

Neural and Hormonal Systems

MODULE OVERVIEW

Module 4 is concerned with the body's neural systems, which provide the basis for all human behavior. Under the direction of the brain, the nervous and endocrine systems coordinate a variety of voluntary and involuntary behaviors and serve as the body's mechanisms for communication with the external environment.

NOTE: Answer guidelines for all Module 4 questions begin on page 44.

MODULE REVIEW

First, skim each section, noting headings and bold-face items. After you have read the section, review each objective by answering the fill-in and essay-type questions that follow it. In some cases, Study Tips explain how best to learn a difficult concept and Applications help you to know how well you understand the material. As you proceed, evaluate your performance by consulting the answers beginning on page 44. Do not continue with the next section until you understand each answer. If you need to, review or reread the section in the textbook before continuing.

STUDY TIP: Many students find the technical material in Modules 4-6 difficult to master. Not only are there many terms for you to remember, but you must also know the organization and function of the various divisions of the nervous system. Learning this material will require a great deal of active processing, testing yourself frequently to be sure you know and understand the many structures and their functions. Working the module reviews several times, drawing and labeling brain diagrams, making flash cards, and mentally defining the terms are all useful techniques for learning this type of material.

Biology, Behavior, and Mind

Objective 4-1: Explain why psychologists are concerned with human biology.

- In the most basic sense, every idea, mood, memory, and behavior that an individual has ever experienced is a biological phenomenon.
- The theory that linked our mental abilities to bumps on the skull was phrenology. Although its popularity faded, this theory focused attention on the localization of function.
- Researchers who study the links between biology and behavior are working from the biological perspective.
- We are made up of smaller and smaller subsystems; we are also part of larger systems. Thus, we are bio/psych/social systems.

APPLICATIONS:

- Someone working from the biological perspective would be more likely to study
 - how you learn to express emotions.
 - how to help people overcome emotional disorders.
 - life-span changes in the expression of emotion.
 - the chemical changes that accompany emotions.

6. Which of the following was a major problem with phrenology?
- a. It was "ahead of its time" and no one believed it could be true.
 - b.** The brain is not neatly organized into structures that correspond to our categories of behavior.
 - c. The brains of humans and animals are much less similar than the theory implied.
 - d. All of these were problems with phrenology.

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

How muscle tension varies w/ facial expression
Chemical changes - emotions
heart rate - anger

Neural Communication

Objective 4-2: Describe the parts of a neuron, and explain how its impulses are generated.

8. Our body's neural system is built from billions of nerve cells, or neurons.
9. Identify the major parts of the neuron diagrammed below.
- a. dendrites
 - b. cell body
 - c. axon
 - d. myelin sheath



10. The extensions of a neuron that receive messages from other neurons are the dendrites. The extension of a neuron that transmits information to other neurons is the axon. Some of these extensions are insulated by a fatty tissue called the myelin sheath, which helps speed the neuron's impulses.

11. The neural impulse, or action potential, is a brief electrical charge that travels down a(n) axon.

12. The fluid interior of a resting axon carries mostly (positively/negatively) charged ions, while the fluid outside has mostly (positively/negatively) charged ions. This polarization, called the resting potential, occurs because the cell membrane is selectively permeable.
13. An action potential occurs when the first part of the axon opens its gates and (positively/negatively) charged ions rush in, causing that part of the neuron to become depolarized. During the resting pause following an action potential, called the refractory period, the neuron pumps (positively/negatively) charged ions back outside the cell.
14. To trigger a neural impulse, excitatory signals minus inhibitory signals must exceed a certain intensity, called the threshold. Increasing a stimulus above this level (will/will not) increase the neural impulse's intensity. This phenomenon is called an all or none response.
15. The strength of a stimulus (does/does not) affect the intensity of a neural impulse. A strong stimulus (can/cannot) trigger more neurons to fire.

Objective 4-3: Describe how nerve cells communicate with other nerve cells.

16. The junction between two neurons is called a Synapse, and the gap is called the Synaptic gap (cleft). This discovery was made by Charles Sherrington.
17. The chemical messengers that convey information across the gaps between neurons are called neurotransmitters. These chemicals bind to receptor sites and unlock tiny channels, allowing

electrically charged atoms to enter the neuron.

18. Neurotransmitters influence neurons either by exciting or inhibiting their readiness to fire. Excess neurotransmitters are reabsorbed by the sending neuron in a process called reuptake.

Outline the sequence of reactions that occur when a neural impulse is generated and transmitted from one neuron to another.

excitatory signals exceeding the threshold received by dendrites all or none fashion transmitted down the axon. neurotransmitters are released into the synaptic gap bind to receptor sites of the next neuron dendrite - generates its neural impulse.

Objective 4-4: Describe how neurotransmitters influence behavior, and explain how drugs and other chemicals affect neurotransmission.

19. A neurotransmitter that is important in muscle contraction is acetylcholine; it is also important in learning and memory.
20. Naturally occurring opiate-like neurotransmitters that are present in the brain are called endorphins. When the brain is flooded with drugs such as heroin or morphine, it may stop producing these neurotransmitters.
21. Drugs that produce their effects by mimicking neurotransmitters are called agonists. Drugs that block neurotransmitters' functioning by occupying their receptor sites are called antagonists. Although certain opiate drugs create a temporary "high" by mimicking the endorphins, the poison cyanide produces paralysis by blocking the activity of the neurotransmitter ACh.

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

APPLICATIONS:

22. Several shy neurons send an inhibitory message to neighboring neuron Joni. At the same time, a larger group of party-going neurons sends Joni excitatory messages. What will Joni do?
- fire, assuming that her threshold has been reached
 - not fire, even if her threshold has been reached
 - enter a refractory period
 - become hyperpolarized
23. I am a relatively fast-acting chemical messenger that influences muscle action, learning, and memory. What am I?
- dopamine
 - a hormone
 - acetylcholine
 - glutamate
24. Since Malcolm has been taking a drug prescribed by his doctor, he no longer enjoys the little pleasures of life, such as eating and drinking. His doctor explains that this is because the drug
- triggers release of dopamine.
 - inhibits release of dopamine.
 - triggers release of ACh.
 - inhibits release of ACh.
25. Lolita is feeling depressed for no particular reason. It is possible that she has an undersupply of norepinephrine.
26. Punjab had lunch at the local Chinese restaurant. Afterward, he suffered a migraine, most likely caused by an over supply of glutamate.