The Nervous System

Objective 4-5: Describe the functions of the nervous system's main divisions, and identify the three main types of neurons.

27. Taken altogether, the neurons of the body form the nervous system.

28. The brain and spinal cord form the central nervous system. The neurons that link the brain and spinal cord to the rest of the body form the peripheral nervous system.

29. Axons are bundled into electrical cables called nerves, which link the CNS with muscles, glands, and sense organs. Information arriving in the brain and spinal cord from the body's tissues and sensory receptors travels in sensory neurons. Instructions from the brain and spinal cord are sent to the body's tissues via motor neurons. The neurons that enable internal communication within the brain and spinal cord are called interneurons

30. The division of the peripheral nervous system that enables voluntary control of the skeletal muscles is the somatic nervous system.

31. Involuntary, self-regulating responses—those of the glands and muscles of internal organs—are controlled by the autonomic nervous system.

32. The body is made ready for action by the sympathetic division of the autonomic nervous system.

33. The parasympathetic division of the autonomic nervous system produces relaxation.

Describe and explain the sequence of physical reactions that occur in the body as an emergency is confronted and then passes.

34. The brain's neurons cluster into work groups called neural networks.

35. Automatic responses to stimuli, called reflexes, illustrate the work of the spinal cord. Simple pathways such as these are involved in the knee-jerk response and in the pain reflex.

Beginning with the sensory receptors in the skin, trace the course of a spinal reflex as a person reflexively jerks his or her hand away from an unexpectedly hot burner on a stove.

sensory → interneuron spinal cord — motor

STUDY TIP: To keep the various functions of the peripheral nervous system (PNS) straight, remember that the PNS consists of two main divisions: somatic and autonomic. The somatic ("S") division primarily regulates "S functions," such as the *senses* and *skeletal* muscles. The autonomic ("A") division regulates *automatic* ("A") physical systems that do not require conscious attention. These include breathing, heart rate, and digestion, to name a few.

APPLICATIONS:

36. You are sitting at your desk at home, studying for an exam. No one else is home, but you hear creaking floorboards. You sneak downstairs, only to discover your parents have returned home early. Describe and explain the sequence of physical reactions that occurred in your body as you felt fear and then relief.

NS. aroused
heart
blood-oxygen
blood pressure
calves dilate
perspiration to cool
parasympathetic
calm

37. You are able to pull your hand quickly away from hot water before pain is felt because
    a. movement of the hand is a reflex that involves intervention of the spinal cord only.
    b. movement of the hand does not require intervention by the central nervous system.
    c. the brain reacts quickly to prevent severe injury.
    d. the autonomic division of the peripheral nervous system intervenes to speed contraction of the muscles of the hand.

38. Following Jayshree's near-fatal car accident, her physician noticed that the pupillary reflex of her eyes was abnormal. This MAY indicate that Jayshree's autonomic N.S. was damaged in the accident.

39. Your brother has been taking prescription medicine and experiencing a number of unpleasant side effects, including unusually rapid heartbeat and excessive perspiration. It is likely that the medicine is exaggerating activity in the
    a. central nervous system.
    b. sympathetic nervous system.
    c. parasympathetic nervous system.
    d. somatic nervous system.

The Endocrine System

Objective 4-6: Describe the nature and functions of the endocrine system and its interaction with the nervous system.

40. The body's chemical communication network is called the endocrine system. This system transmits information through chemical messengers called hormones at a much _____ (faster/slower) rate than the nervous system, and its effects last _____ (a longer time/a shorter time).

41. In a moment of danger, the autonomic nervous system orders the adrenal glands to release epinephrine and norepinephrine. These hormones increase heart rate, blood pressure, and blood sugar.

42. The most influential gland is the pituitary, which, under the control of an adjacent brain area called the hypothalamus, helps regulate growth and the release of hormones by other endocrine glands. The hormone oxytocin enables contractions associated with birthing, milk flow during nursing, and orgasm. It also promotes pair bonding, group cohesion, social ties.

Write a paragraph describing the feedback system that links the nervous and endocrine systems.

hypothalamus → pituitary – regulates all other endocrine glands – hormones then influence the brain and dictate behavior.

APPLICATIONS:

43. I am a relatively slow-acting (but long-lasting) chemical messenger carried throughout the body by the bloodstream. What am I?
    a. a hormone
    b. a neurotransmitter
    c. acetylcholine
    d. dopamine

44. A bodybuilder friend suddenly seems to have grown several inches in height. You suspect that your friend's growth spurt has occurred because he has been using drugs that affect the
    a. pituitary gland.
    b. pancreas.
    c. adrenal glands.
    d. parathyroids.

PROGRESS TEST

Multiple-Choice Questions

Circle your answers to the following questions and check them with the answers beginning on page 45. If your answer is incorrect, read the explanation for why it is incorrect and then consult the text.

1. The axons of certain neurons are covered by a layer of fatty tissue that helps speed neural transmission. This tissue is
    a. dopamine.
    b. the myelin sheath.
    c. acetylcholine.
    d. an endorphin.