

Unit III - Answer Key

Biological Bases of Behavior

Module 9 - Biological Psychology and Neurotransmission

While You Read

9-1

1. He proposed that phrenology (studying bumps on the skull) could reveal a person's mental abilities and character traits.
2. He was incorrect because bumps on a skull can't tell you anything about a person's personality or the brain's underlying functions. However, he was correct that biological activity can be linked to psychological events. Different parts of the brain do control different aspects of behavior.
3. Answers will vary, but in general students should recognize that there was little scientific truth to Gall's findings.

9-2

1. The information systems of humans and other animals operate so similarly that you could not distinguish between small samples of brain tissue from a human and a monkey. This allows researchers to study other animals to discover how our own systems work.

2.

Structure	Function
dendrite	receives messages and conducts impulses toward the cell body

cell body	the cell's life-support center; contains the nucleus
axon	passes messages to other neurons or to muscles or glands
terminal branches	form junctions with other cells; contain the vesicles with neurotransmitters
myelin sheath	a fatty tissue layer that enables vastly greater transmission speed as neural impulses hop from one node to the next
glial cells	While not technically a neural structure, these cells are vital in supporting, nourishing and protecting neurons

3. The action potential is the electrical impulse that travels down an axon. Without an action potential, there is no neural communication.
4. The fluid outside the axon membrane is largely made up of positively charged ions but the fluid inside the membrane is primarily made up of negatively charged ions. This state is referred to as the resting potential. We refer to the axon's surface as selectively permeable since it will only allow particular ions to pass through. When a neuron fires, the axon membrane becomes permeable and positively charged sodium ions flow into the cell. This depolarizes that part of the axon and then causes the next section of the membrane to become permeable. This occurs over and over down the line of the axon and serves to push the nerve impulse down the neuron. During the,

refractory period, the positive ions are pumped back out of the cell and the axon returns to the original state of polarity, called the resting potential, prepared to fire again.

5. Excitatory signals act like the accelerator of a car and cause neural activity.
Inhibitory signals act like the brake of a car and prevent neural activity.
Excitatory signals must outweigh inhibitory signals for an action potential to occur.
6. It does not increase the impulse intensity; it merely activates the action potential. Neurons fire according to the all-or-none law: They either fire or do not fire, there are not degrees of firing.
7. Neural transmission is like . . . Answers will vary but should reflect knowledge of the action potential, resting potential, or threshold.

9-3

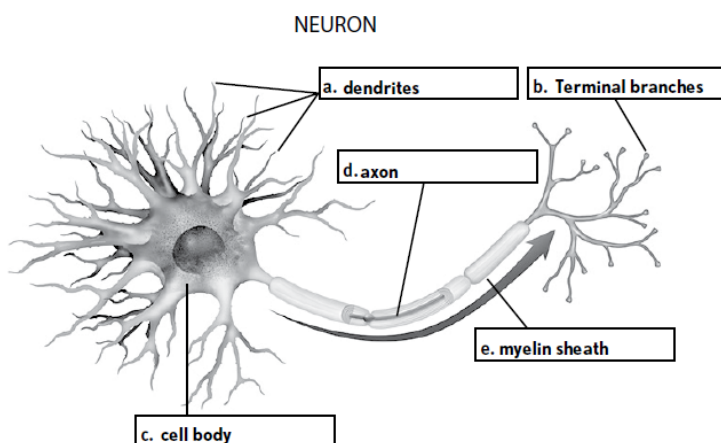
1. A synapse is the junction between the axon tip of the sending neuron and the dendrite or cell body of the receiving neuron.
2. When an action potential reaches the knob-like terminals at an axon's end, it triggers the release of chemical messengers called neurotransmitters. Within milliseconds, the neurotransmitters cross the synaptic gap and bind to the receptor sites on the receiving neuron. The receiving neurons unlock ion channels, the ions flow in and either excite or inhibit the receiving neuron's ability to fire.
3. Reuptake is a neurotransmitter's reabsorption by the sending neuron. SSRIs prevent serotonin from being reabsorbed by the sending neuron, this allows more of the neurotransmitter to stay in the synaptic gap and may reduce the symptoms of depression.

9-4

1. Answers will vary. For example, opiate drugs can be agonists and amplify normal sensations.
2. Answers will vary. For example, as an antagonist, Botox blocks neurotransmitters and so paralyzes facial muscles.
3. Because it mimics dopamine the drug L-dopa would be considered an agonist.
4. Endorphin, or endogenous morphine, is a type of neurotransmitter similar to morphine that is released in response to pain and vigorous exercise. The release of endorphins has a calming, pain-relieving effect on the body.
5.
 - a. an undersupply of serotonin: linked to depression
 - b. an oversupply of dopamine: linked to schizophrenia
 - c. an oversupply of glutamate: linked to seizures in some people
 - d. a deterioration in acetylcholine neurons: linked to Alzheimer's disease

After You Read

Module 9 Review



Terms

- E 1. glial cells
- H 2. neuron
- J 3. dendrites
- L 4. axon
- O 5. myelin sheath
- F 6. action potential
- I 7. refractory period
- M 8. all-or-none response
- C 9. threshold
- D 10. synapse
- B 11. neurotransmitters
- A 12. reuptake
- G 13. endorphins
- K 14. agonist
- N 15. antagonist

Definitions

- A.** Reabsorption of the neurotransmitter by the sending neuron
- B.** Chemical messengers that cross the synapse between neurons
- C.** Level of physical stimulation required to trigger an impulse
- D.** The junction between the axon tip of the sending neuron and the dendrites of the receiving neuron
- E.** Cells in the nervous system that support, nourish, and protect neurons
- F.** Brief electrical charge that travels down an axon
- G.** Opiate-like neurotransmitters linked to pain control
- H.** Basic building block of the nervous system
- I.** A period of inactivity after a neuron fires
- J.** Receives neural messages and sends impulse to cell body
- K.** Molecule similar to a neurotransmitter that triggers a response
- L.** Extension of neuron that passes messages through its branches to other neurons, muscles or glands
- M.** Neural reaction of either firing or not firing
- N.** Molecule that binds to a receptor and inhibits a

response

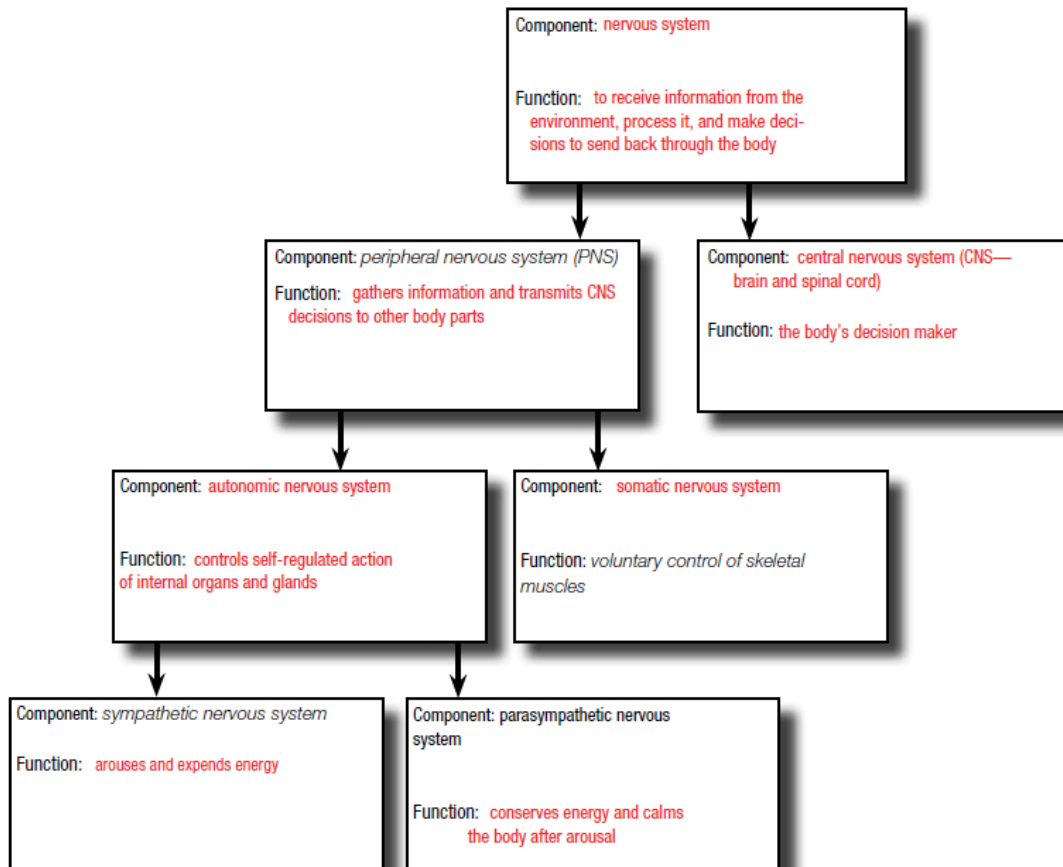
O. Fatty tissue layer encasing the axon

Module 10 - The Nervous and Endocrine Systems

While You Read

10-1

1.



2.

a. You write with a pencil: somatic

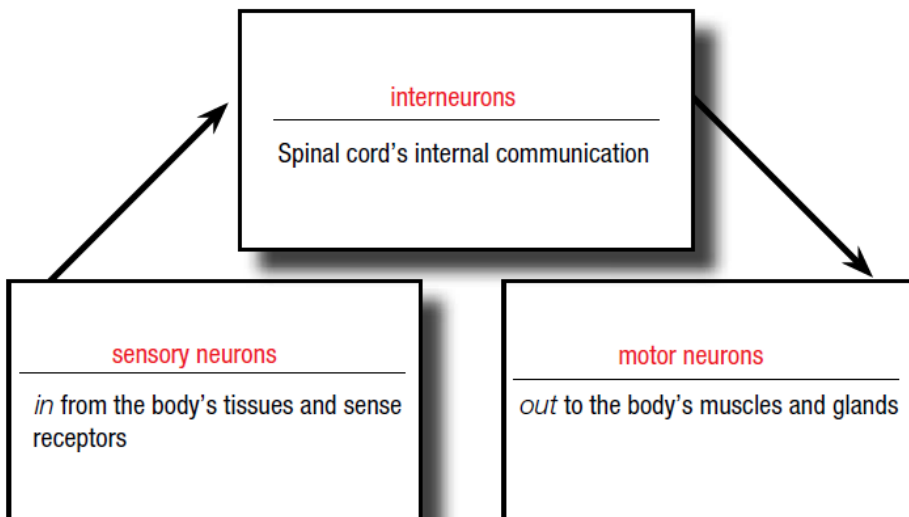
b. You are nervous about asking someone to prom: sympathetic

c. You are thinking about the answer to a math equation: central

3.

	Effect When Sympathetic Nervous System Is Stimulated	Effect When Parasympathetic Nervous System Is Stimulated
Pupil of the eye	Dilates	Contracts
Heart	Accelerates	Decelerates
Stomach	Inhibits digestion	Stimulates digestion
Liver	<i>Glucose is released by the liver</i>	<i>No effect</i>
Gallbladder	<i>No effect</i>	Stimulates
Adrenal glands	Stimulates secretion of epinephrine and norepinephrine	<i>No effect</i>
Bladder	Relaxes	<i>Contracts</i>
Sex organs	Stimulates ejaculation	Allows blood flow to sex organs

4.



10-2

1. Both secrete chemical messages within the body. The endocrine system secretes hormones and works slower than the nervous system, which secretes neurotransmitters and works very fast.

2.

Structure	Function
Hypothalamus	controls pituitary gland
Ovary	secretes female hormones
Adrenal glands	triggers fight-or-flight response
Pituitary gland	releases growth hormone, oxytocin, and other hormones
Thyroid gland	affects metabolism
Testis	secretes male hormones
Pancreas	regulates the level of sugar in the blood
Par thyroid	regulates level of calcium in the blood

3. It regulates other endocrine glands under the influence of the hypothalamus.

After You Read

Module 10 Review

1. After placing your hand on a hot stove, pain signals are sent from the sense receptors in your skin through sensory (afferent) neurons to the spinal cord where the signal is processed by interneurons and finally to the muscles in your hand via the motor (efferent) neurons, causing

you to remove your hand from the stove. This reflex does not (does/does not) involve the brain.

2. The somatic nervous system sends the signal to stand.
3. The autonomic nervous system regulates the control of your heartbeat.
4. Any sympathetic nervous system response from Figure 10.2 is acceptable.
5. Any parasympathetic nervous system response from Figure 10.2 is acceptable.

Module 11 - Studying the Brain, Older Brain Structures, and the Limbic System

While You Read

11-1

1. To lesion the brain is to destroy tiny clusters of brain cells to study functions of specific parts of the brain. By destroying a portion of the brain, scientists can learn what behaviors/thoughts/ emotions/memories, and so on were controlled by that part of the brain.
- 2.

Full name of brain scan technology	Abbreviation	Method Used to Produce Image
Electroencephalogram	EEG	electrodes placed on the scalp
Computed tomography scan	CT	X-ray photographs taken from different angles and combined by a computer into a composite
Positron emission tomography	PET	brain activity detected by a radioactive form of glucose
Magnetic resonance imaging	MRI	magnetic fields and radio waves
Functional magnetic resonance imaging	fMRI	comparing successive MRI scans
Magnetoencephalography	MEG	measures magnetic fields from the brain's natural electrical activity

3.

EEG: Shows electrical activity across the brain's surface

MEG: Shows activity in active areas of the brain

CT: Reveals brain structure, including brain damage

PET: Shows "hot spots" where brain areas are active as a person does various activities

MRI: Provides detailed pictures of soft tissues, including the structure of the brain

fMRI: Reveals brain functioning as well as structure

11-2

1. The brainstem structures are responsible for automatic survival functions, such as heartbeat and breathing, and so they are the most necessary for basic life functions.

2.

Structure	Function	How is the structure used when listening to the radio?
Medulla	Controls heartbeat and breathing	Answers will vary.
Pons	Coordinates movements	Answers will vary.
Thalamus	Brain's sensory control center; directs messages to the sensory receiving areas of the cortex and transmits replies to the cerebellum and medulla.	Answers will vary.
Reticular formation	Controls arousal	Answers will vary.

Cerebellum	Processes sensory input, coordinates movement output and balance, and enables nonverbal learning and memory.	Answers will vary.
------------	--	--------------------

11-3

1. The limbic system structures are generally responsible emotions and drives.
- 2.

Structure	Function	How is the structure used when listening to the radio?
Amygdala	Plays a role in aggression and fear	Answers will vary.
Hippocampus	Processes conscious memories	Answers will vary.
Hypothalamus	Directs maintenance activities (eating, drinking, body temperature) helps govern the endocrine system, and is linked to emotion and reward	Answers will vary.

3. Experiments have revealed that the pleasure received from the release of dopamine can impact behavior—people choose options that have been linked to dopamine release
Use Figure 11.11 on page 106 to check your two charts above. Combine the information from the text and the diagram to make sure your chart is as complete as possible.

After You Read

Module 11 Review

Terms

- D 1. EEG
- B 2. CT scan
- A 3. PET scan
- C 4. MRI
- E 5. fMRI

Definitions

- A.** Shows brain activity by tracking glucose absorption
- B.** Reveals brain damage through use of X-rays
- C.** Depicts brain structures through the use of magnetic fields and radio waves
- D.** Provides an amplified readout of brain waves by using electrodes on the scalp
- E.** Reveals brain activity and functioning by tracking increased oxygen-laden blood flow

6.

- a.** The pons would coordinate movement; the cerebellum would work in concert with the pons to control voluntary movement.
- b.** The thalamus routes auditory input to auditory cortex.
- c.** The amygdala registers fear and aggression; the cerebellum and pons control the voluntary movements, and the reticular formation sends signals through the thalamus to increase arousal.
- d.** The hippocampus processes new memories of facts and events.
- e.** The hypothalamus is a reward center.

Multiple Choice

1. c. medulla: breathing and heart rate
2. d. cerebellum
3. b. smell
4. b. amygdala
5. d. hypothalamus

Module 12 - The Cerebral Cortex

While You Read

12-1

1. The motor cortex controls motor movements, the visual cortex is involved in visual perception, the auditory cortex is involved in auditory processing, and the somatosensory cortex registers and processes body touch and movement sensations.
2. The wrinkles allow for a greater surface area in the same space inside of the skull. Without the wrinkles, the cortex would need an area about three times bigger.
3. Frontal lobes: speaking, muscle movements, making plans and judgments
Parietal lobes: receives sensory input for touch and body position
Occipital lobes: includes areas that receive information from the visual fields
Temporal lobes: includes the auditory areas, each receiving information from the ears
4.
 - a. Thumbs and lips
 - b. Thumbs are essential to human action and require precise control. Lips are involved in speaking, eating, smiling, etc. all of which are key human behaviors that ensure survival.
 - c. Thumbs and lips
 - d. Because they have many nerve endings that receive sensory input from the environment and will need a great deal of space in the somatosensory cortex.
5. The motor cortex's location in the rear of the frontal lobe helps us understand that its function involves coordinating voluntary movements with the rest of the body.
6. Answers will vary but should show some understanding of how interpretations of brain signals by a computer can mimic actions of the brain by the computer, giving new hope to people

who have lost limbs or to situations where the ability to predict someone's thoughts would be beneficial.

7. It's located in the parietal lobe. This lobe is concerned with the receiving of stimuli from the environment.

8. Visual cortex: occipital lobes

Auditory cortex: temporal lobes

9. Any three of these:

They are involved in higher mental functions such as learning, remembering, thinking, and speaking.

10. His personality changed drastically after the accident. The link between the frontal lobes, which control judgment and decision making, and the limbic system, the seat of emotionality, caused an unfiltered expression of varied and discordant emotions in Gage.

11. Broca's area is involved in expressive language and damage to this area causes speech disruption.

Wernicke's area is involved in receptive language and damage to this area disrupts understanding.

12-2

1. A majority of the brain is devoted to higher mental functions.

12-3

1. It helps an individual compensate for loss of function and continue functioning to some degree.

12-4.

1. Plasticity involves the reuse of existing brain areas for new purposes, while neurogenesis involves the creation of new brain cells.

After You Read

Module 12 Review

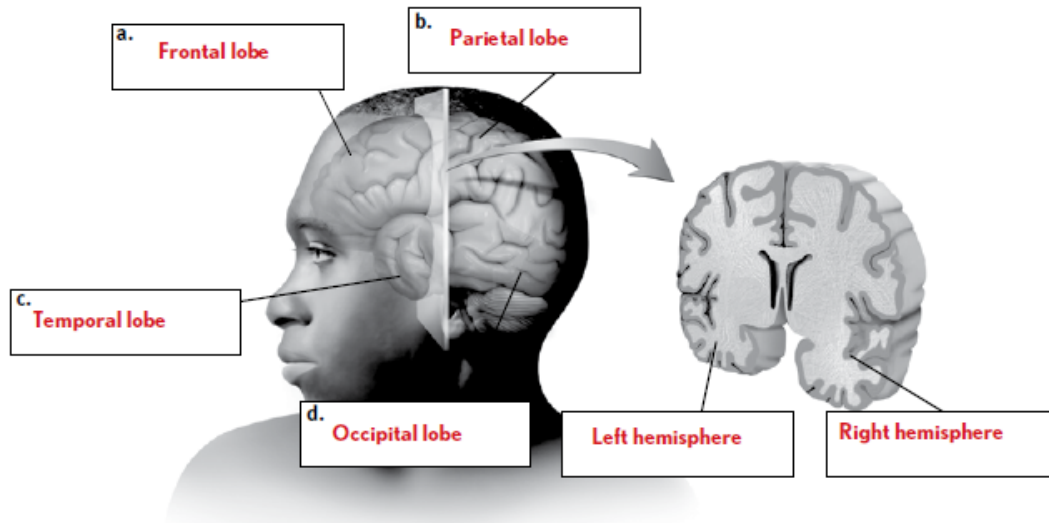
Terms

- B 1. cerebral cortex
- H 2. Broca's Area
- A 3. motor cortex
- C 4. somatosensory cortex
- D 5. association areas
- F 6. plasticity
- G 7. Neurogenesis
- E 8. Wernicke's Area

Definitions

- A.** Area at the rear of the frontal lobes that controls voluntary movements
- B.** The body's ultimate control and processing center that covers the cerebral hemispheres
- C.** Area at the front of the parietal lobes that processes body touch and movement sensations
- D.** Areas of the cortex involved in higher mental functions such as learning and speaking
- E.** Damage to this area will disrupt understanding of speech
- F.** The brain's ability to reorganize after damage or build new pathways based on experience
- G.** The formation of new neurons
- H.** Damage to this area will disrupt speech production

Label the lobes and identify the brain's hemispheres in the cross-section. Then, briefly describe each lobe's function below.



Module 13 - Brain Hemisphere Organization and the Biology of

Consciousness

While You Read

13-1

1. Lateralization is the differing functions of the left and right hemispheres of the brain.

Research over the years has shown that damage to one hemisphere or the other can produce different problems and knowing this can help predict behavior.

2. Split brain is a term used to describe the brain after cutting the corpus callosum. It is typically done to control epileptic seizures.

- 3.

Left Hemisphere Functions	Right Hemisphere Functions
reading	perceptual tasks
writing	making inferences
speaking	modulating speech
certain arithmetic reasoning/calculating	orchestrating our sense of self

4. Answers will vary; however, strong answers will indicate an understanding that strength in any task is not due solely to the activation of structures in only one hemisphere but is a coordinated, holistic process that includes the entire brain.

5.

- a.** ART was flashed in the right visual field of the screen and was transmitted to the left hemisphere of the brain.

The left hemisphere contains language centers such as Broca's and Wernicke's area and is able to send a signal to the motor cortex to direct the person to say "ART."

- b.** HE was flashed in the left visual field of the screen and was transmitted to the right hemisphere of the brain.

The right hemisphere controls the motor coordination of the left side of the body and will direct the left arm to point to the word HE. (TIP: Even though it goes to the opposite side of the brain, a person will always use the hand that the word was on initially to point to it.)

- 6.** Because we have only one brain; even though some activities may be performed predominantly by one hemisphere, the whole brain is constantly working together to understand the world and coordinate our responses.
- 8.** By severing the corpus callosum and the communication between each hemisphere, researchers can study the functions of each hemisphere separately.

13-2

- 1.** Cognitive neuroscience relates specific brain states to conscious experiences and thus helps us to understand the "how" of the brain.
- 2.** Dual processing is the principle that information is often simultaneously processed on separate conscious and unconscious tracks.

Answers will vary.

3. Visual information is typically processed in the occipital lobe. In patients with blindsight there may be a level of visual awareness, even when they cannot “see” something. This leads to the understanding that the eyes send visual information to other parts of the brain as well.

After You Read

Module 13 Review

1. c. Jonathon’s ability to speak
2. e. be unable to make the inference necessary to produce the word.
3. a. use their right hand to point to the word “ART.”
4. c. use their left hand to point to a picture of a frog.
5. b. parallel processing; sequential processing.

Module 14 - Behavior Genetics: Predicting Individual Differences

While You Read

14-1

1.

- a. Your book of life: _____ You _____
- b. chromosomes : the chapters in your book
- c. words in the chapter: _____ genes _____

2. Genes can either be active/expressed or inactive. What does this mean?

Genes can either be turned on or off.

3. They are interested in the small variations because they give clues to our uniqueness—why one person has a disease that another does not, why one person is short and another tall, outgoing or shy, and so on.

14-2

1. Identical twins form from a single fertilized egg cell and are genetically identical.

Although they have the same genes, they don't always have the same number of copies of those genes—one twin may be more at risk for certain illnesses. Most twins share a placenta but one of every three has two separate placentas—one twin's placenta may provide slightly better nourishment which would contribute to twin differences.

2. Fraternal twins form from separate fertilized eggs. They share a fetal environment but are genetically no more similar than brothers and sisters.

3. Studies show that on both extraversion and neuroticism, identical twins are more similar than fraternal twins.

Identical twins, more than fraternal twins, also report being treated alike.

4. He studied identical twins raised apart and found similarities in tastes, physical attributes, personality, abilities, interests, and even fears.
5. The plural of anecdote is not data; in other words if researchers brought together a control group of unrelated strangers and had them spend several hours together comparing stories and histories, they would find many similarities that might seem striking.
6. People who grow up together, whether biologically related or not, do not much resemble each other in personality. Adopted children are more similar to their biological parents than to their adopted parents, with whom they live.
7. The environment shared by a family's children has virtually no discernible impact on their personalities.
 - a. Environment really doesn't have that large of an impact on personality and this is surprising because most people would argue that it does. In fact, children in the same family are often very different.
 - b. Answers will vary.

14-3

1. Heritability is the proportion of variation among individuals that we can attribute to genes. Heritability may vary, depending on the range of populations and environments studied.
2. As environments become more similar, heredity as a source of difference becomes more important.

Why is this the case?

Because as environments are more alike, any differences between people are increasingly due to genes. If everyone was raised in a loving, healthy home, then if one person differed from another in any significant way, genes would explain the difference better than environment.

3. Molecular genetics is the subfield of biology that studies the molecular structure and function of genes.

The study of molecular genetics is important to the study of human behavior because genetics influence human behavior.

4. People's genes can reveal if they are at risk for learning disorder, depression, schizophrenia, and alcohol use disorder.

14-4

1. You are born with a certain set of genes (your hand) and how you play it—either to win or lose the hand—is the environment.
2. The baby with the attractive, sociable, and easygoing genetics (heredity) attracts the more affectionate and stimulating care (environment) and thus develops into a warmer and more outgoing person.
3. Epigenetics is the study of how environmental influences may cause the same genes to express themselves differently. Genes react to the environment and, even in identical twins, different environments (classrooms, friends, sports teams, and so on) can trigger a particular gene to react and thus launch a series of environment and hereditary interactions that result in differences between the twins.

After You Read

Module 14 Review

1. high
2. low
3. low
4. True
5. False

Module 15 - Evolutionary Psychology: Understanding Human Nature

While You Read

15-1

1. They selected and mated the tamest 5 percent of males and 20 percent of females. Over more than 30 generations of foxes, they repeated this procedure. Eventually they had a new breed of foxes that were domesticated.
2.
 - a. The typical genetic difference between the two Icelandic villagers or between the two Kenyans is much greater than the average difference between the groups.
 - b. The genetic differences between two males is greater than the average difference between males and females.
3. The “second Darwinian revolution” is the application of Darwinian principles to psychology. Evolutionary psychologists ask what over time has caused certain behaviors and fears, such as phobias of snakes over more dangerous threats such as guns.
4. The behaviors that promote success in survival become selected over generations.

15-2

1. One man can spread his genes through many females, and is capable of fathering more children at once than a woman can mother/carry.
2. Women conceive and protect one infant at a time and by pairing wisely, a woman increases the odds that her genes will pass into the future.
3. Because these men have an increased ability to provide for the woman and a child they are likely to “pair wisely” and choose that person over another

4. People believe them to be true and women look for older, mature, and settled males for partners, while men look for younger, fertile women for partners.

15-3

1.

- starts with an effect and works backward
- suggests a genetic determinism
- blurs the line between genetic legacy and social-cultural tradition

15-4

1. Answers will vary, but a strong answer discusses biological influences, psychological influences, and social-cultural influences from the figure.

2.

- a. Answers will vary. sample answer: genetic predisposition to behave aggressively
- b. Answers will vary. sample answer: aggressive treatment by parents and/or peers
- c. Answers will vary. sample answer: a belief that one has to be aggressive to succeed in the world

After You Read

Module 15 Review

Terms or Names

Definitions or Descriptions

 B 1. evolutionary psychology

A. A culturally modeled guide for how to act in

 D 2. natural selection

various situations

C 3. mutation

 E 4. biopsychosocial approach

 A 5. social script

B. The study of the gradual change over time of behavior and the mind

C. A random error in gene application that leads to a change

D. The principle that inherited traits that contribute to reproduction and survival will most likely be passed on to succeeding generations

E. The belief that we are products of our genes, our environment, and our psychological decisions

✓ Check Yourself

1. The dendrites of Sam's neurons are picking up signals and conveying them through the cell body (soma) and into the axon. The action potential occurs and the impulse speeds down the myelinated axon toward the terminal branches. The vesicles within release neurotransmitters (see #2 below) into the synapse where they are received by receptor sites on the post-synaptic neuron's dendrites. The signal moves to the next neuron and reuptake occurs as the neurotransmitters are reabsorbed into the vesicles.
2. Sample answer: glutamate, a major excitatory neurotransmitter, might be released as neurons increase the speed of the nervous system functions. Sample answer 2: acetylcholine, a neurotransmitter that enables muscle action might be released as Sam's interneurons send signals to the efferent(motor) neurons to contract his leg muscles. Additional responses may be correct—student should correctly state a neurotransmitter (from the chart on page 82, Module 9) that would plausibly be involved in the running of a cross country meet.

3. Sample answer: Samuel's cerebellum is active as it controls balance and coordination as Samuel runs. Samuel's occipital lobe is active as he sees the runners around him on the course. Samuel's motor cortex will send the signals to move the muscles necessary to run the race. Samuel's Broca's area may be used to make the speech sounds to congratulate his teammates after they win the race.
4.
 - a. These neurons pick up the auditory signal from the auditory nerve and transmit it to the brain.
 - b. These neurons move the signal to the temporal lobe where it will be processed in the auditory cortex. Then these neurons initiate transmission to the motor cortex of the frontal lobe signaling the leg muscles to move.
 - c. These neurons carry the motor signal down Samuel's body to his legs to alert the muscles to begin running.
5.
 - a. controls Sam's voluntary movements as he stretches, coordinates his arm and leg motions, and raises his hands above his head after completing the race to allow more oxygen into his lungs
 - b. arouses his body as he prepares for and competes in the race and causes the physiological changes shown in Figure 10.2 on page 92
 - c. calms his body after the race as he cools down and causes the physiological changes shown in Figure 10.2 on page 92
6. Sample answer: The adrenal glands secrete adrenaline and noradrenaline (epinephrine, norepinephrine) to increase Samuel's heart rate, blood pressure, and blood sugar, which

provides him with a surge of energy. Additional responses may be correct—student should correctly state an endocrine structure from Figure 10.5 in Module 10 (and the hormone it releases) that would plausibly be involved in the running of a cross country meet.