

## Chapter 35 Nervous System

### Summary

#### 35-1 Human Body Systems

The levels of organization in a multicellular organism include cells, tissues, organs, and organ systems. Cells are the basic units of structure and function in living things. In multicellular organisms, cells are specialized to perform certain functions. Tissues are groups of similar cells that perform a single function. There are four different types of tissues. Epithelial tissue covers body surfaces. Connective tissue supports the body and connects its parts. Nervous tissue carries messages throughout the body. Muscle tissue enables the body to move. An organ is a group of tissues that work together to perform a complex function. An organ system is a group of organs that perform related functions. Humans have 11 organ systems.

Organ systems work together to maintain stable conditions in the body. The process of maintaining stable internal conditions is called homeostasis. Homeostasis may involve feedback inhibition, or negative feedback. For example, the nervous system senses when the body cools and signals the cells to produce more heat.

#### 35-2 The Nervous System

The nervous system controls and coordinates functions throughout the body and responds to internal and external stimuli. Messages carried by the nervous system are electrical signals called impulses. Cells that transmit impulses are called neurons. A neuron has a cell body containing the nucleus. Short branches, called dendrites, carry impulses toward the cell body. A long fiber, called the axon, carries impulses away from the cell body. A myelin sheath surrounds parts of the axon in some neurons. Impulses can jump over the myelin and travel faster.

A resting neuron is one that is not transmitting an impulse. Resting potential is the difference in electrical charge across the cell membrane of a resting neuron. An impulse begins when a resting neuron is stimulated by another neuron or by the environment. The impulse is a sudden reversal of charge across the cell membrane, called an action potential. The lowest level of stimulus needed to activate a neuron is known as the threshold.

At the end of the axon is a synapse. A synapse is the location at which a neuron can transfer an impulse to another cell. Chemicals called neurotransmitters transmit impulses across the synapse.

#### 35-3 Divisions of the Nervous System

The nervous system has two major divisions: the central nervous system and the peripheral nervous system. The central nervous system is the control center of the body. It relays messages, processes information, and analyzes information. The peripheral nervous system carries messages back and forth between the environment and the central nervous system.

The central nervous system consists of the brain and spinal cord. Both are wrapped in layers of tissue called meninges. Between the meninges and nervous tissue is cerebrospinal fluid, which cushions and protects nervous tissue.

The brain is divided into several regions. The cerebrum controls voluntary actions. The cerebellum controls actions of the muscles. The brain stem controls basic body functions. The thalamus receives impulses from the senses and sends them to the cerebrum. The hypothalamus connects the nervous and endocrine systems.

The spinal cord connects the brain and rest of the body. Certain kinds of information, including some reflexes, are processed directly in the spinal cord. A reflex is a quick, automatic response to a stimulus.

Sneezing is an example of a reflex. The pathway an impulse travels in a reflex is called the reflex arc.

The peripheral nervous system has two divisions. The sensory division transmits impulses from sensory neurons to the central nervous system. The motor division transmits impulses from the central nervous system to muscles and glands. The motor division is further divided into somatic and autonomic nervous systems. The somatic nervous system controls voluntary actions. The autonomic nervous system controls involuntary actions.

### 35-4 The Senses

Sensory receptors are neurons that react to stimuli in the environment and send impulses to the central nervous system. There are five types of sensory receptors. Pain receptors respond to pain. Thermoreceptors respond to temperature. Mechanoreceptors respond to pressure. Chemoreceptors respond to chemicals. Photoreceptors respond to light.

Light enters the eye through the pupil, which is a small opening at the front of the eye. Light then passes through the lens, which focuses the light on the retina. Photoreceptors called rods and cones are located in the retina. Rods are sensitive to dim light. Cones are sensitive to colors.

Sound vibrations enter the ear and create pressure waves in a fluid-filled structure called the cochlea. Sensory receptors in the cochlea send impulses to the brain. Three tiny canals in the ear, called semicircular canals, help the central nervous system maintain balance.

The sense organs that detect taste are the taste buds. Skin—the largest sense organ—contains sensory receptors that respond to temperature, touch, and pain.

### 35-5 Drugs and the Nervous System

A drug is any substance, other than food, that changes the structure or function of the body. Several types of drugs can affect the nervous system. Stimulants increase actions controlled by the nervous system, such as heart rate. Stimulants also increase the release of neurotransmitters in the brain. Depressants decrease actions, such as heart rate, that are controlled by the brain. Cocaine causes the sudden release in the brain of a neurotransmitter called dopamine. Opiates act like natural brain chemicals called endorphins, which normally help overcome pain. Marijuana can cause memory and concentration problems.

Alcohol is a depressant. It slows down the central nervous system. Drinking alcohol during pregnancy may cause fetal alcohol syndrome (FAS). Babies born with FAS have birth defects. People who are addicted to alcohol have a disease called alcoholism.

Addiction is an uncontrollable dependence on a drug. Drug abuse is the intentional misuse of any drug for nonmedical purposes. The best way to avoid the effects of drugs is to avoid drugs.