

Chapter Three

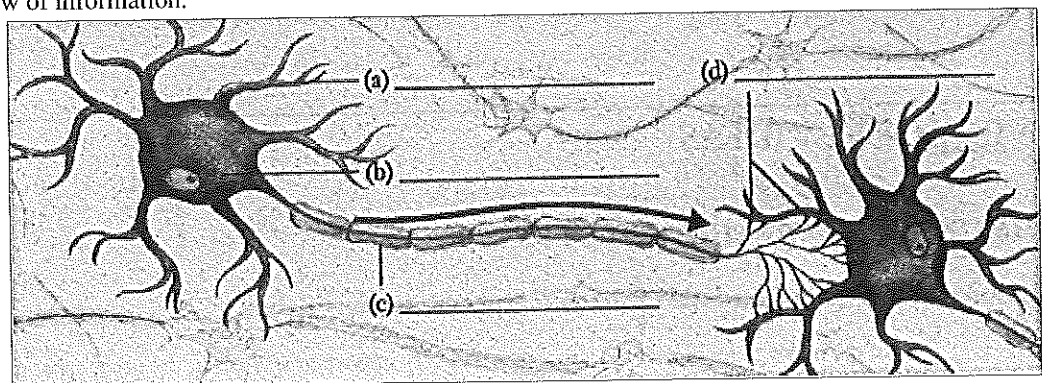
THE BIOLOGICAL BASES OF BEHAVIOR

Review of Key Ideas

COMMUNICATION IN THE NERVOUS SYSTEM

1. Describe the various parts of the neuron and their functions.

- 1-1. The neuron has three basic parts: the dendrites, the cell body or soma, and the axon. The major mission of the average neuron is to receive information from one neuron and pass it on to the next neuron. The receiving part is the job of the branch-like parts called _____. They then pass the message along to the nucleus of the cell, called the cell body, or _____. From there the message is sent down the _____ to be passed along to other neurons.
- 1-2. Many axons are wrapped in a fatty jacket called the _____, which permits for faster transmission of information and prevents messages from getting on the wrong track. Like the covering on an electrical cord, myelin acts as an _____ material.
- 1-3. When the neural message reaches the end of the axon it excites projections called terminal _____, which then release a chemical substance into the junction that separates them from other neurons. This junction between neurons is called the _____.
- 1-4. Identify the major parts of a neuron in the figure below. Note that the arrow indicates the direction of the flow of information.



(a) _____ (b) _____ (c) _____ (d) _____

Answers: 1-1. dendrites, soma, axon 1.2. myelin sheath, insulating 1-3. buttons, synapse 1-4. (a) dendrites, (b) cell body or soma, (c) axon, (d) terminal buttons.

2. Describe the main functions of glia cells

- 2-1. In addition to supplying nourishment to neurons, removing their waste products, and providing insulation, what other recently discovered function might glia serve?

Answers: 2-1. They might also send and receive chemical signals.

3. Describe the neural impulse.

- 3-1. When it is at rest, the neuron is like a tiny battery in that it contains a weak (negative/positive) charge. When the neuron is stimulated, the cell membrane becomes more permeable. This allows positively charged _____ ions to flow into the cell, thus lessening the cell's negative charge.
- 3-2. The change in the charge of the cell caused by the inflow of positively charged sodium ions, called an _____ potential, travels down the _____ of the neuron. After the firing of an action potential, there is a brief period in which no further action potentials can be generated. This brief period is called the absolute _____ period.
- 3-3. The text likens the neuron to a gun in that it either fires or it does not fire. This property of the neuron is called the _____ law. Neurons transmit information about the strength of a stimulus by variations in the number of action potentials generated. For example, in comparison to a weak stimulus, a strong stimulus will generate a (higher/lower) rate of action potentials.

Answers: 3-1. negative, sodium 3-2. action, axon, refractory 3-3. all or none, higher.

4. Describe how neurons communicate at chemical synapses.

- 4-1. A neuron passes its message on to another neuron by releasing a chemical messenger into the gap or _____ that separates it from other neurons. The sending neuron, called the _____, releases a chemical messenger into the synaptic cleft, which then excites the _____ neuron.
- 4-2. The chemical messenger that provides this transmitting service is called a _____. The chemical binds with specifically tuned receptor sites on the postsynaptic neurons. In other words, the receptor sites accept some neurotransmitters and reject _____.

Answers: 4-1. synaptic cleft, presynaptic, postsynaptic 4-2. neurotransmitter, others.

5. Describe the two types of postsynaptic potentials and how neurons integrate and form neural circuits.

- 5-1. When the neurotransmitter combines with a molecule at the receptor site it causes a voltage change at the receptor site called a _____ potential (PSP). One type of PSP is excitatory and (increases/ decreases) the probability of producing an action potential in the receiving neuron. The other type is inhibitory and _____ the probability of producing an action potential.
- 5-2. Whether or not a neuron fires depends on the number of excitatory PSPs it is receiving and the number of _____ PSPs it is receiving. PSPs (do/do not) follow the all or none law.
- 5-3. Put the five steps of communication at the synapse in their correct order (by using the numbers 1 through 5):
- _____ (a) The reuptake of transmitters by the presynaptic neuron.
 - _____ (b) The enzyme inactivation or drifting away of transmitters in the synapse.
 - _____ (c) The synthesis and storage of transmitters.
 - _____ (d) The binding of transmitters at receptor sites on the postsynaptic membrane.
 - _____ (e) The release of transmitters into the synaptic cleft.
- 5-4. Whether or not a neuron fires depends upon the balance between excitatory PSPs and _____ PSPs.
- 5-5. Most neurons are interlocked in complex networks that are constantly changing, eliminating old networks and adding new ones. Which process, adding networks or pruning, plays the larger role in molding the neural networks?

Answers: 5-1. postsynaptic, increases, decreases 5-2. inhibitory, do not 5-3. (a) 5, (b) 4, (c) 1, (d) 3, (e) 2
5-4. inhibitory 5-5. pruning.

6. Discuss some of the functions of acetylcholine and the monoamine neurotransmitters.

- 6-1. Our moods, thoughts, and actions all depend on the action of neurotransmitters. For example, the movement of all muscles depends on _____ (ACh). Like other neurotransmitters, ACh can only bind to specific sites, much like a lock and _____. However, other chemical substances can fool the receptor sites. For example, an agonist like nicotine can (block/mimic) the action of ACh, while an antagonist like curare can (block/mimic) the action of ACh.
- 6-2. Three neurotransmitters, dopamine, norepinephrine, and serotonin, are collectively known as _____. Both Parkinson's and schizophrenia have been linked with alterations in _____ activity, while the mood changes found in depression have been linked to receptor sites for norepinephrine and _____. Serotonin also plays a key role in the regulation of _____ and wakefulness and perhaps _____ behavior in animals.

Answers: 6-1. Acetylcholine, key, mimic, block 6-2. monoamines, dopamine, serotonin, sleep, aggressive.

7. Discuss how GABA and endorphins are related to behavior.

- 7-1.** GABA and its partner glycine are peculiar in that they appear to produce only (excitatory/inhibitory) PSPs.
- 7-2.** Endorphins are chemicals internally produced by the body that have effects similar to those produced by the drug _____ and its derivatives. That is, they are able to reduce pain and also induce _____, such as the “runner’s high” sometimes experienced by joggers.

Answers: 7-1. inhibitory 7-2. opium, pleasure (or euphoria).

ORGANIZATION OF THE NERVOUS SYSTEM

8. Provide an overview of the peripheral nervous system, including its subdivisions.

With approximately 85 to 180 billion individual neurons to control, it is important that the central nervous system has some kind of organizational structure. This organizational structure is depicted in Figure 3.6 of the text, and it will prove helpful if you have this figure in front of you while answering the following questions.

8-1. Answer the following questions regarding the organization of the peripheral nervous system:

(a) What constitutes the peripheral nervous system?

(b) What two subdivisions make up the peripheral nervous system?

(c) What is the role of the afferent and efferent nerve fibers?

(d) What two subdivisions make up the autonomic nervous system?

(e) Describe the opposing roles of the sympathetic and parasympathetic nervous systems.

Answers: 8-1. (a) All of the nerves that lie outside of the brain and spinal cord. (b) The somatic nervous system and the autonomic nervous system. (c) Afferent fibers carry information inward from the periphery, while efferent fibers carry information outward to the periphery. (d) The sympathetic nervous system and the parasympathetic nervous system. (e) The sympathetic system prepares the body for fight or flight, and the parasympathetic system conserves the body’s resources.

9. Distinguish between the central nervous system and the peripheral nervous system.

9-1. What are the two parts of the central nervous system?

9-2. What is the name given to all of the nerves that lie outside of the central nervous system?

Answers: **9-1.** The brain and the spinal cord. **9-2.** The peripheral nervous system.

LOOKING INSIDE THE BRAIN: RESEARCH METHODS

10. Describe how the EEG, lesioning, and ESB are used to investigate brain function.

10-1. The electroencephalograph, or _____, is a device that can measure the brain's _____ activity. Electrodes are placed on the scalp, and the brain's electrical activity is then monitored by the EEG machine and transformed into line tracings called _____ waves.

10-2. Answer the following questions regarding the use of lesioning and ESB to investigate brain function:

(a) What technique involves the actual destruction of brain tissue in order to examine the resulting effect on behavior?

(b) What technique would most likely be employed by a neurosurgeon to map the brain of a patient?

(c) Which techniques employ the use of electrodes and electrical currents?

(d) In what fundamental way does lesioning differ from ESB?

Answers: **10-1.** EEG, electrical, brain **10-2.** (a) lesioning, (b) ESB, (c) lesioning and ESB, (d) Lesioning is used to actually destroy tissue, whereas ESB is used to merely elicit behavior.

11. Describe transcranial stimulation and various brain imaging procedures.

11-1. Scientists can use transcranial magnetic stimulation to create “virtual lesions” in the human brain. What does this mean?

- 11-2.** Three kinds of brain-imaging procedures are widely used. One of these procedures consists of a computer enhanced X-ray machine that compiles multiple X-rays of the brain into a single vivid picture. The resulting images are called _____ scans. An even newer device that produces clearer three-dimensional images of the brain goes by the name of magnetic resonance imaging scanner, and the images it produces are known as _____ scans.
- 11-3.** Unlike CT and MRI scans, which can only show the structure of the brain, the positron emission tomography scanner can portray the brain's actual _____ across time. The images produced by this procedure are called _____ scans. Newer variations of MRI scans can also monitor brain activity, such as blood and oxygen flow, and thus provide both functional and structural information. These scans are called _____ magnetic images (fMRI).

Answers: 11-1. They can either increase or decrease the excitability of neurons in a particular area. 11-2. CT, MRI 11-3. activity, PET, functional.

THE BRAIN AND BEHAVIOR

12. Summarize the key functions of the medulla, pons, cerebellum, and midbrain.

- 12-1.** Three separate structures make up the hindbrain: the cerebellum, the pons, and the medulla. Identify these structures from the descriptions given below.
- (a) This structure is essential for executing and coordinating physical movement.
 - (b) This structure attaches to the top of the spinal cord and controls many essential functions such as breathing and circulation.
 - (c) This structure forms a bridge of fibers between the brainstem and cerebellum and plays an important role in both sleep and arousal.
- 12-2.** Helping to locate objects in space is one of the major roles of the _____. In addition, dopamine releasing neurons originate here and help to regulate the performance of _____ movements carried out by higher brain centers. It also shares a structure with the hindbrain that is essential for the regulation of sleep and wakefulness as well as modulation of muscular reflexes, breathing, and pain perception. This structure is called the _____ formation.

Answers: 12-1. (a) cerebellum, (b) medulla, (c) pons 12-2. midbrain, voluntary, reticular.

13. Summarize the key functions of the thalamus and hypothalamus.

13-1. The structure that serves as a way station for all sensory information headed for the brain is called the _____. The thalamus also appears to play an active role in _____ sensory information.

13-2. In addition to its role in controlling the autonomic nervous system and linking the brain to the endocrine system, the hypothalamus also plays a major role in regulating basic biological drives such as fighting, _____, feeding, and _____.

Answers: **13-1.** thalamus, integrating **13-2.** fleeing, mating.

14. Describe the nature and location of the limbic system, and summarize some of its key functions.

14-1. An interconnected network of structures involved in the control of emotion, motivation, and memory are collectively known as the _____ system. The hippocampus, for example, appears to play a key role in the formation of _____. However, the limbic system is best known for its role as the seat of _____. Electrical stimulation of particular areas of the limbic system in rats (particularly in the medial forebrain bundle) appears to produce intense _____. These “pleasure centers” actually appear to be neural circuits that release the neurotransmitter _____.

Answers: **14-1.** limbic, memories, emotion, pleasure, dopamine.

15. Name the four lobes in the cerebral cortex, and identify some of their key functions.

15-1. The cerebrum is the brain structure that is responsible for our most complex _____ activities. Its folded outer surface is called the _____ cortex. The cerebrum is divided into two halves, known as the right and _____ cerebral hemispheres. The two hemispheres communicate with each other by means of a wide band of fibers called the _____.

15-2. Each cerebral hemisphere is divided into four parts called lobes. Match these four lobes (occipital, parietal, temporal, and frontal) with their key function:

_____ (a) Contains the primary motor cortex that controls the movement of muscles.

_____ (b) Contains the primary visual cortex which initiates the processing of visual information.

_____ (c) Contains the primary auditory cortex which initiates the processing of auditory information.

_____ (d) Contains the primary somatosensory cortex that registers the sense of touch.

15-3. The prefrontal cortex seems to play an active role in higher order functions involving working memory and relational reasoning, suggesting to some that it serves an “executive _____ system”.

Answers: **15-1.** mental, cerebral, left, corpus callosum **15-2.** (a) frontal, (b) occipital, (c) temporal, (d) parietal **15-3.** control.

16. Summarize evidence on the brain's plasticity.

16-1. Research shows that the brain (is/is not) hardwired in the manner of computers. Rather, both children and adults can generate new neurons, and the wiring of the brain itself is flexible. This brain plasticity (increases/decreases) with age.

Answers: 16-1. is not, decreases.

RIGHT BRAIN/LEFT BRAIN: CEREBRAL LATERALITY

17. Explain why scientists viewed the left hemisphere as the dominant hemisphere, and describe how split-brain research changed this view.

17-1. Until recent years, it was believed that the left hemisphere dominated a submissive right hemisphere. Evidence for this belief came from several sources which all seemed to indicate that the left hemisphere played the dominant role with respect to the use of _____. For example, damage to an area in the frontal lobe known as _____ area was associated with speech deficits. Also, damage to another area located in the temporal lobe was found to be associated with difficulty in speech comprehension. This area is called _____ area. Both of these areas are located in the _____ cerebral hemisphere.

17-2. Answer the following questions regarding split-brain research:

(a) What was the result of severing the corpus callosum in these patients?

(b) Which hemisphere was found to be primarily responsible for verbal and language tasks in general?

(c) Which hemisphere was found to be primarily responsible for visual and spatial tasks?

17-3. What can be concluded with respect to hemispheric domination from split-brain studies?

Answers: 17-1. language, Broca's, Wernicke's, left 17-2. (a) The two cerebral hemispheres could no longer communicate with each other. (b) The left cerebral hemisphere. (c) The right cerebral hemisphere. 17-3. Neither hemisphere dominates, rather each has its own specialized tasks.

18. Describe how neuroscientists conduct research on cerebral specialization in normal subjects and what this research has revealed.

18-1. Researchers have looked at left-right imbalances in the speed of visual or auditory processing in the two hemispheres and (have/have not) observed perceptual asymmetries in normal subjects.

18-2. Answer the following questions regarding the conclusions that can be drawn from the research on hemispheric asymmetry:

(a) Are you more likely to identify verbal stimuli quickly and accurately when presented to the right visual field (left hemisphere), or when presented to the left visual field (right hemisphere)?

- (b) Are you more likely to identify visual-spatial information quickly and accurately, such as recognizing a face, when the stimuli are presented to the right visual field (left hemisphere) or when presented to the left visual field (right hemisphere)?
- (c) What conclusions can be drawn from the research on normal subjects regarding hemispheric specialization with respect to cognitive tasks?

Answers: 18-1. have 18-2. (a) When presented to the right visual field (left hemisphere). (b) When presented to the left visual field (right hemisphere). (c) The two hemispheres are specialized to handle different cognitive tasks.

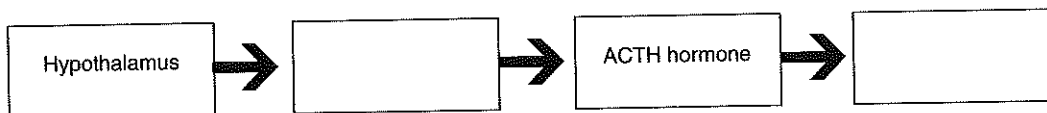
THE ENDOCRINE SYSTEM: ANOTHER WAY TO COMMUNICATE

19. Describe some of the ways in which hormones regulate behavior.

19-1. Answer the following questions regarding the workings of the endocrine system:

- (a) What is the role played by the hormones in the endocrine system?
- (b) While many glands comprise the endocrine system, which one functions as a master gland to control the others?
- (c) What structure is the real power behind the throne here?

19-2. Fill in the boxes in the diagram below showing the role of the pituitary gland in the “fight or flight” response to stress.



19-3. The communication between the brain and the endocrine system (is/is not) a one-way street. The levels of many hormones are regulated through (positive/negative) feedback systems.

19-4. What is the role of sexual hormones:

(a) Prior to birth?

(b) At puberty?

Answers: 19-1. (a) They serve as chemical messengers. (b) the pituitary gland (c) the hypothalamus 19-2. pituitary, adrenal gland 19-3. is not, negative 19-4. (a) They direct the formation of the external sexual organs. (b) They are responsible for the emergence of the secondary sexual characteristics.

HEREDITY AND BEHAVIOR: IS IT ALL IN THE GENES?

20. Describe the structures and processes involved in genetic transmission.

20-1. When a human sperm and egg unite at conception they form a one-celled organism called a _____. This cell contains 46 chromosomes, half of which are contributed by each _____, thus making 23 pairs. Each member of a pair operates in conjunction with its _____ member. The zygote then evolves to form all of the cells in the body, each of which have _____ pairs of chromosomes.

20-2. Each chromosome is actually a threadlike strand of a _____ molecule, and along this threadlike structure are found the individual units of information, called _____, that determine our biological makeup. Like chromosomes, genes operate in _____. For example, type of ear lobe is determined by a pair of genes. If both parents contribute a gene for the same type, the child will inherit this type, and the two genes are said to be _____. If the parents contribute two different genes for the type of ear lobe, the genes are said to be _____, and the child will inherit the type carried by the dominant gene. When heterozygous genes are paired, the dominant gene masks the _____ gene.

Answers: 20-1. zygote, parent, opposite, 23 20-2. DNA, genes, pairs, homozygous, heterozygous, recessive.

21. Explain the difference between genotype and phenotype and the meaning of polygenic inheritance.

21-1. Answer the following questions about the difference between genotype and phenotype:

(a) What are the two genes that make up your ear lobe type said to be?

(b) What is your resulting ear lobe type said to be?

(c) Can your genotype or phenotype change over time?

21-2. What is meant when it is said that most human traits are polygenic?

Answers: 21-1. (a) your genotype, (b) your phenotype, (c) only your phenotype can change 21-2. They are determined by two or more pairs of genes.

22. Explain the special methods used to investigate the influence of heredity on behavior.

22-1. If a trait is due to heredity, then more closely related members of a family should show (lesser/greater) resemblance on this trait than less closely related family members. Studies using this method are called _____ studies. Data gathered from family studies (can/cannot) furnish conclusive proof as to the heritability of a specific trait. Even when it is demonstrated that a particular trait is highly related to the degree of family relationship, the cause for this relationship could be either heredity or _____.

22-2. A second method in this line of investigation is to compare specific traits across identical twins and fraternal twins. This method, called _____ studies, assumes that inherited traits are much more likely to be found among (identical/fraternal) twins. These studies do in fact show that for many characteristics, such as intelligence and extraversion, the resemblance is closest for _____ twins. However, since identical twins are far from identical on these characteristics, _____ factors must also play a role here.

22-3. A third method in this line of investigation is to study children who have been separated from their biological parents at a very early age and raised by adoptive parents. The idea behind these _____ studies is that if the adoptive children more closely resemble their biological parents with respect to a specific trait, then it can be assumed that _____ plays a major role. On the other hand, if the adoptive children more closely resemble their adoptive parents with respect to a specific trait it would indicate that _____ plays a major role. Studies using this method to study the heritability of intelligence have found that adoptive children _____ resemble their biological and adoptive parents on this particular trait. This would indicate that a trait such as intelligence is influenced by both heredity and _____.

Answers: 22-1. greater, family, cannot, environment 22-2. twin, identical, identical, environmental 22-3. adoption, heredity, environment, equally, environment.

THE EVOLUTIONARY BASES OF BEHAVIOR

23. Explain the four key insights that represent the essence of Darwin's theory.

23-1. Darwin's four key insights are listed below. Match each one with the statement that best reflects the essence of the insight.

1. Organisms vary in endless ways.
2. Some of these characteristics are heritable.

3. Organisms tend to reproduce faster than the available resources necessary for their survival.
4. If a specific heritable trait contributes to survival or reproductive fitness its prevalence will increase over generations.
 - _____ (a) The gazelle that runs the fastest is most likely to leave offspring behind.
 - _____ (b) The members of most species die from starvation or other side effects of overcrowding.
 - _____ (c) Birds fly, fish swim, and lions roar.
 - _____ (d) We all have some traits that are very similar to our grandparents.

Answers: 23-1. 1 (c), 2 (d), 3 (b), 4 (a).

24. Describe some subsequent refinements to evolutionary theory.

24-1. Although contemporary theorists accept Darwin's basic theory of natural selection, they have found that natural selection operates on a gene pool that is also influenced by genetic drift, mutations, and gene flow. Match these terms with the definitions given below.

- (a) Spontaneous, heritable changes in a piece of DNA can occur in an individual organism.

- (b) Gene frequencies in a population can shift because of emigration (out flow) and immigration (in flow). _____
- (c) There can be random fluctuations in a gene pool. _____

Answers: 24-1. (a) mutation (b) gene flow (c) genetic drift.

25. Provide some examples of animal behavior that represent adaptations.

25-1. Answer the following questions about behavioral adaptations:

- (a) What advantage do gazelles that stot (we humans call it mooning) gain when spotting a cheetah?
- (b) What advantage do rats gain by only eating a small amount when they encounter a new food?

Answers: 25-1. (a) It increases their chances of escaping. (b) It decreases their chances of being poisoned.

REFLECTING ON THE CHAPTER'S THEMES

26. Explain how this chapter highlighted three of the texts unifying themes.

26-1. Indicate which of the three unifying themes (heredity and environment jointly influence behavior, behavior is determined by multiple causes, and psychology is empirical) is particularly illustrated in each of the following situations:

- (a) The discovery of the factors that lead to the development of schizophrenic disorders.
- (b) The development of many new techniques and instruments that led to the discovery of cerebral specialization.
- (c) A new look at the two major factors that influence the development of personal characteristics such as intelligence and temperament.

Answers: 26-1. (a) Behavior is determined by multiple causes. (b) Psychology is empirical. (c) Heredity and environment jointly influence behavior.

EVALUATING THE CONCEPT OF “TWO MINDS IN ONE”

27. Critically evaluate the five ideas on cerebral specialization and cognitive processes discussed in the chapter.

27-1. Your text lists five popular ideas that have found support among some neuroscientists and psychologists. These ideas are:

- (a) The two hemispheres are _____ to process different cognitive tasks.
- (b) Each hemisphere has its own independent stream of _____.
- (c) The two hemispheres have _____ modes of thinking.
- (d) People vary in their _____ on one hemisphere as opposed to the other.

Answers: 27-1. (a) specialized (b) consciousness (c) different (d) reliance (dependence).

27-2. We will now proceed through each of these five assumptions to show how each has to be qualified in light of currently available evidence.

- (a) The idea that the left and right brains are specialized to handle different kinds of information (is/is not) supported by research. However, there is evidence that this specialization hardly occurs in some persons, while in other persons the specialization is reversed, particularly among _____ handed persons. Moreover, most tasks require the ongoing cooperation of _____ hemispheres.
- (b) The evidence that each hemisphere has its own mind, or stream of consciousness, is actually very weak, except for persons who have undergone _____ - _____ surgery. The resulting “two minds” in these patients appears to be a byproduct of the surgery.

- (c) The assertion that each hemisphere has its own mode of thinking is (plausible/confirmed). A big problem here, however, is that mode of thinking, or cognitive style, has proven difficult to both define and _____.
- (d) The assertion that some people are left-brained while others are right-brained (is/is not) conclusive at this time. Abilities and personality characteristics (do/do not) appear to be influenced by brainedness.
- (e) The notion that most schooling overlooks the education of the right brain (does/does not) really make sense. Since both hemispheres are almost always sharing in accomplishing an ongoing task, it would be _____ to teach only one hemisphere at a time.

Answers: 27-2. (a) is, left, both (b) split-brain (c) plausible, measure (d) is not, do not (e) does not, impossible.

28. Explain how neuroscience research has been overextrapolated by some education and child care advocates who have campaigned for infant schooling.

28-1. Answer the following questions regarding neuroscience research:

- (a) What happened to kittens deprived of light to one eye for the first 4-6 weeks of life?
- (b) What happened to kittens deprived of light to one eye for the same amount of time after four months of age?
- (c) What is the name given to that early period in the kitten's life when light is essential for the normal development of vision?
- (d) What difference was found in synapses in rats that were raised in "enriched" environments when compared to rats raised in "impoverished" environments?

28-2. Answer the following questions regarding the overextrapolation of neuroscience findings:

- (a) What findings argue against the notion that brain development is more malleable during the first three years of life?
- (b) There are findings that argue against the notion that greater synaptic density is associated with greater intelligence. Which of the following is correct?
 1. Infant animals and human beings begin life with an overabundance of synaptic connections.
 2. Infant animals and human beings begin life with an insufficient number of synaptic connections.
 3. Learning involves the pruning of inactive synapses and reinforcing heavily used neural pathways.

Answers: 28-1. (a) They became blind in the light-deprived eye. (b) They did not suffer blindness in that eye. (c) critical period (d) They had more synapses. **28-2.** (a) It has been found that the brain remains malleable throughout life. (b) 1 and 3 are correct.

Review of Key Terms

Afferent nerve fibers	Fitness	Parasympathetic division
Agonist	Forebrain	Perceptual asymmetries
Antagonist	Fraternal (dizygotic) twins	Peripheral nervous system
Autonomic nervous system (ANS)	Genes	Phenotype
Axon	Genetic mapping	Pituitary gland
Behavioral genetics	Genotype	Polygenic traits
Central nervous system (CNS)	Heterozygous condition	Postsynaptic potential (PSP)
Cerebral cortex	Hindbrain	Recessive gene
Cerebral hemispheres	Homozygous condition	Resting potential
Cerebrospinal fluid (CSF)	Hormones	Reuptake
Chromosomes	Hypothalamus	Soma
Corpus callosum	Identical (monozygotic) twins	Somatic nervous system
Critical period	Inclusive fitness	Split-brain surgery
Dendrites	Inhibitory PSP	Sympathetic division
Dominant gene	Lesioning	Synapse
Efferent nerve fibers	Limbic system	Synaptic cleft
Electrical stimulation of the brain (ESB)	Midbrain	Terminal buttons
Electroencephalograph (EEG)	Myelin sheath	Thalamus
Endocrine System	Natural selection	Transcranial magnetic stimulation (TMS)
Endorphins	Nerves	Twin studies
Excitatory PSP	Neurons	Zygote
Family studies	Neurotransmitters	

- _____ 1. A technique that temporarily enhances or depresses neural activity in a specific area of the brain.
- _____ 2. A limited time span for the development of an organism that is optimal for certain capacities to emerge because the organism is especially responsive to certain experiences.
- _____ 3. Refers to the reproductive success of an individual organism relative to the average reproductive success in the population.
- _____ 4. Individual cells in the nervous system that receive, integrate, and transmit information.
- _____ 5. Neuron part that contains the cell nucleus and much of the chemical machinery common to most cells.
- _____ 6. Branchlike parts of a neuron that are specialized to receive information.
- _____ 7. A long, thin fiber that transmits signals away from the soma to other neurons, or to muscles or glands.
- _____ 8. An insulating jacket, derived from glia cells that encases some axons.
- _____ 9. Small knobs at the end of the axon that secrete chemicals called neurotransmitters.
- _____ 10. A junction where information is transmitted between neurons.
- _____ 11. The stable, negative charge of an inactive neuron.
- _____ 12. A process in which neurotransmitters are sponged up from the synaptic cleft by the presynaptic neuron.

- _____ 13. Posits that heritable characteristics that provide a survival or reproductive advantage are more likely than alternative characteristics to be passed on to subsequent generations and thus come to be “selected” over time.
- _____ 14. A microscopic gap between the terminal buttons of the sending neuron and the cell membrane of another cell.
- _____ 15. Chemicals that transmit information from one neuron to another.
- _____ 16. A voltage change at the receptor site of a neuron.
- _____ 17. An electric potential that increases the likelihood that a postsynaptic neuron will fire action potentials.
- _____ 18. An electric potential that decreases the likelihood that a postsynaptic neuron will fire action potentials.
- _____ 19. A technique for assessing hereditary influence by examining blood relatives to see how much they resemble each other on a specific trait.
- _____ 20. A chemical that mimics the action of a neurotransmitter.
- _____ 21. A chemical that opposes the action of a neurotransmitter.
- _____ 22. An entire family of internally produced chemicals that resemble opiates in structure and effects.
- _____ 23. System that includes all those nerves that lie outside the brain and spinal cord.
- _____ 24. Bundles of neuron fibers (axons) that travel together in the peripheral nervous system.
- _____ 25. System made up of the nerves that connect to voluntary skeletal muscles and sensory receptors.
- _____ 26. Axons that carry information inward to the central nervous system from the periphery of the body.
- _____ 27. Axons that carry information outward from the central nervous system to the periphery of the body.
- _____ 28. System made up of the nerves that connect to the heart, blood vessels, smooth muscles, and glands.
- _____ 29. The branch of the autonomic nervous system that mobilizes the body’s resources for emergencies.
- _____ 30. The branch of the autonomic nervous system that generally conserves bodily resources.
- _____ 31. System that consists of the brain and spinal cord.
- _____ 32. A solution that fills the hollow cavities (ventricles) of the brain and circulates around the brain and spinal cord.
- _____ 33. A device that monitors the electrical activity of the brain over time by means of recording electrodes attached to the surface of the scalp.
- _____ 34. Assessing hereditary influence by comparing the resemblance of identical twins and fraternal twins on a trait.
- _____ 35. Method that involves destroying a piece of the brain by means of a strong electric current delivered through an electrode.
- _____ 36. Method that involves sending a weak electric current into a brain structure to stimulate (activate) it.
- _____ 37. Part of the brain that includes the cerebellum and two structures found in the lower part of the brainstem, the medulla and the pons.
- _____ 38. The segment of the brainstem that lies between the hindbrain and the forebrain.

- _____ 39. Part of the brain encompassing the thalamus, hypothalamus, limbic system, and cerebrum.
- _____ 40. A structure in the forebrain through which all sensory information (except smell) must pass to get to the cerebral cortex.
- _____ 41. A structure found near the base of the forebrain that is involved in the regulation of basic biological needs.
- _____ 42. A densely connected network of structures located beneath the cerebral cortex, involved in the control of emotion, motivation, and memory.
- _____ 43. The convoluted outer layer of the cerebrum.
- _____ 44. The right and left halves of the cerebrum.
- _____ 45. The structure that connects the two cerebral hemispheres.
- _____ 46. The process of determining the location and chemical sequence of specific genes or chromosomes.
- _____ 47. Surgery in which the corpus callosum is severed to reduce the severity of epileptic seizures.
- _____ 48. System of glands that secrete chemicals into the bloodstream that help control bodily functioning.
- _____ 49. The chemical substances released by the endocrine glands.
- _____ 50. The “master gland” of the endocrine system.
- _____ 51. Threadlike strands of DNA molecules that carry genetic information.
- _____ 52. A one-celled organism formed by the union of a sperm and an egg.
- _____ 53. DNA segments that serve as the key functional units in hereditary transmission.
- _____ 54. A gene that is expressed when the paired genes are different (heterozygous).
- _____ 55. A gene that is masked when paired genes are heterozygous.
- _____ 56. A person’s genetic makeup.
- _____ 57. The ways in which a person’s genotype is manifested in observable characteristics.
- _____ 58. Characteristics that are influenced by more than one pair of genes.
- _____ 59. The sum of an individual’s own reproductive success, plus the effects the organism has on the reproductive success of related others.
- _____ 60. Twins that result when two eggs are fertilized simultaneously by different sperm cells, forming two separate zygotes.
- _____ 61. Left-right imbalances between the cerebral hemispheres in the speed of visual or auditory processing.
- _____ 62. Twins that emerge from one zygote that splits.
- _____ 63. An interdisciplinary field that studies the influence of genetic factors on behavioral traits.
- _____ 64. The two genes in a specific pair are the same.
- _____ 65. The two genes in a specific pair are different.

Answers: 1. transcranial magnetic stimulation 2. critical period 3. fitness 4. neurons 5. soma 6. dendrites 7. axon 8. myelin sheath 9. terminal buttons 10. synapse 11. resting potential 12. reuptake 13. natural selection 14. synaptic cleft 15. neurotransmitters 16. postsynaptic potential (PSP) 17. excitatory PSP 18. inhibitory PSP 19. family studies 20. agonist 21. antagonist 22. endorphins 23. peripheral nervous system 24. nerves 25. somatic nervous system 26. afferent nerve fibers 27. efferent fibers 28. autonomic nervous system (ANS) 29. sympathetic division 30. parasympathetic division 31. central nervous system (CNS) 32. cerebrospinal fluid (CSF) 33. electroencephalograph (EEG)

34. twin studies 35. lesioning 36. electrical stimulation of the brain (ESB) 37. hindbrain 38. midbrain 39. forebrain 40. thalamus 41. hypothalamus 42. limbic system 43. cerebral cortex 44. cerebral hemispheres 45. corpus callosum 46. adoption studies 47. split-brain surgery 48. endocrine system 49. hormones 50. pituitary gland 51. chromosomes 52. zygote 53. genes 54. dominant gene 55. recessive gene 56. genotype 57. phenotype 58. polygenic traits 59. inclusive fitness 60. fraternal (dizygotic) twins 61. perceptual asymmetries 62. identical (monozygotic) twins 63. behavioral genetics 64. monozygous condition 65. heterozygous condition.

Review of Key People

Charles Darwin	James Olds & Peter Milner	Robert Plomin
Alan Hodgkin & Andrew Huxley	Candice Pert & Solomon Snyder	Roger Sperry & Michael Garzzaniga

- | | |
|-------|--|
| _____ | 1. Unlocked the mystery of the neural impulse. |
| _____ | 2. Known for their work with the split-brain. |
| _____ | 3. Showed that morphine works by binding to specific receptors. |
| _____ | 4. Discovered "pleasure-centers" in the limbic system. |
| _____ | 5. One of the leading behavior genetics researchers in the last decade. |
| _____ | 6. Identified natural selection as the mechanism that orchestrates the process of evolution. |

Answers: 1. Hodgkin & Huxley 2. Sperry & Garzzaniga 3. Pert & Snyder 4. Olds & Milner 5. Plomin 6. Darwin.

Self-Quiz

- Most neurons are involved in transmitting information:
 - from one neuron to another
 - from the outside world to the brain
 - from the brain to the muscles
 - from the brain to the glands
- Which part of the neuron has the responsibility for receiving information from other neurons?
 - the cell body
 - the soma
 - the axon
 - the dendrites
- The myelin sheath serves to:
 - permit faster transmission of the neural impulse
 - keep neural impulses on the right track
 - add structural strength
 - permit faster transmission and keep neural impulses on track
- The change in the polarity of a neuron that results from the inflow of positively charged ions and the outflow of negatively charged ions is called the:
 - presynaptic potential
 - postsynaptic potential
 - synaptic potential
 - action potential

5. The task of passing a message from one neuron to another is actually carried out by:
 - a. the myelin sheath
 - b. the glia cells
 - c. the action potential
 - d. neurotransmitters

6. Which of the following techniques is often used by neurosurgeons to map the brain when performing brain surgery?
 - a. EEG recordings
 - b. ESB
 - c. lesioning
 - d. all of the above

7. The seat of emotion is to be found in the:
 - a. reticular formation
 - b. hindbrain
 - c. limbic system
 - d. forebrain

8. Persons having difficulty with language and speech following an accident that resulted in injury to the brain are most likely to have sustained damage in the:
 - a. right cerebral hemisphere
 - b. left cerebral hemisphere
 - c. right cerebral hemisphere if they are a male and left cerebral hemisphere if they are a female
 - d. I have no idea what you are talking about

9. In carrying out the “fight or flight” response, the role of supervisor is assigned to the:
 - a. adrenal gland
 - b. pituitary gland
 - c. hypothalamus
 - d. parasympathetic nervous system

10. A person’s current weight and height could be said to exemplify his or her:
 - a. genotype
 - b. phenotype
 - c. both of the above
 - d. none of the above

11. Which of the following kinds of studies can truly demonstrate that specific traits are indeed inherited?
 - a. family studies
 - b. twin studies
 - c. adoption studies
 - d. none of the above

12. Current evidence indicates that schizophrenia results from:
 - a. genetic factors
 - b. environmental factors
 - c. multiple causes that involve both genetic and environmental factors
 - d. completely unknown factors

13. Psychology as a science can be said to be:
 - a. empirical
 - b. rational
 - c. analytic
 - d. both b and c

14. Which of the following statements is/are correct?
- a. The right side of the brain is the creative side.
 - b. The right and left brains are specialized to handle different kinds of information.
 - c. The left side of the brain always handles language tasks.
 - d. Most schooling overlooks the education of the right brain.
15. Which of the following is not one of Darwin's four key insights?
- a. Some characteristics are heritable.
 - b. Organisms vary in endless ways.
 - c. Genetic drift is a major factor in the evolution of species.
 - d. Organisms tend to reproduce faster than available resources.
16. The evolution of species is:
- a. a fact
 - b. a theory with a few flaws
 - c. a theory with many flaws
 - d. a speculation not open to empirical verification
17. Which of the following is correct?
- a. Human beings begin life with an insufficient number of synapses.
 - b. Human beings begin life with an overabundance of synapses.
 - c. Synaptic density is associated with intelligence.
 - d. Brain development is only malleable during the first 3 years of life.

Answers: 1. a 2. d 3. c 4. d 5. d 6. b 7. c 8. b 9. c 10. b 11. d 12. c 13. a 14. b 15. c 16. a 17. b

InfoTrac Keywords

Family studies

Twin Studies