# *Experience Psychology 5th edition King Test Bank*

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CORRECT ANSWERS ARE LOCATED IN THE 2ND HALF OF THIS DOC.

**MULTIPLE CHOICE - Choose the one alternative that best completes the statement or answers the question.**

1) The _____ system is the body's electrochemical communication circuitry.
   A) pulmonary
   B) nervous
   C) endocrine
   D) respiratory

2) The field that studies the nervous system is called
   A) neuroscience.
   B) immunology.
   C) physiology.
   D) ethnoscience.

3) Amelia, a scientist, studies the body's electrochemical communication circuitry. Amelia is most likely a(n)
   A) geoscientist.
   B) neuroscientist.
   C) physiologist.
   D) orthodontist.

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4) Ashley, a secretary at Plato Inc., is typing on her computer, talking on the phone, and handing some papers to her colleague simultaneously. Which of the following characteristics of the nervous system is best illustrated in this scenario?
   A) complexity
   B) resting potential
   C) polarization
   D) plasticity

5) Liam is able to sing, play the guitar, and play the harmonica simultaneously. Which of the following characteristics of the nervous system most likely is represented by Liam's ability to carry out the multitude of tasks?
   A) complexity
   B) adaptability
   C) polarization
   D) plasticity

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6) Which of the following characteristics of the brain refers to the brain's ability to pull information together?
   A) integration
   B) complexity
   C) adaptability
   D) plasticity

7) The term "plasticity" refers to the
   A) flexibility of the endocrine system.
   B) lack of ability to adapt to new surroundings.
   C) ability to connect electrical impulses and chemical messengers.
   D) brain's special capacity for change.

8) Plasticity best reflects which of the following characteristics of the nervous system?
   A) complexity
   B) integration
   C) adaptability
   D) electrochemical transmission

9) Stand-up comedians who improvise constantly while on stage are demonstrating their ability to change according to the environment. Which of the following characteristics of the nervous system is most likely playing a predominant role?
   A) resting potential
   B) reuptake
   C) polarization
   D) adaptability

10) You are listening to a lecture. Then the bell rings in the hallway. In order to hear this stimulus, _____ nerves must carry electrochemical messages from your ears to your brain.
   A) afferent
   B) olfactory
   C) efferent
   D) pyramidal

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11) The lecture you were listening to is over. The bell that rang in the hall signaled the end of class. You get up, pick up your things, and walk out the classroom door. Which kind of nerves sent the signals from your brain to your muscles to initiate your physical movements?
A) afferent
B) pyramidal
C) efferent
D) olfactory

12) Martin is riding his motorcycle to his office. When he hears the honking of a truck trying to overtake him, he gives way to the truck. In the context of the pathways in the nervous system, in this scenario, which type of nerves communicated information from Martin's brain to his muscles and made him move his motorcycle?
A) efferent
B) pyramidal
C) afferent
D) olfactory

13) _____ carry information out of the brain and spinal cord to other areas of the body.
A) Afferent nerves
B) Auditory nerves
C) Efferent nerves
D) Sensory nerves

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14) Information from the brain and spinal cord to the muscles is sent through _____, thus enabling the body to move.
A) afferent nerves
B) efferent nerves
C) auditory nerves
D) olfactory nerves

15) Your brain has instructed your body muscles to move so that you avoid burning your hand on a hot stove. Which type of nerves carried the information from your brain to your muscles so that you could avoid getting burned?
A) efferent nerves
B) afferent nerves
C) olfactory nerves
D) auditory nerves

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16) _____ are interconnected groups of nerve cells that integrate sensory input and motor output.
A) Sensory networks
B) Afferent nerves
C) Efferent nerves
D) Neural networks

17) Which of the following statements is true of neural networks?
A) They are networks of nerve cells that connect the brain and spinal cord to other parts of the body.
B) They integrate sensory input and motor output and make up most of the brain.
C) They are also called motor nerves.
D) They carry information about the external environment to the brain and spinal cord.

18) The brain and spinal cord make up the
A) peripheral nervous system.
B) central nervous system.
C) autonomic nervous system.
D) somatic nervous system.

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19) Which of the following statements is true of the central nervous system (CNS)?
A) More than 99 percent of all nerve cells are located in the CNS.
B) The neocortex makes up 40 percent of the cortex in the CNS of human beings.
C) The function of the CNS is to bring information to and from the brain and spinal cord.
D) The CNS has two major divisions: the somatic nervous system and the autonomic nervous system.

20) The _____ connects the brain and spinal cord to the rest of the body.
A) central nervous system
B) peripheral nervous system
C) limbic system
D) endocrine system

21) The somatic nervous system and autonomic nervous system are components of the
A) sensory system.
B) central nervous system.
C) limbic system.
D) peripheral nervous system.

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22) The somatic nervous system consists of motor nerves, whose function is to
A) mobilize the body for action in a dangerous situation.
B) tell muscles what to do.
C) reduce the stress levels of the body.
D) convey information from the skin and muscles to the central nervous system.

23) The function of sensory nerves of the somatic nervous system is to
A) take messages to and from the body's internal organs, monitoring such processes as breathing, heart rate, and digestion.
B) be involved in the experience of stress and calm the body.
C) arouse the body to mobilize it for action.
D) convey information from the skin and muscles to the CNS about conditions such as pain and temperature.

24) The function of the _____ is to take messages to and from the body's internal organs, monitoring such processes as breathing, heart rate, and digestion.
A) central nervous system
B) autonomic nervous system
C) somatic nervous system
D) voluntary nervous system

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25) Which of the following essential body functions are under the control of the autonomic nervous system?
A) functions of reproductive system
B) excretory functions
C) sensory functions such as vision and hearing
D) functions of heart rate, breathing, and digestion

26) The sympathetic nervous system and parasympathetic nervous system are components of the
A) central nervous system.
B) endocrine system.
C) somatic nervous system.
D) autonomic nervous system.

27) The _____ is the part of the autonomic nervous system that arouses the body to mobilize it for action and thus is involved in the experience of stress.
A) sympathetic nervous system
B) parasympathetic nervous system
C) somatic nervous system
D) central nervous system

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28) In the context of the autonomic nervous system, the _____ calms the body.
A) sympathetic nervous system
B) parasympathetic nervous system
C) somatic nervous system
D) central nervous system

29) Which of the following is one of the functions of the sympathetic nervous system?
A) convey information from skin to the central nervous system (CNS)
B) calm the body
C) fight-or-flight reaction
D) tell muscles what to do

30) _____ are the circumstances and events that threaten individuals and tax their coping abilities.
A) Stressors
B) Synapses
C) Blips
D) Stimulators

31) You are walking to school when you encounter a barking dog. You start sweating and contemplate whether you should run away. Which nervous system is primarily responsible for this "fight-or-flight" reaction?
A) somatic
B) sympathetic
C) parasympathetic
D) central

32) Just before you went on a job interview your heart was pounding like crazy. You experienced a shortness of breath and felt sick to your stomach. These symptoms were most likely produced by your _____ nervous system.
A) central
B) somatic
C) parasympathetic
D) sympathetic

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33) Which division of the peripheral nervous system is responsible for producing physiological symptoms (such as increased heart rate and butterflies in the stomach) under conditions of stress?
A) somatic
B) parasympathetic
C) sympathetic
D) central

34) If a person needs to run away from a dangerous situation, the _____ nervous system sends blood to the person's extremities to prepare them for taking off.
A) central
B) somatic
C) sympathetic
D) parasympathetic

35) After taking her English final, Natalie attempts to relax in her chair by meditating. She is attempting to reduce her heart and respiration rates, as well as her muscular tension. In this scenario, her physiological relaxation can be best attributed to the functioning of her _____ nervous system.
A) somatic
B) central
C) parasympathetic
D) sympathetic

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36) After a game of football, David tries to calm down by relaxing in the swimming pool. He tries to get his breath back and relax to avoid muscle cramps. In this scenario, which part of the autonomic nervous system is most likely involved in calming David's body?
A) the somatic nervous system
B) the central nervous system
C) the sympathetic nervous system
D) the parasympathetic nervous system

37) Maya burns her fingers while cooking dinner. Which of the following divisions of the nervous system will be primarily responsible for the pain she feels?
A) the central nervous system
B) the autonomic nervous system
C) the somatic nervous system
D) the parasympathetic nervous system



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38) After finishing a psychology test, you try to relax by engaging in some meditation techniques. Doing these exercises should increase the response of the _____ nervous system, which results in a slower heart and respiration rate and less muscular tension.
A) somatic
B) central
C) parasympathetic
D) sympathetic

39) Corticosteroids are
A) stress hormones.
B) sex hormones.
C) neurotransmitters that regulate mood.
D) neurotransmitters that regulate memory.

40) _____ stress is the momentary stress that occurs in response to life experiences.
A) Intrinsic
B) Differential
C) Chronic
D) Acute

41) The uncertainty of the COVID-19 pandemic resulted in a prolonged period of _____ stress for many people throughout the world.
A) chronic
B) acute
C) sympathetic
D) autonomic

42) Which of the following types of cells in the nervous system handle the information-processing function?
A) neurons
B) glial cells
C) sclerenchyma cells
D) sensors

43) _____ provide support, nutritional benefits, and other functions in the nervous system.
A) Neurons
B) Glial cells
C) Sclerenchyma cells
D) Dendrites

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44) The cell body contains the _____, which directs the manufacture of substances that a neuron needs for growth and maintenance.
A) myelin
B) nucleus
C) axon
D) dendrite

45) Which of the following is a true statement about dendrites?
A) They encase and insulate most axons.
B) They are treelike fibers projecting from a neuron.
C) They contain the nucleus of a neuron.
D) They direct the manufacture of substances required for growth of neurons.

46) Which of the following is a true statement about an axon?
A) It encases and insulates most nuclei.
B) It is a treelike fiber projecting from a neuron.
C) It is extremely thin and has many branches.
D) It directs the manufacture of substances required for growth of neurons.

47) Dendrites are
A) the part of the neuron that is responsible for sending information away from the cell body toward other cells.
B) treelike fibers which receive information and orient it toward the neuron's cell body.
C) located inside the cell body.
D) the layer of fat cells that encase and insulate the neuron.

48) The axon is
A) the part of the neuron that carries information away from the cell body toward other cells.
B) the branchlike part of the neuron that is responsible for receiving information from other neurons.
C) located inside the cell body.
D) the layer of fat cells that encase and insulate the neuron.

49) A _____ is a layer of fat cells that insulates most axons and speeds up the transmission of nerve impulses.
A) dendrite
B) myelin sheath
C) cyton
D) nucleolus

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50) Which of the following is a function of the myelin sheath?
A) carry information away from the cell body toward other cells
B) increase the surface area of nerve cells
C) speed up the transmission of nerve impulses
D) play a role in imitation

51) In multiple sclerosis, which part of the neuron typically hardens and disrupts the flow of information through the neurons?
A) the nucleus
B) the dendrites
C) the cell body
D) the myelin sheath

52) In the context of the neural impulse, the membrane that encases the axon is called semipermeable because
A) only sodium ions can cross the membrane.
B) any type of substance can pass through the membrane.
C) fluids can sometimes flow into and out of it.
D) depolarization of the membranes cannot occur.

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53) Normally, when a neuron is not transmitting information and a slight negative charge is present on the inside of the cell membrane, the neuron is said to be
A) depolarized.
B) resting.
C) active.
D) highly charged.

54) Resting potential is the
A) amount of time a signal travels through the central nervous system.
B) amount of time a neuron must "rest" in between firing episodes.
C) stable, positive charge of an inactive neuron.
D) stable, negative charge of an inactive neuron.

55) The membrane of the resting neuron is said to be
A) deconcentrated.
B) depolarized.
C) concentrated.
D) polarized.

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56) When a neuron is at its resting state, what is the status of the charges on each side of the cell membrane?
A) There is a negative charge on the outside of the cell membrane and a positive charge on the inside.
B) There is a negative charge on the inside of the cell membrane and a positive charge on the outside.
C) There is a negative charge on both the outside and the inside of the cell membrane.
D) There is a positive charge on both the outside and the inside of the cell membrane.

57) In the context of the neural impulse, which of the following is true about the depolarization of neuron membranes?
A) It is characterized by more negatively charged ions on the inside of the cell and more positively charged ions on the outside.
B) It occurs when there is a decrease in the charge difference between the fluids inside and outside of the neuron.
C) It is the brief wave of positive electrical charge that sweeps down the axon.
D) It is the phase that allows sodium ions to move out of the neuron.

58) The brief wave of positive electrical charge that sweeps down the axon is
A) resting potential.
B) action potential.
C) graded potential.
D) polarized potential.

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59) When a neuron sends an action potential, it is commonly said to be
A) firing.
B) grading.
C) depolarizing.
D) classifying.

60) According to the all-or-nothing principle,
A) if all the neurons in a network are not integrated, the "message" carried by the neurons will be lost.
B) the amount of time a neuron must "rest" in between firing episodes is stable.
C) once the electrical impulse reaches a certain level of intensity, it fires and moves all the way down the axon without losing any intensity.
D) as a person ages, his or her neurological system slows down and the intensity of neural impulses decreases significantly.

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61) Which of the following refers to tiny spaces between neurons?
A) dendrites
B) axons
C) synapses
D) basal ganglia

62) _____ are chemical substances that are stored in very tiny sacs within the neuron's terminal buttons and involved in transmitting information across a synaptic gap to the next neuron.
A) Neurotransmitters
B) Neural impulses
C) Synapses
D) Dendrites

63) Acetylcholine is a neurotransmitter that plays an important role in
A) learning and memory.
B) vision and hearing.
C) mood regulation.
D) reproductive function.

64) Your relative is experiencing memory loss related to Alzheimer disease. Research suggests that the decline in memory is due to a(n) _____ deficiency in this individual's brain.
A) serotonin
B) gamma-aminobutyric acid (GABA)
C) acetylcholine
D) dopamine

65) _____ inhibits the firing of neurons in the central nervous system, but it excites the heart muscle, intestines, and urogenital tract.
A) Serotonin
B) Dopamine
C) Norepinephrine
D) GABA

66) Which of the following pairs are correctly matched?
A) high levels of oxytocin—Alzheimer disease
B) low levels of dopamine—Parkinson disease
C) low levels of acetylcholine—schizophrenia
D) high levels of serotonin—depression

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67) Emma has recently started to suffer from migraine headaches and seizures. She also suffers from anxiety and depression. In the context of neurochemical messengers, which of the following conditions is most likely to be the cause for her symptoms?
A) too little norepinephrine
B) too much glutamate
C) too much acetylcholine
D) too little dopamine

68) Depression is associated with low levels of which neurotransmitter?
A) acetylcholine
B) serotonin
C) dopamine
D) oxytocin

69) In the context of neurotransmitters, which of the following best describes the effect of norepinephrine stimulation?
A) It plays a role in the human tendency to feel pleasure during orgasm.
B) It plays a role in forming emotional bonds with romantic partners.
C) It inhibits the heart muscle, intestines, and urogenital tract.
D) It helps to control the level of alertness.

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70) Which of the following is true of the neurotransmitter serotonin?
A) It is related to the personality trait of extraversion.
B) It inhibits the firing of neurons in the central nervous system.
C) It is involved in the regulation of mood and attention.
D) It is hardly involved in the regulation of sleep.

71) _____ are natural opiates that mainly stimulate the firing of neurons.
A) Endorphins
B) Corticosteroids
C) Aldosterones
D) Histidines

72) Which of the following is a function of endorphins?
A) shielding the body from pain and elevating feelings of pleasure
B) playing an important role in the experience of love and social bonding
C) regulating sleep, mood, attention, and learning
D) stimulating the release of norepinephrine, which helps to control alertness

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73) Problems regulating dopamine are associated with
A) depression.
B) multiple sclerosis.
C) Alzheimer disease.
D) schizophrenia.

74) Who among the following is most likely to have elevated levels of endorphins?
A) Amy, a 30-year-old teacher, who is in shock after a car wreck
B) Jamie, a 40-year-old diplomat, who is on a cruise
C) Martha, a 32-year-old homemaker, who is showing symptoms of schizophrenia
D) Joshua, a 17-year-old student, who is depressed after seeing his low SAT scores

75) _____ is a hormone and neurotransmitter that plays an important role in the experience of love and social bonding.
A) Acetylcholine
B) Dopamine
C) Serotonin
D) Oxytocin

76) A powerful surge of oxytocin is released in a
A) person who is in shock after a car wreck.
B) long-distance runner.
C) young boy on a roller-coaster ride.
D) mother who has just given birth.

77) Lilly, who has just given birth, is able to provide nourishment for her baby and loves her newborn unconditionally. Which of the following neurotransmitters is said to play an important role in this case?
A) acetylcholine
B) serotonin
C) dopamine
D) oxytocin

78) An _____ is a drug that mimics or increases a neurotransmitter's effects, whereas an _____ is a drug that blocks a neurotransmitter's effects.
A) agonist; antagonist
B) antagonist; agonist
C) oxytocin; endorphin
D) endorphin; oxytocin

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79) Morphine, a neurotransmitter, mimics the actions of endorphins by stimulating receptors in the brain and spinal cord associated with pleasure and pain. Morphine, therefore, is an example of a(n)
A) agonist.
B) antagonist.
C) synapse.
D) stressor.

80) Drugs used to treat schizophrenia interfere with the activity of dopamine. Such a drug is an example of a(n)
A) agonist.
B) antagonist.
C) synapse.
D) stressor.

81) Izabella Johnson, a doctor in Dallas, prescribed an antidepressant drug Prozac to her patient, Ted. Prozac works by increasing brain levels of serotonin. This means that Prozac is considered
A) an agonist.
B) an antagonist.
C) an endorphin.
D) an oxytocin.

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82) Michael has schizophrenia. His doctor prescribed a new drug that blocks or interferes with the activity of dopamine. The doctor is using _____ to treat Michael's disorder.
A) an agonist
B) an antagonist
C) a brain lesion
D) a lobotomy

83) _____ is an abnormal disruption in the tissue of the brain resulting from injury or disease.
A) Brain lesioning
B) Brain imaging
C) Brain ischemia
D) Brain stem stroke



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84) Neuroscientists who surgically remove, destroy, or eliminate the brain tissue of laboratory animals are using which of the following techniques for studying the brain?
A) electroencephalogram
B) positron emission tomography (PET)
C) magnetic resonance imaging (MRI)
D) brain lesioning

85) Which of the following is a significance of the brain-lesioning process?
A) It assesses the amount of glucose in the various brain regions.
B) It gives a three-dimensional view of various brain regions.
C) It gives a sense of the functions of the damaged brain regions.
D) It assesses the amount of radioactivity in several brain regions.

86) Which of the following methods of studying the brain involves recording the brain's electrical activity by placing electrodes on the scalp to detect brain-wave activity?
A) electroencephalograph (EEG)
B) positron emission tomography (PET)
C) magnetic resonance imaging (MRI)
D) functional MRI (fMRI)

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87) Harry has been diagnosed with epilepsy by his neurologist. Which of the following should the neurologist use to assess Harry's epilepsy by studying his brain-wave activity?
A) electrooculography
B) electromyography
C) electroencephalograph
D) electrocardiograph

88) Arnold Becker, a doctor in Seattle, needs information about the location and extent of damage involving stroke and loss of memory of his patient, Judith. Which of the following techniques will he most likely use to diagnose Judith's condition?
A) brain lesioning
B) computerized axial tomography (CAT scan)
C) positron emission tomography (PET)
D) electroencephalogram (EEG)

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89) Jasmine, a doctor, is studying the extent of damage to the brain involving loss of memory in her patient Kayla. She examines a three-dimensional image obtained from X-rays of Kayla's head that are assembled into a composite image. In the context of brain imaging, which of the following techniques was most likely used to produce the three-dimensional image?
A) computerized axial tomography (CAT scan or CT scan)
B) positron-emission tomography (PET scan)
C) magnetic resonance imaging (MRI)
D) transcranial magnetic stimulation (TMS)

90) Stern Tyler, a neuroscientist who is collecting data for a new research study, uses a technique for monitoring the amount of glucose in various areas of the brain. Which of the following methods is Stern Tyler using in this study?
A) brain lesioning
B) staining
C) positron emission tomography (PET scan)
D) electroencephalogram (EEG)

91) In the context of brain imaging, _____ involves creating a magnetic field around a person's body and using radio waves to construct images of the person's tissues and biochemical activities.
A) transcranial magnetic stimulation (TMS)
B) magnetic resonance imaging (MRI)
C) positron-emission tomography (PET scan)
D) computerized axial tomography (CAT scan or CT scan)

92) Functional magnetic resonance imaging (fMRI) is a technique that
A) allows scientists to see what is happening in the brain while it is working.
B) requires injecting the brain with a substance but still cannot portray brain function.
C) measures the amount of glucose in various areas of the brain and then sends this information to a computer for analysis.
D) examines the effects of lesions in brain tissue.

93) In which of the following ways does functional magnetic resonance imaging (fMRI) detect the functioning of the brain?
A) It exploits changes in blood oxygen that occur in association with brain activity.
B) It measures the amount of glucose in various areas of the brain.
C) It places electrodes on the scalp to detect brain-wave activity.
D) It establishes a cause-effect relationship between variables associated with brain activity.

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94) Which of the following principles underlies the technique of functional magnetic resonance imaging (fMRI)?
A) It rests on the principle that mental activity is associated with changes in glucose levels in the brain.
B) It rests on the principle that mental activity is associated with changes in the oxygenated blood levels in the brain.
C) It rests on the principle that mental activity is associated with changes in hydrogenated blood levels in the brain.
D) It rests on the principle that mental activity is associated with changes in magnetic fields in the brain.

95) Which of the following is true of the brain-imaging technique known as transcranial magnetic stimulation (TMS)?
A) It does not allow researchers to draw cause-and-effect conclusions.
B) It examines neuronal functioning following brain-injuring events.
C) It is not used to treat any neurological and psychological disorders.
D) It is the most painful technique used in examining the role of various regions of the brain.

96) A researcher in the field of neuroscience has a theory about a specific area of the brain causing difficulties in face recognition. To draw a solid causal inference, they intend to test their hypothesis on dogs by disrupting regions of the dogs' brains and examining the effects of this disruption on the dogs' face-recognition capacity. Which of the following techniques should be used by the researcher?
A) computerized axial tomography (CAT scan)
B) magnetic resonance imaging (MRI)
C) transcranial magnetic stimulation (TMS)
D) functional magnetic resonance imaging (fMRI)

97) In the context of the major regions of the brain, which of the following is the lowest portion of the brain?
A) hindbrain
B) forebrain
C) cerebral cortex
D) hypothalamus

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98) Which part of the nervous system regulates breathing and heart rate?
A) hypothalamus
B) pons
C) medulla
D) cerebellum

99) Damien has been unable to sleep for the past few weeks. He wakes up in the middle of the night and cannot go back to sleep. On certain occasions, he cannot fall asleep at all and at other times, he is unable to wake up from sleep. In the context of organization of the brain, Damien's problem with sleep and arousal is most likely caused by the poor functioning of the
A) pons.
B) amygdala.
C) medulla.
D) cerebellum.

100) Marshall's cerebellum was damaged in a car accident. Marshall is likely to have problems with
A) breathing and heart rate.
B) seeing and hearing.
C) talking and understanding.
D) balance and muscle coordination.

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101) The _____ relays information between the brain and the eyes and ears.
A) forebrain
B) midbrain
C) hindbrain
D) cerebellum

102) The reticular formation of the midbrain is involved in
A) controlling breathing and regulating reflexes to maintain an upright posture.
B) stereotyped patterns of behavior such as walking, sleeping, or turning to attend to a sudden noise.
C) the control and coordination of balance, hearing, and parasympathetic function.
D) governing higher brain functions, such as thinking, learning, and consciousness.

103) Which of the following is the brain's largest division?
A) forebrain
B) midbrain
C) hindbrain
D) medulla

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104) The _____ is a set of subcortical brain structures central to emotion, memory, and reward processing.
A) thalamus
B) limbic system
C) cerebrum
D) cerebral cortex

105) Joe has suffered a massive stroke. Since then, he finds it difficult to remember names of new people whom he meets or even to recognize them. This is because he is unable to retain any new memories after the stroke. In the context of the organization of the brain, these symptoms are most likely due to a damaged
A) amygdala.
B) thalamus.
C) hippocampus.
D) hypothalamus.

106) Which of the following parts of the brain are correctly matched?
A) thalamus—hindbrain
B) amygdala—midbrain
C) basal ganglia—hindbrain
D) limbic system—forebrain

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107) Nathan is suffering from amnesia, an illness that prevents the retrieval of new memories. In the context of the organization of the brain, which area of Nathan's brain is most likely responsible for the amnesia?
A) basal ganglia
B) reticular formation
C) cerebellum
D) hippocampus

108) Discrimination of objects that are necessary for survival (such as appropriate food) as well as emotional awareness and expression involves the
A) hippocampus.
B) occipital lobe.
C) medulla.
D) amygdala.

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109) Carrie suffered brain damage when she was injured in a car accident. Since then, she is unable to take pleasure in the things she used to. She has also lost interest in sexual intimacy with her husband and does not enjoy the taste of her favorite foods. In this scenario, damage to which of the following areas of the brain is most likely causing her inability to experience pleasure?

A) medulla
B) hippocampus
C) hypothalamus
D) pituitary gland

110) Steven was in a serious automobile accident that caused a severe injury to his hippocampus. What type of problem is Steven likely to experience as a result of this brain injury?

A) He will probably be unable to speak.
B) He will probably be unable to comprehend language.
C) He will probably be unable to retain any new conscious memories.
D) He will probably be unable to move on his own.

111) Large neuron clusters located above the thalamus and under the cerebral cortex that work with the cerebellum and the cerebral cortex to control and coordinate voluntary movements are called

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A) occipital lobes.
B) basal ganglia.
C) medulla.
D) amygdala.

112) The _____ is a small forebrain structure that monitors pleasurable activities (e.g., eating, drinking, and sex), emotion, stress, and reward.

A) hypothalamus
B) basal ganglia
C) corpus callosum
D) medulla

113) The _____ is part of the forebrain, the outer layer of the brain, and is responsible for the most complex mental functions, such as thinking and planning.

A) cerebral cortex
B) hypothalamus
C) amygdala
D) hippocampus

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114) The _____ is the outermost part of the cerebral cortex, making up 80 percent of the human brain's cortex.
A) motor cortex
B) thalamus
C) hypothalamus
D) neocortex

115) As a result of a brain injury after an accident, James lost his vision. Which of the following regions of James's cerebral cortex is most likely to be damaged?
A) association cortex
B) parietal lobe
C) occipital lobe
D) somatosensory cortex

116) Samantha had a stroke. Doctors told her she sustained substantial damage to the occipital lobes. What type of deficiencies is Samantha likely to experience as a result of this brain damage?
A) She may be blind or unable to see clearly.
B) She will probably be unable to comprehend language.
C) She will probably have difficulties with memory function.
D) She will probably suffer from impaired cognitive functioning.

117) Structures in the cerebral cortex that are involved in hearing, language processing, and memory are called
A) temporal lobes.
B) frontal lobes.
C) occipital lobes.
D) parietal lobes.

118) The _____ are involved in personality, intelligence, and the control of voluntary muscles.
A) temporal lobes
B) frontal lobes
C) occipital lobes
D) parietal lobes

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119) Zeus was injured in a mining accident and suffered severe brain damage. In time, his brain healed, and he was back to working in the mines. The only change was in his personality. From being a highly aggressive and temperamental individual, he became mild-mannered and calm, almost to the extent of being placid. In this scenario, the region of the cerebral cortex that was most likely damaged in the accident was the _____ lobe.

A) frontal
B) occipital
C) temporal
D) parietal

120) Which of the following are correctly matched?

A) frontal lobes—hearing, language processing, and memory
B) occipital lobes—personality, intelligence, and the control of voluntary muscles
C) temporal lobes—visual stimuli
D) parietal lobes—spatial location, attention, and motor control

121) Gregory is an excellent basketball player. He is always able to gauge the distance between himself and the basket correctly, and he never misses a shot. To help him use this spatial location skill, which of the following regions of the cerebral cortex should function the most efficiently?

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A) the parietal lobe
B) the temporal lobe
C) the somatosensory cortex
D) the prefrontal cortex

122) The _____, located at the front of the parietal lobes, is defined as a region in the cerebral cortex that processes information about body sensations.

A) motor cortex
B) prefrontal cortex
C) somatosensory cortex
D) neocortex

123) The _____ is the part of the cerebral cortex that processes information about voluntary movement.

A) motor cortex
B) sensory cortex
C) limbic system
D) temporal lobe

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124) Which of the following is true with regard to the association cortex?
A) It processes information about body sensations.
B) It makes up 25 percent of the cerebral cortex.
C) It is at the rear of the frontal lobes, processes information about voluntary movement.
D) It is the site of the highest intellectual functions, such as thinking and problem solving.

125) Katy was in a car accident and sustained serious brain damage. Since the accident, Katy can speak only one word. This is an example of
A) amnesia.
B) aphasia.
C) multiple sclerosis.
D) epilepsy.

126) _____ plays an important role in the production of speech, whereas _____ plays an important role in the comprehension of language.
A) Wernicke's area; Broca's area
B) Broca's area; Wernicke's area
C) The occipital lobe; the hippocampus
D) The hippocampus; the occipital lobe

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127) The _____ is the large bundle of axons that connects the brain's two hemispheres and is responsible for relaying information between the two sides.
A) corpus callosum
B) neocortex
C) association cortex
D) hypothalamus

128) Neurosurgeons can reduce the unbearable seizures some epileptics experience by severing the
A) hypothalamus.
B) cerebellum.
C) amygdala.
D) corpus callosum.

129) The left hemisphere of the brain plays an important role in managing or regulating
A) speech and grammar.
B) spatial perception.
C) visual recognition.
D) movement in the left side of the body.

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130) As it relates to the functioning of the brain's two hemispheres, which of the following is true?
A) Most day-to-day activities involve an interplay between the brain's two hemispheres.
B) All verbal abilities are controlled by the left brain.
C) The brain's two hemispheres only work together when they are forced to because of some type of brain damage.
D) Speech and grammar are localized in the right brain.

131) The endocrine system
A) directs the most complex mental functions, such as thinking and planning.
B) connects the brain and the spinal cord to the rest of the body.
C) consists of a set of glands that regulate the activities of certain organs by releasing their chemical products into the bloodstream.
D) communicates through the release of neurotransmitters.

132) Which of the following is defined as organs or tissues in the body that create chemicals that control many bodily functions?
A) glands
B) dendrites
C) synapses
D) pons

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133) The chemical messengers produced by the endocrine glands are known as
A) neurotransmitters.
B) hormones.
C) axons.
D) stem cells.

134) The _____ gland is defined as a pea-sized gland just beneath the hypothalamus that controls growth and regulates other glands.
A) sebaceous
B) adrenal
C) thyroid
D) pituitary

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135) The _____ is sometimes referred to as the "master gland" because almost all of its hormones direct the activity of target glands elsewhere.
A) anterior thyroid gland
B) posterior adrenal gland
C) anterior pituitary gland
D) posterior parathyroid gland

136) Ellie has recently experienced irregular mood swings. Her energy level has decreased, and she seems to have greater difficulty coping with stress. Based on her symptoms, it seems as though Ellie may have problems with her _____ glands.
A) pituitary
B) pineal
C) adrenal
D) thymus

137) _____ and _____ are secreted by the adrenal glands.
A) Epinephrine; norepinephrine
B) Estrogen; testosterone
C) Estrogen; epinephrine
D) Acetylcholine; testosterone

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138) The _____ is defined as a dual-purpose gland under the stomach that performs both digestive and endocrine functions.
A) pancreas
B) pituitary gland
C) adrenal gland
D) hypothalamus

139) Which of the following play(s) an important role in insulin production, metabolism, and body weight?
A) testes and ovaries
B) adrenal gland
C) pituitary gland
D) pancreas

140) Which of the following glands are involved in sexual development and reproduction?
A) testes and ovaries
B) adrenal glands
C) pituitary glands
D) pancreas

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141) When the axons of healthy neurons adjacent to damaged cells grow new branches, _____ has occurred.
A) collateral sprouting
B) substitution of function
C) neurogenesis
D) synaptic pruning

142) When Charlie was three years old, he fell off the slide at the playground and damaged the left hemisphere of his brain. Despite this injury, as Charlie grew older, he still retained some of his language abilities because the right hemisphere of his brain took control over the language function. Which of the following mechanisms of brain-damage repair is apparent in this example?
A) collateral sprouting
B) substitution of function
C) neurogenesis
D) lobotomy

143) Which of the following is true about neurogenesis?
A) Neurogenesis cannot occur in human adults.
B) Researchers have found that neurogenesis does not occur in a few mammals such as mice.
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C) Researchers have documented neurogenesis in only two brain regions in mammals: the hippocampus and the olfactory bulb.
D) Recent research has revealed that exercise decreases neurogenesis.

144) In the context of brain tissue implants, what is unique about stem cells?
A) They survive for extended periods outside of the body.
B) They can develop into most types of human cells.
C) They are insusceptible to the effects of plasticity.
D) They transfer genetic information into human cells.

145) In the human cell, threadlike structures that come in 23 pairs, one member of each pair originating from each parent, and that contain DNA are called
A) chromosomes.
B) ergosomes.
C) ribosomes.
D) polysomes.

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146) _____ is a complex molecule in the cell's chromosomes that carries genetic information.
A) RNA
B) DNA
C) Ribosome
D) Polysome

147) Genes
A) consist of short segments of ribosomes composed of RNA.
B) match and link small pieces of RNA.
C) manufacture the proteins that are necessary for maintaining life.
D) act independently and do not collaborate with another gene.

148) Which of the following refers to an organism's complete genetic material?
A) genome
B) action potential
C) genotype
D) phenotype

149) According to _____, two brown-eyed parents can have a child with blue eyes.
A) the dominant-recessive genes principle
B) molecular genetics
C) the genome-wide association method
D) linkage analysis

150) _____ is a term used by scientists to describe the influences of multiple genes on behavior.
A) Sequencing
B) Polygenic inheritance
C) Phenotype
D) Genotype

151) _____ involves the manipulation of genes using technology to determine their effect on behavior.
A) Molecular genetics
B) Selective breeding
C) Genome-wide association method
D) Behavior genetics

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152) _____ is a genetic method in which organisms are chosen for reproduction based on how much of a particular trait they display.
A) Selective breeding
B) Experimental evolution
C) Polymorphism
D) Natural selection

153) Matthew, a behavioral psychologist, studies the hunting ability of dogs. He controls the mating of dogs so they exhibit a particular characteristic of hunting. In this scenario, which of the following genetic methods is Matthew most likely using for his study?
A) selective breeding
B) natural selection
C) the genome-wide association method
D) polymorphism

154) A team of researchers collected DNA from a group of people with a particular form of cancer and compared it to DNA from a group of people who do not have the disease. They are hoping to determine whether certain genetic variations occur more frequently in those with the disease and, therefore, where on the human genome the disease-causing problem exists. Which of the following is true of the researchers?
A) The researchers are using the genome-wide association method.
B) The researchers are behavior geneticists.
C) The researchers are undertaking an experiment in selective breeding.
D) The researchers are molecular geneticists.

155) Dr. Cardinale is interested in the effects of heredity and environment on intelligence. She compares the similarity of IQ scores of identical twins to the similarity of IQ scores of fraternal twins. In this case, Dr. Cardinale is studying heredity's influence on behavior using
A) human genome.
B) molecular genetics.
C) behavior genetics.
D) selective breeding.

156) A(n) _____ is a person's genetic heritage, his or her actual genetic material.
A) prototype
B) phenotype
C) endophenotype
D) genotype

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157) Molly's natural hair color is brown, but she has had it dyed blonde. Molly changed her
A) phenotype.
B) genotype.
C) chromosomes.
D) genetic heritage.

158) Even if a gene has a strong relationship to a particular phenotype, that characteristic may not show itself if a person's experiences do not lead the gene to express itself. This reflects which of the following principles?
A) gene x environment interaction
B) dominant-recessive genes
C) selective breeding
D) genome-wide association

**ESSAY. Write your answer in the space provided or on a separate sheet of paper.**

159) Briefly describe the peripheral nervous system and its four divisions. What is the function of each? Give examples of situations that would activate each division and how they would do so.

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160) Describe the structure of a neuron and explain the function of each component.

161) Briefly explain how one neuron sends a message to another neuron. Be sure to include a description of the roles that the various structures of the neuron play in communicating neural messages.

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162) Compare and contrast the techniques researchers use to study the brain. Explain what type of information can be gained by each approach.

163) Identify the major functions of the hypothalamus, cerebellum, and the reticular formation. Give examples of their functions in terms of real behaviors.

164) Explain how the right and left hemispheres of the brain are specialized for different functions.

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165) Compare and contrast the nervous system and the endocrine system.

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166) How does the endocrine system transmit its messages? What functions do the pituitary gland, adrenal glands, pancreas, and gonads (testes or ovaries) perform?

167) Discuss the three ways through which brain repair can take place.



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168) Explain the difference between genotype and phenotype. Be sure to mention the role of environmental influences.

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## Answer Key

Test name: Chapter 02

1) B
The Nervous System

2) A
The Nervous System

3) B
The Nervous System

4) A
The Nervous System

5) A
The Nervous System

6) A
The Nervous System

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7) D
The Nervous System

8) C
The Nervous System

9) D
The Nervous System

10) A
The Nervous System

11) C
The Nervous System

12) A
The Nervous System

13) C

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The Nervous System

14) B
The Nervous System

15) A
The Nervous System

16) D
The Nervous System

17) B
The Nervous System

18) B
The Nervous System

19) A
The Nervous System

20) B
The Nervous System

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21) D
The Nervous System

22) B
The Nervous System

23) D
The Nervous System

24) B
The Nervous System

25) D
The Nervous System

26) D
The Nervous System

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# Experience Psychology Edition 5 by King

27) A
The Nervous System

28) B
The Nervous System

29) C
The Nervous System

30) A
The Nervous System

31) B
The Nervous System

32) D
The Nervous System

33) C
The Nervous System

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34) C
The Nervous System

35) C
The Nervous System

36) D
The Nervous System

37) C
The Nervous System

38) C
The Nervous System

39) A
The Nervous System

40) D

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The Nervous System

41) A
The Nervous System

42) A
Neurons

43) B
Neurons

44) B
Neurons

45) B
Neurons

46) C
Neurons

47) B
Neurons

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48) A
Neurons

49) B
Neurons

50) C
Neurons

51) D
Neurons

52) C
Neurons

53) B
Neurons

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# Experience Psychology Edition 5 by King

54) D
Neurons

55) D
Neurons

56) B
Neurons

57) B
Neurons

58) B
Neurons

59) A
Neurons

60) C
Neurons

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61) C
Neurons

62) A
Neurons

63) A
Neurons

64) C
Neurons

65) C
Neurons

66) B
Neurons

67) B

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Neurons

68) B
Neurons

69) D
Neurons

70) C
Neurons

71) A
Neurons

72) A
Neurons

73) D
Neurons

74) A
Neurons

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75) D
Neurons

76) D
Neurons

77) D
Neurons

78) A
Neurons

79) A
Neurons

80) B
Neurons

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81) A
Neurons

82) B
Neurons

83) A
Structures of the Brain and Their Functions

84) D
Structures of the Brain and Their Functions

85) C
Structures of the Brain and Their Functions

86) A
Structures of the Brain and Their Functions

87) C
Structures of the Brain and Their Functions

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88) B
Structures of the Brain and Their Functions

89) A
Structures of the Brain and Their Functions

90) C
Structures of the Brain and Their Functions

91) B
Structures of the Brain and Their Functions

92) A
Structures of the Brain and Their Functions

93) A
Structures of the Brain and Their Functions

94) B

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Structures of the Brain and Their Functions

95) B
Structures of the Brain and Their Functions

96) C
Structures of the Brain and Their Functions

97) A
Structures of the Brain and Their Functions

98) C
Structures of the Brain and Their Functions

99) A
Structures of the Brain and Their Functions

100) D
Structures of the Brain and Their Functions

101) B
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Structures of the Brain and Their Functions

102) B
Structures of the Brain and Their Functions

103) A
Structures of the Brain and Their Functions

104) B
Structures of the Brain and Their Functions

105) C
Structures of the Brain and Their Functions

106) D
Structures of the Brain and Their Functions

107) D
Structures of the Brain and Their Functions

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108) D
Structures of the Brain and Their Functions

109) C
Structures of the Brain and Their Functions

110) C
Structures of the Brain and Their Functions

111) B
Structures of the Brain and Their Functions

112) A
Structures of the Brain and Their Functions

113) A
Structures of the Brain and Their Functions

114) D
Structures of the Brain and Their Functions

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115) C
Structures of the Brain and Their Functions

116) A
Structures of the Brain and Their Functions

117) A
Structures of the Brain and Their Functions

118) B
Structures of the Brain and Their Functions

119) A
Structures of the Brain and Their Functions

120) D
Structures of the Brain and Their Functions

121) A

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# Experience Psychology Edition 5 by King

Structures of the Brain and Their Functions

122) C
Structures of the Brain and Their Functions

123) A
Structures of the Brain and Their Functions

124) D
Structures of the Brain and Their Functions

125) B
Structures of the Brain and Their Functions

126) B
Structures of the Brain and Their Functions

127) A
Structures of the Brain and Their Functions

128) D
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Structures of the Brain and Their Functions

129) A
Structures of the Brain and Their Functions

130) A
Structures of the Brain and Their Functions

131) C
The Endocrine System

132) A
The Endocrine System

133) B
The Endocrine System

134) D
The Endocrine System

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135) C
The Endocrine System

136) C
The Endocrine System

137) A
The Endocrine System

138) A
The Endocrine System

139) D
The Endocrine System

140) A
The Endocrine System

141) A
Brain Damage, Plasticity, and Repair

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142) B
Brain Damage, Plasticity, and Repair

143) C
Brain Damage, Plasticity, and Repair

144) B
Brain Damage, Plasticity, and Repair

145) A
Genetics and Behavior

146) B
Genetics and Behavior

147) C
Genetics and Behavior

148) A

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Genetics and Behavior

149) A
Genetics and Behavior

150) B
Genetics and Behavior

151) A
Genetics and Behavior

152) A
Genetics and Behavior

153) A
Genetics and Behavior

154) A
Genetics and Behavior

155) C
Genetics and Behavior

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156) D
Genetics and Behavior

157) A
Genetics and Behavior

158) A
Genetics and Behavior

159) Essay
The Nervous System

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The peripheral nervous system (PNS) is the network of nerves that connects the brain and spinal cord to other parts of the body. The two major divisions of the PNS are the somatic and autonomic divisions. The somatic nervous system consists of sensory nerves (afferent), whose function is to convey information from the skin and muscles to the CNS about conditions such as pain and temperature, and motor nerves (efferent), whose function is to tell muscles what to do. The function of the autonomic nervous system is to take messages to and from the body's internal organs, monitoring such processes as breathing, heart rate, and digestion. The autonomic division is further subdivided into the sympathetic and parasympathetic divisions, and these subdivisions are most noticeable during emergencies. The sympathetic division prepares the body for emergencies and helps us to either fight stressors or to flee from them. If you were inside a burning house, for example, the sympathetic division would produce the necessary arousal that would allow you to either run out of the house to safety, or to find a fire extinguisher to help battle the blaze. The parasympathetic division restores the body to its resting state once an emergency has ended. Once it is clear that your house was not on fire, your breathing and heart rate return to normal, and you eventually feel a sense of calm.

160) Essay
Neurons

Every neuron has three components: a cell body, dendrites, and an axon. Dendrites are treelike fibers that receive information and orient it towards the neuron's cell body. Most nerve cells have multiple dendrites. The axon is the part of the neuron that carries information away from the cell body toward other cells. The cell body contains the nucleus, which directs the manufacture of substances that the neuron needs for growth and maintenance.

161) Essay
Neurons

When neurons are at rest, they have a negative electrical charge. When an excitatory message is received from another neuron, the neuron becomes more positive. As the charge reaches a critical level of positivity, an action potential occurs and the electrical message travels along the neuron's axon. Once the message passes any point of the axon, that section becomes negatively charged once again, and the neuron is unable to fire again immediately. When a nerve impulse reaches the end of the axon, the terminal buttons on the ends of the axon release neurotransmitters into the synapse. Dendrites of nearby neurons receive messages from the neurotransmitters that "fit" onto their particular receptor sites. If the concentration of excitatory neurotransmitters that have been received is higher, then the neuron fires. If the concentration of inhibitory neurotransmitters that have been received is higher, then the neuron will not fire.

162) Essay



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Structures of the Brain and Their Functions

One way researchers have learned more about the brain is by studying the effects of brain lesions or brain damage. By examining the person or animal that has the lesion, researchers get a sense of the function of the part of the brain that was damaged. Electroencephalograph (EEG) involves recording the brain's electrical activity. Researchers also might use one of several brain-imaging techniques. Computerized axial tomography (CAT scan or CT scan) involves the use of X-rays to produce a composite three-dimensional image and can provide information about the location and extent of brain damage. Positron-emission tomography (PET scan) is another brain-imaging technique that is based on metabolic (glucose) changes related to brain activity. Magnetic resonance imaging (MRI) involves creating a magnetic field around a person's body and using radio waves to construct images of the person's tissues and biochemical activities. MRI scans provide valuable information about the structure of the brain and can allow researchers to see if and how experiences affect brain structure. Although MRI scans can reveal considerable information about brain structure, they cannot portray brain function. A new method known as functional magnetic resonance imaging (fMRI) allows scientists to see what is happening in the brain while it is working. The fMRI charts track changes in blood oxygen that occur in association with brain activity.

163) Essay
Structures of the Brain and Their Functions

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The hypothalamus is a small forebrain structure that monitors three pleasurable activities—eating, drinking, and sexual behavior—as well as emotion, stress, and reward. It also regulates the body's internal state. For example, the hypothalamus works to keep the body at a constant temperature, triggering perspiration when the body is hot and shivering when the body is cold. The cerebellum extends from the rear of the hindbrain, just above the medulla. It consists of two rounded structures thought to play important roles in motor coordination. Damage to the cerebellum impairs the performance of coordinated movements. When this damage occurs, people's movements become awkward and jerky. Extensive damage to the cerebellum makes it impossible even to stand up. The reticular formation is a diffuse collection of neurons involved in stereotyped patterns of behavior such as walking, sleeping, and turning to attend to a sudden noise.

164) Essay
Structures of the Brain and Their Functions

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The right hemisphere receives information only from the left side of the body, and the left hemisphere receives information only from the right side of the body. When you hold an object in your left hand, for example, only the right hemisphere of your brain detects the object. When you hold an object in your right hand, only the left hemisphere of the brain detects it. The most extensive research on the brain's two hemispheres has focused on language. Speech and grammar are localized to the left hemisphere. Although it is a common misconception that all language processing occurs in the left hemisphere, much language processing and production does come from this hemisphere. The right hemisphere dominates in processing nonverbal information such as spatial perception, visual recognition, and emotion.

165) Essay
The Endocrine System

Neuroscientists have discovered that the nervous system and endocrine system are intricately interconnected. Both systems work together to control the body's activities. However, the nervous system and endocrine system do differ in a variety of ways. First, the parts of the endocrine system are not all connected in the way that the parts of the nervous system are. Second, the endocrine system communicates via hormones, whereas the nervous system communicates via electrical impulses and neurotransmitters. Hormones are released in the bloodstream and are transported throughout the body by the circulatory system. Thus, hormones move much more slowly than the neural impulses in the nervous system.

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166) Essay
The Endocrine System

The endocrine system consists of a set of glands that regulate the activities of certain organs by releasing hormones (chemical substances) into the bloodstream. The pituitary gland regulates growth and its anterior part is known as the "master gland" because almost all of its hormones direct the activity of target glands elsewhere. Adrenal glands are located at the top of each kidney. They secrete epinephrine and norepinephrine and play an important role in regulating mood, energy level, and the ability to cope with stress. The pancreas, which is located under the stomach, performs both digestive and endocrine functions. The pancreas produces insulin, which is a hormone that controls glucose levels in the body and is related to metabolism, body weight, and obesity. The ovaries and testes are the sex-related endocrine glands that produce hormones related to sexual development and reproduction.

167) Essay
Brain Damage, Plasticity, and Repair

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There are three ways that brain repair might take place:
In collateral sprouting, the axons of some healthy neurons adjacent to damaged cells grow new branches. In substitution of function, the damaged region's function is taken over by another area or areas of the brain. Neurogenesis is the process by which new neurons are generated. Researchers have found that neurogenesis occurs in mammals such as mice. It is now accepted that neurogenesis can occur in humans.

168) Essay
Genetics and Behavior

A genotype is one's genetic heritage, the actual genetic material that determines characteristics. A phenotype is one's observable characteristics. The phenotype is influenced by the genotype but also by environmental factors. The activity of genes (genetic expression) is affected by their environment. For example, hormones that circulate in the blood make their way into the cell where they can turn genes on and off. The flow of hormones, too, can be affected by environmental conditions, such as light, day length, nutrition, and behavior.

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# Chapter 2
# The Brain and Behavior

## Chapter Overview

### 1. The Nervous System

The **nervous system** is the body's electrochemical communication circuitry. Four important characteristics of the brain and nervous system are complexity, integration, adaptability, and electrochemical transmission. The brain's special ability to adapt and change is called plasticity.

Decision making in the nervous system occurs in specialized pathways of nerve cells. Three of these pathways involve sensory input, motor output, and neural networks.

The nervous system is divided into two main parts: central (CNS) and peripheral (PNS). The CNS consists of the brain and spinal cord. The PNS has two major divisions: somatic and autonomic. The autonomic nervous system consists of two main divisions: sympathetic and parasympathetic. In particular, the sympathetic nervous system is involved in the experience of stress.
*Neuroscience* is the field of study of the nervous system. The researchers who conduct research on the nervous system are *neuroscientists*.

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#### A. Characteristics of the Nervous System

Several characteristics allow the nervous system to direct behavior. These characteristics include: (1) complexity, (2) integration, (3) adaptability, and (4) electro-chemical transmission.

Complexity
The brain is made up of billions of nerve cells, the orchestration of which allows a person to carry out a variety of activities.

Integration
The brain integrates information from the environment, so that people can function in the world. Each nerve cell in the brain communicates with thousands of other nerve cells.

Adaptability
As the world constantly changes, the brain and nervous system allow a person to adjust to those changes. The brain has a lot of **plasticity,** meaning it has a vast capacity for modification and change.



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Electrochemical Transmission
Electrical impulses and chemical messenger systems allow the brain and nervous system to work as an information-processing system.

**B. Pathways in the Nervous System**

As people interact with and adapt to the world around them, the brain and nervous system receive and transmit incoming sensory information. The brain and nervous system integrate this information and direct the body's motor activities. **Afferent nerves** carry information to the brain and spinal cord. **Efferent nerves** carry information from the brain out to the body. **Neural networks,** made up of nerve cells, integrate sensory input and motor output.

**C. Divisions of the Nervous System**

The **central nervous system (CNS)** is comprised of the brain and spinal cord. The **peripheral nervous system (PNS)** consists of the nerves that connect the brain and spinal cord to other parts of the body. The function of the PNS is to direct information to and from the brain and spinal cord. It also carries out the commands of the CNS. The PNS is comprised of the **somatic nervous system** and the **autonomic nervous system.** The function of the somatic nervous system is to convey information from the skin and muscles to the CNS. It regulates information such as signals about pain and temperature. The autonomic nervous system's function is to take messages to and from the body's internal organs, thus regulating breathing, heart rate, and digestion. The autonomic nervous system is comprised of both the **sympathetic nervous system** and the **parasympathetic nervous system.** The sympathetic nervous system prepares a person for a stressful situation; the parasympathetic nervous system calms the body down after the stressful situation. **Stress** is the response of individuals to **stressors**: circumstances or events that threaten an individual's well-being.

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When a person experiences stress, physiological changes take place, such as sweating and an elevated heartbeat. Exposure to a stressful situation activates the sympathetic nervous system (the fight or flight response). *Acute stress*, the momentary stress response, ends with the cessation of the stressful event. *Chronic stress* is stress that occurs continuously. In this type of stress, the nervous system sends out *corticosteroids* (stress hormones) that can wear down the immune system.

## 2. Neurons

**Neurons** are the nerve cells that control the information-processing function. *Mirror neurons* play a role in imitation. They are activated when we perform an action or observe others in action. These neurons may play a role in empathy and understanding others. **Glial cells** provide support and nutrition to the nervous system.



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### A. Specialized Cell Structures

Not all neurons are alike, but they all have a cell body, dendrites, and an axon. The **cell body** contains the nucleus that manufactures what neurons need for growth and maintenance. **Dendrites** receive information and send it on to the cell body. The **axon** carries information away from the cell body and on to other cells. A **myelin sheath,** which encases and insulates most axons, is semipermeable, meaning that certain substances can pass into and out of the axon. The degenerative nerve disorder called multiple sclerosis occurs when there is a breakdown of the myelin sheath.

### B. The Neural Impulse

The axon is a tube encased in a membrane. The membrane has hundreds and thousands of tiny gates in it. The membrane is *semipermeable* because fluids can sometimes flow in and out of these gates. Floating in those fluids are electrically charged particles called *ions.* The positive ions are sodium and potassium. The negative ions are chlorine and other elements. In order for a neuron to send information to another neuron, the source neuron first sends an electrical charge. Inside the membrane of the axon are gated pathways known as *ion channels*. These channels open and close, allowing the positive and negative ions to cross into and out of the axon. When a neuron is at rest and not transmitting information, the ion channels are closed and there is a negative charge on the inside of the axon and a positive charge on the outside of it. The stable, negative charge of an inactive neuron is called its **resting potential**. When an electrical impulse flows down the axon, it becomes *depolarized.* The channels open, and the positive ions move into the axon and the negative ions move outside the axon. Then the potassium channels open, and the positive ions move back out and return the axon to its normal charge. The term **action potential** describes the brief wave of positive electrical charge that sweeps down the axon. The **all-or-nothing principle** refers to the situation that occurs when an electrical impulse reaches a certain level of intensity called its *threshold*; it fires and moves all the way down the axon, without losing any of its intensity.

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### C. Synapses and Neurotransmitters

Synaptic Transmission

**Synapses** are the tiny spaces between neurons. The space between one neuron and the dendrites of another neuron is called the *synaptic gap*. At the end of the axon are fibers that end in what are called *terminal buttons*. **Neurotransmitters** are stored in the terminal buttons. These chemical substances carry electrical information across the synaptic gap.

Neurochemical Messengers

There are a variety of neurotransmitters. Each plays a different role and has its own function. Some neurotransmitters excite the neuron and cause it to fire, whereas other neurotransmitters inhibit the neuron. Some neurotransmitters are both excitatory *and* inhibitory. After the neurotransmitter crosses over the synaptic gap, it gets picked up by a receiving neuron. Most neurons pick up and secrete only one type of neurotransmitter.



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*Acetylcholine* sets the firing of neurons into motion and is involved in muscle action, learning, and memory. *GABA* keeps many neurons from firing. Low levels of GABA are linked with anxiety. *Glutamate* has a key role in exciting many neurons to fire and is involved in learning and memory. *Norepinephrine* inhibits the firing of neurons in the CNS, but it excites the heart muscle, intestines, and urogenital tract. Stress stimulates the release of norepinephrine. *Dopamine* helps to control voluntary movement and affects sleep, mood, attention, learning, and the ability to recognize rewards. Low levels of dopamine are associated with Parkinson's disease. *Serotonin* is involved in sleep regulation, mood attention, and learning. *Endorphins* stimulate neuron firing. Endorphins alleviate pain and elevate feelings of pleasure. *Oxytocin* plays a role in the feelings of love and social bonding.

Drugs and Neurotransmitters

A drug that mimics or increases a neurotransmitter's effects is known as an **agonist**. A drug that blocks a neurotransmitter's effect is known as an **antagonist**.

**D. Neural Networks**

Neural networks can be altered through changes in synaptic connections. How strongly neurons are connected determines how well a person remembers information.

## 3. Structures of the Brain and Their Function

Neuron networks are not visible to the human eye; however, technology has helped neuroscientists form pictures of the structures of the neurons and the brain.

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**A. How Researchers Study the Brain and Nervous System**

Much of the brain imaging available today has been developed from studies on patients with brain damage or injury from disease.

Brain Lesioning

Brain lesions can be the result of injury or disease. Neuroscientists sometimes create lesions in the brains of nonhuman animals to see the effect on the animal's behavior. Brain lesions can be made by removing brain tissue, destroying tissue with a laser, or eliminating tissue by injection with a drug.

Electrical Recording

The *electroencephalograph (EEG)* records the electrical activity in the brain. When electrodes are placed on a person's scalp, they detect brain-wave activity, which is recorded on a chart. The EEG is used to assess brain damage, epilepsy, and other problems. *Single-unit recording* is used when a probe is inserted in or near an individual neuron. The probe transmits the electrical activity to an amplifier so that researchers can see the activity.



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Brain Imaging

A *computerized axial tomography* (*CAT scan* or *CT scan*) produces a three-dimensional image obtained from X-rays of the head. A *positron emission tomography* scan, or *PET scan*, measures the amount of glucose in various areas of the brain and then sends this information to a computer, where it is analyzed. A *magnetic resonance image (MRI)* creates a magnetic field around a person's body and uses radio waves to construct images of the person's tissue and biochemical activities. A newer method of the MRI is the *functional magnetic resonance image (fMRI)*, which allows researchers to see what is happening in the brain while it is working. An additional method for studying brain functioning, and one that does allow for causal inferences, is *transcranial magnetic stimulation (TMS).* In the TMS procedure, magnetic coils are placed over the person's head and directed at a particular brain area. TMS uses a rapidly changing magnetic field to induce brief electric current pulses in the brain, and these pulses trigger action potentials in neurons. Immediately following this burst of action potentials, activity in the targeted brain area is inhibited, causing what is known as a *virtual lesion*.

**B. How the Brain Is Organized**

The nervous system starts out in a human embryo as a long, hollow tube. Then, three weeks after conception, cells making up the tube start to differentiate into neurons. These neurons begin to develop into the three major parts of the brain: the hindbrain, the midbrain, and the forebrain.

The Hindbrain

The **hindbrain** is the lowest portion of the brain. The *medulla* helps in controlling breathing and heart rate. It also regulates our reflexes. The *cerebellum* plays an important role in motor coordination. For example, it controls leg and arm movements. The *pons* is involved in sleep and arousal. The **brain stem** (the oldest part of the brain) includes much of the hindbrain except the cerebellum and the midbrain. The brain stem determines alertness and regulates such basic survival functions as breathing, heart rate, and blood pressure.

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The Midbrain

The **midbrain** is located between the hindbrain and the forebrain. The midbrain communicates information between the brain and the eyes and ears. The **reticular formation** is involved in walking, sleeping, or turning to attend to a sudden noise. It uses the neurotransmitters serotonin, dopamine, and norepinephrine.

The Forebrain

The **forebrain** is the brain's largest division and its most forward part. The most important structures are the (1) limbic system, (2) thalamus, (3) basal ganglia, (4) hypothalamus, and (5) cerebral cortex.

Limbic System

The **limbic system** is important in both memory, emotion, and reward processing. The **amygdala** is a center involved in the discrimination of objects necessary for the organism's survival. It fires selectively at the sight of appropriate food, mates, and social rivals. The amygdala is also involved in emotional



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awareness and expression. The **hippocampus** is involved in the formation and storage of memories. People who have hippocampus damage cannot retain new memories after the damage.

Thalamus

An important function of the **thalamus** is to sort through information and send it to the appropriate place in the forebrain for further integration and interpretation.

Basal Ganglia

The **basal ganglia** work with the cerebellum and the cerebral cortex in coordinating voluntary movements.

Hypothalamus

The **hypothalamus** monitors eating, drinking, and sexual behavior, along with emotion, stress, and reward.

**C. The Cerebral Cortex**

The **cerebral cortex,** the outer layer of the brain, controls some of the highest mental functions, such as thinking and planning. The **neocortex**, the outermost part of the brain, makes up 80 percent of the cerebral cortex.

Lobes

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The lobes are divided into two *hemispheres*. Each hemisphere is divided into four lobes: the occipital lobe, the temporal lobe, the frontal lobe, and the parietal lobe. The **occipital lobes**, in the back of the head, respond to visual stimuli. The **temporal lobes**, in the cerebral cortex just above the ears, are involved in hearing, language processing, and memory. The **frontal lobes**, behind the forehead, are involved in the control of voluntary muscles, intelligence, and personality. A fascinating case study illustrating how damage to the frontal lobes can significantly alter personality is the story of Phineas Gage, a 19th-century railroad worker. During an accident, an iron rod went through his face, up into his brain, and damaged his frontal lobe. After the accident, Gage's personality changed dramatically. He became obstinate, moody, irresponsible, selfish, and incapable of taking part in planned activities. The **prefrontal cortex**, an important part of the frontal lobes, is at the front of the motor cortex. It is involved in higher cognitive functions such as planning, reasoning, and self-control. The **parietal lobes**, at the top and toward the rear of the head, involve registering spatial location, attention, and motor control. It is important to note that no two brains are exactly alike and the function of each of the lobes may differ slightly across individuals.

Somatosensory Cortex and Motor Cortex

The **somatosensory cortex** processes information about body sensations. The **motor cortex** processes information about voluntary movements. The somatosensory and motor areas are associated with different parts of the body. When Wilder Penfield conducted research on the somatosensory and motor areas, he found that when he stimulated certain somatosensory and motor areas of the brain, a certain part of the body would move.



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Association Cortex

Making up 75 percent of the cerebral cortex, the **association cortex** processes information about sensory input and motor output. The association cortex is involved in thinking and problem-solving.

**D. The Cerebral Hemispheres and Split-Brain Research**

*Aphasia* is a language disorder associated with brain damage. Damage to *Broca's area* causes a person to have difficulty in speaking a language. Damage to *Wernicke's area* causes problems in comprehending language.

The Role of the Corpus Callosum

The **corpus callosum** is a large bundle of axons that connects the left and right hemispheres of the brain and is responsible for relaying information between the two sides. If the corpus callosum is severed, the two hemispheres cannot communicate with each other.

Hemispheric Differences in Functioning

In people with intact brains, specialization of function, or what is sometimes called *lateralization,* occurs in some areas. The *left hemisphere* is where speech and grammar are localized. The *right hemisphere* dominates in processing nonverbal information such as spatial perception, visual recognition, and emotion. The right hemisphere also may be more involved than the left hemisphere in processing information about emotions, both when we express emotions ourselves and when we recognize others' emotions. It is also adept at interpreting story meanings and voice intonations.

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**E. Integration of Function in the Brain**

There is considerable integration of function between different areas in the brain. When information, or stimuli, is noticed, the information gets sent to the correct area of the brain, where it is processed, and then sent out of the brain to the correct area in the body. Along the way, from the beginning to the end, the information goes through various areas of the brain and all the areas work together to have the information processed.

## 4. The Endocrine System

The **endocrine system** consists of glands that regulate certain organs by releasing their chemical products into the bloodstream. **Glands** are organs or tissues in the body that create chemicals that control many bodily functions. **Hormones** are chemical messengers that are manufactured by the endocrine system and are carried by the bloodstream throughout the body. The **pituitary gland** controls growth and regulates other glands. The **adrenal glands** are involved in regulating mood, energy level, and the ability to cope with stress. The adrenal glands secrete both epinephrine and norepinephrine. The **pancreas** is involved in the digestive and endocrine functions. It secretes insulin, which controls blood sugar, which itself is implicated in metabolism, weight, and obesity. The **ovaries** and **testes** are involved in sexual development and reproduction.



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## 5. Brain Damage, Plasticity, and Repair

Research has been conducted on patients with brain damage to determine how well the brain can repair itself. Recovery from brain damage depends on the age of the individual, the extent of the damage, the area of the brain affected, and the unique characteristics of the person.

### A. The Brain's Plasticity and Capacity for Repair

Although the young child's brain has more plasticity than an older child's, because of its immaturity, it also is more vulnerable to insults. Much of the brain's ability to repair itself depends on whether the neurons in the damaged area have been completely destroyed. If these neurons were not totally destroyed, brain function may be restored over time.

*Collateral sprouting* is one way in which the brain can repair itself. In this process, some healthy axons on adjacent neurons grow new branches. *Substitution of function* is a second way the brain can repair itself. When this happens, another area in the brain takes over the functions of the damaged area or areas. *Neurogenesis* is the process through which new neurons are generated. Research suggests that neurogenesis in humans can occur in the hippocampus, the area involved in memory. In other mammals, neurogenesis has been found in the olfactory bulb, responsible for sense of smell.

### B. Brain Tissue Implants

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*Brain grafts* are implants of healthy tissue into damaged brains. The most successful cases of brain grafts occur when the tissue for the implants comes from the fetal stage. The use of **stem cells** has been hotly debated in recent years. Stem cells are unique because they have the ability to develop into most types of human cells.

## 6. Genetics and Behavior

### A. Chromosomes, Genes, and DNA

The nucleus of each cell contains 46 **chromosomes**, which are essentially 23 pairs of chromosomes with one of each pair coming from each parent. Chromosomes contain **deoxyribonucleic acid**, or **DNA**. DNA is the molecule that carries a person's genetic information. **Genes** are the segments of chromosomes that are composed of DNA. Genes carry the heredity information of the individual. *Genome* refers to an organism's complete genetic material.

### B. The Study of Genetics

Gregor Mendel, an Austrian monk, started the research on genetics in the mid-19th century when he studied heredity in pea plants. The **dominant-recessive genes principle** refers to the principle that if one



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gene of a pair is dominant and one is recessive, the dominant gene overrides the recessive gene. A recessive gene exerts its influence only if both genes of a pair are recessive.

Molecular Genetics

*Molecular genetics* involves the manipulation of genes.

Selective Breeding

*Selective breeding* occurs when organisms are chosen for reproduction based on how much of a particular trait they display.

Genome-Wide Association Method

The *genome-wide association method* is used to identify genetic variations linked to particular diseases.

Behavior Genetics

*Behavior genetics* is the study of the degree and nature of heredity's influence on behavior. In twin studies, behavior genetics studies the extent to which individuals are shaped by their heredity and the influence of the environment on them. The behavioral similarity of identical twins is compared to the behavioral similarity of fraternal twins.

**C. Genes and the Environment**

A **genotype** is a person's genetic heritage—their actual genetic material. A **phenotype** is a person's observable characteristics—both physical and psychological characteristics. The phenotype is influenced by the genotype but also by environmental factors. Gene × environment (G × E) interactions suggests that even if people share genetic similarities, they are still likely to be different. Environmental experiences in a person's life will influence the expression (or not) of a particular gene.

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## Chapter Features and Activities

Intersection: Neuroscience and Language: What Is a Word to a Dog?

Psychological Inquiry: The Brain in Different Species

Psychology in Our World: Protecting the Athlete's Brain

Do It! The Happiness Gene

Psychological Inquiry: Identical Twins

Challenge Your Thinking: How Should We Think About Genes and Behavior?



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## Key Terms

**action potential** The brief wave of positive electrical charge that sweeps down the axon.

**adrenal glands** Glands at the top of each kidney that are responsible for regulating moods, energy level, and the ability to cope with stress.

**afferent nerves** Also called sensory nerves; nerves that carry information about the external environment to the brain and spinal cord via sensory receptors.

**agonist** A drug that mimics or increases a neurotransmitter's effects.

**all-or-nothing principle** The principle that once the electrical impulse reaches a certain level of intensity (its threshold), it fires and moves all the way down the axon without losing any intensity.

**amygdala** An almond-shaped structure within the base of the temporal lobe that is involved in the discrimination of objects that are necessary for the organism's survival, such as appropriate food, mates, and social rivals.

**antagonist** A drug that blocks a neurotransmitter's effects.

**association cortex** Sometimes called association areas, the region of the cerebral cortex that is the site of the highest intellectual functions, such as thinking and problem-solving.

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**autonomic nervous system** The body system that takes messages to and from the body's internal organs, monitoring such processes as breathing, heart rate, and digestion.

**axon** The part of the neuron that carries information away from the cell body toward other cells.

**basal ganglia** Large neuron clusters located above the thalamus and under the cerebral cortex that work with the cerebellum and the cerebral cortex to control and coordinate voluntary movements.

**brain stem** The stemlike brain area that includes much of the hindbrain (excluding the cerebellum) and the midbrain; connects with the spinal cord at its lower end and then extends upward to encase the reticular formation in the midbrain.

**cell body** The part of the neuron that contains the nucleus, which directs the manufacture of substances that the neuron needs for growth and maintenance.

**central nervous system (CNS)** The brain and spinal cord.



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**cerebral cortex** Part of the forebrain, the outer layer of the brain, responsible for the most complex mental functions such as thinking and planning.

**chromosomes** In the human cell, threadlike structures that come in 23 pairs, one member of each pair originating from each parent, and that contain DNA.

**corpus callosum** The large bundle of axons that connects the brain's two hemispheres, responsible for relaying information between the two sides.

**dendrites** Treelike fibers projecting from a neuron, which receive information and orient it toward the neuron's cell body.

**deoxyribonucleic acid (DNA)** A complex molecule in the cell's chromosomes that carries genetic information.

**dominant-recessive genes principle** The principle that if one gene of a pair is dominant and one is recessive, the dominant gene overrides the recessive gene. A recessive gene exerts its influence only if both genes of a pair are recessive.

**efferent nerves** Also called motor nerves; nerves that carry information out of the brain and spinal cord to other areas of the body.

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**endocrine system** The body system consisting of a set of glands that regulate the activities of certain organs by releasing their chemical products into the bloodstream.

**forebrain** The brain's largest division and its most forward part.

**frontal lobes** The portion of the cerebral cortex behind the forehead, involved in personality, intelligence, and the control of voluntary muscles.

**gene × environment (g × e) interaction** The interaction of a specific measured variation in DNA and a specific measured aspect of the environment.

**genes** The units of hereditary information, consisting of short segments of chromosomes composed of DNA.

**genotype** An individual's genetic heritage; their actual genetic material.

**glands** Organs or tissues in the body that create chemicals that control many bodily functions.

**glial cells** The second of two types of cells in the nervous system; glial cells (also called glia) provide support, nutritional benefits, and other functions and keep neurons running smoothly.



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**hindbrain** Located at the skull's rear, the lowest portion of the brain, consisting of the medulla, cerebellum, and pons.

**hippocampus** The structure in the limbic system that has a special role in the storage of memories.

**hormones** Chemical messengers that are produced by the endocrine glands and carried by the bloodstream to all parts of the body.

**hypothalamus** A small forebrain structure, located just below the thalamus, that monitors three pleasurable activities—eating, drinking, and sex—as well as emotion, stress, and reward.

**limbic system** A set of subcortical brain structures central to emotion, memory, and reward processing.

**midbrain** Located between the hindbrain and forebrain, an area in which many nerve-fiber systems ascend and descend to connect the higher and lower portions of the brain; in particular, the midbrain relays information between the brain and the eyes and ears.

**motor cortex** A region in the cerebral cortex, located just behind the frontal lobes, that processes information about voluntary movement.

**myelin sheath** A layer of fat cells that encases and insulates most axons.

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**neocortex** The outermost part of the cerebral cortex, making up 80 percent of the human brain's cortex.

**nervous system** The body's electrochemical communication circuitry.

**neural networks** Networks of nerve cells that integrate sensory input and motor output.

**neurons** One of two types of cells in the nervous system; neurons are the nerve cells that handle the information-processing function.

**neurotransmitters** Chemical substances that are stored in very tiny sacs within the neuron's terminal buttons and involved in transmitting information across a synaptic gap to the next neuron.

**occipital lobes** Structures located at the back of the head that respond to visual stimuli.

**ovaries** Sex-related endocrine glands that produce hormones involved in sexual development and reproduction.

**pancreas** A dual-purpose gland under the stomach that performs both digestive and endocrine functions.

**parasympathetic nervous system** The part of the autonomic nervous system that calms the body.



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**parietal lobes** Structures at the top and toward the rear of the head that are involved in registering spatial location, attention, and motor control.

**peripheral nervous system (PNS)** The network of nerves that connects the brain and spinal cord to other parts of the body.

**phenotype** An individual's observable characteristics.

**pituitary gland** A pea-sized gland just beneath the hypothalamus that controls growth and regulates other glands.

**plasticity** The brain's special capacity for change.

**prefrontal cortex** An important part of the frontal lobes that is involved in higher cognitive functions such as planning, reasoning, and self-control.

**resting potential** The stable, negative charge of an inactive neuron.

**reticular formation** A system in the midbrain comprising a diffuse collection of neurons involved in stereotyped patterns of behavior such as walking, sleeping, and turning to attend to a sudden noise.

**risk factor** Characteristics, experiences, or exposures that increase the likelihood of a person developing a disorder or disease.

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**somatic nervous system** The body system consisting of the sensory nerves, whose function is to convey information from the skin and muscles to the central nervous system about conditions such as pain and temperature, and the motor nerves, whose function is to tell muscles what to do.

**somatosensory cortex** A region in the cerebral cortex that processes information about body sensations, located at the front of the parietal lobes.

**stem cells** Unique primitive cells that have the capacity to develop into most types of human cells.

**stress** The responses of individuals to environmental stressors.

**stressors** Circumstances and events that threaten individuals and tax their coping abilities and that cause physiological changes to ready the body to handle the assault of stress.

**sympathetic nervous system** The part of the autonomic nervous system that arouses the body to mobilize it for action and thus is involved in the experience of stress.

**synapses** Tiny spaces between neurons; the gaps between neurons are referred to as synaptic gaps.



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**temporal lobes** Structures in the cerebral cortex that are located just above the ears and are involved in hearing, language processing, and memory.

**testes** Sex-related endocrine glands in the scrotum that produce hormones involved in sexual development and reproduction.

**thalamus** The forebrain structure that sits at the top of the brain stem in the brain's central core and serves as an important relay station.

## Connect

The following are assignable via Connect:

| Practice Quizzes | Concept Clips | Interactivities |
|---|---|---|
| • Pretest<br>• Reading Assignment quizzes (one per major chapter section)<br>• Posttest<br>• Terminology Quiz | • Nervous System<br>• How Neurons Work<br>• Mirror Neurons<br>• Brain Structures and Functions<br>• The Forebrain<br>• The Midbrain<br>• The Hindbrain<br>• The Four Lobes | • Neurons<br>• The Structure of Neurons<br>• Brain Activity and Communication |
| Videos | Labeling/Classification Exercises | **Course-Wide Content** |
| | • Sympathetic and Parasympathetic Nervous System<br>• The Neuron<br>• Lobes of the Brain<br>• Functional Regions Within the Lobes<br>• Structure of the Brain<br>• Functions of the Brain<br>• The Major Endocrine Glands | • Psychology at Work Videos<br>• Psychology NewsFlash<br>• McGraw Hill Psychology APA Documentation Guide<br>• Scientific Reasoning Exercises<br>• Power of Process Readings (from main assignment page) |

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## Lecture Ideas

**Importance of Biological Psychology.** Students often do not initially understand why they have to learn so much biology. To introduce them to the topic of biological psychology, ask them why we need to study biology in a psychology course. Ask them how biology affects behavior and cognition.

### Parts of the Neuron

**The Neuron and the Synapse.** Students should be able to identify the various parts of the neuron and the synapse, and be able to explain how information is communicated between neurons.

### Helpful Hints for Students: Neurons

Here are some ways to make it easier for students to remember the parts of the neuron. Students will groan, but these hints will come in handy!

- Dendrites: These structures resemble the branches of a tree (the word *tree* can be made out of *dendrite*).
- Axon: The length of this structure can vary greatly; although most are several millimeters in length, some can be as long as 3 feet (as a hint, tell students that an "ax" can be used to cut a "tree branch"—i.e., dendrite).
- Cell body: This structure is similar to parts of all other cells in the body (i.e., *cells* in *body*).
- Terminal buttons: These are small bulges that actually look like buttons (i.e., *buttons* that are *terminal*).
- Myelin sheath: This is a protective coating of fat and protein (like a dress, which is also a *sheath*). The thicker it is, the faster the speed of transmission down the axon.

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**All-or-None Law:** Discuss the implications of the all-or-none law: Intense stimuli do not result in higher peaks but more frequent impulses. It is especially important to point out the significance of the fact that the synapse is not a hardwired connection between neurons. This means that neurons can be more flexible, but it also means that more can "go wrong" in the nervous system, such as if there is too much neurotransmitter present in the synapse (as is the case when cocaine stimulates dopamine receptors), too little (as is the case with dopamine in Parkinson disease), or too much activity of reuptake enzymes (as is the case with serotonin and psychological disorders such as depression and anxiety). Emphasize the importance of the receptor sites on the postsynaptic surface. Talk about the variety of neurotransmitters and the functions they serve in the nervous system, and the fact that some neurotransmitters can have different effects (excitatory vs. inhibitory), depending on the area of the nervous system in which they are acting.

**The Resting Potential and the Action Potential:** Students should be able to describe how ions maintain a resting potential and how a change in the charge of the ion can cause action potential.



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**Reuptake:** Many drugs used to treat depression directly affect reuptake to allow some neurotransmitters that affect mood to stay in the synapse longer. *Discussion:* Here is a great link to a description of how Zoloft/Sertraline works. It involves a simplified description of reuptake that students will respond to: www.youtube.com/watch?v=quBrrh5m17M.

**DNA and the Brain:** Glutamate doesn't function properly in people with schizophrenia, and so they become confused. Restoring glutamate function is the focus of new treatments for schizophrenia. *Discussion:* James Watson, of DNA discovery fame, discusses brain disorders such as schizophrenia, Alzheimer disease, and depression in the *DNA and the Brain* interview: www.youtube.com/watch?v=Z6ZfrXHgiVY (1:15:13). Note that the sound does not start until the seventh minute.

**H. M. and the Role of the Hippocampus:** Psychologists learned how essential the hippocampus is in memory and learning through a case study of Henry Molaison (H. M.), who had this structure surgically removed on both sides of the brain. *Discussion:* A National Public Radio broadcast of the story of H. M. and the history of memory: www.npr.org/templates/story/story.php?storyId=7584970.

**Central and Peripheral Nervous Systems:** The major divisions of the human nervous system, the central and peripheral, are to be indicated with a pictorial depiction that also describes the bodily functions that each part controls. The students could be asked to identify each part of both the nervous systems.

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## Helpful Hints for Students: Nervous System

Here are some hints to give students to help them remember the terms:

- *Autonomic nervous system*: Think of "automatic." This part of the nervous system controls actions that we do not think about and that happen without our control.
- *Sympathetic nervous system*: Think of "sympathetic." When we get emotional ("sympathetic"), we experience arousal and stimulation, exactly the actions of this part of the autonomic nervous system.
- *Parasympathetic nervous system*: Think of "pear." When your parasympathetic nervous system is aroused, you can eat food, such as a pear.
- *Somatic nervous system*: *Soma* means "body." The somatic nervous system is the "bodily" nervous system, meaning that it translates information received through the bodily senses and gives instructions to the muscles and glands (a long explanation, but if they remember "body," it will help them to remember the term).

## Negative Feedback in the Endocrine System

Describe the process of hormone secretion in terms of a negative feedback loop. The hypothalamus-pituitary axis regulates hormone production in the other glands in the endocrine system when blood levels of a hormone become too low or when the hypothalamus is triggered to release a hormone that in turn



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will increase the production of hormones by other glands. The pancreas operates on a separate dimension that regulates glucose metabolism.

## Hormonal Supplements

Ask students what they think of hormonal supplements such as steroids for body builders and athletes (many recent examples of this, unfortunately!) and estrogen for women going through the menopause. Some aging baby boomers are turning to growth hormones as the key to maintaining their youthful vitality. However, all of these strategies carry risks. Are the dangers of steroid replacement and supplement worth possible harmful effects?

## Structures of the brain

The following table provides a succinct description of each key brain structure discussed in the chapter:

| | |
|---|---|
| Medulla | Controls critical body functions, including breathing and heartbeat. |
| Pons | Transmits motor information. Coordinates muscles and integrates movement between the right and left halves of the body. Involved in the control of sleep. |
| Cerebellum | Helps maintain balance by monitoring feedback from the muscles to coordinate their placement, movement, and tension. Also involved in some cognitive functions. |
| Reticular formation | Activates other parts of the brain to produce general bodily arousal. During sleep, filters out background stimuli. |
| Thalamus | Relay station for information concerning the senses. Integrates information from higher parts of the brain to send to the cerebellum and medulla. |
| Hypothalamus | Maintains a steady internal environment for the body. Produces and regulates behavior critical to the survival of the species, such as eating, self-protection, and sex. |
| Limbic system (amygdala, hippocampus, fornix) | Serves basic functions relating to emotions and self-preservation, such as eating, aggression, and reproduction. Plays an important role in learning and memory. |
| Visual cortex | Raw sensory input of images from the eyes is received in this area of the brain and transformed into meaningful stimuli. |
| Primary auditory cortex | Responsible for the sense of hearing. Stimulation of this area results in the experience of sounds such as clicks or hums. |
| Primary somatic sensory cortex | Specific locations associated with the ability to perceive touch and pressure in a particular area of the body. |
| Primary motor cortex | Responsible for the body's voluntary movement. |



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| | |
|---|---|
| Broca's area | Responsible for production of speech. |
| Wernicke's area | Responsible for comprehension of speech. |
| Frontal lobe | Responsible for planning and judgment. |

## Helpful Hints for Students: The Brain

Here are some hints to give students to help them remember the terms (spoiler alert: the puns here are really bad—but effective!):

- *Medulla*: Without breathing, you would be very "dull."
- *Pons*: Pond's hand cream is something you put on your hands, and it could help your muscles move.
- *Cerebellum*: You need this for balance—cere-bal-(ance)-um.
- *Reticular formation*: Like a military formation, it sends messages up and down within the brain.
- *Thalamus*: You would throw a ball during a relay race. The thalamus is a relay station.
- *Hypothalamus*: Sounds like *homeostasis*, the state of stability in the body's internal environment.
- *Limbic system*: When you dance the limbo, you feel happy (emotion function), and later you remember having a good time (memory function).
- *Hippocampus*: You would remember if you saw a hippo while you were camping out in the woods.
- *Broca's area*: Think of Tom Brokaw, the newscaster. Without speech, he would not be able to announce the news.
- *Wernicke's area*: Not Broca's area.

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## Background on Split Brain

Go to: www.macalester.edu/projects/UBNRP/Split_Brain/Split_Brain_Consciousness.html, which documents various aspects of the split-brain phenomenon, including procedures for testing patients with split brains.

## The Brain's EEG Response to Language

Learning a language is an important milestone for a baby. It can change the baby's world and the baby's brain. Psychologists have learned that people who do not hear certain sounds when they are young have problems learning to tell the difference between them. For example, many Japanese speakers cannot tell apart the American English R and L, which are not used in the Japanese language. Buchwald et al. (1994) decided to see if there was a physical difference in the way that the brains of native Japanese and Americans react to the sounds of R and L. The researchers took electroencephalogram (EEG) recordings from English-speaking Japanese and American adults. The subjects listened to pairs of similar words beginning with R and L, such as *rip* and *lip*, and pairs of sounds that began with other letters, such as *ba* and *pa*. The Americans showed a strong increase in brain electrical activity 250 milliseconds after they



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heard all words; the Japanese did too, but not for R and L words. Otherwise, the EEGs looked the same. In spite of years of exposure to English, the Japanese speakers' brains still did not react to sounds that do not occur in Japanese.

## The Story of Phineas Gage

In a freak accident in 1848, an explosion drove a 3-foot-long iron bar completely through the skull of railroad worker Phineas Gage, where it remained after the accident. Amazingly, Gage survived and, despite the rod being lodged through his head, a few minutes later seemed to be fine. But he wasn't. Before the accident, Gage was hardworking and cautious. Afterward, he became irresponsible, drank heavily, and drifted from one wild scheme to another. In the words of one of his physicians, "he was 'no longer Gage.'" Students are often fascinated by the story of Phineas Gage: www.youtube.com/watch?v=yXbAMHzYGJ0.

**The Limbic System:** The limbic system is instrumental in emotional functioning. What happens when it is damaged? The text outlines the famous case of Phineas Gage, but there are more recent and scientific outlines of this issue. For example, Bauman, Lavenex, Mason, Capitanio, and Amaral (2004) lesioned different portions of the limbic system in rhesus monkeys and found that specific parts of the limbic system are involved in specific emotional and social behaviors (e.g., the amygdala is linked with avoiding potential danger). See www.mitpressjournals.org/doi/pdf/10.1162/0898929042304741 for more information.

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**Epigenetics:** What a pregnant individual does and is exposed to can change which genes get turned off in the body of the baby. This is the link to the Centers for Disease Control and Prevention's site on fetal alcohol spectrum disorders (FASDs): www.cdc.gov/ncbddd/fasd/index.html. You may also want to discuss with students how smoking, drinking, and doing drugs are ill-advised. You may want to have a representative from your school's student health center come by at some point in the semester to talk to students about safe sex and things they or their partner can do if they are pregnant to minimize negative effects on fetal development, such as quitting smoking. You may also want to stress to students that today, the general advice in the field is to avoid anything that may be teratogenic as there is no data supporting what a safe level is for many of these stimuli.

**Brain Plasticity and Neurogenesis:** If a person is not exposed to language much before mid- to late childhood, the ability to speak is limited because the brain loses some of its plasticity as we age. *Discussion:* You may want to take this opportunity to preview what's to come and talk about feral children. For example, the case of Genie, a 13-year-old California girl who was severely neglected and raised with minimal human contact, often holds students' attention. Despite the efforts of the best linguists in the field at that time, she was never able to learn to speak and had moderately developed cognitive abilities.



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## Classroom Activities

### Neuroscience

**Web-Based Learning: Neuroscience:** Go to: http://faculty.washington.edu/chudler/neurok.html. At this site, you will find a variety of authentic activities such as games and mini-experiments, along with creative ways to reinforce nervous system principles for children and students. One easy idea from this site is Nervous System Hang-Man.

### Neurons

**Designing a Neuron from Food:** Go to the local grocery store and pick up the following items: red vines licorice (axon), large marshmallows (cell body or myelin), mini M & M's (nucleus or neurotransmitters), mini-pretzel sticks (dendrites), and orange slices candy (terminal button). After lecturing on the various parts of the neuron, have the students design their own neuron with these candy and food items. Design the neurons on paper towels so once finished, students can move their neurons closer to each other without touching (simulating the synapse between neurons) and explain each part and its function. Afterward, students can eat their design and enjoy a kinesthetic approach to learning about neural structure and function. *Note:* Instructors can substitute any type of food items or candy that produces the same concept (e.g., Runt's Candy, with its different shapes and colors, can be used for neurotransmitters to illustrate antagonists/agonists and the "lock and key method" of binding onto receptor sites).

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**Neural Transmission:** Write the steps for neural transmission on the board. Ask for 12 volunteers. Assign a role to each of the students: electrical stimulus, dendrite, cell body, axon, myelin sheath (use four students for this one), positive ion, negative ion, terminal button, and neighboring neuron. Line the students up so that they are in the correct order. Go through the steps on the board with the students and have them act out their parts as you go through the steps. Do this a couple of times until you think they have understood it. Next, allow the students to run through the steps by themselves. The students should gain a hands-on idea of how electrical information is passed along an axon for neural transmission to occur.

**Neural Activity:** One of the best ways for students to understand neural activity is to "act like a neuron." Have students form two lines of 10 students each in front of the class. For one line, have each student place their right arm on the right leg of the student in front of them. For the other line, have each student place their right arm on the right shoulder of the person in front of them. Instruct the students that when you say "go," they are to squeeze the right leg of the person in front of them or the right shoulder. When each person feels the squeeze of the person behind them, they are to squeeze the person in front of them. Record the duration (seconds) it takes for the "message" to travel from the rear of the line to the front of each line. Divide each value by 10, and ask the class to speculate on the difference between these average values. *Reference:* 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,* 91–94.



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## Neurotransmitters

**Parts of the Nervous System:** Have students complete **Handout 1: Parts of the Nervous System**.

**Neurotransmitters:** Use **Handout 2: Neurotransmitters** as a way for students to understand the needs and functions of the various neurotransmitters. The students will have to find, on their own, the purpose for each of the neurotransmitters and determine what could possibly occur if there were a decrease or excess of neurotransmitters.

**Drugs and Neurotransmitters:** Use **Handout 3: What's in Your Medicine Cabinet?** This activity will have students examine their own medications to find out if any of them are agonists or antagonists.

**The Nervous System:** Break the class into groups and tell them to imagine themselves walking down a dark street late at night. All of a sudden, they think they hear someone following them. Ask them to discuss and write down what would be happening to them physiologically as the information they are hearing is going through the nervous system. After they are finished, write the six nervous systems on the board, and have one member of each group come to the front of the room and explain the physiological characteristics their group decided on.

**Electrochemical Transmission:** Have the students search on the Internet for a website that talks about epileptic seizures. After the students find and read the page, have them write a one- to two-page paper on how electrical charges are disrupted during a seizure and how this affects information being passed from one area of the brain to the other.

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## The Endocrine System

**The Endocrine System:** Have students complete **Handout 4: Parts of the Endocrine System**.

**Hormones:** Have the students do a search on the Internet and find a website that discusses hormonal changes in animals. Ask the students to discuss, in a one- to two-page paper, how animal hormonal changes differ from human hormonal changes.

**Exploring the Connections Between the Endocrine and Nervous Systems:** As a class discussion, explore why and how the endocrine and nervous systems are interconnected. What is the reason for studying the endocrine system in a psychology class? For reference, use the following link to aid in discussion: http://endocrineexplanation.weebly.com/endocrine-explanation.html.

## Parts of the Brain

**Parts of the Brain: Handouts 5 and 6** contain assignments for the **Parts of the Brain**.



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**Left and Right Brain Hemispheres:** Use **Handout 7: Which Hemisphere Is It?** Have students identify the hemisphere responsible for different activities. The students will gain an idea of hemispheric differences.

## Brain Plasticity and Repair

**Brain Damage Repair:** Have the students go on the Internet and find cases where neurogenesis has been successful. Have them discuss how the research was conducted and what concerns there are about conducting this type of research in humans.

**Brain Grafts and Stem Cell Research:** Break the class into two groups and have them make a pro and con list for the use of stem cells in research and the possible use of stem cells in helping humans. The students will probably get an active debate going, and they should see how much of a controversial issue this really is.

**Split Brains:** Have the students go on the Internet and find a website that discusses split-brain surgery. Next, have them write a one- to two-page paper summarizing what they read and their feelings on the ethics of conducting split-brain surgery.

**Stem Cell Research:** This is a good place to discuss the controversial issue of stem cell research and human cloning. You may want to outline the issues for those who are unfamiliar with current controversies (see the following site for suggested activities and videos: https://kera.pbslearningmedia.org/asset/nsn08_vid_stemcell2.

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**Stem Cells:** Ask students to write an essay regarding the following topic: "Do you oppose the use of stem cells in research. Why?" To further the idea of research, require two valid research articles to support the student's opinion.

**NFL and TBI:** Ask students to think about sports and brain injury. In particular, ask them to think about football and brain injury. You may want them to read the following article: NFL needs to aid brain, concussion research. *San Francisco Chronicle*. September 6, 2009. Ask them if sports should be made safer. Ask them who should be held accountable for players who develop dementia early in life.

## Behavioral Genetics

**Happiness Gene:** This can be assigned as homework or an in-class project in pairs or small groups. Have students search the web for information about the happiness gene. Answer the questions on Handout 8: *The Happiness Gene.* If it is a large class, randomly ask pairs to report their results. If the class is in groups, ask one student from each group to report on the findings.

**Human Genome Project:** Have the students go to the following link http://web.ornl.gov/sci/techresources/Human_Genome/index.shtml and read about the Human Genome



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Project. Have them locate and describe three genes related to psychological functioning. Next, ask them to go to the following website: www.genome.gov/19516567. Here they will read about genes and testing for various diseases. Finally, have students write a one- to two-page paper summarizing what they have read. In addition, have students write about their thoughts on the Human Genome Project. The students will gain knowledge about the Human Genome Project and how knowing about genes will help researchers in conducting research on various diseases and disorders.

**Heritability of IQ:** Genetics influence about 50 percent of the differences in performance on intelligence tests, leaving about the same amount to be explained by nongenetic influences.

**Discussion:** The following link is to the Bouchard et al. (1990) study on heritability of IQ: www.sciencemag.org/content/250/4978/223.short. See the suggested readings for the full citation.

**Phenotype and Genotype:** Have students look in the mirror and describe what they see—hair color, eye color, hair texture (straight, curly, etc.), and so on. Have them report the same information for their parents. Have them discuss genotypes and phenotypes, and outline which of their phenotypic features are dominant and which are recessive. If they want their child to look like them, what phenotype will their partner need to display?

**Evolution:** You may want to avoid asking students if they believe in evolution but rather focus on the theory and their understanding of how natural selection works. For example, recent media reports indicated that blondes are going extinct (see www.youtube.com/watch?v=ab1EixVFKZE). This seems odd, but remember, blonde is a recessive trait. However, red hair is an even more recessive trait and has yet to go extinct. You may also want to point out that other traits are passed on via natural selection as well (e.g., preference for novelty). The point here is that there is an ebb and flow to all traits as environment (and culture) selects what traits are "in" and what traits are "out."

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## Discussion Questions

### The Study of the Nervous System in Psychology

Why does a course on psychology begin by examining the structures and function of the nervous system?

Search the web (use Google) to find the cases of famous people who suffered from nervous system disorders. Describe the nature of their disorder and how it affected their behavior when alive as well as whether it caused them to die prematurely.

What is your interpretation of the quote "The brain is wider than the sky?"



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## The Neuron and the Synapse

Are medications for psychological disorders overprescribed? (This also can be used as a discussion question in class.)

What are the implications of the fact that neurons communicate across synapses rather than being directly hardwired?

What are the advantages in the nervous system of having neurons fire according to the all-or-none law?

## How the Endocrine System Functions

What is meant by "negative feedback"? How does the endocrine system ensure that hormones do not reach too high a level in our bodies?

What do you think the significance is that the hypothalamus is a structure in both the nervous and endocrine systems?

In times of stress, how do the endocrine and autonomic nervous systems work together?

## General Questions About the Brain

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Can machines ever be designed that would "read our minds?" Why or why not?

What might be the importance of the fact that the amygdala and the hippocampus, the centers for emotion and memory, are located close together and are both part of the "old brain?"

How might the findings on neuroplasticity be applied to issues such as retraining older workers or helping brain-injured individuals recover lost functions?

Imagine your favorite food. Now imagine taking a bite of that food. What parts of the brain became activated as you ate your favorite food?

What is the importance of considering genetics and the brain when analyzing behavior and mental processes?

What behaviors have been passed on in your family, and how far back can they be traced?

Ask students what they know about the nature–nurture debate. Do they know the current consensus (that genes and environment interact to influence many traits)? Ask students if they understand the concept of a nature and nurture interaction. How much do they believe is nature? How much do they believe is environment? What types of things constitute nature? What types of things constitute environment?



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If you talk about Alzheimer disease in your class, you may want to ask students the following: Pretend that someone close to you is diagnosed with Alzheimer disease. In what ways will that impact your life? What will you do to try to help this person? What will you do to try to cope with your relative or friend's illness?

## Polling Questions

**Polling Question: Speed of Transmission:** True or False: All neurons transmit impulses at the same speed.

**Polling Question: Selective Breeding Is *Big* Business:** Merging science and business, selective breeding has had a long history. With the advances of modern science, selective breeding animals has come into some controversy. Many of our food products are created by animals selectively bred for specific traits or characteristics. With that being said, how many of you are aware that much of the food you eat comes from selectively bred animals? Who thinks breeding animals based on chosen characteristics is acceptable?

**Polling Question: Speaking from a Matter of Difference:** For quite some time, researchers have been uncovering various differences in structure and function between the female and male brains. In an article from Cosgrove, Mazure, and Staley (2007), *Evolving Knowledge of Sex Differences in Brain Structure, Function, and Chemistry*, they conclude, ". . . there are important differences that distinguish the male from the female brain. Overall brain volume is greater in men than women, yet, when controlling for total volume, women have a higher percentage of gray matter and men a higher percentage of white matter. Regional volume differences are less consistent. Global cerebral blood flow is higher in women than in men. Sex-specific differences in dopaminergic, serotonergic, and GABAergic markers indicate that male and female brains are neurochemically distinct." How many of you agree that male and female brains are different? Who thinks that this explanation accounts for all of the reasons people have considered males and females different? Who thinks this type of research and conclusion can create more bias and promote stereotyping behavior?

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**Polling Question: The Billon Dollar Quest to Build a Supercomputer:** Currently, researchers are in the process of mapping brain structures, functions, and analyzing data to produce "The Human Brain Project." The plan is to produce a computer that supersedes our brain power and capacity. Who thinks this project can actually happen? How many would agree that it is possible to make a computer function better than your own brain? If a supercomputer is built, how many of you think that would be bad for humans?

## Suggested Media

*Aging Is Not Inevitable: Are Stem Cells the Fountain of Youth?* (2016): Stanford Medicine. Available at www.youtube.com/watch?v=ZPNFQkzMdo4.



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*BBC: Science: Human body.* Available at www.bbc.co.uk/science/humanbody. This site has archived data and useful activities, but it is no longer updated.

*The Big Idea: Epigenetics.* A brief video exploring the epigenetic question: Can our experiences be passed down biologically to our children and grandchildren?
Available at www.bbc.co.uk/sounds/play/p066wkwv.

*The Brain.* Films for the Humanities and Sciences, 2008, 90:00. Using simple analogies, real-life case studies, and computer-generated images, this program shows how the brain works, explains the frequent battle between instinct and reason, and unravels the mysteries of memory and decision making.

*The Brain:* Teaching module #1, "Organization and evaluation of brain function." Video File, 1997. Available at www.learner.org/series/the-brain-teaching-modules/organization-and-evaluation-of-brain-function. Brain structures and functions are described.

*The Brain:* Teaching module #2, "The effects of hormones and the environment on brain development." Video File, 1997. Available at www.learner.org/series/the-brain-teaching-modules/the-effects-of-hormones-and-the-environment-on-brain-development. Research on the differences between male and female brains is discussed.

*The Brain:* Teaching module #5, "The divided brain." Video File, 1997. Available at www.learner.org/series/the-brain-teaching-modules/the-divided-brain. Hemispheric functions and the split brain are explored.

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*The Brain:* Teaching module #7, "Brain anomaly and plasticity: hydrocephalus." Video File, 1997. Available at www.learner.org/series/the-brain-teaching-modules/brain-anomaly-and-plasticity-hydrocephalus. Brain plasticity is described.

*The Brain:* Teaching module #30, "Understanding the brain through epilepsy." Video File, 1997. Available at www.learner.org/series/the-brain-teaching-modules/understanding-the-brain-through-epilepsy. The effects of neurotransmitters and epilepsy are investigated.

*The Brain:* Teaching module #31, "Brain transplants in Parkinson's patients." Video File, 1997. Available at www.learner.org/series/the-brain-teaching-modules/brain-transplants-in-parkinsons-patients. Brain transplants as a treatment for Parkinson disease are presented.

*The Brain:* Teaching module #32, "Neurorehabilitation." Video File, 1997. Available at www.learner.org/series/the-brain-teaching-modules/neurorehabilitation/. Case studies of brain injuries and their treatments are discussed.

*Brain Games.* Available at https://kids.nationalgeographic.com/videos/topic/brain-games.



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*Brain Physiology & Anatomy: The Teen Brain: 6 Things to Know.* National Institute of Mental Health (NIMH). Available at www.nimh.nih.gov/health/publications/the-teen-brain-7-things-to-know.

*The Brain That Changes Itself* (2008). A documentary exploring the repair and adaptation inherent in neuroplasticity. Available at www.youtube.com/watch?v=VIdWFuuZaxw.

*Brain Trauma.* NOVA Science Now Video File, 2008. An 11-minute video that discusses brain trauma. Available at www.pbs.org/wgbh/nova/sciencenow/0306/02.html.

*Brain Web.* Available at https://dana.org/explore-neuroscience/brain-basics. Brain Web provides links about brain diseases and disorders.

*Brainman.* Focus Productions, 2006, 60:00. The brain of British savant Daniel Tammet is explored. Tammet has amazing brain capabilities that go beyond memory.
Available at www.youtube.com/watch?v=Kf3-el-dJAw.

*Bringing New Life to 'Patient H.M', the Man Who Couldn't Make Memories.* PBS NewsHour.
Available at www.youtube.com/watch?v=_7akPs8ptg4. Author Luke Dittrich discusses his book, "Patient H. M.: A Story of Memory, Madness, and Family Secrets."

*CDC: Traumatic Brain Injury*. Available at www.cdc.gov/traumaticbraininjury.

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*Clive Wearing.* Available at www.youtube.com/watch?v=Vwigmktix2Y.
Clive Wearing, who suffered a severe form of amnesia, is shown in this brief clip. You may want to use this when discussing the hippocampus or memory.

*Cracking the Code of Life.* NOVA Video File, 2001. Sixteen video clips (105 minutes) that focus on the human genome. Available at www.pbs.org/wgbh/nova/teachers/programs/2809_genome.html.

*Discovering Psychology.* PBS series. Available at www.learner.org/series/discovering-psychology.

*Epigenetic Transformation: You Are What Your Grandparents Ate*. Pamela Peeke, TEDxLowerEastSide (2014, January). Available at www.youtube.com/watch?v=Udlz7CMLuLQ.

*Epigenetics* (2012). A look at the power of epigenetics.
Available at www.youtube.com/watch?v=kp1bZEUgqVI.

*Epigenetics: The Hidden Life of Our Genes.* Terranoa, 2009, 52:00. This program presents evidence that DNA is not necessarily destiny, and that diet, stress, and environmental exposures can all modify gene expression. Available at www.youtube.com/watch?v=gQbvKHivXFo.

*The Era of Personal DNA Testing Is Here* (2016, October). Sebastian Kraves. This 13-minute video concentrates on personal DNA testing. Available at www.youtube.com/watch?v=DzNN_4rcIjs.



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*The Forgetting: A Portrait of Alzheimer's.* Warner Home Video, 2003, 60:00 (plus 30:00 Q & A). A PBS special spotlighting Alzheimer's research and several families dealing with Alzheimer's.
Available at www.youtube.com/watch?v=YUfZP3vcEK4.

*Harnessing the Power of the Brain.* CBS *60 Minutes*, 25:00. This video provides a great story illustrating the connection between mind, brain, and our cognitive abilities.
Available at www.cbsnews.com/news/harnessing-the-power-of-the-brain.

*Living with Traumatic Brain Injury.* A brief clip on life with TBI.
Available at www.youtube.com/watch?v=AyyTX3UqmXQ.

*Louise Leakey Discussing Human Origins.*
Available at http://www.ted.com/index.php/talks/louise_leakey_digs_for_humanity_s_origins.html.

*McGraw-Hill Psychology Episode IV: Biology of Behavior.*
Available at https://soundcloud.com/user-250403395/episode-iv-biology-of-behavior.

*The Mind, 2nd ed.* Teaching module #5, "Endorphins: The brain's natural morphine," Video File, 1999. This video explores neural networks, synapses, and neurotransmitters.
Available at https://www.youtube.com/watch?v=7S5yn-3vfr8&list=PLez3PPtnpncT0cvKA2SIyNYX6l82yx64Z&index=5.

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*The Mind, 2nd ed.* Teaching module #7, "The frontal lobes: Cognition and awareness," Video File, 1999. The brain's frontal lobes and function are the topics of discussion. Available at www.youtube.com/watch?v=GNDHwAsg5Fg&list=PLez3PPtnpncT0cvKA2SIyNYX6l82yx64Z&index=7.

*The Mind, 2nd ed.* Teaching module #26, "The bilingual brain." Video File, 1999. The use of fMRI studies to examine brain function is discussed. Available at www.youtube.com/watch?v=cA3QPivxe2U&list=PLez3PPtnpncT0cvKA2SIyNYX6l82yx64Z&index=25.

*Mirror Neurons.* NOVA Science Now Video File, 2006. This 14-minute video addresses mirror neurons.
Available at www.youtube.com/watch?v=Xmx1qPyo8Ks.

*The Most Amazing Machine: Neuroscience and Behavior.* 2006, Insight Media, 30:00. This film focuses on the connection between biology and behavior.
Available at www.youtube.com/watch?v=dzyxSgLtyRM.

*The Nervous System, Part 1: Crash Course.*
Available at www.youtube.com/watch?v=qPix_X-9t7E.



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*The Nervous System, Part 2: Action! Potential! Crash Course.*
Available at www.youtube.com/watch?v=OZG8M_ldA1M.
*Neuron Synapse.* Available at www.youtube.com/watch?v=LT3VKAr4roo.

*NOVA Clips on DNA: Cracking the Code of Life.* This two-hour program is divided into 16 chapters, each separated into its individual video topic area.
Available at www.pbs.org/wgbh/nova/genome/program.html.

*NOVA Clips on the Effects of Learning on the Brain: Of Mice and Memory.*
Available at www.pbs.org/wgbh/nova/sciencenow/0301/02.html.

*Neuron Resting Potential.* Available at www.youtube.com/watch?v=YP_P6bYvEjE.

*Neurons and How They Work.* Discovery Channel.
Available at www.dnatube.com/video/1298/Neurons-and-How-They-Work.

*Personal DNA Testing: The Era of Personal DNA Testing Is Here.* This 13-minute video concentrates on personal DNA testing. Available at www.youtube.com/watch?v=DzNN_4rcIjs.

*Pieces of Mind.* PBS, 1997, 60:00. Alan Alda, host of *Scientific American Frontiers*, explores how the brain plays a role in storing and retrieving memories. Split brain patients are also discussed.
Available at www.youtube.com/watch?v=q6ryKGiQh3w.

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*Prosopagnosia.* Primetime Medical Mysteries—Part 6 (Visual Prosopagnosia).
Available at www.youtube.com/watch?v=vwCrxomPbtY.

*Secret Life of the Brain.* PBS Distribution, five-part series, 56 minutes each.
Available at www.ncbi.nlm.nih.gov/pmc/articles/PMC3592580.

*The Baby's Brain: Wider Than the Sky.*
Available at www.youtube.com/watch?v=U0L0mYi_ftc.

*The Child's Brain: From Syllable to Sound.*
Available at www.youtube.com/watch?v=DK4NhmY5bK0&t=24s.

*The Teenage Brain: A World of Their Own.*
Available at www.youtube.com/watch?v=FGaz_fHLHNU.

*The Adult Brain: To Think by Feeling.*
Available at www.youtube.com/watch?v=G5-HTuRGMmk.

*The Aging Brain: Through Many Lives.*
Available at www.youtube.com/watch?v=d-8NmkSfM-8.

*Secret Life of Twins* (2009).
www.youtube.com/playlist?list=PLbpi6ZahtOH5v5tFLOmL_YCSvv8cnBRuY.



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*Scientific American Frontiers: Severed Corpus Callosum.* Documents the life of a man who has undergone split brain surgery to deal with seizures. www.youtube.com/watch?v=AiaAA34XKbE.

*Stems Cells Breakthrough.* NOVA Science Now Video File, 2008. A 13-minute video that shows creating stem cells without harming human embryos. www.pbs.org/wgbh/nova/sciencenow/0305/03.html.

*Three Identical Strangers* (2018). A documentary telling the story of identical triplet boys separated at birth and raised by three different families who are reunited through astonishing coincidence. Trailer www.youtube.com/watch?v=uM5TQ4f7ycw.

*What's It Like for Kids With Tourette's Growing Up?* Nurture (2018) 46:10. Stories of children who are dealing with Tourette's are presented. www.youtube.com/watch?v=PiOx01HQL9E.

### Popular Movies

**Coping With Brain Damage:** Older movies illustrating people who must cope with brain damage are *Regarding Henry* and *Rocky V*.

**The Limbic System:** A very funny scene that students will enjoy is the medulla oblongata scene from the movie *The Waterboy*, when the protagonist argues with his professor about the role of the brain in behavior. This short scene will definitely lighten the lecture. It is also a good scene to show because it is actually incorrect—when they discuss the medulla oblongata as having a role in aggression and happiness, they are actually referring to the amygdala!

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**Twins:** *Parent Trap* (1998 or the 1961 original) discusses twins. Adaptation (2002) is another film about twins.

***Still Alice*** (2014). A feature film portraying the life of a linguistics professor faced with early onset Alzheimer disease.

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## Handouts

### Handout 1: Parts of the Nervous System

Identify each part of the nervous system:
**(Correct answers are given in parentheses.)**

Exerts control over all parts of the body
(nervous system)

Controls all voluntary movements, thoughts, and registration of incoming information
(CNS)

The site where processing of all central nervous system activity takes place
(brain)

Main carrier of messages between the brain and the body
(spinal cord)

Registers information and controls movements outside of the central nervous system
(peripheral nervous system)

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Takes charge over the body's involuntary functions outside conscious awareness
(autonomic nervous system)

Coordinates incoming information from the senses and sends instructions to the muscles and glands
(somatic nervous system)

Increases heart rate in an emergency situation
(sympathetic nervous system)

Stimulates digestion of food when the body is in a state of rest
(parasympathetic nervous system)

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## Handout 2: Neurotransmitters

Find the purpose of each of the neurotransmitters listed below. Also, describe for each what might happen to a person if they have an excess amount or a lesser amount of the neurotransmitter.

Acetylcholine

GABA

Glutamate

Norepinephrine

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Dopamine

Serotonin

Endorphin

Oxytocin

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## Handout 3: What's in Your Medicine Cabinet?

Go home and take a look in your medicine cabinet. Take out all the prescription medications. Go on the Internet and search for each of the medications. Find out what warnings there are for the medications and how they might influence brain activity.

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## Handout 4: Parts of the Endocrine System

Identify each part of the endocrine system:
**(Correct answers are given in parentheses.)**

Major chemical in the endocrine system
(hormone)

Regulates the pituitary gland
(hypothalamus)

The body's "master gland"
(pituitary)

Hormones involved in sugar metabolism
(insulin and glucagon)

Female reproductive organ
(ovary)

Organ that produces hormones involved in sugar metabolism
(pancreas)

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Gland that controls metabolic rate
(thyroid)

Nervous system organ that is also in the endocrine system
(hypothalamus)

Male reproductive organ
(testis)

Type of regulation in the endocrine system
(negative feedback)

Gland involved in controlling bodily size
(pituitary)

Involved in regulating body's reaction to stress
(adrenal gland)

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## Handout 5: Parts of the Brain

Describe one daily routine that you do that uses each of these parts of the brain. (You can use one example or five separate examples.)

1. Cerebellum

2. Hypothalamus

3. Reticular formation

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4. Limbic system

5. Frontal lobe



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## Handout 6: Activities in the Parts of the Brain

Identify the part of the nervous system associated with each of the following activities:
(Correct answers are given in parentheses.)

Balancing on a tight rope
(cerebellum)

Clapping your hands
(pons)

Waking up when the alarm goes off
(reticular formation)

Feeling hungry
(hypothalamus)

Understanding your psychology professor's lecture
(Wernicke's area)

Planning your route to drive home
(frontal lobe)

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Becoming enraged when someone buds in front of you in a line
(limbic system)

Talking on your cell phone
(Broca's area)

Hearing your favorite music group on your smartphone
(auditory area)

Feeling drops of rain on your face
(somatosensory area)

Seeing a traffic light change color
(visual cortex)

Breathing while you sleep
(medulla)

Pushing the "open" button on the computer when a file has downloaded
(thalamus)



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## Handout 7: Which Hemisphere Is It?

Read each of the below activities and then circle which hemisphere (the left or the right) controls that behavior; and then explain why.

1. Writing lecture notes while in class: LEFT or RIGHT

2. Watching your favorite TV show: LEFT or RIGHT

3. Catching a ball in left field: LEFT or RIGHT

4. Doing math problems for a homework assignment: LEFT or RIGHT

5. Doing a crossword puzzle: LEFT or RIGHT

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6. Running a marathon: LEFT or RIGHT

7. Listening to a love song with your significant other: LEFT or RIGHT

8. Putting together a desk you bought at the office superstore: LEFT or RIGHT

9. Taking a spelling test: LEFT or RIGHT

10. Doing your yearly taxes: LEFT or RIGHT

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