chemicals are hormones.

87. Hormones are produced primarily by _____.
a. epithelial cells
b. stem cells
c. glands
d. neurons
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Hormones are produced by the endocrine glands and are released directly into the bloodstream, which carries them to organs and glands where they have an effect.

88. Chemical substances secreted by glands that affect the functioning of bodily organs are called _____.
a. endorphins
b. neurotransmitters
c. hormones
d. opioid peptides
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Hormones are chemical substances, secreted by organs called glands, that affect the functioning of other organs.

89. Melatonin is secreted by the _____.
a. gonads
b. adrenal gland
c. pineal gland


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d. pituitary gland
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Melatonin, which is secreted by the pineal gland deep within the brain, helps to regulate daily biological rhythms and promotes sleep.

90. Oxytocin is secreted by the _____.
a. endocrine gland
b. adrenal gland
c. pineal gland
d. pituitary gland
Answer: d
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Oxytocin, which is secreted by a small gland in the brain, the pituitary gland, enhances uterine contractions during childbirth and facilitates the ejection of milk during nursing.

91. Adrenal hormones are produced by the glands _____.
a. in the testes
b. deep within the brain
c. right above the kidneys
d. in the ovaries
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The adrenal glands, organs that are perched right above the kidneys, are involved in emotion and stress.

92. Adrenal hormones are involved in _____.
a. sleep
b. emotion and stress
c. daily biological rhythms
d. uterine contractions during childbirth
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The adrenal glands, organs that are perched right above the kidneys, are involved in emotion and stress.


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93. Adrenal hormones play an important role in _____.
    a. facilitating the ejection of milk during nursing
    b. promoting attachment and trust
    c. the regulation of daily biological rhythms
    d. the regulation of blood sugar
    Answer: d
    Topic: Communication in the Nervous System
    Skill Level: Remember the Facts
    Difficulty Level: Moderate
    Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
    Rationale: The outer part of each adrenal gland produces cortisol, which increases blood sugar levels and boosts energy.

94. The outer part of each adrenal gland produces _____, which increases blood sugar levels and boosts energy.
    a. estrogen
    b. oxytocin
    c. cortisol
    d. melatonin
    Answer: c
    Topic: Communication in the Nervous System
    Skill Level: Remember the Facts
    Difficulty Level: Moderate
    Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
    Rationale: The outer part of each adrenal gland produces cortisol, which increases blood sugar levels and boosts energy.

95. In general, the function of hormones is to _____.
    a. enable neurons to excite or inhibit each other
    b. modulate the effects of neurotransmitters
    c. affect the functioning of target organs and tissue
    d. reduce pain and promote pleasure
    Answer: c
    Topic: Communication in the Nervous System
    Skill Level: Remember the Facts
    Difficulty Level: Easy
    Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
    APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
    Rationale: Hormones are released directly into the bloodstream, which carries them to organs and cells that may be far from their point of origin.

96. Which substance is a hormone?
    a. glutamate
    b. epinephrine
    c. dopamine
    d. serotonin
    Answer: b
    Topic: Communication in the Nervous System
    Skill Level: Remember the Facts


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Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Epinephrine is a hormone released from the adrenal glands.

97. Sex hormones are secreted by tissue in the _____ and also by the adrenal glands.
a. kidneys
b. gonads
c. pineal gland
d. pituitary gland
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Sex hormones are secreted by tissue in the gonads (testes in men and ovaries in women) and also by the adrenal glands.

98. Which substance is a type of androgen?
a. estrogen
b. progesterone
c. testosterone
d. oxytocin
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Androgens (the most important of which is testosterone) are masculinizing hormones produced mainly in the testes but also in the ovaries and the adrenal glands.

99. Which outcome is one effect of androgens?
a. triggering physical changes at puberty
b. regulating daily biological rhythms and sleep
c. triggering responses to drugs, such as caffeine and nicotine
d. causing increased emotion in women prior to menstruation
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Androgens set in motion the physical changes males experience at puberty, including a deepened voice and facial and chest hair.

100. Which sex hormone contributes to the growth and maintenance of the uterine lining in preparation for a fertilized egg?
a. estrogen


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b. progesterone
c. testosterone
d. androgen
Answer: b
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Progesterone contributes to the growth and maintenance of the uterine lining in preparation for a fertilized egg, among other functions.

101. Which sex hormone brings on physical changes in females at puberty, such as breast development and menstruation?
a. estrogens
b. progesterone
c. testosterone
d. androgen
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Estrogens are feminizing hormones that bring on physical changes in females at puberty, such as breast development and menstruation.

102. Research on sex hormones suggests that _____.
a. fluctuating levels of progesterone make women emotional before menstruation
b. the testes are the only site for the production of androgens
c. estrogen enhances learning and memory
d. estrogen and progesterone are produced only by females
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy
Rationale: The body's natural estrogen in both sexes is thought to enhance learning and memory by promoting the formation of synaptic connections in certain areas of the brain and by indirectly increasing the production of acetylcholine

103. Chemical substances in the nervous system that are similar in structure and in action to opiates—such as heroin and morphine—are _____.
a. hormones
b. endorphins
c. androgens
d. neurotransmitters
Answer: b
Topic: Communication in the Nervous System


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Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Endorphins are produced in the nervous system and are similar in structure and effect to the opiate drugs.

104. The primary effect of endorphins is to _____.
a. reduce pain but also reduce pleasure
b. heighten pain and reduce pleasure
c. flatten mood and emotional expression
d. reduce pain and promote pleasure
Answer: d
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Endorphins have effects similar to those of natural opiates such as heroin; that is, they reduce pain and promote pleasure.

105. Endorphins have effects most similar to those of _____.
a. heroin
b. aspirin
c. amphetamines
d. marijuana
Answer: a
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Endorphins have effects similar to those of natural opiates such as heroin; that is, they reduce pain and promote pleasure.

106. Endorphins provide organisms with an evolutionary advantage because they _____.
a. eliminate pain when a painful stimulation is prolonged
b. increase the output of energy during emotion and stress
c. make pain bearable so that it doesn't interfere with actions in an emergency
d. regulate the "biological clock" in the brain
Answer: c
Topic: Communication in the Nervous System
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Endorphins give animals an adaptive advantage by making pain bearable when an organism is threatened. The body's built-in system of counteracting pain is only partly successful, though, especially when painful stimulation is prolonged.


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107. Research has shown that endorphins _____.
a. increase the distress felt when separated from a loved one
b. increase the stress of interpersonal contact
c. strengthen an infant's bond to its mother in animals
d. are not related to social contact
Answer: c
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Research with animals suggests that in infancy, contact with the mother stimulates the flow of endorphins, which strengthens the infant's bond with her.

108. _____ is an approach used only with animals to study the brain.
a. Positron-emission tomography
b. Transcranial magnetic stimulation
c. Transcranial direct current stimulation
d. The lesion method
Answer: d
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains
Rationale: The lesion method involves the removal or disabling of a non-human animal's brain structure to gain better understanding of its function.

109. How does transcranial magnetic stimulation (TMS) work?
a. magnetic pulses are applied to the outer areas of the brain using copper wire coils
b. a pulsating beam of light is used to activate selective neurons on the surface of the brain
c. scalp electrodes pass a very low amplitude current to the brain
d. the tip of electrode is inserted into a specific brain region and an electrical current is applied
Answer: a
Topic: Mapping the Brain
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Transcranial magnetic stimulation (TMS) is a method of manipulating brain cells used by researchers to temporarily stimulate or inactivate neural circuits.

110. When applying _____, brain cells are stimulated using a powerful magnetic field produced by a wire coil placed on a person's head that temporarily stimulates or inactivates neural circuits.
a. positron-emission tomography
b. functional magnetic resonance imaging
c. transcranial direct current stimulation
d. transcranial magnetic stimulation
Answer: d
Topic: Mapping the Brain


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Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Transcranial magnetic stimulation is a method of stimulating brain cells, using a powerful magnetic field produced by a wire coil placed on a person's head, that can be used by researchers to temporarily stimulate or inactivate neural circuits.

111. _____ is a technique that applies a very small electric current to stimulate or suppress activity in parts of the brain's cortex.
a. TMS
b. tDCS
c. EEG
d. MRI
Answer: b
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Transcranial direct current stimulation (tDCS) is a technique that applies a very small electric current to stimulate or suppress activity in parts of the brain's cortex.

112. Dr. Fong is studying what happens behaviorally when a brain area is temporarily inactivated. Which method is she most likely to be using?
a. fMRI
b. PET scan
c. TMS
d. EEG
Answer: c
Topic: Mapping the Brain
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy
Rationale: Transcranial magnetic stimulation (TMS) can temporarily stimulate or inactivate neural circuits.

113. _____ is a recording of neural activity detected by electrodes; it is a technique used for studying the brain.
a. TMS
b. tDCS
c. EEG
d. MRI
Answer: c
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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Rationale: An electroencephalogram (EEG) uses electrodes placed on the scalp to record electrical activity in the brain.

114. An EEG or brain-wave recording _____.
a. can precisely locate the source of activity
b. reflects the activities of only a few cells at a time
c. is performed with the help of electrodes taped onto the scalp
d. is recorded by inserting needle electrodes into the brain
Answer: c
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: EEG is carried out by gluing or taping electrodes onto the scalp to detect the simultaneous electrical activity of millions of neurons in particular brain regions. A standard EEG is not very precise because it reflects the activities of so many cells at once.

115. Electrodes are pasted onto Olga's scalp, and they are connected by wires to a machine that translates the electrical energy from her brain into wavy lines on a monitor. From this description, it is evident that Olga's brain is being studied with the help of _____.
a. positron-emission tomography
b. functional magnetic resonance imaging
c. transcranial direct current stimulation
d. an electroencephalogram
Answer: d
Topic: Mapping the Brain
Skill Level: Apply What You Know
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.3 Describe applications of psychology
Rationale: An electroencephalogram (EEG) uses electrodes attached to the scalp to record brain waves.

116. Dr. O'Malley is studying patterns of electrical activity in the brain, which are being translated into wavy lines on a screen. Which method is she most likely to be using?
a. fMRI
b. PET scan
c. TMS
d. EEG
Answer: d
Topic: Mapping the Brain
Skill Level: Apply What You Know
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: An electroencephalogram (EEG) is a recording of neural activity detected by electrodes.

117. _____ records biochemical changes in the brain as they are happening, often using injections of a glucose-like substance containing a radioactive element.
a. ERP


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b. EEG
c. PET
d. MRI
Answer: c
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: A PET scan is used for analyzing biochemical activity in the brain, for example, by using injections of a glucose-like substance containing a radioactive element.

118. A PET scan _____.
a. records brain waves through electrodes taped to the scalp
b. records biochemical changes in the brain as they are happening
c. stimulates the brain by producing a magnetic field through a wire coil
d. uses radio frequencies and a magnetic field to produce images of the brain
Answer: b
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: In a PET scan, a radioactively-labeled substance such as glucose is injected. The most active cells absorb the most glucose. Therefore, it is possible to scan the brain to see which cells are active in a particular task as changes are happening.

119. Xuxa's physician refers her to a medical center in order to have the biochemical activity in her brain analyzed. She is given an injection of a glucose-like substance containing a radioactive element and her brain is then scanned. The technique being used is called _____.
a. positron-emission tomography
b. functional magnetic resonance imaging
c. the lesion method
d. electroencephalography
Answer: a
Topic: Mapping the Brain
Skill Level: Apply What You Know
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: In a PET scan, a radioactively-labeled substance such as glucose is injected. The most active cells absorb the most glucose. Therefore, it is possible to scan the brain to see which cells are active in a particular task.

120. Which technique uses radio frequencies and a magnetic field to produce images of the brain?
a. EEG
b. PET
c. MRI
d. TMS
Answer: c
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy


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Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Magnetic resonance imaging (MRI) uses powerful magnetic fields and radio frequencies to take highly detailed pictures of the brain.

121. Structural magnetic resonance imaging allows a scientist to _____.
a. see brain activity associated with specific thoughts or behaviors
b. study the consumption of glucose in different regions of the brain
c. know what an individual's brain looks like
d. detect electrical activity within a single cell
Answer: c
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy
Rationale: Structural MRI helps scientists study what the brain looks like, but not what it does.

122. Pietro and Marisol were talking one day. "I'm a little nervous," confessed Pietro. "My doctor told me I should get a brain scan…M-R-something." "Oh!" Marisol replied. "MRI, or fMRI?" "Hmm, I'm not sure," replied Pietro. "What's the difference?" Can you answer Pietro's question?
a. MRI records the structure of the brain, whereas fMRI records both structure and brain activity associated with thoughts and behaviors.
b. MRI records changes in blood glucose levels, whereas fMRI records generalized electrical activity.
c. There is no difference between the two acronyms.
d. MRI uses a pulsating electromagnetic current to stimulate the brain, whereas fMRI uses low-voltage current.
Answer: a
Topic: Mapping the Brain
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: MRI is designed to assess structure; fMRI is designed to assess function.

123. Which observation is a reason for caution in using brain imaging technology?
a. Brain scans can only be used to study abnormal brains.
b. Brain scans tell us what is happening, but not precisely where it is happening.
c. Brain scans can lead to oversimplified and even misleading impressions.
d. It is not known how safe repeated usage of brain scans is for an individual.
Answer: c
Topic: Mapping the Brain
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy


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Rationale: As with any type of figure, graph, or data analysis, researchers make a variety of choices that can leave small contrasts looking more dramatic than they really are or larger ones seeming insignificant.

124. Specialization of particular brain regions for particular roles is called _____.
a. phrenology
b. localization of function
c. lateralization
d. plasticity
Answer: b
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Localization of function refers to the fact that some functions can be associated with particular structures or areas within the brain.

125. Although Joseph Gall's theory of phrenology has been debunked, modern neuroscience does generally support Gall's assertion that _____.
a. different brain structures and regions are specialized to perform different functions
b. personality traits are reflected in the development of specific bumps on the skull
c. the left hemisphere and right hemisphere are mirror images of one another
d. the left hemisphere is specialized for visual-spatial tasks
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains, 2.2 Demonstrate psychology information literacy
Rationale: Gall's theory of phrenology was completely wrongheaded, but his general notion of specialization in the brain had merit.

126. Which part of the brain is located at the base of the skull and looks like a stalk rising out of the spinal cord?
a. amygdala
b. brain stem
c. hypothalamus
d. thalamus
Answer: b
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The brain stem looks like a stalk rising out of the spinal cord.

127. Which structure is part of the brain stem?
a. amygdala
b. medulla
c. thalamus
d. hypothalamus
Answer: b


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Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The brain stem looks like a stalk rising out of the spinal cord. Pathways to and from upper areas of the brain pass through its two main structures: the medulla and the pons.

128. The two main structures of the brain stem are the _____.
a. hippocampus and the amygdala
b. cerebellum and the thalamus
c. thalamus and the hypothalamus
d. medulla and the pons
Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The brain stem looks like a stalk rising out of the spinal cord. Pathways to and from upper areas of the brain pass through its two main structures: the medulla and the pons.

129. The _____ is a structure in the brain stem responsible for certain automatic functions, such as breathing and heart rate.
a. reticular activating system
b. pons
c. medulla
d. cerebellum
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The medulla is responsible for bodily functions that do not have to be consciously willed, such as breathing and heart rate.

130. The _____ is a structure in the brain stem that is involved in activities like sleeping, waking, and dreaming.
a. medulla
b. pons
c. thalamus
d. cerebellum
Answer: b
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The pons is involved in (among other things) sleeping, waking, and dreaming.


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131. Innes receives a sharp blow to the back of his head, causing him to go to the hospital for tests and brain imaging. He complains that he is having difficulty coordinating his movements, sitting upright without leaning or falling over, and controlling his fine motor skills. Which area of the hindbrain will the emergency room physician most likely see injured when examining Innes's assessments?
a. pons
b. medulla
c. cerebellum
d. reticular activating system
Answer: c
Topic: A Tour Through the Brain
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy
Rationale: The cerebellum contributes to a sense of balance and coordinates muscle movements.

132. A dense network of neurons found in the core of the brain stem that screens incoming information and arouses higher centers is called the _____.
a. pons
b. cerebellum
c. reticular activating system
d. medulla
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Extending upward from the core of the brain stem is the reticular activating system. This dense network of neurons, which extends above the brain stem into the center of the brain and has connections with areas that are higher up, screens incoming information and arouses the higher centers when something happens that demands their attention.

133. Felipe suffered brain damage in a car accident. As a result, he is clumsy and uncoordinated. Which structure was most likely damaged?
a. hippocampus
b. medulla
c. cerebellum
d. reticular activating system
Answer: c
Topic: A Tour Through the Brain
Skill Level: Apply What You Know
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The cerebellum contributes to a sense of balance and coordinates the muscles so that movement is smooth and precise.


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134. LaKeesha is exceedingly clumsy and uncoordinated. She has difficulty using a pencil or threading a needle. It is most likely that LaKeesha's _____ somehow has been damaged.
a. hippocampus
b. medulla
c. reticular activating system
d. cerebellum
Answer: d
Topic: A Tour Through the Brain
Skill Level: Apply What You Know
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The cerebellum contributes to a sense of balance and coordinates the muscles so that movement is smooth and precise.

135. The _____ is involved in classical conditioning and remembering simple skills.
a. pons
b. medulla
c. reticular activating system
d. cerebellum
Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: In addition to being involved in motor coordination, posture, and balance, the cerebellum is involved in classical conditioning and remembering simple skills.

136. The _____, or "lesser brain," was once considered just a motor center, but evidence has accumulated that it also plays a part in perceptual processes, working memory, and speech and language.
a. pons
b. medulla
c. auditory cortex
d. cerebellum
Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy
Rationale: The cerebellum, which was once considered just a motor center, is not as "lesser" as its name implies; it is involved in perceptual processes, working memory, and speech and language.

137. A ballerina's coordinated and graceful movements will rely primarily on which brain structure that is involved in regulating balance?
a. hypothalamus
b. pons
c. cerebellum


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d. thalamus
Answer: c
Topic: A Tour Through the Brain
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The cerebellum regulates movement and balance and is involved in some kinds of higher cognitive tasks.

138. Which brain structure acts as the sensory relay station and is involved in routing incoming sensory messages to higher areas in charge of vision, sound, or touch?
a. thalamus
b. cerebellum
c. hypothalamus
d. limbic system
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.B Describe the location and function of the thalamus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The thalamus is the sensory relay station of the brain. As sensory messages come into the brain, the thalamus directs them to higher areas in charge of vision, sound, or touch.

139. The only sense that completely bypasses the thalamus in the brain is the sense of _____.
a. vision
b. smell
c. touch
d. taste
Answer: b
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.B Describe the location and function of the thalamus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The only sense that completely bypasses the thalamus is the sense of smell, which has its own private switching station, the olfactory bulb.

140. The reason why particular odors, such as the smell of gardenias, often rekindle memories of important personal experiences might be because _____.
a. the smell areas of the human brain are more highly developed than the other sensory areas
b. sensory information about odors is processed in the cerebellum
c. the thalamus gives priority processing to the sense of smell
d. the olfactory bulb is directly connected to brain regions involved in emotion
Answer: d
Topic: A Tour Through the Brain
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.4.B Describe the location and function of the thalamus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy


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Rationale: The olfactory bulb has connections to areas involved in emotion. Therefore, particular odors may acquire emotional associations.

141. The _____ constantly monitors the body's current state and issues instructions to help the body maintain homeostasis.
a. hypothalamus
b. thalamus
c. cerebellum
d. limbic system
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The hypothalamus is the body's boss, constantly monitoring the body's current state and issuing instructions to help the body maintain a steady state called homeostasis.

142. The _____ is the structure in the brain involved in basic survival drives including feeding, fighting, fleeing, and sex.
a. reticular activating system
b. hypothalamus
c. parietal lobes
d. temporal lobes
Answer: b
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The hypothalamus is the area in the brain that is involved in basic survival drives associated with feeding, fighting, fleeing, and sex.

143. Where is the hypothalamus located in the brain?
a. below the thalamus
b. just under the cerebellum, at the top of the spinal cord
c. on either side of the olfactory bulbs
d. midway between the medulla and the pons
Answer: a
Topic: A Tour Through the Brain
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: "Hypo" means "below" or "under," as in "hypodermic" or "hypothermia."

144. The _____ in the brain contain(s) the biological clock that controls the body's daily rhythms.
a. parietal lobes
b. amygdala
c. reticular activating system
d. hypothalamus
Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts


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Difficulty Level: Moderate
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The hypothalamus contains the biological clock that controls the body's daily rhythms.

145. Hanging down from the hypothalamus in the human brain, connected to it by a short stalk, is a cherry-sized endocrine gland called the _____.
a. olfactory bulb
b. pineal gland
c. pituitary gland
d. temporal lobe
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The pituitary gland is attached to the hypothalamus on the underside of the brain.

146. The _____ is often called the body's "master gland" because the hormones it secretes affect many other endocrine glands.
a. olfactory bulb
b. pineal gland
c. pituitary gland
d. temporal lobe
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The pituitary is often called the body's "master gland" because the hormones it secretes affect many other endocrine glands.

147. Which structure in the brain controls the pituitary gland through chemical signals?
a. thalamus
b. cerebellum
c. hypothalamus
d. limbic system
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The hypothalamus sends chemicals to the pituitary that tell it when to "talk" to the other endocrine glands.

148. The _____ is sometimes called "the emotional brain," although researchers have discovered it has functions unrelated to emotions.
a. thalamus
b. medulla
c. reticular activating system
d. limbic system
Answer: d
Topic: A Tour Through the Brain


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Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Structures in the limbic system are involved in the emotions that we share with other animals, such as rage and fear, so the region is also sometimes called "the emotional brain." But researchers now know that these structures also have other functions, and that parts of the brain outside of the old limbic system are involved in emotion.

149. The initial decision to approach or withdraw from a person or situation is determined with the help of the _____.
a. amygdala
b. pons
c. hippocampus
d. cerebellum
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.D Describe the location and function of the amygdala.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The amygdala is involved in evaluating the emotional importance of sensory information and influencing decisions to approach or avoid a stimulus.

150. The _____ is described by some people as the brain's "fear center," although it contributes to many other tasks and behaviors as well.
a. hypothalamus
b. cerebellum
c. hippocampus
d. amygdala
Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.D Describe the location and function of the amygdala.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Some people describe the amygdala as the brain's "fear center."

151. Which structure in the brain has the ability to combine components of sight, sound, and feelings and bind them together into one "memory"?
a. amygdala
b. thalamus
c. hippocampus
d. cerebrum
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.E Describe the location and function of the hippocampus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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Rationale: The hippocampus is a key brain structure in the formation of new memories. It enables us to take in and combine different components of experiences—sights, sounds, and feelings—and bind them together into one "memory."

152. Rocco has suffered damage to his hippocampus. What functions are most likely to be disrupted because of this?
a. memory formation
b. emotional expression
c. coordination
d. logic and reasoning
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.E Describe the location and function of the hippocampus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The hippocampus plays a critical role in the formation of long-term declarative memories.

153. Carmen had a stroke that caused damage to her brain. As a result, she can longer form new memories about people she meets or information she learns. Which part of Carmen's brain is most likely damaged?
a. hippocampus
b. pons
c. cerebellum
d. thalamus
Answer: a
Topic: A Tour Through the Brain
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.4.E Describe the location and function of the hippocampus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The hippocampus is located immediately behind the amygdala and is a key memory structure in the formation of new memories." Carmen's case is similar to the real-life case of Henry Molaison (H. M.), who could no longer form new memories for facts and events following the removal of his hippocampus.

154. The _____ is the upper part of the brain above the pons and cerebellum and is in charge of most sensory, motor, and cognitive processes.
a. cerebrum
b. thalamus
c. amygdala
d. hippocampus
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the structure of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The cerebrum refers to the upper part of the brain above the pons and cerebellum. It is divided into two hemispheres and is in charge of most sensory, motor, and cognitive processes.

155. The cerebrum is divided into two separate halves that are connected by a large band of fibers called the _____.
a. thalamus
b. hypothalamus
c. hippocampus
d. corpus callosum


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Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the structure of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The corpus callosum connects the two halves of cerebrum, allowing them to communicate with each other.

156. Generally speaking, the _____ hemisphere in the brain is in charge of the left side of the body.
a. left
b. right
c. frontal
d. rear
Answer: b
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the structure of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: In general, the right hemisphere is in charge of the left side of the body, and the left hemisphere is in charge of the right side of the body.

157. Lateralization takes place in the _____.
a. cerebrum
b. amygdala
c. hippocampus
d. cerebral cortex
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the structure of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Lateralization is the specialization of the two cerebral hemispheres for particular operations.

158. Lateralization is defined as the _____.
a. interaction between the two cerebral hemispheres through a bundle of nerve fibers
b. reception of visual information in the lower back area of the brain
c. specialization of the two cerebral hemispheres for particular operations
d. process by which various layers of densely-packed cells are formed within the cerebrum
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the structure of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Lateralization is the specialization of the two cerebral hemispheres for particular operations.

159. The cerebrum is covered by several thin layers of densely-packed cells known collectively as the _____.
a. thalamus
b. hypothalamus
c. cerebral cortex


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d. corpus callosum
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The cerebrum is covered by several thin layers of densely-packed cells known collectively as the cerebral cortex.

160. The cortex in the human brain is about _____ millimeters in thickness.
a. 100
b. 50
c. 3
d. 1
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Although cortex is only about 3 millimeters (one-eighth inch) thick, it contains almost three-fourths of all the cells in the human brain.

161. If the human brain didn't have so many deep crevices and wrinkles in the cortex, then:
a. the amygdala would not be able to regulate the person's initial emotional responses.
b. fetuses would die prenatally because the hypothalamus wouldn't be able to regulate the autonomic nervous system.
c. the billions of neurons in the cortex would require us to have gigantic heads.
d. basic life functions, such as breathing, sleeping, and feeding, could not be regulated.
Answer: c
Topic: A Tour Through the Brain
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy
Rationale: The cortex has many deep crevices and wrinkles, which enable it to contain its billions of neurons in a compact space.

162. Which region in the brain contains the visual cortex?
a. temporal lobes
b. parietal lobes
c. frontal lobes
d. occipital lobes
Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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Rationale: The occipital lobes contain the visual cortex, where visual signals are processed.

163. Damage to the occipital lobes may result in difficulty with _____.
a. language comprehension
b. speech production
c. feeling pain and pressure
d. sight
Answer: d
Topic: A Tour Through the Brain
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The occipital lobes contain areas that receive visual information.

164. The _____ contain the somatosensory cortex and are located at the top of the brain.
a. temporal lobes
b. occipital lobes
c. frontal lobes
d. parietal lobes
Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The parietal lobes are at the top of the brain. They contain the somatosensory cortex, which receives information about pressure, pain, touch, and temperature from all over the body.

165. Which region in the brain contains the somatosensory cortex, which receives information about pressure, pain, touch, and temperature from all over the body?
a. temporal lobes
b. parietal lobes
c. frontal lobes
d. occipital lobes
Answer: b
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The parietal lobes contain somatosensory cortex, which receives information about pressure, pain, touch, and temperature from all over the body.

166. Which region in the brain contains the auditory cortex?
a. temporal lobes
b. parietal lobes
c. frontal lobes
d. occipital lobes
Answer: a


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Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Processing of auditory information occurs in the temporal lobes.

167. Which region in the brain is involved in language comprehension?
a. frontal lobes
b. parietal lobes
c. temporal lobes
d. occipital lobes
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: An area of the posterior left temporal lobe known as Wernicke's area is involved in language comprehension.

168. Which region in the brain contains the motor cortex, which issues orders to the muscles of the body to produce voluntary movement?
a. temporal lobes
b. parietal lobes
c. frontal lobes
d. occipital lobes
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The frontal lobes contain the motor cortex, which issues orders to the 600 muscles of the body to produce voluntary movement.

169. Which region in the brain is involved in the ability to make plans and think creatively?
a. frontal lobes
b. temporal lobes
c. parietal lobes
d. occipital lobes
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The frontal lobes are involved in controlling emotions and impulses, making plans, thinking creatively, and empathizing with others.

170. Broca is to production as Wernicke is to _____.
a. removal


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b. comprehension
c. application
d. deduction
Answer: b
Topic: A Tour Through the Brain
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Broca's area helps coordinate response related to language production, whereas Wernicke's area contributes to language comprehension.

171. Sara suffered brain damage to her posterior left temporal lobe. When she was interviewed in the hospital a few days later, the physician asked how she was feeling. "Just snake, doctor. My head feels eleven," she replied. What diagnosis is the doctor likely to make for Sara's condition?
a. damage to Wernicke's area
b. sudden onset schizophrenia
c. damage to the corpus callosum
d. amnesia
Answer: a
Topic: A Tour Through the Brain
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Sara has trouble comprehending language, and her brain damage is in the brain region where Wernicke's area can be found.

172. A surgeon is probing an area of association cortex in your brain with a stimulation probe. Which sensation would you most likely experience?
a. a sense of being gently touched
b. swirls of color
c. a bright flash of light
d. nothing at all
Answer: d
Topic: A Tour Through the Brain
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Although stimulation of sensory or motor areas can produce sensations or movements, stimulation of association areas typically produces no noticeable response.

173. Although it barely exists in mice and rats, the _____ accounts for approximately one-third of the entire cortex in human beings.
a. motor cortex
b. prefrontal cortex
c. somatosensory cortex
d. primary visual cortex


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Answer: b
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The prefrontal cortex accounts for approximately one-third of the entire cortex in human beings.

174. The _____ is the most recently evolved part of our brains and is associated with such complex abilities as reasoning, decision making, and planning.
a. limbic cortex
b. somatosensory cortex
c. prefrontal cortex
d. thalamic cortex
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The prefrontal cortex is the most recently evolved part of our brains, and is associated with such complex abilities as reasoning, decision making, and planning.

175. Phineas Gage is believed to have experienced a dramatic personality change after his 1848 railroad construction accident. Which area of his brain is thought to have been damaged?
a. prefrontal cortex
b. parietal lobes
c. pons and medulla
d. temporal lobes
Answer: a
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains
Rationale: Gage is believed to have had damage to his frontal lobes, particularly the prefrontal area, as this area deals with personality.

176. Parts of the _____ are involved in social judgment, inhibiting behavior, rational decision-making, and the ability to set goals and to make and carry through plans.
a. temporal lobes
b. parietal lobes
c. occipital lobes
d. frontal lobes
Answer: d
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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Rationale: The prefrontal cortex, part of the frontal lobes, is involved in social judgment, inhibiting behavior, rational decision-making, and the ability to set goals and to make and carry through plans.

177. Which lobe of the brain is involved in the ability to do a series of tasks in proper sequence and then to stop doing these tasks at the proper time?
a. temporal lobes
b. parietal lobes
c. frontal lobes
d. occipital lobes
Answer: c
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: The frontal lobes govern the ability to do a series of tasks in the proper sequence and to stop doing them at the proper time.

178. After a serious head injury, LaShea faced difficulty in doing a series of tasks in the proper sequence. It is most likely that LaShea's _____ was injured.
a. occipital lobe
b. frontal lobe
c. parietal lobe
d. temporal lobe
Answer: b
Topic: A Tour Through the Brain
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: The frontal lobes govern the ability to do a series of tasks in the proper sequence and to stop doing them at the proper time.

179. Which statement is true concerning the functioning of the brain?
a. Patients with right hemisphere damage may have difficulties with reading and identifying objects.
b. Patients with left hemisphere damage may have difficulty identifying faces and understanding music or art.
c. Each hemisphere receives sensory input from the same side of the body, but controls the movement of the opposite side of the body.
d. The two hemispheres are similar in structure but are specialized for different functions.
Answer: d
Topic: The Two Hemispheres of the Brain
Skill Level: Analyze It
Difficulty Level: Difficult
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Although similar in structure, the left and the right hemispheres have somewhat separate talents, or areas of specialization.


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180. Patients with _____ hemisphere damage in the brain may have difficulties with reading, identifying objects, making symbolic gestures or pantomimes, and describing events in the correct order.
a. left
b. right
c. frontal
d. rear
Answer: a
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Patients with left-hemisphere damage may have difficulties with reading, identifying objects, making symbolic gestures or pantomimes, and describing events in the correct order.

181. Patients with _____ hemisphere damage in the brain may have difficulty identifying faces, interpreting emotional expressions, or understanding music or art.
a. left
b. right
c. frontal
d. rear
Answer: b
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Patients with right-hemisphere damage may have difficulty identifying faces, interpreting emotional expressions, or understanding music or art.

182. After Ronald Myers and Roger Wolcott Sperry severed the corpus callosum in cats, they found that _____.
a. one side of the brain did not know what the other side was doing
b. abnormal eating behaviors occurred because the cats could not regulate hunger
c. the left side of the cats' bodies were not affected by this operation
d. disorganized electrical activity spread from one hemisphere to the other
Answer: a
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains
Rationale: When Myers and Sperry trained the cats to perform tasks with one eye blindfolded, they found that apparently one side of the brain did not know what the other side was doing.

183. The primary reason for initially performing split-brain surgery on humans was to _____.
a. find out what each half of the brain can do, cut off from the other
b. reduce the seizures in patients with debilitating, uncontrollable epilepsy
c. find out whether the two hemispheres would develop an alternate means of communication
d. reduce the tremors, stiffness, and rigidity of severe Parkinson's disease
Answer: b
Topic: The Two Hemispheres of the Brain


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Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains
Rationale: The split-brain operation is performed on humans to control severe epilepsy that cannot be controlled by medication.

184. If you look straight ahead, then everything in the left side of the scene before you goes to the _____.
a. right half of your brain
b. left half of your brain
c. front half of your brain
d. top half of your brain
Answer: a
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Each hemisphere perceives information in the opposite half of the visual field.

185. Imagine that an image of a cat was received by a split-brain patient's left hemisphere, and an image of a dog was received by that same patient's right hemisphere. If the patient was prompted to point at a picture of what was seen using her or his *left* hand, what picture would that be?
a. The patient would be unable to point at anything.
b. the dog
c. the cat
d. equally likely to be the dog or the cat
Answer: b
Topic: The Two Hemispheres of the Brain
Skill Level: Understand the Concepts
Difficulty Level: Difficult
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy
Rationale: The information received by the right hemisphere (in this case, information registering "dog") is the information that would be identified by the left hand.

186. Imagine that an image of a cat was received by a split-brain patient's left hemisphere, and an image of a dog was received by that same patient's right hemisphere. If prompted for a verbal response, what would the patient say?
a. "I saw a cat."
b. "I saw a dog."
c. "I saw a cat and a dog."
d. "I'm not sure what I saw."
Answer: a
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy
Rationale: The information received by the left hemisphere (in this case, information registering "cat") is the information that would be verbally reported.

187. Linguistic and analytic skills are typically handled by the _____.
a. right half of your brain
b. left half of your brain
c. top half of your brain
d. back half of your brain
Answer: b
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: For most people, language is primarily a left hemisphere function, while the right hemisphere is more important for processing spatial information, including recognizing faces.

188. The right hemisphere of the brain _____.
a. excels in the ability to read facial expressions
b. has a "mental module" that constantly tries to explain actions that are nonverbal
c. excels in logical, sequential, and symbolic tasks, such as solving math problems
d. is responsible for language processing in most individuals
Answer: a
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: For most people, the right hemisphere is more important for processing spatial information, including recognizing faces, and perceiving emotional expressions.

189. The best split-brain researchers would agree that _____.
a. the mental skills of the left hemisphere are superior to those of the right hemisphere
b. in normal brains, the left and right hemispheres cooperate naturally in everyday activities
c. the mental skills of the right hemisphere are superior to those of the left hemisphere
d. the left hemisphere and the right hemisphere are exactly the same
Answer: b
Topic: The Two Hemispheres of the Brain
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy, 2.4 Interpret, design, and conduct basic psychological research
Rationale: in most real-life activities, the two sides cooperate naturally, with each making a valuable contribution. In visual perception, the left hemisphere generally "sees" the details, while the right hemisphere "sees" how they fit together.

190. Which statement about the brain is true?
a. Our brains are fully formed at birth.
b. Adulthood is the greatest period of plasticity for the brain.
c. The brain's ability to change and adapt continues throughout life.
d. Human brains lose the ability to physically change in adulthood.
Answer: c


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Topic: The Flexible Brain
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.6.A Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena
Rationale: Plasticity, the brain's ability to change in response to new experiences, is most pronounced during infancy and early childhood, but it continues throughout life.

191. Although people typically think of the brain as fully formed or "static" by adulthood, it actually has the ability to change in response to new experiences, by strengthening some neural connections, pruning others, or reorganizing itself. This property is called _____.
a. constructivism
b. proliferation
c. optimization
d. plasticity
Answer: d
Topic: The Flexible Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.6.A Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology
Rationale: Plasticity is the brain's ability to change and adapt in response to new experiences.

192. Which conclusion is true regarding the effects of culture on the brain?
a. Some evidence suggests that bilingual people use different parts of their brains for their two languages.
b. Illiterate individuals tend to have more white matter in a part of the parietal cortex.
c. Technological literacy cannot affect brain activity.
d. The patterns of brain activity during mathematical processing are the same in all humans.
Answer: a
Topic: The Flexible Brain
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.6.B Discuss the relationship between cultural forces and brain function.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.5 Incorporate sociocultural factors in scientific inquiry
Rationale: Research has shown that different brain areas are involved in a first language versus a second language.

193. Which statement is true regarding sex differences in the brain?
a. The brains of males and females do not differ.
b. There are biochemical differences, but not anatomical differences, between male and female brains.
c. Males are more likely to be right-brained and females are more likely to be left-brained.
d. Ideology often gets in the way of interpreting research on sex differences and the brain.
Answer: d
Topic: The Flexible Brain
Skill Level: Analyze It
Difficulty Level: Difficult
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy, 2.5 Incorporate sociocultural factors in scientific inquiry
Rationale: Ideology often gets in the way of interpreting research on sex differences and the brain: Some people worry that the research can be used to justify sexism and others argue that ignoring the evidence is antiscientific.

194. As a critical thinker in psychology, it is important to recognize that _____.
a. the overlap between the sexes is less than the differences between them
b. biological differences between the sexes always have implications for behavior
c. brain differences could be the result, not the cause, of behavioral differences between the sexes
d. animal studies show that sex differences in the brain do not affect behavior
Answer: c
Topic: The Flexible Brain
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy
Rationale: Some male–female differences in the brain result from, rather than cause, behavioral differences.


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**True-False Questions**

1. One of the functions of a nervous system is to gather and process information.
   Answer: True
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

2. The central nervous system consists of the brain and the spinal cord.
   Answer: True
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

3. The spinal cord acts as a bridge between the brain and the parts of the body below the neck.
   Answer: True
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

4. All reflexes are produced by the spinal cord.
   Answer: False
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

5. Erection in men is a spinal reflex.
   Answer: True
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

6. Spinal reflexes are automatic and cannot be influenced by thoughts and emotions.
   Answer: False
   Topic: The Nervous System: A Basic Blueprint
   Skill Level: Remember the Facts
   Difficulty Level: Easy
   Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

7. The peripheral nervous system is a collection of neurons and supportive tissue running from the base of the brain down the center of the back.
Answer: False
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

8. Motor nerves carry messages from special receptors in the skin to the spinal cord.
Answer: False
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

9. Sensory nerves put us in touch with both the outside world and with the activities within our own bodies.
Answer: True
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

10. The somatic nervous system is sometimes called the skeletal nervous system.
Answer: True
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

11. When you feel a bug on your arm, your somatic nervous system is critical to experiencing the sensation.
Answer: True
Topic: The Nervous System: A Basic Blueprint
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

12. The sympathetic nervous system enables the body to conserve and store its energy.
Answer: False
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

13. The parasympathetic nervous system mobilizes the body for action.
Answer: False
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

14. Activation of the sympathetic nervous system pushes up the body's heart rate and blood pressure.
Answer: True
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

15. The somatic nervous system regulates the functioning of the internal organs.
Answer: False
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

16. The autonomic nervous system controls skeletal muscles.
Answer: False
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

17. The sympathetic nervous system acts like an accelerator on a car, mobilizing the body for action.
Answer: True
Topic: The Nervous System: A Basic Blueprint
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

18. Neurons are also called nerve cells.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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19. Neurons greatly outnumber glial cells in the central nervous system.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

20. Glial cells hold neurons in place.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

21. An adult brain contains about 171 billion cells.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

22. Many axons are insulated by a surrounding layer of fatty material called the myelin sheath.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

23. Axons commonly divide at their ends into branches called axon terminals.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

24. One purpose of the myelin sheath is to prevent signals in adjacent cells from interfering with each other.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

25. In individuals diagnosed with multiple sclerosis, dense build-up of myelin on the dendrites cause erratic nerve signals.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

26. In the peripheral nervous system, the fibers of individual neurons are collected together in bundles called nerves.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

27. The human body has 43 pairs of peripheral nerves.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

28. Neurons in the central nervous system can neither reproduce nor regenerate themselves.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

29. Central nervous system cells cannot be produced after infancy.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

30. Stem cells are immature cells that have the potential to develop into mature cells of various types.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

31. Neurogenesis refers to the process by which dopamine molecules cross the blood-brain barrier.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

32. Given encouraging environments, stem cells from early embryos can develop into any cell type.
Answer: True
Topic: Communication in the Nervous System


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Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

33. Synaptic vesicles are tiny sacs in the tip of the axon terminals.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

34. A neuron at rest is neutral in its electrical charge.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

35. In myelinated axons, the action potential appears to "hop" from one node to the next.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

36. Nerve impulses travel more slowly in babies than in older children and adults.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

37. Neurotransmitters make it possible for one neuron to excite or inhibit another.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

38. Neurotransmitters exist only in the brain and spinal cord.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate


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Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

39. The nature of the effect of a neurotransmitter depends on the type of receptor it binds with.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

40. Serotonin affects neurons involved in appetite and pain suppression.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

41. Acetylcholine affects neurons involved in arousal, and is also involved in muscle action.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

42. Glutamate functions as the major inhibitory neurotransmitter in the brain.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

43. Glutamate is the major excitatory neurotransmitter in the brain.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

44. People diagnosed with Alzheimer's disease lose brain cells responsible for producing acetylcholine.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy


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Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

45. A loss of cells that produce norepinephrine is responsible for the tremors and rigidity of Parkinson's disease.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

46. Serotonin levels will decrease after a protein-rich meal.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

47. Hormones are chemical substances secreted by glands that affect the functioning of organs.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

48. Norepinephrine may be considered either a neurotransmitter or a hormone, depending on where it is located and the function it is performing.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

49. Melatonin is secreted by the pituitary gland.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

50. Melatonin helps to regulate daily biological rhythms and promotes sleep.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy


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Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.3 Describe applications of psychology

51. Adrenal hormones are produced by the pineal gland.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

52. Melatonin facilitates the ejection of milk during nursing.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

53. Androgens are feminizing hormones that bring about physical change in females at puberty.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

54. Progesterone contributes to the growth and maintenance of the uterine lining in preparation for a fertilized egg.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

55. Cortisol produced by the outer part of each adrenal gland increases blood-sugar levels.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

56. Hormones have effects similar to natural opiates.
Answer: False
Topic: Communication in the Nervous System


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Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

57. Endorphins reduce pain and promote pleasure.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

58. Endorphins are known technically as endogenous opioid peptides.
Answer: True
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

59. Endorphin levels decrease considerably when an animal or a person is afraid or under stress.
Answer: False
Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

60. The lesion method of studying the brain is often used with human participants.
Answer: False
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

61. Transcranial magnetic stimulation (TMS) uses a powerful magnetic field in order to temporarily inactivate neural circuits in the brain.
Answer: True
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

62. A recording of neural activity detected by electrodes is called an electroencephalogram.
Answer: True
Topic: Mapping the Brain
Skill Level: Remember the Facts


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Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

63. Event-related potentials (ERP) isolate the neural activity associated with a specific stimulus.
Answer: True
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

64. Magnetic resonance imaging (MRI) involves using radio frequencies to take highly detailed pictures of bodily organs.
Answer: True
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

65. Magnetic resonance imaging (MRI) involves the injection of a glucose-like substance containing a radioactive element into the brain.
Answer: False
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

66. Positron emission tomography (PET) is a method for analyzing the biochemical activity in the brain.
Answer: True
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

67. A structural MRI allows us to see brain activity associated with specific thoughts or behaviors.
Answer: False
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

68. Functional MRI (fMRI) can identify where something is happening in the brain better than an EEG.
Answer: True


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Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

69. If researchers do not use the correct statistical procedures, it is possible for an fMRI to detect brain activity where none exists.
Answer: True
Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy

70. The concept of "localization of function" can be traced to Joseph Gall's theory of phrenology.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains

71. The area of the brain at the base of the skull is called the thalamus.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

72. The medulla and the pons are the two main structures of the brain stem.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

73. The medulla is responsible for breathing and heart rate.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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74. The pons is responsible for bodily functions that do not have to be consciously willed, such as breathing and heart rate.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

75. Without the reticular activating system in our brain, we would not be alert.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

76. If your cerebellum were damaged, you would become exceedingly clumsy and uncoordinated.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

77. The thalamus is a brain structure that relays sensory messages to the cerebral cortex.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.B Describe the location and function of the thalamus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

78. The only sense that completely bypasses the thalamus in the brain is touch.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.B Describe the location and function of the thalamus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

79. The thalamus is a brain structure involved in emotions and drives that are vital for survival.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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80. A cherry-sized endocrine gland called the pineal gland hangs down from the hypothalamus.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

81. The pituitary gland is often called the body's "master gland."
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

82. The amygdala is involved in the arousal and regulation of emotion.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.D Describe the location and function of the amygdala.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

83. The hippocampus is an important brain structure that contributes to memory formation.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.E Describe the location and function of the hippocampus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

84. The upper part of the brain above the pons and cerebellum is the cerebrum.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the functions of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

85. The left cerebral hemisphere is in charge of the left side of the body and the right cerebral hemisphere is in charge of the right side of the body.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the functions of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

86. The corpus callosum is the bundle of nerve fibers that connect the two cerebral hemispheres.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the functions of the cerebrum and the corpus callosum.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

87. The process by which the two cerebral hemispheres communicate with one another is known as lateralization.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the functions of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

88. The cerebrum is covered by several thick layers of densely-packed cells known collectively as the corpus callosum.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.F Describe the functions of the cerebrum and the corpus callosum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

89. The gray matter in the brain consists of long, myelin-covered axons.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

90. The cortex contains almost three-fourths of all the cells in the human brain.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

91. The cerebral cortex in humans is smoother than in other mammals.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

92. The occipital lobes contain the visual cortex, where visual signals are processed.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

93. The parietal lobes contain the auditory cortex, which processes sounds.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

94. The areas of the somatosensory cortex that receive signals from the hands and the face are disproportionately large.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

95. The parietal lobes are at the sides of the brain, just above the ears and behind the temples.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

96. An area of the left temporal lobe known as Wernicke's area is involved in language comprehension.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

97. The motor cortex is located in the frontal lobes.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

98. Broca's area, which is involved in speech production, is located in the parietal lobe.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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99. Many areas of the cortex, when stimulated, would produce no obvious response or sensation.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

100. If a surgeon applied electrical currents to a part of your brain and you felt nothing, it would indicate severe brain damage.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Apply What You Know
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

101. The prefrontal cortex accounts for approximately one-third of the entire cortex in human beings.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

102. Activity in the prefrontal lobes affects personality.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

103. The frontal lobes govern the ability to perform a series of tasks in the proper sequence.
Answer: True
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

104. The temporal lobes govern the ability to stop doing certain tasks at the proper time.
Answer: False
Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

105. People with damage in the left cerebral hemisphere may lose the ability to speak or understand language.
Answer: True
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

106. Patients with right hemisphere damage may have difficulty understanding music or art.
Answer: True
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

107. After split-brain surgery, patients are usually unable to walk or to care for their daily physical needs.
Answer: False
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

108. Each brain hemisphere receives information from the eyes about the opposite side of the visual field.
Answer: True
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

109. One of the major roles of the right cerebral hemisphere is to continually provide a reasonable story to explain our thoughts, feelings, and behaviors.
Answer: False
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

110. In most people, the right cerebral hemisphere of the brain is specialized for processing facial emotion.
Answer: True
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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111. In most people, the left cerebral hemisphere of the brain is specialized for reading.
Answer: True
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

112. The left hemisphere is specialized for processing the tone of voice in which the words are spoken.
Answer: False
Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

113. During infancy, synapses proliferate at a slower rate than they do in adulthood.
Answer: False
Topic: The Flexible Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.6.A Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

114. The brain's ability to change and adapt in response to experience is called lateralization.
Answer: False
Topic: The Flexible Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.6.A Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

115. In blind people, the visual areas in the brain might be active during tasks requiring hearing or touch due to plasticity.
Answer: True
Topic: The Flexible Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.6.A Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

116. Illiterate people tend to have less white matter in a part of the parietal cortex when compared with literate people.
Answer: True
Topic: The Flexible Brain
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.6.B Discuss the relationship between cultural forces and brain function.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology


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117. Women are more talkative than men, a finding that has been replicated across hundreds of experiments in psychology.
Answer: False
Topic: The Flexible Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.5 Incorporate sociocultural factors in scientific inquiry

118. Differences in the brain always account for the differences in people's behavior across situations.
Answer: False
Topic: The Flexible Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.5 Incorporate sociocultural factors in scientific inquiry

119. Sex differences in the brain could be the result rather than the cause of behavioral differences between men and women.
Answer: True
Topic: The Flexible Brain
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.5 Incorporate sociocultural factors in scientific inquiry


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**Short Answer Questions**

1. Why do you immediately pull your hand away from something hot?
Answer: A good answer will include the following key points.
- This is a spinal reflex.
- It is controlled by the spinal cord.
- Sensory input triggers a motor response.

Topic: The Nervous System: A Basic Blueprint
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy

2. A brain without a peripheral nervous system would be like a radio without a receiver. Explain what is meant by this analogy, identifying aspects of the nervous system that correspond to aspects of radio transmission.
Answer: A good answer will include the following key points.
- The peripheral nervous system picks up signals from sensory organs, just as a radio receiver picks up radio waves.
- Without a peripheral nervous system, the brain has no information to work with, just as a radio without a receiver plays only static.

Topic: The Nervous System: A Basic Blueprint
Skill Level: Analyze It
Difficulty Level: Difficult
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy

3. Why can the sympathetic nervous system be compared to the accelerator of a car?
Answer: A good answer will include the following key points.
- The sympathetic nervous system increases arousal like the accelerator increases speed of a car.
- The sympathetic nervous system shifts the body into "action mode," just as the accelerator causes a car to speed up.

Topic: The Nervous System: A Basic Blueprint
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

4. Why can the parasympathetic nervous system be compared to the brake of a car?
Answer: A good answer will include the following key points.
- The parasympathetic nervous system slows activity in the body like the brake slows a car.
- The parasympathetic nervous system conserves energy.

Topic: The Nervous System: A Basic Blueprint
Skill Level: Understand the Concepts
Difficulty Level: Moderate


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Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

5. List five different functions of glial cells.
Answer: A good answer will include the following key points.
- Provide a scaffold for neurons.
- Provide neurons with nutrients.
- Insulate neurons.
- Protect brain from toxic agents.
- Remove cellular debris when neurons die.
- Communicate with each other and with neurons.
- Help determine which neural connections get stronger or weaker.

Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

6. List the three main components of the neuron and explain the role each plays in the transmission of neural communication.
Answer: A good answer will include the following key points.
- Dendrites—receive messages from other neurons and transmit them to cell body.
- Cell body—keeps the neuron alive and produces many important neurochemicals.
- Axon—transmits messages from the cell body to other neurons or to muscle or gland cells.

Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

7. When a neurotransmitter binds briefly with a receptor site, the ultimate effect is either excitatory or inhibitory. Explain what each of these effects means.
Answer: A good answer will include the following key points.
- Excitatory effect—a voltage shift in the positive direction occurs.
- It increases the probability that the receiving neuron will fire.
- Inhibitory effect—a voltage shift in the negative direction occurs.
- It decreases the probability that the receiving neuron will fire.

Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

8. Name any four neurotransmitters discussed in the textbook and explain what aspects of behavior, memory, and well-being each one influences.
Answer: A good answer will include the following key points.
- Serotonin—sleep, appetite, sensory perception, temperature regulation, pain suppression, mood.
- Dopamine—voluntary movement, learning, memory, emotion, pleasure or reward, and possibly response to novelty.
- Acetylcholine— muscle action, arousal, vigilance, memory, and emotion.
- Norepinephrine—learning, memory, dreaming, waking from sleep, emotion, and those involved in the increased heart rate and the slowing of intestinal activity during stress.


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Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

9. As she entered a health food store, Ginger noticed a sign recommending an herbal remedy called "St. John's wort" for the treatment of depression. Explain how this remedy affects the biochemistry of the nervous system.
Answer: A good answer will include the following key points.
- Saint John's wort prevents cells that release serotonin from reabsorbing excess molecules in the synaptic cleft.
- As a result, levels of serotonin rise.
- Since low serotonin levels are associated with depression, this may help relieve depression.

Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.3 Describe applications of psychology, 2.2 Demonstrate psychology information literacy

10. Name two hormones discussed in the textbook and explain some of the tasks that these hormones perform.
Answer: A good answer will include the following key points.
- Melatonin—regulates daily biological rhythms, promotes sleep.
- Oxytocin—enhances uterine contractions during childbirth and facilitates the ejection of milk during nursing. Along with another hormone, vasopressin, oxytocin contributes to relationships in both sexes by promoting attachment and trust.
- Cortisol—increases blood sugar levels and boosts energy.
- Epinephrine (adrenalin) and norepinephrine (noradrenalin)—increase arousal levels, prepare a person for action, enhance memory.
- Testosterone—causes masculinizing effects on the body, influences sexual arousal in both sexes.
- Estrogen—causes feminizing effects on the body.
- Progesterone—contributes to the growth and maintenance of the uterine lining in preparation for a fertilized egg.

Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

11. Researchers are studying the possible involvement of sex hormones in behavior not directly related to sex and reproduction. Cite one example of this research.
Answer: A good answer will include the following key points.
- The body's natural estrogen may contribute to learning and memory.
- Estrogen seems to promote the formation of synapses in some parts of the brain.
- The effects occur in both women and men.

Topic: Communication in the Nervous System
Skill Level: Remember the Facts
Difficulty Level: Moderate


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Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.5 Incorporate sociocultural factors in scientific inquiry

12. A soldier whose best friend has been seriously injured in battle carries the wounded person to safety. After he reaches the medics, he realizes that he, too, is wounded. How could the soldier have carried his comrade to safety without noticing the pain from his own wound?
Answer: A good answer will include the following key points.
- Stress causes endorphin levels to increase.
- Endorphins temporarily suppress the perception of pain.

Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.3 Describe applications of psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

13. Name one drawback of the transcranial magnetic stimulation (TMS) method for understanding the brain.
Answer: A good answer will include the following key points.
- When neurons fire, they cause many other neurons to become active, too.
- It is hard to tell which neurons are critical for a particular task.
- Therefore it is not precise enough to target individual neurons

Topic: Mapping the Brain
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy

14. An EEG recording is analogous to listening to a ballgame while standing outside a sports stadium. Explain this analogy.
Answer: A good answer will include the following key points.
- Each electrode reports the activity of many neurons.
- There is a lot of background noise.
- It is not very precise.
- Similarly, when standing outside a sports stadium, you know when something is happening, but you can't be sure what it is or who is doing it.

Topic: Mapping the Brain
Skill Level: Understand the Concepts
Difficulty Level: Moderate
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

15. How does an MRI allow the exploration of "inner space" without the injection of chemicals?
Answer: A good answer will include the following key points.
- Powerful magnetic fields produce vibrations in the nuclei of atoms making up the body.
- The vibrations are picked up as signals by special receivers.
- A computer analyzes the signals, their strength and duration, and converts them into a high-contrast picture of the brain (or other organ).


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Topic: Mapping the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy

16. What are the three structures located in the brain stem? What function is associated with each structure?
Answer: A good answer will include the following key points.
- Medulla—regulation of vital body functions such as breathing and heart rate.
- Pons—involved in sleeping, waking, and dreaming.
- Reticular activating system—screens incoming information and arouses higher brain areas.

Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

17. Which structure of the brain is about the size of a small fist and looks like a "little brain?" What functions are associated with this "lesser brain?"
Answer: A good answer will include the following key points.
- The cerebellum is behind the brain stem.
- Contributes to a sense of balance and coordination of movement.
- Also involved in classical conditioning and remembering simple skills.
- May be involved in perceptual and some higher-level cognitive processes.

Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

18. Which is the only sense that completely bypasses the thalamus? How is memory related to this particular sense?
Answer: A good answer will include the following key points.
- Olfactory (smell) information bypasses the thalamus.
- The olfactory bulb is directly connected to areas involved with emotion.
- Odors become associated with memories of important personal experiences.

Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.B Describe the location and function of the thalamus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

19. Describe three tasks coordinated by the amygdala.
Answer: A good answer will include the following key points.
- Evaluating sensory information, determining its significance, and deciding to approach or withdraw.
- Mediating anxiety and depression.
- Role in emotional memory.

Topic: A Tour Through the Brain


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Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.D Describe the location and function of the amygdala.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

20. Explain the function of the hippocampus in memory. What research has been conducted regarding the hippocampus and memory?
Answer: A good answer will include the following key points.
- It enables us to take in and combine different components of experiences—sights, sounds, and feelings—and bind them together into one "memory," although the individual components may ultimately be stored in various parts of the cerebral cortex involved in formation of new memories about facts and events.
- Research on brain-damaged patients with severe memory problems supports these conclusions.
- Case study of H. M. also supports these conclusions.

Topic: A Tour Through the Brain
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.4.E Describe the location and function of the hippocampus.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

21. Why does the human brain have so many crevices and wrinkles in the cerebral cortex?
Answer: A good answer will include the following key points.
- The deep crevices and wrinkles enable it to contain its billions of neurons in a compact space.
- In other mammals, which have fewer neurons, the cortex is less crumpled.

Topic: A Tour Through the Brain
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

22. What is the difference between "gray matter" and "white matter" in the brain?
Answer: A good answer will include the following key points.
- Gray matter—densely-packed cell bodies of neurons.
- White matter—myelin-covered axons.

Topic: A Tour Through the Brain
Skill Level: Understand the Concepts
Difficulty Level: Difficult
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

23. On each cerebral hemisphere, deep fissures divide the cortex into four distinct lobes. Name each of the four lobes and describe its location.
Answer: A good answer will include the following key points.
- Occipital lobes—back of the brain.
- Parietal lobes—top of the brain.
- Temporal lobes—sides of the brain (just above ears).
- Frontal lobes—front of the brain (forehead area).

Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Easy
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

24. Describe the accident involving Phineas Gage and the resulting impact it had on him.
Answer: A good answer will include the following key points.
- In 1848, a bizarre accident drove an inch-thick, three-and-a-half-foot-long iron rod clear through the skull of Phineas Gage.
- The rod entered beneath the left eye and exited through the top of the head, destroying much of his prefrontal cortex.
- Miraculously, Gage survived the trauma and, by most accounts, he retained the ability to speak, think, and remember.
- However, Gage had changed from mild-mannered, friendly, and efficient into foul-mouthed, ill-tempered, and undependable, according to accounts at the time.
- Gage was gainfully employed and able to care for himself for many years after the accident, calling into question the extent of the impact his injuries had on behavior.

Topic: A Tour Through the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains, 2.2 Demonstrate psychology information literacy

25. Ronald Myers and Roger Sperry investigated what would happen if the two hemispheres of the brain were cut off from one another. To explore this question, they severed the corpus callosum in cats. Describe the aspects of the cats' behaviors that remained normal and the aspects that showed a profound change.
Answer: A good answer will include the following key points.
- The cats' everyday behaviors seemed normal.
- If trained in a task with one eye blindfolded, they could not do the task when the blindfold was shifted to the other eye.

Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Moderate
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.2 Develop a working knowledge of psychology's content domains

26. Explain the experimental procedure used when split-brain patients were shown composite photographs. Why did the patients claim to notice nothing unusual about the original photographs?
Answer: A good answer will include the following key points.
- Photographs of faces were cut in half and made into composite pictures combining halves of two different faces.
- Patients were instructed to stare at a dot in the middle of a screen.
- The composite pictures were flashed briefly on the screen.
- Patients would report only the person shown in the right half of the picture.
- The left hemisphere, which could talk, only saw the right half of the picture, so nothing seemed unusual.

Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.


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APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

27. Describe three activities that are more closely associated with the left hemisphere and three activities that are more closely associated with the right hemisphere of the brain.
Answer: A good answer will include the following key points.
- Left hemisphere—language; logical, symbolic, and sequential tasks; understanding technical material.
- Right hemisphere—spatial-visual ability; facial recognition, the ability to read facial expressions; creation and appreciation of art and music.

Topic: The Two Hemispheres of the Brain
Skill Level: Remember the Facts
Difficulty Level: Difficult
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

28. How does plasticity help blind people?
Answer: A good answer will include the following key points.
- The brain's ability to change in response to new experiences is called plasticity.
- In blind people, new connections may form, permitting lasting structural changes.
- The visual areas of the brain may become active during tasks requiring hearing or touch.

Topic: The Flexible Brain
Skill Level: Understand the Concepts
Difficulty Level: Easy
Learning Objective: 2.6.A Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 1.3 Describe applications of psychology, 2.1 Use scientific reasoning to interpret psychological phenomena


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**Essay Questions**

1. Compare and contrast the two main parts of the nervous system and the function of each.
Answer: A good answer will include the following key points.
- The two divisions of the nervous system are the central nervous system and the peripheral nervous system.
- The central nervous system consists of the brain and spinal cord.
- Functions of the central nervous system are defined by specific anatomical structures in the brain and involve bringing in information from the external world and driving motor behaviors in response to the outside world and internal thoughts and feelings.
- The spinal cord carries information in from the external world and back out to the body.
- The peripheral nervous system consists of the somatic nervous system and the autonomic nervous system. The somatic system drives voluntary behavior through sensory and motor nerves and the autonomic system oversees automatic behaviors.
- The autonomic nervous system consists of the sympathetic and parasympathetic divisions. The sympathetic nervous system prepares us for fight or flight while the parasympathetic system calms us.

Topic: The Nervous System: A Basic Blueprint
Skill Level: Analyze It
Difficulty Level: Difficult
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures. 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

2. Distinguish between the opposing systems of the autonomic nervous system. Be sure to include in your answer the name and function of each system and provide a clear example demonstrating the function of the systems. Also include in your answer at least two physiological changes caused by each system.
Answer: A good answer will include the following key points.
- The two divisions are the sympathetic and the parasympathetic divisions.
- The sympathetic division increases arousal and uses energy. It does this by dilating pupils, increasing heart rate, and shutting down digestion and bladder functions.
- The parasympathetic division slows the body and stores and conserves energy. It does this through constricting pupils, slowing heart rate and breathing, stimulating digestion, and allowing the constriction of the bladder.
- Example: A stressful situation, such as giving a speech, causes increased sympathetic activity and arousal. When the speech is over, the parasympathetic division slows body functions to normal.

Topic: The Nervous System: A Basic Blueprint
Skill Level: Analyze It
Difficulty Level: Difficult
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy

3. Geraldo is suffering from multiple sclerosis, a disease in which myelin in the nervous system is gradually destroyed. Knowing the structure and function of myelin, you can predict many of the problems that Geraldo is likely to have as the disease progresses. Describe the structure and function of myelin and how it is formed in the central nervous system. Predict the outcomes of having multiple sclerosis for Geraldo and his family.
Answer: A good answer will include the following key points.
- Myelin is a fatty sheath formed by glial cells.
- It occurs in segments along the axon and looks like a string of link sausages.


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- Its key functions are to prevent signals in adjacent cells from interfering with each other and to speed up conduction of neural impulses.
- In individuals with multiple sclerosis, loss of myelin causes erratic nerve signals resulting in things like loss of sensation, muscle weakness or paralysis, lack of coordination, or vision problems. These problems will get worse over time for Geraldo as more of the myelin is lost.

Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

4. For years, the conventional assumption in neuroscience had been that neurons in the central nervous system could neither reproduce nor regenerate, but research has demonstrated otherwise. Explain the results of studies that have contradicted the conventional wisdom regarding neuronal regeneration.
Answer: A good answer will include the following key points.
- In animal studies, severed axons in the spinal cord can regrow when treated with certain nervous-system chemicals.
- Stem cells in a growth medium in vitro will produce new neurons that continue to divide and multiply.
- Neurogenesis, the production of new neurons, appears to continue in the human brain into adulthood.
- Physical exercise and mental activity can promote this process whereas stress may inhibit it.

Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy

5. Distinguish between electrical and chemical communication within and between neurons.
Answer: A good answer will include the following key points.
- Action potential—an electrical impulse in the axon of a neuron.
- It is caused by a brief inflow of sodium ions followed by a brief outflow of potassium ions.
- It is conducted down the axon from the cell body to the axon terminal.
- Action potential causes the release of chemical neurotransmitter from the axon terminal.
- The neurotransmitter travels across the synaptic gap and binds to receptor sites on the receiving neuron.
- The neurotransmitter can cause either an excitatory effect (positive voltage change) or an inhibitory effect (negative voltage change) in the receiving neuron's membrane.

Topic: Communication in the Nervous System
Skill Level: Analyze It
Difficulty Level: Difficult
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

6. Endorphin levels can elevate when an animal or a person is afraid or under stress. Explain why this is adaptive using your own unique examples.
Answer: A good answer will include the following key points.
- Endorphins suppress perception of pain and increase pleasure.
- When an animal is threatened, it often must act quickly to survive.
- Pain can interfere with action.
- Pain suppression occurs at the same time as the sympathetic nervous system responds with fight or flight.
- Example should describe a situation where responding to pain would put a person in a dangerous


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situation.

Topic: Communication in the Nervous System
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena

7. Distinguish between the different techniques that have been used to explore the workings of the brain.
Answer: A good answer will include the following key points.
- Electroencephalogram (EEG)—recording brain waves through electrodes attached to the scalp.
- Event-related potentials (ERP)—a technique that isolates the neural activity associated with a specific stimulus or event.
- Transcranial magnetic stimulation (TMS)—a method of stimulating brain cells, using a powerful magnetic field produced by a wire coil placed on a person's head; it can be used by researchers to temporarily inactivate neural circuits
- Transcranial direct current stimulation (tDCS)—a technique that applies a very small electric current to stimulate or suppress activity in parts of the cortex; it enables researchers to identify the functions of a particular area.
- Positron-emission tomography (PET scan)—records biochemical changes in the brain, often after injection of radioactively-labeled glucose allowing researcher to "see" which areas of the brain are most active.
- Magnetic resonance imaging (MRI)—using powerful magnetic fields to produce vibration in the nuclei of atoms, then recording the vibrations and converting them into a high-contrast image of the brain.
- Functional MRI (fMRI)—an ultrafast MRI allowing visualization of second-to-second changes in the brain. In fMRI, the receivers detect levels of blood oxygen in different brain areas. Because neurons use oxygen as fuel, active brain areas produce a bigger signal.

Topic: Mapping the Brain
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results. 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy, 2.4 Interpret, design, and conduct basic psychological research

8. Your best friends invite you over for pizza and a friendly game of cards. Name six parts of the brain and explain the role each plays during your evening of food, fellowship, and card playing.
Answer: A good answer will include the following key points.
- Medulla—keeps your heart beating and keeps you breathing.
- Reticular activating system—keeps you awake.
- Frontal lobe—helps you make decisions during the card game.
- Hypothalamus—lets you know when you are hungry and when you are full of bean dip.
- Cerebellum—helps you maintain your balance and move about in a coordinated way as you head to the bathroom.
- Thalamus—sends sensory information to the appropriate areas of cortex for analysis.
- Hippocampus—helps you form new memories of the evening and the plays made by the others.
- Broca's area in frontal lobe—allows you to speak to your friends.

Topic: A Tour Through the Brain
Skill Level: Apply What You Know


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Difficulty Level: Moderate
Learning Objective: 2.4.A List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum. 2.4.B Describe the location and function of the thalamus. 2.4.C Describe the locations and functions of the hypothalamus and pituitary gland. 2.4.E Describe the location and function of the hippocampus 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy

9. Distinguish between the lobes of the brain by describing where they are found and what functions they control.
Answer: A good answer will include the following key points.
- Frontal lobes—located just above your eyes and extending about halfway back to the back of your head, they send commands to skeletal muscles, process short-term memory, direct emotion, assist in making plans, allow you to think creatively, help you take initiative, and help form speech.
- Occipital lobes—located at the very back of the head, they aid in visual processing.
- Parietal lobes—located above the occipital lobes, but behind the frontal lobes, they process touch information, help form attention and various mental operations.
- Temporal lobes—located by your temples, these lobes help process auditory information, memory, perception, emotion, and language comprehension.

Topic: A Tour Through the Brain
Skill Level: Analyze It
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology

10. In 1848, an explosion near railroad-worker Phineas Gage sent a 3½-foot iron rod through his skull. The iron rod entered his head under the left eye and emerged from the top of Phineas' head. What contributions has this case study made to our current understanding of the brain?
Answer: A good answer will include the following key points.
- The damage to the prefrontal cortex in this accident impacted the personality of Phineas Gage. Therefore, this brain region must contribute in some way to personality.
- Gage was reported to have become foul-mouthed, ill-tempered, and undependable. The brain damage impacted his impulsiveness and his adherence to social norms.
- Parts of the frontal lobes are involved in social judgment, rational decision-making, and the ability to set goals and to make and carry out plans. By many accounts, Gage had difficulty performing such tasks.

Topic: A Tour Through the Brain
Skill Level: Apply What You Know
Difficulty Level: Moderate
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.4 Interpret, design, and conduct basic psychological research

11. Suppose you read an article on a news website claiming that a new study has found anatomical differences between the male and female brain that explain why men and women "don't see eye-to-eye on so many topics." What are some reasons why you should be skeptical of this type of claim?
Answer: A good answer will include the following key points.
- Many supposed gender differences in behavior actually reflect stereotypes about males and females.
- The overlap between the sexes is greater than the differences between them.


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- A brain difference does not necessarily explain behavior or performance.
- Differences in the brain do not account for differences in behavior across different situations.
- Sex differences in the brain could be the result, rather than the cause, of behavioral differences.
- These types of results often cannot be replicated.

Topic: The Flexible Brain
Skill Level: Apply What You Know
Difficulty Level: Difficult
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.4 Interpret, design, and conduct basic psychological research, 2.5 Incorporate sociocultural factors in scientific inquiry


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**Integrative Essay Questions: Linking the Chapters**

1. Abnormally low levels of serotonin and dopamine have been associated with harmful effects. Explain these effects and describe what psychologists know about this relationship using your knowledge of correlational studies. What might be an easy assumption to make that may not necessarily be accurate?
Answer: A good answer will include the following key points.
   - Low levels of serotonin are associated with severe depression.
   - Low levels of dopamine are associated with Parkinson's disease.
   - This information usually results from correlational studies and from drug treatment.
   - Correlation does not imply causation.
   - The low levels of neurotransmitters could cause the disorder, could result from the disorder, or could be related to something else entirely.
   - Just because a drug that boosts levels of a neurotransmitter is effective in treating a disorder does not mean that low levels of the neurotransmitter caused the disorder.

   Topic: 2.2 Communication in the Nervous System, 2.3 Mapping the Brain
   Skill Level: Analyze It
   Difficulty Level: Difficult
   Learning Objective: 2.3.B Explain why a correlation between two variables does not establish a causal relationship between those variables. 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.1 Use scientific reasoning to interpret psychological phenomena, 2.2 Demonstrate psychology information literacy, 2.4 Interpret, design, and conduct basic psychological research

2. What can be learned by studying patients who have had a part of the brain damaged because of disease or injury? What can be learned by studying individuals whose disorders have required surgical lesions? What are the drawbacks of the case study method? Include in your essay an evaluation of the case studies of Phineas Gage and split-brain patients.
Answer: A good answer will include the following key points.
   - Case studies of individuals with brain damage from disease, injury, or surgery can lead to hypotheses about brain-behavior relationships.
   - A drawback is that information gained from individual case studies may not generalize to other cases.
   - In such cases, the area of the brain that is damaged varies with each individual, so no two cases are exactly alike.
   - Phineas Gage—results are problematic because there is controversy about the details of the case.
   - Split-brain patients have been carefully studied before and after surgery. There are multiple cases, so comparisons can be made between people. Because of their epilepsy, however, their brains may not have been functioning as that of a normal person before the surgery.

   Topic: 2.2 Communication in the Nervous System, 2.5 The Two Hemispheres of the Brain
   Skill Level: Analyze It
   Difficulty Level: Difficult
   Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions. 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex. Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
   APA Learning Objective: 1.1 Describe key concepts, principles, and overarching themes in psychology, 2.2 Demonstrate psychology information literacy, 2.4 Interpret, design, and conduct basic psychological research


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**Revel Quizzes**

The following questions appear at the end of each module and at the end of the chapter in Revel *for Invitation to Psychology*, 8e.

**End of Module Quiz: 2.1 The Nervous System: A Basic Blueprint**

**Multiple choice questions**

1 . EOM Q2.1.1

The central nervous system is composed of the _____.

a) brain and spinal cord
b) somatic system and autonomic system
c) sympathetic system and parasympathetic system
d) peripheral system and lateral system

Consider This: The sympathetic and parasympathetic systems make up the autonomic nervous system.
2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
Answer: a
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
Skill Level: Remember the Facts
Difficulty Level: Easy

2 . EOM Q2.1.2

Jimmy is camping with friends when he accidentally steps in the campfire and recoils his foot instantaneously. What produced this speedy foot-saving action?

a) the direct operation of the spinal cord
b) a pain signal sent from the brain to the foot
c) a signal relayed from the foot to the brain to the spinal cord back to the foot
d) the complex interplay of brain and spinal signals

Consider This: Some parts of the central nervous system are activated with virtually no conscious effort.
2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
Answer: a
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
Skill Level: Apply What You Know
Difficulty Level: Difficult

3 . EOM Q2.1.3

Nerves that are connected to sensory receptors and to skeletal muscles are part of the _____ nervous system.

a) somatic
b) central
c) sympathetic
d) parasympathetic


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Consider This: The sympathetic and parasympathetic systems make up the autonomic nervous system.
2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
Answer: a
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

4 . EOM Q2.1.4

As Keiko walked through a dark alley late at night, she heard a bottle break, a weird wheezing noise, and something rustling behind a dumpster. Her heart beat faster, she started to sweat, and she began to breathe more deeply. These physiological reactions were produced by Keiko's _____ nervous system.

a) sympathetic
b) parasympathetic
c) somatic
d) central

Consider This: Keiko's body was readying itself to either confront an environmental stressor or flee the scene. 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
Answer: a
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
Skill Level: Apply What You Know
Difficulty Level: Difficult

5 . EOM Q2.1.5

As Keiko continued down the alley, she saw a mangy, asthmatic cat emerge from behind a dumpster. The cat yawned and hobbled away, as Keiko's heartbeat slowed and her breathing returned to normal. These physiological reactions were produced by Keiko's _____ nervous system.

a) parasympathetic
b) sympathetic
c) central
d) somatic

Consider This: Keiko's body was returning itself to normal conditions after preparing to fight or flee. 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
Answer: a
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
Skill Level: Apply What You Know
Difficulty Level: Difficult

**End of Module Quiz: 2.2 Communication in the Nervous System**

**Multiple choice questions**

1 . EOM Q2.2.1


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Nerve cells found in the brain are called _____, whereas support cells found in the brain are called _____.

a) neurons; glia
b) nerve cells; dendrites
c) glia; axons
d) glia; neurons

Consider This: Your brain is made up of two types of cells with specific names and specific functions.
2.2.A Compare the functions of neurons and glial cells.
Answer: a
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
Skill Level: Remember the Facts
Difficulty Level: Easy

2 . EOM Q2.2.2

In a typical neuron, information is received by _____ and transmitted to the next neuron by _____.

a) dendrites; an axon
b) axons; glia
c) dendrites; glia
d) an axon; dendrites

Consider This: Neurons act as a kind of relay station, taking in information on one end and transmitting it out the other end. Picture what a typical neuron looks like and what those receiving and transmitting elements are called. 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
Answer: a
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

3 . EOM Q2.2.3

Embryonic stem cells _____.

a) can generate many types of specialist cells, such as neurons or muscle cells
b) can repair themselves without sending pain signals to the spinal cord
c) can divide four times, as opposed to most cells, which only divide twice
d) always turn into neurons after a one-year incubation period

Consider This: Stem cell research holds a great deal of promise, in large part due to the ability of embryonic cells to develop in many different ways. 2.2.C Explain how stem cells contribute to the process of neurogenesis.
Answer: a
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

4 . EOM Q2.2.4

Anuj was bragging to C. J. "Man, I'm smart!" he crowed. "My brain cells are stitched so tightly together that there's no space between them. Information travels from neuron to neuron without a break!" "You can't be that smart," muttered C. J., "if you don't even understand how misinformed you are." Why is C. J. correct?

a) Neurons do not touch one another; there is a small gap between them called a synaptic cleft.
b) Glial cells are responsible for transmitting information throughout the brain.


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c) Axons touch other axons, and dendrites touch other dendrites; the neuron itself does not matter.
d) Myelin stimulates an action potential, and this sends a signal out through a dendrite; the strength of the signal is more important than the connection.

Consider This: Neurons communicate using an electrochemical messaging system; the "chemical" part is what is important in the present case. 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
Answer: a
Learning Objectives: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
Skill Level: Apply What You Know
Difficulty Level: Difficult

5 . EOM Q2.2.5

_____ is a neurotransmitter involved in voluntary movement, pleasure and reward, and attention.
a) Dopamine
b) GABA
c) Serotonin
d) Acetylcholine

Consider This: Serotonin affects neurons involved in sleep, appetite, sensory perception, temperature regulation, pain suppression, and mood. 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
Answer: a
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
Skill Level: Remember the Facts
Difficulty Level: Easy

**End of Module Quiz: 2.3 Mapping the Brain**

**Multiple choice questions**

1 . EOM Q2.3.1

Surgically removing brain structures from a non-human animal to understand the effects on behavior is a technique for investigating brain function known as _____.
a) the lesion method
b) PET scanning
c) transcranial magnetic stimulation
d) positron emission tomography

Consider This: One method for understanding brain function is to study what happens when parts of the brain are damaged, missing, or otherwise impaired. The technique described here involves direct intervention in the brain. 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
Answer: a
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
Skill Level: Remember the Facts
Difficulty Level: Easy


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2 . EOM Q2.3.2

Although both techniques involve intervening in brain function, _____ employs a large electrical current that generates a magnetic field, whereas _____ uses a relatively small electrical current.

a) TMS; tDCS
b) EEG; ERP
c) tDCS; PET
d) MRI; TMS

Consider This: There are many methods available to researchers for mapping the brain. Recall which techniques involve applying electromagnetic forces to the brain. 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
Answer: a
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

3 . EOM Q2.3.3

When recording brain waves, both _____ and _____ can provide a general record of electrical brain activity.

a) EEG; ERP
b) PET; MRI
c) TMS; tDCS
d) EOM; EOC

Consider This: There are many techniques for recording brain activity; which ones rely on measuring electrical activity? 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
Answer: a
2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

4 . EOM Q2.3.4

The brain's use of glucose can be recorded using _____.

a) PET
b) EEG
c) ERP
d) TMS

Consider This: There are many techniques for recording brain activity; which one relies on measuring biochemical changes in the brain as they occur? 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
Answer: a
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
Skill Level: Understand the Concepts
Difficulty Level: Moderate


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5 . EOM Q2.3.5

Pierre and Solange were talking one day. "I'm a little nervous," confessed Pierre. "My doctor told me I should get a brain scan—M-R-something." "Oh!" Solange replied. "MRI, or fMRI?" "Hmm, I'm not sure," replied Pierre. "What's the difference?" Can you answer Pierre's question?

a) MRI records the structure of the brain, whereas fMRI records brain activity associated with specific thoughts or behaviors.
b) MRI uses a pulsating electromagnetic current to stimulate the brain, whereas fMRI uses a low-voltage current.
c) MRI records changes in blood glucose levels, whereas fMRI records generalized electrical activity.
d) MRI is an intervention technique, whereas fMRI is simply a recording technique.

Consider This: Both MRI and fMRI rely on the same foundation for their operation. 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
Answer: a
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
Skill Level: Analyze It
Difficulty Level: Difficult

**End of Module Quiz: 2.4 A Tour Through the Brain**

**Multiple choice questions**

1 . EOM Q2.4.1

Which of the following is *not* a main structure found in the brain stem?

a) hypothalamus
b) medulla
c) reticular activating system
d) pons

Consider This: Picture where the brain stem is located in the brain, and try to recall the structures that are found there. 2.4.A List and describe the functions of the main structures in the brain stem, and discuss the processes controlled by the cerebellum.
Answer: a
Learning Objective: 2.4.A List and describe the functions of the main structures in the brain stem, and discuss the processes controlled by the cerebellum.
Skill Level: Remember the Facts
Difficulty Level: Easy

2 . EOM Q2.4.2

Which brain structure acts as a sensory relay station, directing visual or auditory sensations to other parts of the brain?

a) thalamus
b) hippocampus
c) pons
d) corpus callosum


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Consider This: The brain structure described here is located deep within the brain's interior. 2.4.B Describe the location and function of the thalamus.
Answer: a
Learning Objective: 2.4.B Describe the location and function of the thalamus.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

3 . EOM Q2.4.3

Cecilia is a researcher who uses fMRI to examine brain activity. If she were to show participants photos of faces depicting different emotional expressions, fMRI would be likely to indicate greater blood flow in the _____ in response to fearful faces compared to neutral faces.

a) amygdala
b) occipital lobe
c) cerebellum
d) hippocampus

Consider This: Fearful facial expressions are learned signals of potential threat in the environment. 2.4.D Describe the location and function of the amygdala.
Answer: a
Learning Objective: 2.4.D Describe the location and function of the amygdala.
Skill Level: Remember the Facts
Difficulty Level: Easy

4 . EOM Q2.4.4

If you had severe difficulty forming memories, what part of your brain might be damaged?

a) hippocampus
b) hypothalamus
c) cerebellum
d) pons

Consider This: Most structures in the brain contribute to multiple processes, but one structure in particular plays an important role in memory; what is that structure? 2.4.E Describe the location and function of the hippocampus.
Answer: a
Learning Objective: 2.4.E Describe the location and function of the hippocampus.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

5 . EOM Q2.4.5

The thick band of fibers that connects the two hemispheres of the brain is called the _____.

a) corpus callosum
b) cerebral cortex
c) thalamic extension
d) basal ganglia

Consider This: The structure described here allows information to pass from one hemisphere to the other. 2.4.F Describe the functions of the cerebrum and the corpus callosum.
Answer: a
Learning Objective: 2.4.F Describe the functions of the cerebrum and the corpus callosum.


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Skill Level: Remember the Facts
Difficulty Level: Easy


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**End of Module Quiz: 2.5 The Two Hemispheres of the Brain**

**Multiple choice questions**

1 . EOM Q2.5.1

Imagine that an image of a cat was received by a split-brain patient's left hemisphere, and an image of a dog was received by that same patient's right hemisphere. If prompted for a verbal response, what would the patient say?

a) "I saw a cat."
b) "I saw a dog."
c) "I saw a cat and a dog."
d) The patient would be unable to verbalize anything.

Consider This: Think about the typical setup of a split-brain experiment, and also think about what brain structure gets split when this operation takes place. 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
Answer: a
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
Skill Level: Apply What You Know
Difficulty Level: Difficult

2 . EOM Q2.5.2

Imagine that an image of a cat was received by a split-brain patient's left hemisphere, and an image of a dog was received by that same patient's right hemisphere. If the patient were prompted to point at an image using her or his *left* hand, what image would that be?

a) the dog
b) the cat
c) The patient would be equally likely to point to either the dog or the cat.
d) The patient would be unable to point at anything.

Consider This: Remember the Facts, when you look straight ahead, everything in the left side of your visual field goes to the right half of your brain. 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
Answer: a
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
Skill Level: Apply What You Know
Difficulty Level: Difficult

3 . EOM Q2.5.3

Imagine that an image of a cat was received by a split-brain patient's left hemisphere, and an image of a dog was received by that same patient's right hemisphere. If the patient were prompted to point at an image using her or his *right* hand, what image would that be?

a) the cat
b) the dog
c) The patient would be equally likely to point to either the dog or the cat.
d) The patient would be unable to point at anything.


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Consider This: Remember the Facts, when you look straight ahead, everything in the left side of your visual field goes to the right half of your brain. 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
Answer: a
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
Skill Level: Apply What You Know
Difficulty Level: Difficult

4 . EOM Q2.5.4

If words were presented to one cerebral hemisphere or the other, which hemisphere would be more likely to show an advantage in reading the words faster?

a) the left hemisphere
b) the right hemisphere
c) There should be no difference between the reading speeds of the two hemispheres.
d) the left hemisphere for short words; the right hemisphere for longer words

Consider This: The two cerebral hemispheres show strengths or specializations for different kinds of information-processing tasks. 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
Answer: a
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
Skill Level: Apply What You Know
Difficulty Level: Difficult

5 . EOM Q2.5.5

What is the most reasonable conclusion to reach about the operation of the cerebral hemispheres, based on all we know from the available research?

a) The two cerebral hemispheres are cooperative partners, each contributing to tasks that benefit the owner of that brain.
b) Some people are "left-brained" whereas others are "right-brained," and determining which is which can make life a lot easier for an individual.
c) The two cerebral hemispheres work in opposition to one another, each vying for supremacy on various kinds of tasks.
d) Thinking that people have one brain is incorrect; people actually have "two brains" that operate independently of one another.

Consider This: Although the human brain has many identifiable structures, there is a reason why we talk about "the brain" rather than "the collection of separate squishy structures housed in your skull." 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
Answer: a
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
Skill Level: Analyze It
Difficulty Level: Difficult

**End of Module Quiz: 2.6 The Flexible Brain**

**Multiple choice questions**

1 . EOM Q2.6.1


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Although people typically think of the brain as fully formed or "static" by adulthood, it actually has the ability to change in response to new experiences by strengthening some neural connections, pruning others, or reorganizing itself. This property is called _____.

a) plasticity
b) generativity
c) reformation
d) reformulation

Consider This: There is a specific term used for the brain's ability to change and adapt. 2.6.A Define neural plasticity, and summarize the main evidence that the brain has the ability to change in response to new experiences.
Answer: a
Learning Objective: 2.6.A Define neural plasticity, and summarize the main evidence that the brain has the ability to change in response to new experiences.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

2 . EOM Q2.6.2

Which statement is correct regarding synaptic connections in the brain?

a) Useful connections are strengthened by learning and experience, whereas connections that are not useful tend to wither away, leaving an efficient network of interconnected neurons.
b) With proper stimulation, all neural connections continue to expand and multiply in scale as a person ages.
c) The number of synaptic connections is low in childhood, reaches its peak by age 12, then slowly but steadily begins to decrease from that point through the remainder of a person's lifespan.
d) The number of neural connections in the brain remains constant from birth to death because neurons cannot regenerate.

Consider This: Synaptic connections form and reform themselves over the lifespan, based on several factors. 2.6.A Define neural plasticity, and summarize the main evidence that the brain has the ability to change in response to new experiences.
Answer: a
Learning Objective: 2.6.A Define neural plasticity, and summarize the main evidence that the brain has the ability to change in response to new experiences.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

3 . EOM Q2.6.3

Which of the following is a reliable sex difference in the brains of women and men that has been documented?

a) The amygdala and hippocampus are larger in men, whereas parts of the frontal lobes are larger in women, after controlling for overall brain size.
b) The occipital lobe is generally larger in men than it is in women, relative to an individual's body size.
c) The hypothalamus is generally more developed among women, whereas the thalamus is generally more developed among men.
d) Men tend to be "left-brained," whereas women tend to be "right-brained."

Consider This: Research suggests that there really is no reliable evidence that some people are "left-brained" while others are "right-brained." 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
Answer: a


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Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
Skill Level: Understand the Concepts
Difficulty Level: Moderate


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4 . EOM Q2.6.4

Which of the following is *not* a caution to bear in mind when interpreting research findings regarding sex differences in the brains of women and men?

a) Anatomical and biochemical sex differences in the brain have not been documented by researchers.
b) Sex differences in the brain could be the result, rather than the cause, of differences in behavior.
c) Differences in the brain do not account for differences in behavior across situations.
d) A brain difference does not necessarily produce a difference in behavior or performance.

Consider This: Establishing a difference between two groups, explaining the reasons for that difference, and documenting the effects of any difference are all separate questions, and the answer to one does not necessarily imply an answer to the others. 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
Answer: a
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
Skill Level: Analyze It
Difficulty Level: Difficult

5 . EOM Q2.6.5

Stevie reads that women's and men's brains are organized differently, and therefore concludes that this organization produces sex differences in behavior. What is wrong about Stevie's logic?

a) A brain difference does not necessarily produce a behavioral difference; different brain organizations can produce the same behavioral outcomes.
b) Relatively small differences in brain organization—a few hundred neural connections or so—are sufficient to impact behavior; overall organization is beside the point.
c) All brain differences are caused by sex stereotypes.
d) Sex differences in behavior are actually due to sex differences in brain *development* rather than sex differences in brain *organization*.

Consider This: Your kitchen might have the pots and pans under the stove, whereas my kitchen might have them in a cabinet by the refrigerator; yet both of us are capable of cooking a delicious soufflé. 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
Answer: a
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
Skill Level: Apply What You Know
Difficulty Level: Difficult

**End of Chapter 2 Quiz: The Brain and the Nervous System**

**Multiple choice questions**

1 . EOC Q2.1

Which part of the central nervous system acts reflexively, sending and receiving signals with little to no conscious effort?

a) the spinal cord
b) the brain
c) the spinal column
d) the parasympathetic system


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Consider This: The spinal column is a protective column of bones. 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
Answer: a
Learning Objective: 2.1.A Describe the primary functions of the central nervous system, and name its two main structures.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

2 . EOC Q2.2

The two subdivisions of the autonomic nervous system are the _____ nervous system and the _____ nervous system.

a) sympathetic; parasympathetic
b) central; peripheral
c) somatic; sympathetic
d) parasympathetic; peripheral

Consider This: There are many subdivisions of the human nervous system. Picture in your mind how each subsystem relates to its larger system. 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.

Answer: a
Learning Objective: 2.1.B List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

3 . EOC Q2.3

What is the distribution between neurons and glial cells in a typical human brain?

a) Neurons and glia are about evenly divided across the 171 billion cells that make up a typical brain.
b) There are 12 times as many glial cells as there are neurons in the brain.
c) Neurons and glia have a 3:1 ratio; for every three neurons, there is one glial cell.
d) There are approximately 1 trillion neurons and 4 billion glial cells in a typical brain.

Consider This: Scientists have increasingly refined the tools and methods used to estimate the number and types of cells in the human brain. They believed for many years that the brain contained about 100 billion neurons and 10 times as many glia, but recent advances put the numbers much lower. 2.2.A Compare the functions of neurons and glial cells.
Answer: a
Learning Objective: 2.2.A Compare the functions of neurons and glial cells.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

4 . EOC Q2.4

The three main parts of a neuron are _____.

a) dendrites, cell body, and axon
b) axon, myelin, and synapse
c) cell body, soma, and dendrites
d) myelin, sclera, and axon terminals


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Consider This: Sketch what a typical neuron looks like, and then try to identify each structure. 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
Answer: a
Learning Objective: 2.2.B Describe each of the three main parts of a neuron, and explain their functions.
Skill Level: Remember the Facts
Difficulty Level: Easy

5 . EOC Q2.5

The production of new neurons from immature stem cells is a process known as _____.

a) neurogenesis
b) fertilization
c) plasticity
d) neurotransmission

Consider This: Research has revealed amazing capacities of embryonic stem cells, one of which is the potential for creating new neurons. Think about what this process is called. 2.2.C Explain how stem cells contribute to the process of neurogenesis.
Answer: a
Learning Objective: 2.2.C Explain how stem cells contribute to the process of neurogenesis.
Skill Level: Remember the Facts
Difficulty Level: Easy

6 . EOC Q2.6

"Argh!" cried Jerry. "I can feel sodium and potassium ions rushing into the cell membranes of my neurons! It's so distracting! My neurons must be forming new myelin sheaths." Jerry's statements are incorrect. First, he cannot really feel ions moving across his cell membranes. Second, if he could, he would be describing _____.

a) an action potential
b) reuptake
c) the synaptic cleft
d) the process of neurogenesis

Consider This: There is a term for the movement of ions across the semipermeable cell membrane of a neuron. 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
Answer: a
Learning Objective: 2.2.D Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.
Skill Level: Apply What You Know
Difficulty Level: Difficult

7 . EOC Q2.7

Three primary types of sex hormones are _____.

a) androgens, estrogens, and progesterone
b) androgens, testosterone, and protosterone
c) estrogens, gestrogens, and testosterone
d) cortisol, epinephrine, and norepinephrine


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Consider This: Sex hormones are released by the gonads and the adrenal glands, and there are some fundamental types that are found in both women and men. 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
Answer: a
Learning Objective: 2.2.E Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.
Skill Level: Remember the Facts
Difficulty Level: Easy

8 . EOC Q2.8

How does transcranial magnetic stimulation (TMS) help researchers to understand functioning in the brain?

a) TMS can temporarily inactivate neural circuits, allowing researchers to observe the effects on behavior.
b) TMS measures changes in blood glucose levels in the brain, which are correlated with different types of information-processing tasks.
c) TMS provides a record of brain-wave activity, which allows researchers to predict where future patterns of thoughts are likely to occur.
d) TMS detects differences in blood oxygen absorption in the brain, providing a kind of "map" of brain functions that researchers can inspect.

Consider This: TMS is a promising technique for intervening in the brain to study effects on behavior. Think about what the *T*, the *M*, and the *S* stand for. 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
Answer: a
Learning Objective: 2.3.A Describe techniques researchers use for manipulating the brain and observing the behavior that results.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

9 . EOC Q2.9

Why should scientists and the public at large be cautious when interpreting the results of an fMRI study claiming to have found a "brain center" for a particular behavior?

a) Brain scan images can often convey misleading or oversimplified conclusions.
b) fMRI is still an experimental technique that has not been used much in research.
c) EEG provides a better mechanism for pinpointing brain-based behavioral changes.
d) Neurogenesis makes isolating brain functions to a particular region impossible.

Consider This: Brain scan images can convey an air of "legitimacy" or authority to the results of an experiment, yet caution should be exercised when evaluating the conclusions. 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
Answer: a
Learning Objective: 2.3.B Describe techniques researchers use for manipulating behavior and observing the effects on the brain.
Skill Level: Analyze It
Difficulty Level: Difficult

10 . EOC Q2.10

The brain stem structure involved in sleeping, waking, and dreaming is the _____.

a) pons
b) medulla oblongata
c) pituitary gland
d) hypothalamic projection


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Consider This: Think of the main structures in the brain stem and recall what each one does. All are involved in crucial but fairly low-level functions. 2.4.A List and describe the functions of the main structures in the brain stem, and discuss the processes controlled by the cerebellum.
Answer: a
Learning Objective: 2.4.A List and describe the functions of the main structures in the brain stem, and discuss the processes controlled by the cerebellum.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

11 . EOC Q2.11

Where is the thalamus located in the human brain?

a) deep inside the brain's interior, almost at the center of the brain
b) next to the pons on the brain stem
c) below the cerebellum, but above the medulla oblongata
d) above the pituitary gland and below the hypothalamus

Consider This: Sketch for yourself the major structures in the human brain, and use the sketch as a guide to locating the thalamus. 2.4.B Describe the location and function of the thalamus.
Answer: a
Learning Objective: 2.4.B Describe the location and function of the thalamus.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

12 . EOC Q2.12

Why is the pituitary gland often called the body's "master gland"?

a) It secretes hormones that affect other endocrine glands.
b) It controls the functions of the hypothalamus.
c) It is located in the exact center of the human brain.
d) It secretes chemicals that affect the prefrontal cortex.

Consider This: Glands secrete hormones, and hormones affect behavior. The hormones secreted by the pituitary gland can have widespread influence. 2.4.C Describe the location and functions of the hypothalamus and pituitary gland.
Answer: a
Learning Objective: 2.4.C Describe the location and functions of the hypothalamus and pituitary gland.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

13 . EOC Q2.13

Participants in an experiment are shown facial expressions of various emotions. Expressions of fear, sadness, anger, and happiness flash on a screen at a rapid rate. Although many parts of the brain are activated in response to these images, which of the following brain structures would play a particularly important role in processing this emotional content?

a) the amygdala
b) the olfactory bulb
c) the hippocampus
d) the cerebellum


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Consider This: Recall the name of the brain structure that is involved in determining the emotional importance of information and making a primary determination of whether a person or situation should be approached or avoided. 2.4.D Describe the location and function of the amygdala.
Answer: a
Learning Objective: 2.4.D Describe the location and function of the amygdala.
Skill Level: Apply What You Know
Difficulty Level: Difficult
14 . EOC Q2.14

Keith and Heather were discussing cosmetic surgery one day. "I'm thinking of having my hippocampus removed," said Keith. "It's so tiny, and I just think my brain would look more streamlined without it." "Yeah—why don't you look into that," Heather replied in sarcastic disbelief. Why does Heather think Keith is pursuing a dramatically foolish idea?

a) Keith would be unable to form new memories.
b) Keith would lose his senses of smell and taste.
c) Keith would be unable to recognize threatening stimuli in his environment.
d) Keith would become partially deaf.

Consider This: What is the primary function of the hippocampus? 2.4.E Describe the location and function of the hippocampus.
Answer: a
Learning Objective: 2.4.E Describe the location and function of the hippocampus.
Skill Level: Apply What You Know
Difficulty Level: Difficult

15 . EOC Q2.15

Why does the human cerebral cortex have so many deep crevices and wrinkles in it?

a) so that billions of neurons can fit in a relatively compact area
b) because a cell's axons need to extend in multiple directions at once
c) because evolutionary pressures caused many "restarts" to brain development
d) so that dendrites can coexist on multiple geometric planes across the cortex

Consider This: The cortices of some animals are smooth, whereas the human cerebral cortex has lots of fissures and ridges to it. These are called *sulci* and *gyri*, if you want to impress your friends. If you want to impress yourself, think of why the cortex looks that way. 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
Answer: a
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
Skill Level: Analyze It
Difficulty Level: Difficult

16 . EOC Q2.16

Where is the occipital lobe of the human cerebral cortex located?

a) at the back of the head
b) at the front of the head
c) above the parietal lobe
d) below the frontal lobe


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Consider This: The parietal lobe is above the occipital lobe. 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
Answer: a
Learning Objective: 2.4.G Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.
Skill Level: Understand the Concepts
Difficulty Level: Moderate

17 . EOC Q2.17

Why would surgeons sever the corpus callosum in the human brain to create a split-brain patient?

a) in order to relieve the consequences of debilitating epileptic seizures
b) as a means of studying how the corpus callosum works
c) for the greater benefit of science
d) to gain access to brain structures such as the thalamus, hypothalamus, and hippocampus

Consider This: Brain surgery is always a serious activity, and not one to be undertaken frivolously. 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
Answer: a
Learning Objective: 2.5.A Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.
Skill Level: Analyze It
Difficulty Level: Difficult

18 . EOC Q2.18

Why is it incorrect to think of people as being "left-brained" or "right-brained"?

a) Information received in one hemisphere travels to the other hemisphere via the corpus callosum, so the "whole brain" is always engaged.
b) There are no identifiable functions associated with one hemisphere or the other; talk of being "left-brained" is a stereotype.
c) The division between "lower" and "upper" brain structures is more important, such that some people are "low-brained" and others are "high-brained."
d) "Left-brain" tasks are complex, whereas "right-brain" tasks deal with basic survival; therefore, we are all right-brained as long as we are alive and breathing.

Consider This: There are indeed left and right hemispheres of the cerebral cortex, and those hemispheres do "specialize" to some extent in particular types of information processing. 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
Answer: a
Learning Objective: 2.5.B Describe why the two hemispheres of the brain are allies rather than opponents.
Skill Level: Analyze It
Difficulty Level: Difficult

19 . EOC Q2.19

Which statement best summarizes our current state of knowledge about the brain?

a) The human brain is a dynamic organ capable of modifying its circuits in response to experience and changes in the environment.


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b) The human brain is fully formed in most humans by the age of 20 and undergoes relatively minor modifications after that.
c) The human brain is a static organ that executes information-processing routines that are shaped by natural selection.
d) The human brain shows explosive growth between birth and five years of age, then rapid decline after the age of 70.

Consider This: Research in neurogenesis and neural plasticity provides a developing picture of how the human brain operates. 2.6.A Define neural plasticity, and summarize the main evidence that the brain has the ability to change in response to new experiences.
Answer: a
Learning Objective: 2.6.A Define neural plasticity, and summarize the main evidence that the brain has the ability to change in response to new experiences.
Skill Level: Analyze It
Difficulty Level: Difficult

20 . EOC Q2.20

Why should we be cautious in interpreting research on sex differences in the human brain?
a) Findings that demonstrate a sex difference may not be replicated with new evidence and better techniques.
b) Promoting sex differences is a sociocultural means of creating divisions that do not exist.
c) Sex differences in brain structures or functions have not been found.
d) MRI scans are notoriously inconclusive evidence for structural differences in the brain.

Consider This: Our knowledge of sex differences in the brain, like our knowledge of science in general, grows and develops over time. 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
Answer: a
Learning Objective: 2.6.C Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.
Skill Level: Analyze It
Difficulty Level: Difficult


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# Chapter 2 *The Brain and the Nervous System*

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# ►Chapter-At-A-Glance

| *Detailed Outline* | *Instructor Resources* | *REVEL Videos* |
|---|---|---|
| **The Nervous System: A Basic Blueprint**<br>The Central Nervous System<br>The Peripheral Nervous System | **Learning Objectives:** 2.1.A, 2.1.B<br>**Lecture Launchers:** 2.1<br>**Activities & Exercises:** 2.1<br>**Handout:** 2.1 | **Video**: Watch: The Basics: How the Brain Works Part 1 |
| **Communication in the Nervous System**<br>Types of Cells<br>The Structure of the Neuron<br>Neurogenesis<br>How Neurons Communicate<br>Chemical Messengers in the Nervous System | **Learning Objectives:** 2.2.A, 2.2.B, 2.2.C, 2.2.D, 2.2.E<br>**Lecture Launchers:** 2.2, 2.3, 2.4, 2.5<br>**Activities & Exercises:** 2.2, 2.3, 2.4, 2.5, 2.6 | **Video**: Watch: The Basics: How the Brain Works Part 2<br>**Video**: Watch: How Neurons Fire<br>**Video**: Watch: Neurotransmitters<br>**Video**: Watch: Your Brain on Drugs |
| **Mapping the Brain**<br>Manipulating the Brain and Observing Behavior<br>Manipulating Behavior and Observing the Brain | **Learning Objectives:** 2.3.A, 2.3.B<br>**Lecture Launchers:** 2.6, 2.7, 2.8 | |
| **A Tour Through the Brain**<br>The Brain Stem and Cerebellum<br>The Thalamus<br>The Hypothalamus and the Pituitary Gland<br>The Amygdala<br>The Hippocampus<br>The Cerebrum<br>The Cerebral Cortex | **Learning Objectives:** 2.4.A, 2.4.B, 2.4.C, 2.4.D, 2.4.E, 2.4.F, 2.4.G<br>**Lecture Launchers:** 2.9, 2.10, 2.11, 2.12, 2.13, 2.14<br>**Activities & Exercises:** 2.7, 2.8<br>**Handout:** 2.2 | **Video:** Watch: Emotional Faces and the Amygdala<br>**Video**: Watch: The Basics: How the Brain Works Part 3 |
| **The Two Hemispheres of the Brain**<br>Split Brains: A House Divided<br>The Two Hemispheres: Allies or Opposites? | **Learning Objectives:** 2.5.A, 2.5.B<br>**Lecture Launchers:** 2.15, 2.16<br>**Activities & Exercises:** 2.9, 2.10, 2.11 | |
| **The Flexible Brain**<br>Experience and the Brain<br>Culture and the Brain<br>Are There “His” and “Hers” Brains? | **Learning Objectives:** 2.6.A, 2.6.B, 2.6.C<br>**Lecture Launcher:** 2.17 | **Video**: The Plastic Brain |


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## ▼ Learning Objectives

LO 2.1.A – Describe the primary functions of the central nervous system, and name its two main structures.

LO 2.1.B – List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.

LO 2.2.A – Compare the functions of neurons and glial cells.

LO 2.2.B – Describe each of the three main parts of a neuron, and explain their functions.

LO 2.2.C – Explain how stem cells contribute to the process of neurogenesis.

LO 2.2.D – Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.

LO 2.2.E – Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.

LO 2.3.A – Describe techniques researchers use for manipulating the brain and observing the behavior that results.

LO 2.3.B – Describe techniques researchers use for manipulating behavior and observing the effects on the brain.

LO 2.4.A – List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.

LO 2.4.B – Describe the location and function of the thalamus.

LO 2.4.C – Describe the location and function of the hypothalamus and pituitary gland.

LO 2.4.D – Describe the location and function of the amygdala.

LO 2.4.E – Describe the location and function of the hippocampus.

LO 2.4.F – Describe the function of the cerebrum and the corpus callosum.

LO 2.4.G – Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.

LO 2.5.A – Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.

LO 2.5.B – Describe why the two hemispheres of the brain are allies rather than opposites.

LO 2.6.A – Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences.

LO 2.6.B – Discuss the relationship between cultural forces and brain function.

LO 2.6.C – Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.


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## ► Rapid Review

Chapter 2 discusses the brain and nervous system. The central nervous system, composed of the brain and spinal cord, receives incoming messages from the senses, processes that information, and sends messages to the muscles and organs. The nerves in the rest of the body make up the peripheral nervous system. This system, in turn, is composed of the somatic nervous system, which regulates sensation and voluntary actions, and the autonomic nervous system, which regulates glands, internal organs, and blood vessels. The autonomic nervous system is composed of the sympathetic nervous system, which mobilizes the body for action, and the parasympathetic nervous system, which conserves energy. The nervous system is made up of neurons; the key components of neurons are dendrites, the cell body, and axons, which end in axon terminals. A neural message goes from dendrites to the axon via an electrical impulse, and neurons communicate with other neurons through chemicals called neurotransmitters that are released into synapses. A variety of methods for mapping the brain, such as EEG, tDCS, TMS, PET, MRI, and fMRI, are discussed. Different brain structures and their functions are explained, along with general issues about how the brain processes information. Research on split-brain patients, who have had the corpus callosum severed, provides insight into hemispheric specialization. Discussion of some challenging issues—how experience shapes the brain, the link between culture and brain functioning, and whether men and women have substantially different types of brains—reveals myths and truths on these subjects.


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# ►Lecture Guide

## I. THE NERVOUS SYSTEM: A BASIC BLUEPRINT

- *Lecture Launcher 2.1 – The Cranial Nerves*
- *Activity 2.1 – Name that Nervous System*
- *Revel Video*

***Learning Objective 2.1.A – Describe the primary functions of the central nervous system, and name its two main structures.***

A. The central nervous system
   1. Functions—receives, processes, interprets, and stores incoming information; sends out messages to muscles, glands, internal organs
   2. Parts—brain and spinal cord (an extension of the brain)

***Learning Objective 2.1.B – List the major structures and major divisions of the peripheral nervous system, and describe their primary functions.***

B. The peripheral nervous system—nervous system outside brain and spinal cord
   1. Functions
      a. Sensory nerves—bring input from skin, muscles, and organs
      b. Motor nerves—carry output to muscles, glands, and organs
   2. Divisions
      a. Somatic nervous system
         i. Nerves connected to sensory receptors
         ii. Nerves connected to skeletal muscles—voluntary action
      b. Autonomic nervous system—works automatically
         i. Functions—regulates blood vessels, glands, organs
         ii. Divisions
            (a) Sympathetic—mobilizes the body for action
            (b) Parasympathetic—enables body to conserve and store energy

## II. COMMUNICATION IN THE NERVOUS SYSTEM

- *Lecture Launcher 2.2 – Neurotransmitters: Chemical Communicators of the Nervous System*
- *Lecture Launcher 2.3 – Exceptions to the Rules*
- *Lecture Launcher 2.4 – The Glue of Life: Neuroglial Cells*
- *Lecture Launcher 2.5 – Hormone Imbalances*
- *Activity 2.2 – Using Dominoes to Understand the Action Potential*
- *Activity 2.3 – Environmental Influences on the Brain*
- *Activity 2.4 – Demonstrating Neural Conduction: The Class as a Neural Network*
- *Activity 2.5 – The Dollar Bill Drop*
- *Activity 2.6 – Reaction Time and Neural Processing*
- *Revel Videos*

***Learning Objective 2.2.A – Compare the functions of neurons and glial cells.***

A. Types of cells
   1. Glial cells—hold neurons in place, nourish, insulate neurons
   2. Neurons—cells that communicate to, from, or within the CNS

***Learning Objective 2.2.B – Describe each of the three main parts of a neuron, and explain their functions.***

B. The structure of the neuron


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1. Dendrites—receive messages from other neurons, transmit to cell body
2. Cell body—keeps the neuron alive, determines whether to fire
3. Axon—transmits messages away from cell body to other neurons
   a. Ends in branches or axon terminals
   b. Many axons are insulated by fatty material called a *myelin sheath*
   c. Bundles of axons in the peripheral nervous system form nerves

***Learning Objective 2.2.C – Explain how stem cells contribute to the process of neurogenesis.***

C. Neurogenesis
   1. Discovery of neurogenesis has reshaped the thinking of many brain scientists
   2. Stem cell research offers an abundance of promising avenues

***Learning Objective 2.2.D – Outline the process by which neurons communicate with each other, and explain the basic functions of the synapse, action potential, synaptic vesicles, and neurotransmitters.***

D. How neurons communicate
   1. Synapse = axon terminal + synaptic cleft (small space between one axon and next dendrite) + covering membrane of receiving dendrite or cell body
      a. Many thousands of neurons may communicate at a synapse
      b. Synaptic connections continue to change throughout life
   2. How neurons communicate
      a. Wave of electric voltage, called action potential, moves down axon to end of axon terminal, called synaptic end bulb
      b. Action potentials travel more rapidly in myelinated axons than in unmyelinated axons
      c. Synaptic end bulb releases chemical neurotransmitters (transmitters) which have been stored in synaptic vesicles (sacs in the end bulb)
      d. Transmitters cross the synaptic cleft and briefly lock onto receptor sites on the receiving dendrites
      e. They can increase or decrease the likelihood that the receiving neuron will generate an action potential
      f. Receiving neuron averages the excitatory and inhibitory incoming messages to determine if it reaches firing threshold
      g. Neurons either fire or do not fire (all or none); the strength of firing does not vary

***Learning Objective 2.2.E – Summarize the effects of the main neurotransmitters in the brain, and identify the main hormones that influence behavior.***

E. Chemical messengers in the nervous system
   1. Neurotransmitters: Versatile couriers
      a. Many have been identified, more are being found
      b. Neurotransmitters exist throughout the body
      c. Better understood neurotransmitters and some of their effects
         i. *Serotonin*—sleep, mood, eating
         ii. *Dopamine*—movement, learning, memory, emotion [pleasure]
         iii. *Acetylcholine*—muscle action, memory, emotion
         iv. *Norepinephrine*—heart rate, learning, memory
         v. *GABA*—major inhibitory neurotransmitter in the brain
         vi. Glutamate—major excitatory neurotransmitter
      d. Levels that are too high or too low may produce problems
         i. Low levels of serotonin and norepinephrine associated with depression
         ii. Abnormal GABA levels associated with sleep and eating disorders and convulsive disorders
         iii. Loss of cells that produce acetylcholine associated with Alzheimer's disease
      e. Each neurotransmitter plays many roles and functions overlap


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f. Cause and effect between neurotransmitters and behavior unclear
2. Hormones: Long-distance messengers
   a. Substances produced in one part of the body but affect another
   b. Originate primarily in endocrine glands that release hormones into the bloodstream, which carries them to other organs and cells
   c. A chemical may act as either a neurotransmitter or a hormone, depending where it is located
   d. Hormones of particular interest to psychologists
      i. *Melatonin*—secreted by the pineal gland, regulates biological rhythms
      ii. *Oxytocin*—secreted by the pituitary gland
      iii. *Adrenal hormones*
         (a) Involved in stress and emotional responses
         (b) Produced by the adrenal glands
         (c) Cortisol, epinephrine, and norepinephrine are produced and activate the sympathetic nervous system and enhance memory
      iv. *Sex hormones*—three major types; all three types occur in both sexes
         (a) *Androgens* (e.g., testosterone)—masculinizing, influence sexual arousal in both sexes
         (b) *Estrogen*—feminizing, influence menstrual cycle, may contribute to improved learning and memory
         (c) *Progesterone*—maintenance of uterine lining
   e. Endorphins
      i. Endorphins are endogenous opioid peptides
      ii. Produce effects similar to natural opiates; reduce pain, promote pleasure, as well as playing a role in other functions
      iii. Levels increase during stress or fear response
      iv. Release of endorphins may also be linked to the pleasures of social contact

## III. MAPPING THE BRAIN

- *Lecture Launcher 2.6 – Psychophysiological Measurement*
- *Lecture Launcher 2.7 – Berger's Wave*
- *Lecture Launcher 2.8 – Lie Detectors 2.0*

***Learning Objective 2.3.A – Describe techniques researchers use for manipulating the brain and observing the behavior that results.***

A. Manipulating the brain and observing behavior
   1. Researchers study the brains of those who have experienced disease or injury
   2. Lesion method involves damaging or removing section of brain in animals and then observing the effects
   3. Transcranial magnetic stimulation (TMS) – brain cells are manipulated through the application of a large electrical current
   4. Transcranial direct current stimulation (tDCS) applies a very small current to stimulate or suppress activity in the cortex

***Learning Objective 2.3.B – Describe techniques researchers use for manipulating behavior and observing the effects on the brain.***

B. Manipulating behavior and observing the brain
   1. Electroencephalogram (EEG) involves brain wave recording; not very specific
   2. Event-related potentials (ERPs) isolate neural activity associated with a specific stimulus
   3. Positron-Emission Tomography (PET)
      a. Records biochemical changes in the brain as they occur
      b. Utilizes a radioactive glucose-like substance
      c. Used to diagnose abnormalities or to learn about normal brain activity


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4. Magnetic Resonance Imaging (MRI) uses magnetic fields and radio frequencies
5. Functional Magnetic Resonance Imaging (fMRI) allows a glimpse at brain activity as it occurs
   a. Have caution: Imaging the brain and thinking critically about brain structure and function need to go hand in hand, so to speak
6. Though imaging gives us a lot of information, it cannot replace critical thinking. Interpretations must be made with caution.

## IV. A TOUR THROUGH THE BRAIN

- *Lecture Launcher 2.9 – Handedness, Eyedness, Footedness, Facedness*
- *Lecture Launcher 2.10 – Brain Metaphors*
- *Lecture Launcher 2.11 – Brain's Bilingual Broca*
- *Lecture Launcher 2.12 – The Importance of a Wrinkled Cortex*
- *Lecture Launcher 2.13 – A New Look at Phineas Gage*
- *Lecture Launcher 2.14 – Freak Accidents and Brain Injuries*
- *Activity 2.7 – Football and Brain Damage*
- *Activity 2.8 – Brain Parts*
- *Revel Videos*

***Learning Objective 2.4.A – List and describe the function of three main structures in the brain stem, and discuss the processes controlled by the cerebellum.***

A. The brain stem and cerebellum
   1. Brain stem—located at base of skull: old part of brain
      a. *Pons*—involved in sleeping, waking, and dreaming
      b. *Medulla*—regulates breathing and heart rate; automatic functions
      c. *Reticular activating system (RAS)*—network of neurons, extends upward and connects with higher brain areas; screens information, responsible for arousal and alertness
   2. *Cerebellum*–regulates balance and coordination of movement; also involved in remembering certain skills and acquired reflexes

***Learning Objective 2.4.B – Describe the location and function of the thalamus.***

B. *Thalamus*—directs incoming sensory messages (except olfactory) to higher centers

***Learning Objective 2.4.C – Describe the location and function of the hypothalamus and pituitary gland.***

C. The *hypothalamus and pituitary gland*
   1. Hypothalamus—associated with drives, such as hunger, thirst, emotion, sex and reproduction, body temperature, and the autonomic nervous system
   2. *Pituitary gland*—"master gland" governed by hypothalamus
   3. Limbic system—structures in the area are involved in emotions

***Learning Objective 2.4.D – Describe the location and function of the amygdala.***

D. *Amygdala*—evaluates sensory information to determine its importance, involved in mediating anxiety and depression

***Learning Objective 2.4.E – Describe the location and function of the hippocampus.***

E. *Hippocampus*—"gateway to memory" that enables us to form new memories

***Learning Objective 2.4.F – Describe the function of the cerebrum and the corpus callosum.***

F. *Cerebrum*—responsible for higher forms of thinking; divided into two halves or cerebral hemispheres


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1. Connected by band of fibers called *corpus callosum*
2. Right hemisphere in charge of left side of the body
3. Left hemisphere in charge of right side of the body
2. Lateralization—each hemisphere has somewhat different tasks and talents

***Learning Objective 2.4.G – Sketch the location of each of the lobes of the cerebral cortex, and explain the major functions each lobe performs, with particular reference to the prefrontal cortex.***

G. Cerebrum is covered by layer of densely packed cells—*cerebral cortex*
   1. Grayish appearance = gray matter
      a. Made up of cell bodies of nerve cells
      b. "White" matter beneath cortex is formed by myelinated axons
   2. Contains three-fourths of all cells in the brain
   3. Divided into four regions
      a. *Occipital lobes*—contain the visual cortex
      b. *Parietal lobes*—contain somatosensory cortex, which receives information about pressure, pain, touch, and temperature from all over the body
      c. *Temporal lobes*—contain auditory cortex
      d. *Frontal lobes*—contain the motor cortex; responsible for making plans, taking initiative, and thinking creatively
   2. *Prefrontal cortex* involved in personality
      a. Case of Phineas Gage shows the outcomes of damage to the prefrontal cortex
      b. Involved in social judgment, rational decision making, and the ability to set goals and make and carry through plans
      c. Involved in determining the proper order of behaviors and knowing when to stop

## V. THE TWO HEMISPHERES OF THE BRAIN

- *Lecture Launcher 2.15 – The Results of a Hemispherectomy*
- *Lecture Launcher 2.16 – En Garde: Dualism versus Monism*
- *Activity 2.9 – Hemispheric Communication and the Split Brain*
- *Activity 2.10 – Hemispheric Lateralization*
- *Activity 2.11 – Left or Right?*

***Learning Objective 2.5.A – Discuss the basic format of a split-brain experiment and what such results reveal about the functioning of the cerebral hemispheres.***

A. Split brains: A house divided
   1. *Corpus callosum*, which connects the cerebral hemispheres in normal brains, is severed
   2. This surgery has been performed in animal studies and for some human conditions such as severe epilepsy
   3. Effects
      a. Split-brain patients are able to lead normal lives
      b. Effects on perception and memory are observable under experimental conditions
   4. The work of Sperry and colleagues is described

***Learning Objective 2.5.B – Describe why the two hemispheres of the brain are allies rather than opposites.***

B. The two hemispheres—allies or opposites?
   1. Left hemisphere handles language for nearly all right-handed people and a majority of left-handers
   2. Left side more active than right during some logical, symbolic, and sequential tasks, such as math
   3. Many researchers believe the left side is dominant because cognitive skills, including rational and analytic abilities, originate here


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4. Others point to abilities of the right hemisphere: superior visual-spatial abilities, facial recognition, appreciation of art and music; some researchers claim it is holistic and intuitive
5. In real life, the two hemispheres cooperate automatically in most activities

## VI. THE FLEXIBLE BRAIN

➢ *Lecture Launcher 2.17 – Neuroplasticity and Learning*
➢ *Revel Video*

***Learning Objective 2.6.A – Define neural plasticity, and summarize some of the main evidence that the brain has the ability to change in response to new experiences.***

A. Experience and the brain
   1. Accumulating evidence for neural plasticity gives cause for rethinking some old tenets of brain research
      a. The brain is a dynamic organ, rather than a static storehouse of information
      b. Experiences and environments can modify the brain
      c. Applications to rehabilitation of all sorts look promising

***Learning Objective 2.6.B – Discuss the relationship between cultural forces and brain function.***

B. Culture and the brain
   1. Cultural neuroscience examines the links between culture and brain functioning
      a. Bilingualism and literacy provide examples

***Learning Objective 2.6.C – Summarize cautions surrounding the conclusion that sex differences in the brain are linked to sex differences in behavior.***

C. Are there “his” and “her” brains?
   1. Efforts to identify male–female differences have reflected biases of the times
   2. Two questions must be asked:
      a. *Are male and female brains physically different?*
         i. Sex differences have been found in animal brains
         ii. Human sex differences are more elusive
            (a) Anatomical and biochemical sex differences have been found
            (b) There are also sex differences in the activity of different parts of the brain

      b. If there are brain differences, what do they mean for the behavior of women and men in real life?
         i. Many supposed sex differences are stereotypes
         ii. Brain differences do not necessarily produce behavioral differences
         iii. Brain differences do not account for behavior differences across situations
         iv. Sex differences in the brain could be the result rather than the cause of behavioral differences
         v. Replicate, replicate, replicate!


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# ▼LECTURE LAUNCHERS AND DISCUSSION TOPICS

2.1 – The Cranial Nerves
2.2 – Neurotransmitters: Chemical Communicators of the Nervous System
2.3 – Exceptions to the Rules
2.4 – The Glue of Life: Neuroglial Cells
2.5 – Hormone Imbalances
2.6 – Psychophysiological Measurement
2.7 – Berger's Wave
2.8 – Lie Detectors 2.0
2.9 – Handedness, Eyedness, Footedness, Facedness
2.10 – Brain Metaphors
2.11 – Brain's Bilingual Broca
2.12 – The Importance of a Wrinkled Cortex
2.13 – A New Look at Phineas Gage
2.14 – Freak Accidents and Brain Injuries
2.15 – The Results of a Hemispherectomy
2.16 – En Garde: Dualism versus Monism
2.17 – Neuroplasticity and Learning

## Lecture Launcher 2.1 – The Cranial Nerves

The textbook discusses various divisions of the nervous system. You may want to add a description of the cranial nerves to your outline of the nervous system. Although the function of the cranial nerves is not different from that of the sensory and motor nerves in the spinal cord, they do not enter and leave the brain through the spinal cord. There are 12 cranial nerves (numbered 1 to 12 and ordered from the front to the back of the brain) that primarily transmit sensory information and control motor movements of the face and head. The 12 cranial nerves are:

1. *Olfactory*. A sensory nerve that transmits odor information from the olfactory receptors to the brain.

2. *Optic*. A sensory nerve that transmits information from the retina to the brain.

3. *Oculomotor*. A motor nerve that controls eye movements, the iris (and therefore pupil size), lens accommodation, and tear production.

4. *Trochlear*. A motor nerve that is also involved in controlling eye movements.

5. *Trigeminal*. A sensory and motor nerve that conveys somatosensory information from receptors in the face and head and controls muscles involved in chewing.

6. *Abducens*. Another motor nerve involved in controlling eye movements.

7. *Facial*. Conveys sensory information and controls motor and parasympathetic functions associated with facial muscles, taste, and the salivary glands.

8. *Auditory-vestibular*. A sensory nerve with two branches, one of which transmits information from the auditory receptors in the cochlea and the other conveys information concerning balance from the vestibular receptors in the inner ear.

9. *Glossopharyngeal*. This nerve conveys sensory information and controls motor and parasympathetic functions associated with the taste receptors, throat muscles, and salivary glands.


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10. *Vagus*. Primarily transmits sensory information and controls autonomic functions of the internal organs in the thoracic and abdominal cavities.

11. *Spinal accessory*. A motor nerve that controls head and neck muscles.

12. *Hypoglossal*. A motor nerve that controls tongue and neck muscles.

As is their custom, medical students have developed several mnemonics for memorizing the cranial nerves. Some of the family-friendly ones include:

On Old Olympus' Tiny Tops, A Friendly Viking Grew Vines And Hops
Oh Once One Takes The Anatomy Final Very Good Vacations Are Heavenly
One Of Our Two Timing Adults Found Very Good Values At Home
On Occasion Our Trusty Truck Acts Funny. Very Good Vehicle Any How
Orlando's Overweight Octopuses Try To Avoid Fuddrucker's And Grabbing Vienna Sausage Hamburgers
On Our Overseas Trip To Argentina Found Very Grand Villas And Huts

## Lecture Launcher 2.2 – Neurotransmitters: Chemical Communicators of the Nervous System

In 1921, Otto Loewi put two living hearts in a fluid bath that kept them beating. He stimulated the vagus nerve of one of the hearts. This is a bundle of neurons that serves the parasympathetic nervous system and causes a reduction in the heart's rate of beating. A substance was released by the nerve of the first heart and was transported through the fluid to the second heart. The second heart reduced its rate of beating. The substance released from the vagus nerve of the first heart was later identified as *acetylcholine*, one of the first neurotransmitters to be identified. Although many other neurotransmitters have now been identified, we continue to think of acetylcholine as one of the most important neurotransmitters. For example, curare is a poison that was discovered by South American Indians, who put it on the tips of the darts they shoot from their blowguns. Curare blocks acetylcholine receptors, and paralysis of internal organs results. The victim is unable to breathe and eventually dies. As another example, a substance in the venom of black widow spiders stimulates release of acetylcholine at synapses. More commonly, botulinum toxin, found in improperly canned foods, blocks release of acetylcholine at the synapses and has a deadly effect. It takes less than one millionth of a gram of this toxin to kill a person. Finally, a deficit of acetylcholine is associated with Alzheimer's disease, which afflicts a high percentage of older adults.

Many neurotransmitters have been identified in the years since 1921, and there is increasing evidence of their importance in human behavior. Psychoactive drugs affect consciousness because of their effects on synaptic transmission. For example, cocaine and the amphetamines prolong the action of certain neurotransmitters, and opiates imitate the action of natural neuromodulators called endorphins. It appears that the neurotransmitters dopamine, norepinephrine, and serotonin are associated with some of the most severe forms of mental illness.

Loewi, O. (1921). Über humorale übertragbarkeit der herznervenwirkung. [About humoral transmissibility of the heart nervous system] *Pflüger's Archiv für die gesamte Physiologie des Menschen und der Tiere*, [Pflüger's Archive for the Whole Physiology of Man and Animals], *189*(1), 239–242.
Loewi, O. (1960). An autobiographic sketch. *Perspectives in Biology and Medicine*, *4*(1), 3–25.

## Lecture Launcher 2.3 – Exceptions to the Rules

In an introductory psychology class, students learn the basic rules that generally govern neuronal communication. In many cases, however, the exceptions to these rules may be as important as the rules themselves. Several of these exceptions are described below.


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*Rule #1: Neuron-to-neuron signaling is chemical, not electrical.*
*Exception: Gap junctions*

Although it is generally the case that a neuron's electrical signal must first be converted to a chemical signal in order excite or inhibit another neuron, this is not always the case. Some neurons have *gap junctions,* which connect their intracellular fluids. This means that the electrical signal can flow directly from one neuron to another. Unlike chemical synapses, most electrical synapses formed by gap junctions are bidirectional, meaning that electrical signals can travel in both directions through the gap junctions. Gap junctions also contain *gates,* which can be closed to prevent the electrical signal from being passed to the neighboring neuron.

*Rule #2: Axons always synapse on dendrites.*
*Exception: Axo-axonic and axosomatic synapses*

Axons can form synapses on all parts of a postsynaptic neuron. Synapses located on the soma (i.e., cell body) of a neuron are often inhibitory. In other words, transmitters released at these axosomatic synapses make it harder for the postsynaptic neuron to reach the threshold for generating an action potential. When an axon synapses on the axon of another neuron, it is called an axo-axonic synapse. Because these synapses usually occur near the end of the axon, they have no effect on whether the post synaptic cell generates an axon potential or not. Instead, axo-axonic synapses usually modulate how much neurotransmitter is released from the postsynaptic neuron.

*Rule #3: Action potentials only travel in one direction.*
*Exception: Back-propagating action potentials*

Action potentials begin at the axon hillock, where the axon emerges from the soma. From there, the action potential travels down the axon and away from the soma. At the same time, however, a back-propagating action potential can travel from the axon hillock, through the soma, and into the dendrites. Back-propagating action potentials are thought to affect the functioning of receptors located in the soma and dendrites.

Kandel, E., Schwartz, J., & Jessell, T. (2012). *Principles of neural science* (5th ed.). New York: McGraw-Hill.

## Lecture Launcher 2.4 – The Glue of Life: Neuroglial Cells

*Glia* is derived from the Greek word for glue and is an appropriate name for the cells that surround all neurons, sealing them together. Glial cells outnumber neurons ten to one, and, although tiny in size, still make up half of the brain's bulk. Unlike neurons, glia do not possess excitable membranes and so cannot transmit information in the way neurons do. Yet so many thousands of cells must be there for some purpose.

Researchers studying the brain have suggested that glia can take up, manufacture, and release chemical transmitters, and so may help to maintain or regulate synaptic transmission. Researchers know that glia help to buffer the cellular environment and assist in reuptake of transmitters. Other researchers suggest that glia can manufacture and possibly transmit other kinds of molecules, such as proteins. The anatomy of some glial cells is striking in this regard, for they seem to form a conduit between blood vessels and neurons, and so may bring nourishment to the neurons. It is thought that these cells may have important functions during prenatal development and recovery from brain injury. One role of the glia is known definitely: Certain kinds of glia, called by the tongue-twisting name of *oligodendroglia,* form the myelin sheath that insulates central nervous system axons and speeds conduction of the nerve impulse. A counterpart called a *Schwann cell* performs the same role for the neurons that make up peripheral nerves.

The study of glia is difficult because these tiny cells are inextricably entwined with neurons. As the most


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numerous type of cell in the brain, their potential importance is vast, and investigation of their function seems likely to yield exciting results in the near future.

## Lecture Launcher 2.5 – Hormone Imbalances

Various problems are caused by imbalances within the endocrine system. The following disorders and medical problems are associated with abnormal levels within the pituitary, thyroid, and adrenal glands.

Pituitary malfunctions

*Hypopituitary dwarfism*
If the pituitary gland secretes too little of its growth hormone during childhood, the person will be very small, although normally proportioned.

*Giantism*
If the pituitary gland oversecretes the growth hormone while a child is still in the growth period, the long bones of the body in the legs and other areas grow very, very long—a height of 9 feet is not unheard of. The organs of the body also increase in size, and the person may have health problems associated with both the extreme height and the organ size.

*Acromegaly*
If the oversecretion of the growth hormone happens after the major growth period is ended, the person's long bones will not get longer, but the bones in the face, hands, and feet will increase in size, producing abnormally large hands, feet, and facial bone structure. The famous wrestler/actor, André the Giant (André René Roussimoff), had this condition, as did the great actor Rondo Hatton.

Thyroid malfunctions

*Hypothyroidism*
In hypothyroidism, the thyroid does not secrete enough thyroxin, resulting in a slower than normal metabolism. The person with this condition will feel sluggish and lethargic, have little energy, and tend to be obese.

*Hyperthyroidism*
In hyperthyroidism, the thyroid secretes too much thyroxin, resulting in an overly active metabolism. This person will be thin, nervous, tense, and excitable. He or she will also be able to eat large quantities of food without gaining weight (oh, if only we came equipped with thyroid control knobs!).

Adrenal gland malfunctions

Among the disorders that can result from malfunctioning of the adrenal glands are Addison's disease (which is caused by adrenal insufficiency) and Cushing syndrome (caused by elevated levels of cortisol). In the former, fatigue, low blood pressure, weight loss, nausea, diarrhea, and muscle weakness are some of the symptoms, whereas for the latter, obesity, high blood pressure, a "moon" face, and poor healing of skin wounds is common. John F. Kennedy, Helen Reddy, and (perhaps) Osama bin Laden were well-known Addisonians.

If there is oversecretion of the sex hormones in the adrenals, virilism and premature puberty are possible problems. Virilism results in women with beards on their faces and men with exceptionally low, deep voices. Premature puberty, or full sexual development while still a child, is a result of excessive sex hormones during childhood. (Puberty is considered premature if it occurs before age 8 in girls and age 9 in boys.) Treatment is possible using hormones to control the appearance of symptoms, but must begin early in the disorder.


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## Lecture Launcher 2.6 – Psychophysiological Measurement

There are various strategies for measuring activity in the brain, especially recently developed techniques such as PET, TMS, and MRI. There are, of course, other bodily systems and other techniques for measuring them, many of which rely on the electrophysical activity of the body. Cover these as well as some of the newest brain techniques, including diffusion tensor imaging (DTI).

■ *DTI—Diffusion tensor imaging.* DTI is an MRI technique that measures water-molecule diffusion and its directionality. It can be used to trace cellular pathways in the brain.

■ *EMG—Electromyography*. An electromyogram records the action potential given off by contracting muscle fibers. A common example is the recording of facial EMG, in which either inserted electrodes or surface electrodes record the activity of muscles as they pose various expressions.

■ *EGG—Electrogastrography*. Electrogastrograms provide a record of smooth-muscle activity in the abdomen. The contractions of the stomach or intestines, for example, can be measured by comparing the readings from a surface electrode attached to the abdomen with those of an electrode attached to the forearm. In the special case of measuring contractions in the esophagus, surface electrodes are attached to a balloon, which is "swallowed" by the person being measured. EGG may be used successfully to gain information about fear, anxiety, or other emotional states.

■ *EOG—Electrooculography*. Readings from electrodes placed around the posterior of the eyes are the basis for EOG. Electrical signals result from small saccadic eye movements as well as more gross movements that can be directly observed. EOG can be used for measuring rapid eye movements during sleep.

■ *EKG—Electrocardiography*. EKG records changes in electrical potential associated with the heartbeat. Electrodes are placed at various locations on the body, and their recordings yield five waves that can be analyzed: P-waves, Q-waves, R-waves, S-waves, and T-waves. EKG may be used by psychologists to supplement observations relevant to stress, heart disease, or Type A behavior patterns.

■ *EDA—Electrodermal activity*. Formerly called *galvanic skin response*, *skin resistance*, and *skin conductance*, EDA refers to the electrical activity of the skin. As activity in the sympathetic nervous system increases, it causes the eccrine glands to produce sweat. This activity of the eccrine glands can be measured by EDA, regardless of whether or not sweat actually rises to the skin surface. The folklore of "sweaty palms" associated with a liar might be measured using this technique.

■ *EEG—Electroencephalography*. As discussed in the text, EEG provides information about the electrical activity of the brain, as recorded by surface electrodes attached to the scalp. EEG has been used in a variety of ways to gather information about brain activity under a wide range of circumstances.

■ *Pneumography*—Pneumographs, which measure the frequency and amplitude of breathing, are obtained through a relatively straightforward procedure. A rubber tube placed around the chest expands and contracts in response to the person's inhalations and exhalations. These changes can then be recorded with either an ink pen or an electrical signal.


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## Lecture Launcher 2.7 – Berger's Wave

Ask if anyone knows what is meant by the term *Berger's wave*. Explain that the study of electrical activity in the brain was once limited to studies in which different kinds of measuring devices were attached to the exposed brains of animals. Studies involving humans were rare; researchers could only measure the electrical activity of the living human brain in individuals who had genetic defects of their skull bones that caused the skin of their scalps to be in direct contact with the surfaces of their brains. Yuck!

All this changed when a German physicist named Hans Berger, after several years of painstaking research, discovered that it was possible to amplify and measure the electrical activity of the brain by attaching special electrodes to the scalp which, in turn, sent impulses to a machine that graphed them. In his research, Berger discovered several types of waves, one of which he called the "alpha" wave for no other reason than being the first one he discovered ("alpha" is the first letter of the Greek alphabet). He kept his research a secret until he published an article about it in 1929. The alpha wave is also sometimes called *Berger's wave* in honor of Berger's discovery.

Obviously, Berger achieved one of the most important discoveries in the history of neuroscience. However, his life was not a happy one. Shortly after his article was published, the Nazis rose to power in Germany, which greatly distressed him. In addition, his work wasn't valued in Germany; he was far better known in the United States. As a result, Berger fell into a deep depression in 1941 and hanged himself.

Gloor, P. (1969). Hans Berger and the discovery of the electroencephalogram. *Electroencephalography and Clinical Neurophysiology*: Supplement 28, 1–36.
Millett, D. (2001). Hans Berger: From psychic energy to the EEG. *Perspectives in Biological Medicine, 44*(4), 522–542.
Tudor, M., Tudor, L., & Tudor, K. I. (2005). Hans Berger (1873–1941): The history of electroencephalography. *Acta medica Croatica: Casopis Hravatske akademije medicinskih znanosti*, *59*(4), 307–313.
Wiedemann, H. R. (1994). Hans Berger (1873–1941). *European Journal of Pediatrics, 153*(10), 705.

## Lecture Launcher 2.8 – Lie Detectors 2.0

A staple of police and lawyer television shows is the "lie detector scene," in which the suspect is connected to a polygraph and asked a series of questions about a crime. As the questions are asked, the needles on the machine record the suspect's heart rate, breathing, skin conductance, and other physiological responses to the questions. Polygraphs have been used in this way by various law enforcement agencies for many years. The principle behind the test is that the act of lying causes an involuntary change in the autonomic nervous system, which can be detected by the polygraph. The accuracy of polygraphs, however, is controversial, and in many courts they are inadmissible as evidence. More recently, some researchers have tried to create a new generation of lie detectors, which can measure activity in the brain directly. These techniques look for patterns in the brain that, at least in theory, correlate with lying.

One technique that might be adapted to lie detection is electroencephalography, more commonly referred to as EEG. During an EEG recording, electrodes are placed at various locations on the scalp. These electrodes are capable of measuring the electrical activity produced by neurons located in different parts of the brain. Although the activity of individual neurons cannot be identified, the patterns of electrical activity produced by thousands of neurons working together can be a sign that the brain is functioning in a particular way. One way EEGs may be useful as lie detectors is by identifying event-related potentials (ERPs). An ERP is a brief electrical change that occurs at a reliable time point relative to a specific event. For example, it has been found that 300 to 500 ms after a person has been shown something that is unexpected or novel, there is a brief electrical change in that person's EEG. Theoretically, this ERP could be used to determine if a subject has previous knowledge of a piece of evidence. For instance, occurrence of an ERP 300 ms after being shown a picture of the murder weapon might indicate that the suspect had not seen the murder weapon before.

More recently, fMRIs have been suggested as potential lie detectors. fMRI, or functional magnetic resonance imaging, works by detecting the increase in blood flow to more active regions in the brain.


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(This is not to be confused with structural MRIs, which can only create an image of tissues, bones, and so on.) When a person performs a task in an fMRI machine (adding two numbers together, for example), the brain regions required to perform the task will become active. This activity will cause a change in blood flow, which the fMRI can detect. It is possible that, because different brain regions are involved in recounting an actual event than are involved in making up a story, an fMRI is capable of determining whether someone is lying or telling the truth. Some researchers have found that, even if a lie is well rehearsed, it nonetheless appears to activate different brain regions than telling the truth does.

Despite media interest in new forms of lie detection, many experts agree that the EEG and fMRI approaches currently suffer from the same issues that polygraphs do. For example, although the newer techniques measure brain activity much more directly, there is concern about their reliability. Although certain brain activity might suggest that a person is lying, unless the technology can be made almost 100 percent accurate, innocent people may be accused of crimes they did not commit. Also, it is unclear whether people could find ways to "trick" the machines by performing certain mental tasks during testing.

Law enforcement continues to try to find accurate, reliable ways to detect deception in people. Most recently, use of the model statement technique to detect verbal deception is being tested. Further research is needed to verify its accuracy and reliability.

Farah, M. J., Hutchinson, J. B., Phelps, E. A., & Wagner, A. D. (2014). Functional MRI-based lie detection: Scientific and societal challenges. *Nature Reviews | Neuroscience, 15*, 123–131.
Ganis, G., Kosslyn, S., Stose, S., Thompson, W., & Yurgelun-Todd, D. (2003). Neural correlates of different types of deception: An fMRI investigation. *Cerebral Cortex, 13*(8), 830–836.
Vrij, A., Leal, S., & Fisher, R. P. (2018). Verbal deception and the model statement as a lie detection tool. *Frontiers in Psychiatry, 9,* 492. doi: 10.3389/fpsyt.2018.00492.
Wolpe, P., Foster K., & Langleben D. (2005). Emerging neurotechnologies for lie-detection: Promises and perils. *The American Journal of Bioethics, 5*(2), 39–49.

## Lecture Launcher 2.9 – Handedness, Eyedness, Footedness, Facedness

Although the title sounds like a Dr. Seuss rhyme, it actually denotes something meaningful to neuropsychologists. Most people are familiar with the concept of handedness. The human population is distributed across many people who are adept at using their right hands for most tasks, some who have greater skill using the left hand, and a smaller proportion of those who are equally skilled using either hand (or who alternate hands for certain tasks). The concepts of footedness, leggedness, eyedness, and facedness may be less familiar to the layperson, although they stem from the same principle as handedness.

The basis of these distinctions lies in the concept of *laterality.* Just as the cerebral hemispheres show specialization (e.g., left hemisphere for language functions, right hemisphere for visual–spatial functions), so too are there preferences or asymmetries in other body regions. The concept of *eyedness,* then, refers to the preference for using one eye over the other, such as when squinting to sight down the crosshairs of a rifle or to thread a needle. *Footedness* and *leggedness* similarly refer to a preference for one limb over the other; drummers and soccer players will attest to the importance of being equally adept at using either foot and also to the difficulty in achieving that. Finally, *facedness* refers to the strength with which information is conveyed by the right or left side of the face. It has been suggested that verbal information shows a right-face bias, whereas emotional expressions are more strongly shown on the left side of the face, although these conclusions remain somewhat controversial.

Why are these distinctions useful? They play their largest role in the areas of sensation and perception, engineering psychology, and neuropsychology. Studies of reaction time, human–machine interaction, ergonomic design, and so on take into account the preferences and dominance of some body systems over others. In the case of facedness and emotional expression, researchers are working to illuminate the link between facial expressions and cerebral laterality. Given the right hemisphere's greater role in emotional activities, the contralateral control between the right hemisphere and the left hemiface


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becomes an important proving ground for investigating both brain functions and the qualities of expression.

Borod, J. C., Caron, H. S., & Koff, E. (1981). Asymmetry of facial expression related to handedness, footedness, and eyedness: A quantitative study. *Cortex*, *17*, 381–390.
Ekman, P., Hagar, C. J., & Friesen, W. V. (1981). The symmetry of emotional and deliberate facial actions. *Psychophysiology*, *18*, 101–106.
Forrester, G. S. (2017). Hand, limb, and other motor preferences. *Lateralized Brain Functions: Methods in Human and Non-Human Species*, 121–152.
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Kozlovskiy, S. A., Marakshina, J. A., Vartanov, A. V., & Kiselnikov, A. A. (2016). ERP study of the influence of handedness and eyedness on the response inhibition in a go/nogo task. *International Journal of Psychophysiology*, (108), 102.
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## Lecture Launcher 2.10 – Brain Metaphors

Metaphors are a handy toolbox in psychology, because they help us to understand systems that aren't directly observable through reference to things that are more familiar and perhaps better understood (Weiner, 1991). Our understanding of the human brain and its activity has been aided by a reliance on metaphor. The metaphors used, however, have changed over time.

■ *Hydraulic models*. Thinkers such as Galen and Descartes described the brain as a pneumatic/hydraulic system, relying on the "newfangled" plumbing systems dominant during their lifetimes. Galen, for example, believed that the liver generated "spirits" or gases that flowed to the brain, where they then formed "animal spirits" that flowed throughout the nervous system. Descartes expanded on this view, adding that the pineal gland (the supposed seat of the soul) acted on the animal spirits to direct reasoning and other behaviors. In short, the brain was a septic tank, storing, mixing, and directing the flow of spirit gases throughout the body for the purposes of behavior and action.

■ *Mechanical and telephone models*. With the advent of new technology came new metaphors for the brain. During the Industrial Revolution machine metaphors dominated, and in particular the brain was conceived as a complex mechanical apparatus involving (metaphorical) *levers, gears, trip hammers,* and *pulleys.* During the 1920s, the brain developed into a slightly more sophisticated machine resembling a switchboard; the new technology of the telephone provided a new metaphor. *Inputs, patch cords, outputs,* and *busy signals* (though no "call waiting") dominated explanations of brain activity. This metaphor, however, faltered by viewing the brain as a system that shut down periodically, as when no one was dialing a number. We now know, of course, that the brain is continually active.

■ *Computer models*. Starting in the late 1950s, metaphors for the brain relied on computer technology. *Input, output, memory, storage, information processing,* and *circuitry* were all terms that seemed equally suited to talking about computer chips or neurons. Although perhaps a better metaphor than plumbing or telephones, the computer model eventually showed its shortcomings. As a descriptive device, however, this metaphor can at least suggest limits in our understanding and point the way to promising areas of research.

Weiner, B. (1991). Metaphors in motivation and attribution. *American Psychologist*, *46*, 921–930.


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## Lecture Launcher 2.11 – Brain's Bilingual Broca

Se potete parlare Italiano, allore potete capire questa sentenza. Of course, if you only speak English, you probably only understand *this* sentence. If you speak both languages, then by this point in the paragraph you should be really bored.

Bilingual speakers who come to their bilingualism in different ways show different patterns of brain activity. Joy Hirsch (now at the Yale School of Medicine) and her colleagues at Memorial Sloan-Kettering Cancer Center in New York monitored the activity in Broca's area in the brains of bilingual speakers who acquired their second language starting in infancy and compared it to the activity of bilingual speakers who adopted a second language in their teens. Participants were asked to silently recite brief descriptions of an event from the previous day, first in one language and then in the other. An fMRI was taken during this task. All of the 12 adult speakers—representing speakers of English, French, and Turkish, among other tongues—were equally fluent in both languages.

Hirsch and her colleagues found that among the infancy-trained speakers, the same region of Broca's area was active, regardless of the language they used. Among the teenage-trained speakers, however, a different region of Broca's area was activated when using the acquired language. Similar results were found in Wernicke's area in both groups. Although the full meaning of these results is a matter of some debate (do they reflect sensitivity in Broca's area to language exposure or pronounced differences in adult versus childhood language learning?), they nonetheless reveal an intriguing link between la testa e le parole.

Coderre, E. L., Smith, J. F., Van Heuven, W. J., & Horwitz, B. (2016). The functional overlap of executive control and language processing in bilinguals. *Bilingualism: Language and Cognition*, *19*(03), 471–488.
Fabbro, F. (2013). *The neurolinguistics of bilingualism: An introduction*. Psychology Press.
Kim, K. H., Relkin, N. R., Lee, K. M., & Hirsch, J. (1997). Distinct cortical areas associated with native and second languages. *Nature*, *388*(6638), 171–172.
Marian, V., Spivey, M., & Hirsch, J. (2003). Shared and separate systems in bilingual language processing: Converging evidence from eyetracking and brain imaging. *Brain and language*, *86*(1), 70–82.

## Lecture Launcher 2.12 – The Importance of a Wrinkled Cortex

At the beginning of your lecture on the structure and function of the brain, ask students to explain why the cerebral cortex is wrinkled. There are always a few students who correctly answer that the wrinkled appearance of the cerebral cortex allows it to have a greater surface area while fitting in a relatively small space (i.e., the head). To demonstrate this point to your class, hold a plain white sheet of paper in your hand and then crumple it into a small, wrinkled ball. Note that the paper retains the same surface area, yet is now much smaller and is able to fit into a much smaller space, such as your hand. You can then mention that the brain's actual surface area, if flattened out, would be roughly the size of a newspaper page. Laughs usually erupt when the class imagines what our heads would look like if we had to accommodate an unwrinkled, newspaper-sized cerebral cortex!

## Lecture Launcher 2.13 – A New Look at Phineas Gage

For over 30 years, Jack and Beverly Wilgus had a daguerreotype portrait—a type of early photograph—of a well-dressed young man with one eye closed. Because the photo showed the young man holding what appeared to be part of a harpoon, the Wilguses believed that the man was a 19th-century whaler who had lost his eye, perhaps in a whaling accident. It was only after a copy of the portrait was posted online that the couple was told that the object in the man's hands did not appear to be a harpoon. Then, in 2008, a person viewing the image online posted a comment that the young man may be Phineas Gage, making the "harpoon," the infamous tamping rod that was blasted through his skull and brain. By carefully examining the rod in the daguerreotype, and by comparing the young man's face to the cast made of Gage's head after his death, the Wilguses were able to confirm that the portrait is almost certainly that of


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Phineas Gage, made sometime after his accident. Importantly, this is the only known photograph of the man who became one of the most famous case studies in psychology.

One of the consequences of the portrait's discovery has been a renewed debate about how Gage's injuries affected his personality and behavior. Many psychology textbooks explain that the accident left Gage a permanently changed man, with his once well-balanced, gregarious, and hard-working personality replaced with profane, inconsiderate, and impulsive behavior for the rest of his life. This, however, is not necessarily supported by the few original sources researchers have to go on. For example, although the evidence clearly indicates that Gage had major psychological changes for a period after his accident, we also know that Gage later spent many years driving stagecoaches before he died in 1860, 12 years after the accident. Many have questioned whether the post-accident Phineas Gage commonly described in introductory psychology classes could have performed the tasks required to drive a stagecoach, interact with passengers, and be reliable enough to maintain employment for long periods at a time. Does this indicate that many of the psychological changes Gage suffered were temporary? Certainly the newly discovered daguerreotype of a healthy-looking and well-kept Phineas Gage lends further support to the idea that Phineas was able to largely recover from his accident, both physically and mentally. If true, this may mean that the case of Phineas Gage may be as much a story about the incredible plasticity of the brain and its ability to compensate for the loss of specific brain regions, as it is about the localization of specific functions.

The newly discovered portrait of Phineas Gage can be found by searching the Internet for "Phineas Gage daguerreotype."

Jarrett, C., & Sutton, J. (2009, July 20). Face to face with Phineas Gage, http://www.thepsychologist.org.uk (search Phineas Gage).
Macmillan, M. (2008). Phineas Gage–Unravelling the myth. *The Psychologist, 21(9)*, 828–831.
Shetty, S. R., Wadhwa, S., Ganigi, P. M., Hegde, T., & Bopanna, K. M. (2017). Phineas Gage revisited: An "Indian crowbar case". *Journal of Neurological Surgery Part B: Skull Base*, *78*(S 01), P028.

## Lecture Launcher 2.14 – Freak Accidents and Brain Injuries

Students may be interested in the unusual cases of individuals who experience bizarre brain injuries due to freak accidents with nail guns. The most fascinating example involved Isidro Mejias, a construction worker in Southern California, who had six nails driven into his head when he fell from a roof onto his coworker who was using a nail gun. (X-ray images of the embedded nails can be found at several sites on the Internet.) Incredibly, none of the nails caused serious damage to Mejia's brain. One nail lodged near his spinal cord, and another came very close to his brain stem. Immediate surgery and treatment with antibiotics prevented deadly infections that could have been caused by the nails. In a similar accident, a construction worker in Colorado ended up with a nail lodged in his head due to a nail gun mishap. Unlike Mejia, Patrick Lawler didn't realize he had a nail in his head for six days. The nail was discovered when he visited a dentist due to a "toothache." It appears that Lawler had fired a nail into the roof of his mouth. The nail barely missed his brain and the back of his eye.

Field, P. (2006). Variations on an historical case study. *NSTA WebNews Digest*, http://www.nsta.org/ (search title of article)
Nail gun victim lives. *Current Science*, A Weekly Reader publication, *90*(1), Sept. 10, 2004, Page 12.
Additional resources can be found by searching Mejias and Lawler online.

## Lecture Launcher 2.15 – The Results of a Hemispherectomy

When Matthew was 6 years old, surgeons removed half of his brain.

His first three years of life were completely normal. Just before he turned 4, however, Matthew began to experience seizures, which did not respond to drug treatment. The seizures were both life threatening and frequent (as often as every 3 minutes). The eventual diagnosis was Rasmussen's encephalitis, a rare and incurable condition of unknown origin.


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The surgery, a hemispherectomy, was performed at Johns Hopkins Hospital in Baltimore. A few dozen such operations are performed each year in the United States, usually as a treatment for Rasmussen's and for forms of epilepsy that destroy the cortex but do not cross the corpus callosum. After surgeons removed Matthew's left hemisphere, the empty space quickly filled with cerebrospinal fluid.

The surgery left a scar that runs along one ear and disappears under his hair; however, his face has no lopsidedness. The only other visible effects of the operation are a slight limp and limited use of his right arm and hand. Matthew has no right peripheral vision in either eye. He undergoes weekly speech and language therapy sessions. For example, a therapist displays cards that might say "fast things" and Matt must name as many fast things as he can in 20 seconds. He does not offer as many examples as other children his age. However, he is making progress in the use of language, perhaps as a result of fostering and accelerating the growth of dendrites.

The case of Matthew indicates the brain's remarkable plasticity. Furthermore, it is interesting to note that Matt's personality never changed through the seizures and surgery.

Boyle, M. (1997, August 1). Surgery to remove half of brain reduces seizures. *Austin American-Statesman*, A18.
Handley, S. E., Vargha-Khadem, F., Bowman, R. J., & Liasis, A. (2017). Visual function 20 years after childhood hemispherectomy for intractable epilepsy. *American Journal of Ophthalmology*, *177*, 81–89.
Rasmussen, T., Olszewski, J., & Lloyd-Smith, D. (1958). Focal seizures due to chronic localized encephalitis. *Neurology, 8*(6), 435–445.
Sachdev, M., Vanags, J., Arehart, E., Grant, G., & Mikati, M. A. (2017). Visual hallucinations as a novel complication following hemispherectomy (P6. 224). *Neurology*, *88*(16 Supplement), 6–222.
Schusse, C. M., Smith, K., & Drees, C. (2017). Outcomes after hemispherectomy in adult patients with intractable epilepsy: Institutional experience and systematic review of the literature. *Journal of Neurosurgery*, 1–9.
Swerdlow, J. L. (1995, June). Quiet miracles of the brain. *National Geographic, 87*, 2–41.
Vining, E. P., Freeman, J. M., Pillas, D. J., Uematsu, S., Carson, B. S., Brandt, J., Boatman, D., Pulsifer, M. B., & Zuckerberg, A. (1997). Why would you remove half a brain? The outcome of 58 children after hemispherectomy—the Johns Hopkins experience: 1968 to 1996. *Pediatrics*,*100*(2 Pt 1), 163–171.

*Find more hemispherectomy stories and information at*: http://hemifoundation.intuitwebsites.com/

## Lecture Launcher 2.16 – En Garde! Dualism versus Monism

René Descartes certainly didn't lack for credentials. As the "Father of Rationalism," "Father of Modern Philosophy" (also father of Francine, by the way), and originator of Cartesian geometry, he had more than enough interests to fill his spare time. But his role as "Father of Skepticism" helped popularize a major change in thinking about the nature of human experience. Dualism, or the doctrine that mind and body are of two distinct natures, is one of the key philosophical problems inherited by psychology. In both philosophy and psychology, there have been several attempts to reconcile the mind and body.

On the dualism side of the argument, *psychophysical parallelism* and *psychophysical interactionism* have been advanced as explanations for the workings of mind and body. Parallelism has it that mental and physical events are independent of one another but occur simultaneously. Philosophers such as Leibniz, for example, held that the activities of the mind and body were predetermined and that both simply ran their course in a carefully orchestrated, synchronized, yet independent fashion. Interactionists, on the other hand, hold that mental and physical events are related in a causal way, such that the mind can influence the body and vice versa. Descartes championed this idea with his notion that humans are "pilots in a ship"—mental beings who guide physical bodies through the world. Both psychophysical parallelism and psychophysical interactionism agree that the mind and the body are of two different natures, but they disagree over how closely those natures may interact.

Monists, by comparison, argue that things have only one nature, although they disagree about whether it is primarily mental or primarily physical. *Subjective idealism* (or "mentalism," as it is often called), argues that there is only the mental world, and that the reality of the physical world is suspect. George Berkeley, for example, provided numerous arguments as to why the essence of existence is to be perceived; when not in direct perception, the physical world cannot support the claim of its existence. (Berkeley, by the way, apparently hated walks in the forest, for fear of all those falling trees that he may or may not have


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heard.) In contrast, *materialistic monism* takes the position that there is only physical "stuff" to the world, such that ideas, thoughts, and images are actually physical events in the body. Many modern biological scientists would agree with this form of monism, arguing that the brain is primary while the "mind" is either illusory or epiphenomenal.

Add to this mix a handful of specialty doctrines and you've got quite an argument. But why all the fuss? As research on mind and behavior grows to embrace evidence gathered in the neurosciences, what once was a stuffy philosophical issue takes on a new importance. Many thinkers, especially those in the materialist camp, would claim that we are closer and closer to identifying the neural connections and chemical actions that produce our experience of "an idea." Fueled by the boom in neural network modeling, the notion that the circuitry of the brain can be mapped to identify where thoughts, images, memories, creativity, and similar "mental activities" originate seems more like science and less like science fiction. Whether dualism will be completely resolved to everyone's satisfaction seems doubtful, but biopsychologists and neuropsychologists continue to contribute data to address this philosophical puzzle.

Wegner, D. M., & Gray, K. (2016). *The mind club: Who thinks, what feels, and why it matters.* New York: Penguin.

## Lecture Launcher 2.17 – Neuroplasticity and Learning

Neuroplasticity is the brain's ability to adapt and change. It is important in the role of recovering from brain injury or disease, but it also plays a daily role in learning. Each time we repeat a task or repeat a word and its definition, a new pathway is being formed. For this pathway to be formed, the brain must experience the information repeatedly in rapid succession. So, a critical part of learning is repetitively going over the same information. Those repetitions signal the brain that this information is important and is something we will need again and again. When repeated, connections along the pathway become stronger, resulting in a strong memory trace that is resistant to forgetting. Helping students to understand the importance of repeated and distributed practice will help them develop a study practice that will assist them throughout life.

Lynch, M. A. (2004). Long-term potentiation and memory. *Physiological Reviews, 84*, 87–135.


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# ▼CLASSROOM ACTIVITIES AND EXERCISES

2.1 – Name That Nervous System
2.2 – Using Dominoes to Understand the Action Potential
2.3 – Environmental Influences on the Brain
2.4 – Demonstrating Neural Conduction: The Class as a Neural Network
2.5 – The Dollar Bill Drop
2.6 – Reaction Time and Neural Processing
2.7 – Football and Brain Damage
2.8 – Brain Parts
2.9 – Hemispheric Communication and the Split Brain
2.10 – Hemispheric Lateralization
2.11 – Left or Right?

## Activity 2.1 – Name That Nervous System

Often it is hard for students to remember the functions of the parts of the nervous system, particularly the sympathetic and parasympathetic nervous systems. Have students paractice their learning by using **Handout Master 2.1** and have them label which division of the nervous system performs each task.

Answers:

1. constricts bronchi (parasympathetic nervous system)
2. inhibits bladder contractions (sympathetic nervous system)
3. voluntary motor movements (somatic nervous system)
4. slows heart rate (parasympathetic nervous system)
5. decreases salivation (sympathetic nervous system)
6. decreases digestive functions (sympathetic nervous system)
7. higher order thinking (brain)
8. reflexes (spinal cord)
9. constricts pupils (parasympathetic nervous system)
10. sensing a bug on your arm (somatic nervous system)

## Activity 2.2 – Using Dominoes to Understand the Action Potential

Walter Wagor suggests using real dominoes to demonstrate the so-called "domino effect" of the action potential as it travels along the axon. For this demonstration, you'll need a smooth tabletop surface (at least 5 feet long) and one or two sets of dominoes. Set up the dominoes beforehand, on their ends and about an inch apart, so that you can push the first one over and cause the rest to fall in sequence. Proceed to knock down the first domino in the row, and students should clearly see how the "action potential" is passed along the entire length of the axon. You can then point out the concept of refractory period by showing that, no matter how hard you push on the first domino, you will not be able to repeat the domino effect until you take the time to set the dominoes back up (i.e., the resetting time for the dominoes is analogous to the refractory period for neurons). You can then demonstrate the all-or-none characteristic of the axon by resetting the dominoes and by pushing so lightly on the first domino that it does not fall. Just as the force on the first domino has to be strong enough to knock it down before the rest of the dominoes will fall, the action potential must be there in order to perpetuate itself along the entire axon. Finally, you can demonstrate the advantage of the myelin sheath in axonal transmission. For this demonstration, you'll need to set up two rows of dominoes (approximately 3 or 4 feet long) next to each other. The second row of dominoes should have foot-long sticks (e.g., plastic rulers) placed end-to-end in sequence on top of the dominoes. By placing the all-domino row and the stick-domino row parallel to each other and pushing the first domino in each, you can demonstrate how much faster the action potential can travel if it can jump from node to node rather than having to be passed on sequentially, single domino by single domino. Ask your students to discuss how this effect relates to myelinization.


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Wagor, W. F. (1990). Using dominoes to help explain the action potential. In V. P. Makosky, C. C. Sileo, L. G. Whittemore, C. P. Landry, & M. L. Skutley (Eds.), *Activities handbook for the teaching of psychology: Vol. 3* (pp. 72–73). Washington, DC: American Psychological Association.

## Activity 2.3 – Environmental Influences on the Brain

You may want to remind students that brain function and structure are subject to environmental influences. Ask students to identify the behaviors that are important for keeping the brain healthy and functioning well. The following are some possibilities:

***Good nutrition, especially during childhood*** Adequate nutrition is vital for proper brain development. Even in adults, diet may influence brain function. Studies are showing that although high levels of cholesterol may be bad for your heart, low levels of cholesterol may be bad for the brain. Low cholesterol may be associated with low levels of the neurotransmitter serotonin, which can result in higher levels of aggression and depression.

***Mental stimulation*** High levels of stimulation help to form neural connections that in turn enhance brain function.

***Physical fitness*** Studies have shown that aerobic fitness has an impact on the density of capillaries in the brain. More capillaries result in greater blood flow to the brain.

***Maternal health during pregnancy*** The uterine environment can have an enormous impact on the brain development of a fetus. Women who do not have adequate nutrition; who drink, smoke, or do drugs; and who are exposed to certain environmental toxins are more likely to have children with lower IQs and learning disabilities.

## Activity 2.4 – Demonstrating Neural Conduction: The Class as a Neural Network

In this engaging exercise (suggested by Paul Rozin and John Jonides), students in the class simulate a neural network and get a valuable lesson in the speed of neural transmission. Depending on your class size, arrange 15 to 40 students so that each person can place his or her right hand on the right shoulder of the person in front of them. Note that students in every other row will have to face backwards in order to form a snaking chain so that all students (playing the role of individual neurons) are connected to one another. Explain to students that their task as a neural network is to send a neural impulse from one end of the room to the other. The first student in the chain will squeeze the shoulder of the next person, who, upon receiving this "message," will deliver (i.e., "fire") a squeeze to the next person's shoulder and so on until the last person receives the message. Before starting the neural impulse, ask students (as "neurons") to label their parts; they typically have no trouble stating that their arms are axons, their fingers are axon terminals, and their shoulders are dendrites.

To start the conduction, the instructor should start the timer on a stopwatch while simultaneously squeezing the shoulder of the first student. The instructor should then keep time as the neural impulse travels around the room, stopping the timer when the last student/neuron yells out "stop." This process should be repeated once or twice until the time required to send the message stabilizes (i.e., students will be much slower the first time around as they adjust to the task). Next, explain to students that you want them to again send a neural impulse, but this time you want them to use their ankles as dendrites. That is, each student will "fire" by squeezing the ankle of the person in front of them. While students are busy shifting themselves into position for this exercise, ask them if they expect transmission by ankle-squeezing to be faster or slower than transmission by shoulder-squeezing. Most students will immediately recognize that the ankle-squeezing will take longer because of the greater distance the message (from


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the ankle as opposed to the shoulder) has to travel to reach the brain. Repeat this transmission once or twice and verify that it indeed takes longer than the shoulder squeeze.

This exercise—a student favorite—is highly recommended because it is a great icebreaker during the first few weeks of the semester, and it also makes the somewhat dry subject of neural processing come alive.

Rozin, P., & Jonides, J. (1977). Mass reaction time measurement of the speed of the nerve impulse and the duration of mental processes in class. *Teaching of Psychology, 4*, 91–92.

## Activity 2.5 – The Dollar Bill Drop

After engaging in the neural network exercise, follow it up with the "dollar bill drop" (Fisher, 1979), which not only delights students but also clearly illustrates the speed of neural transmission. Ask students to get into pairs and to come up with one crisp, flat, one-dollar bill (or something larger, if they trust their fellow classmates!) between them. First, each member of the pair should take turns trying to catch the dollar bill with their nondominant (for most people, the left) hand as they drop it from their dominant (typically right) hand. To do this, they should hold the bill vertically so that the top, center of the bill is held by the thumb and middle finger of their dominant hand. Next, they should place the thumb and middle finger of their nondominant hand around the dead center of the bill, as close as they can get without touching it. When students drop the note from one hand, they should be able to easily catch it with the other before it falls to the ground.

Now that students are thoroughly unimpressed, ask them to replicate the drop, only this time one person should try to catch the bill (i.e., with the thumb and middle finger of the nondominant hand) while the other person drops it (i.e., from the top center of the bill). Student "droppers" are instructed to release the bill without warning, and "catchers" are warned not to grab before the bill is dropped. (Students should take turns playing dropper and catcher). There will be stunned looks all around as dollar bills whiz to the ground. Ask students to explain why it is so much harder to catch it from someone other than themselves. Most will instantly understand that when catching from ourselves, the brain can simultaneously signal us to release and catch the bill, but when trying to catch it from someone else, the signal to catch the bill can't be sent until the eyes (which see the drop) signal the brain to do so, which is unfortunately a little too late.

Fisher, J. (1979). *Body magic*. Briarcliff Manor, NY: Stein and Day.

## Activity 2.6 – Reaction Time and Neural Processing

Yet another exercise that illustrates the speed of neural processing is suggested by E. Rae Harcum. The point made by this simple but effective exercise is that reaction times increase as more response choices become available (i.e., because more difficult choices in responses involve more neuronal paths and more synapses, both of which slow neural transmission). Depending on your class size, recruit two equal groups of students (10 to 20 per group is ideal) and have each group stand together at the front of the room. First, explain that all subjects are to respond as quickly as possible to the name of a U.S. president. Then give written instructions to each group so that neither group knows the instructions given to the other. One group should be instructed to raise their right hands if the president served before Abraham Lincoln and to raise their left hands if the president served after Lincoln. The other group should be instructed simply to raise their left hands when they hear a president's name. Ask participants and audience members to note which group reacts more quickly. When all students are poised and ready to go (i.e., hands level with shoulders and ready to raise), say "Ready" and then "Reagan." The group with the simpler reaction time task should be faster than the group whose task requires a choice.

Harcum, E. R. (1988). Reaction time as a behavioral demonstration of neural mechanisms for a large introductory psychology class. *Teaching of Psychology, 4*, 208–209.


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## Activity 2.7 – Football and Brain Damage

Coaches and medical experts have known for a while that the severe hits that football players take on the field can lead to concussions, blacking out, and even permanent damage. More recently, however, there has been increasing concern that the effects of repeated hits to the head may not manifest themselves until decades later. Early studies suggest that former NFL players suffer high rates of memory and other cognitive problems years after retiring, and that they also may develop these problems earlier than non-football players do. NFL players may also be vulnerable to higher rates of depression and Alzheimer's disease.

To investigate this problem, groups like the Sports Legacy Institute have begun to encourage former NFL players to donate their brains to science when they die. Already, the brains of a handful of players have been examined, with shocking results. Almost all of the brains show high levels of a protein called *tau,* which is suspected of being involved in several neurodegenerative disorders, including Alzheimer's disease. The presence of high levels of tau may explain why football players have a tendency to develop cognitive impairments long after their playing days are over. More disturbing still, high levels of tau have also been found in the brain of an 18 year-old high school football player who died.

After introducing students to this issue, have the class discuss the possible implications for social and sports policy. Should football playing be stopped? Should the rules of the game be changed to eliminate hard hitting? If necessary, pose the following additional questions to stimulate discussion: Everyone knows football is dangerous, but does the fact that these cognitive impairments may take decades to develop make them somehow different? Is the risk of permanent cognitive disability somehow different than the risk of permanent physical disability? Wrestlers, soccer players, boxers, and other types of athletes are also at risk for long-term brain damage. Should these sports be changed of banned?

After discussing the issue in class, have students respond to the following writing prompt.

Writing prompt: Describe a longitudinal and then a cross-sectional study that could be used to determine if professional football players show higher than normal rates of cognitive impairment. Explain some of the advantages and disadvantages of the two designs.

Sample answer: *A longitudinal study might choose a few football players and then test them every 10 years using the same cognitive tests to see how their abilities change over time. A cross-sectional study, on the other hand, might find a group of 65-year-old retired football players and compare their cognitive functioning to that of 65-year-olds who did not play football. The longitudinal study would provide a more complete view of how cognitive function might decline, but it would take decades to complete and might suffer from attrition. The cross-sectional study would be a lot easier to perform but would only offer a "snapshot" of cognitive function. You could not tell, for example, if football players develop cognitive impairment earlier than non-football players typically do.*

Miller, G. (2009). A late hit for pro football players. *Science, 7*, 670–672.

## Activity 2.8 – Brain Parts

To begin helping students learn what the parts of the brain do and how to spell the names of those parts, have them complete the crossword puzzle on **Handout Master 2.2**.

**Across**

4. Lobe of the brain that receives sensory information (parietal)
5. Part of the hindbrain that relays messages between the cerebellum and the cortex (pons)
9. Controls complex thought processes (cerebrum)
10. Connects the left and right hemispheres of the brain (corpus callosum)
11. Part of the forebrain that relays information from sensory organs to the cerebral cortex (thalamus)


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12. Structure involved in assessing the potential biological impact of incoming sensory information and driving the body's response to it (amygdala)
13. Lobe of the brain that oversees hearing, emotion, memory, and language comprehension (temporal)

**Down**
1. Lobe of the brain that receives visual information (occipital)
2. Part of the forebrain that regulates the amount of fear, thirst, sexual drive, and aggression we feel (hypothalamus)
3. Plays a role in our learning, memory, and ability to compare sensory information to expectations (hippocampus)
6. Part of the hindbrain that controls balance and maintains muscle coordination (cerebellum)
7. Lobe of the brain involved in movement, controlling impulses, and higher-order thinking (frontal)
8. Part of the hindbrain where nerves cross over from one side to the other, controls heartbeat, breathing, and swallowing (medulla)

## Activity 2.9 – Hemispheric Communication and the Split Brain

Even after reading the textbook and listening to your lecture, many students may have difficulty conceptualizing the effects of a split-brain operation on an individual's behavior. Morris (1991) described five activities designed to simulate the behavior of split-brain patients. All of the activities have the same basic setup. You will need to solicit two right-handed volunteers and seat them next to each other at a table, preferably in the same chair. The volunteer on the left represents the left hemisphere, and the other student is the right hemisphere. The students are instructed to place their outer hand behind their back and their inner hands on the table with their hands crossed, representing the right and left hands of the split-brain patient. Finally, the student representing the right hemisphere is instructed to remain silent for the remainder of the activity. In one of the activities described by Morris, both students are blindfolded and a familiar object (Morris suggested a retractable ballpoint pen) is placed in the left hand of the "split-brain patient" (the hand associated with the right hemisphere). Then ask the "right hemisphere" student if he or she can identify the object, reminding them that they must do so nonverbally. Next, ask the "right hemisphere" to try to communicate, without using language, what the object is to the "left hemisphere." Your more creative volunteers may engage in behaviors that attempt to communicate what the object is through sound or touch. If your "right hemisphere" has difficulty in figuring out how to communicate, ask the class for suggestions. This demonstration can be used to elicit discussion about why only the "left hemisphere" student can talk, the laterality of the different senses, and how split-brain patients are able to adjust their behavior to accommodate. You should refer to Morris's original article for descriptions of the other activities.

Morris, E. J. (1991). Classroom demonstration of behavioral effects of the split-brain operation. *Teaching of Psychology, 18*, 226–228.

## Activity 2.10 – Hemispheric Lateralization

Hemispheric lateralization results in eyedness, handedness, footedness, earedness, facedness, and other silly-sounding words with important implications (see the related Lecture Launcher in this chapter). Lateralization results from the specialization of each hemisphere for different tasks, such as reading facial expressions, speaking, solving spatial problems, or performing analytic tasks. Although neuropsychologists use sophisticated measures to determine these lateralization, this simple exercise allows students to gauge their own brain organization.

With both eyes open, have students hold up their right thumbs at arm's length under an object across the room directly in front of them. As they alternately close their left and right eyes, their thumbs should appear to jump to the right or to the left with respect to the distant object. For those who are right-eyed, their thumbs should jump to the right when they close their right eyes, but stay as is when they close their


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left eyes. The opposite pattern should occur among those who are left-eyed. Students who see little or no jumping are among the 41 percent of the population who are neither strongly left-eyed nor right-eyed.

As a second test, ask for a volunteer. Present the student with the first paragraph of this exercise (or any suitable short passage) to memorize, a broom, a clock with a second hand, a pencil, and a pad of paper. First, time how long the volunteer can balance the broom on the tip of his or her right index finger while standing on the right foot. Next, measure the time as the volunteer balances the broom on his or her left index finger while standing on the left foot. Finally, repeat these tests while the volunteer recites the memorized passage. Speech will be localized on the side of the brain opposite the hand that is most disrupted by the memorization task.

Another demonstration, suggested by Morton Ann Gernsbacher, requires students to move their right hand and right foot simultaneously in a clockwise direction for a few seconds. Next ask that the right hand and left foot be moved in a clockwise direction. Then, have students make circular movements in opposite directions with the right hand and the left foot. Finally, have students attempt to move the right hand and right foot in opposite directions. This generally produces laughter as students discover that this procedure is most difficult to do even though they are sure—before they try it—that it would be no problem to perform. A simple alternative activity is to ask students to pat their heads and simultaneously rub their stomachs clockwise and then switch to a counterclockwise motion. The pat will show slight signs of rotation as well.

The brain is lateralized to some extent, and this makes some activities difficult to perform. Challenge your students to explain why these types of activities are difficult to execute. This will generally lead to interesting discussions and the assertion by some students that this type of behavior is no problem. Generally, students who have been trained in martial arts, dance, and/or gymnastics have less difficulty completing these activities because of their rigorous physical training.

Haseltine, E. (1999, June). Brain works: Your better half. *Discover,* 112.
Kemble, E. D. (1987). Cerebral lateralization. In V. P. Makosky, L. G. Whittemore, & A. M. Rogers (Eds.), *Activities handbook for the teaching of psychology* (Vol. 2) (pp. 33–36). Washington, DC: American Psychological Association.
Kemble, E. D., Filipi, T., & Gravlin, L. (1985). Some simple classroom experiments on cerebral lateralization. *Teaching of Psychology, 12*, 81–83.

## Activity 2.11 – Left or Right?

In this exercise, students determine which hemisphere of the brain is functioning during a child's responses to a complex test. The handout for this exercise is included as **Handout Master 2.3**. Suggested answers are as follows:

1-Both, 2-Left, 3-Right, 4-Both.


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## ▼ HANDOUT MASTERS

2.1 – Name that Nervous System
2.2 – Brain Parts
2.3 – Left or Right?


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## Handout Master 2.1 Name that Nervous System

For each of the following, identify the part of the nervous system that oversees that function. Examples will come from the brain, the spinal cord, and the somatic, sympathetic, and parasympathetic nervous systems.

1. constricts bronchi

2. inhibits bladder contractions

3. voluntary motor movements

4. slows heart rate

5. decreases salivation

6. decreases digestive functions

7. higher-order thinking

8. reflexes (spinal cord)

9. constricts pupils

10. sensing a bug on your arm

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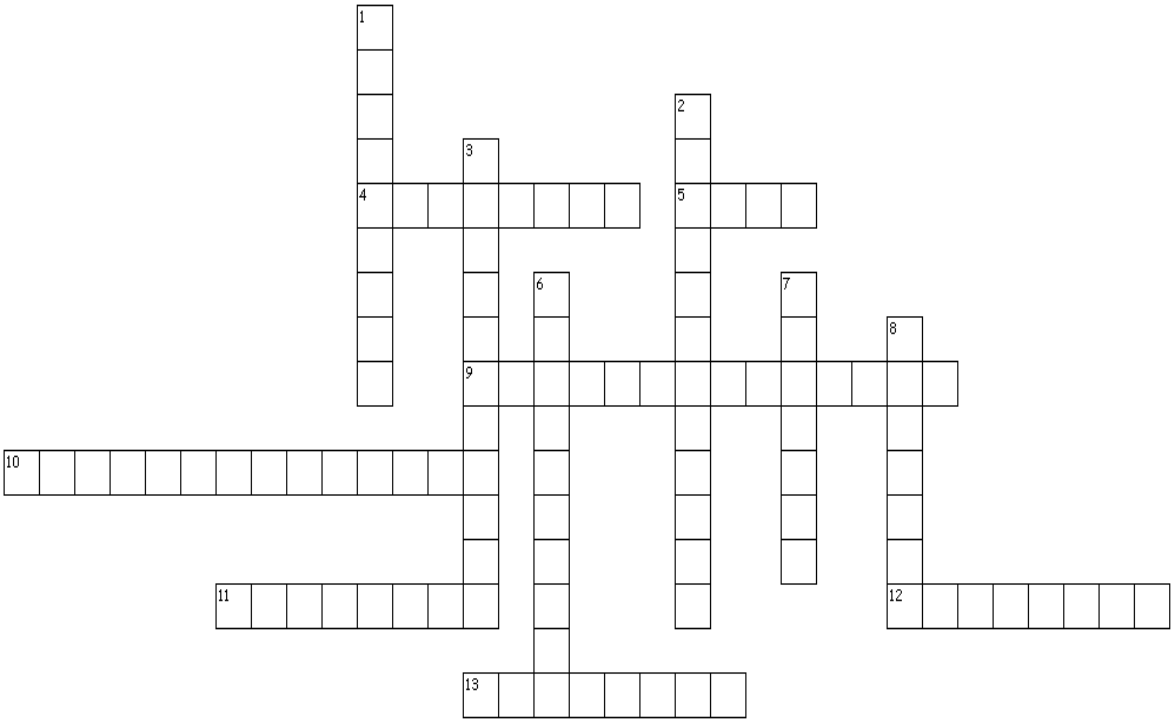
## Handout Master 2.2 Brain Parts




**Across**

4. Lobe of the brain that receives sensory information
5. Part of the hindbrain that relays messages between the cerebellum and the cortex
9. Controls complex thought processes
10. Connects the left and right hemispheres of the brain
11. Part of the forebrain that relays information from sensory organs to the cerebral cortex
12. Structure involved in assessing the potential biological impact of incoming sensory information and driving the body's response to it
13. Lobe of the brain that oversees hearing, emotion, memory, and language comprehension

**Down**

1. Lobe of the brain that receives visual information
2. Part of the forebrain that regulates the amount of fear, thirst, sexual drive, and aggression we feel
3. Plays a role in our learning, memory, and ability to compare sensory information to expectations
6. Part of the hindbrain that controls balance and maintains muscle coordination
7. Lobe of the brain involved in movement, controlling impulses, and higher-order thinking
8. Part of the hindbrain where nerves cross over from one side to the other, controls heartbeat, breathing, and swallowing

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## Handout Master 2.3 Left or Right?

The cerebrum of the brain is divided into two hemispheres. While these hemispheres are integrated by messages that pass through the corpus callosum, the information the brain receives is processed differently by the two different hemispheres. Each hemisphere controls the opposite side of the body and specializes in specific information and functions. In the examples provided below, determine if the ability being demonstrated is related to the function of both hemispheres together or by either the left or right hemisphere alone.

1. An individual who is believed to have exceptional abilities is being tested for his ability to read and follow detailed instructions. For instance, he is instructed to draw a horizontal line with a circle sitting on top of the far right side of the line with a cross in the middle of the circle and a triangle hanging down from the bottom of the circle. He is able to perform these tasks easily and correctly.

2. The next part of the test focuses specifically on reading out loud. He again performs this task easily and without error.

3. Another section of the test asks him to sequence pictures after they are scrambled. For each set of pictures, he must place six pictures back in the order in which he first viewed them. He struggles to accomplish this task and takes a very long time before he is willing to say he is done with the task.

4. The last part of the test requires that he copy pictures of geometric figures with each of his hands. His performance with his right hand is excellent, while he has difficulty performing with his left hand is difficult and the result doesn't really resemble the picture at all.

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## ▼REVEL Videos

**Video**: Watch: The Basics: How the Brain Works Part 1
**Video**: Watch: The Basics: How the Brain Works Part 2
**Video**: Watch: How Neurons Fire
**Video**: Watch: Neurotransmitters
**Video**: Watch: Your Brain on Drugs
**Video**: Watch: Emotional Faces and the Amygdala
**Video**: Watch: The Basics: How the Brain Works Part 3
**Video**: Watch: The Plastic Brain


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