

## 8 The Nervous System

### *Chapter Summary*

The nervous system and the endocrine system are responsible for regulating and coordinating the body parts, and maintaining homeostasis. There are two types of cells within the nervous system, neurons which carry nerve impulses, and neuroglial cells which serve to support, protect, and nourish the neurons. Nerve impulses result from a change in polarity that is propagated along the length of a neuron. Synapses are the spaces between adjacent neuron endings and transmission of an impulse across a synapse is dependent upon chemicals called neurotransmitters. There are two major divisions of the nervous system, the central nervous system (CNS), composed of the brain and spinal cord; and the peripheral nervous system (PNS), composed of the cranial and spinal nerves. The PNS receives sensory information from both the internal and external environments. That information is integrated within the CNS and the appropriate responses are initiated. The PNS then carries impulses to the appropriate effector organs. The brain is divided into four major regions: the cerebrum, diencephalon, cerebellum, and brainstem. These regions perform specific functions. The spinal cord contains the synapses between neurons forming reflex arcs. It also contains nerve tracts, which are composed of fibers that conduct impulses to and from the brain. The PNS is subdivided into the somatic nervous system which is primarily concerned with reactions to outside stimuli, and the autonomic nervous system which regulates the functioning of the internal organs.

### *Chapter Outline*

- I. Nervous System
  - A. Divisions of the Nervous System
  - B. Nervous Tissue
    - 1. Neuron Structure
    - 2. Types of Neurons
      - a. Motor Neurons
      - b. Sensory Neurons
      - c. Interneurons
  - C. Nerve Impulses
    - 1. Resting Potential
    - 2. Action Potential
    - 3. Conduction of Action Potentials
  - D. Transmission Across a Synapse
    - 1. Synaptic Integration
    - 2. Neurotransmitter Molecules
- II. Central Nervous System
  - A. Meninges and Cerebrospinal Fluid
  - B. Spinal Cord
    - 1. Structure of the Spinal Cord
    - 2. Functions of the Spinal Cord
  - C. The Brain
    - 1. Cerebrum
      - a. The Cerebral Cortex
        - i. White Matter
        - ii. Basal Nuclei
        - iii. Limbic System
    - 2. The Diencephalon
    - 3. The Cerebellum
    - 4. The Brain Stem

- III. Peripheral Nervous System
  - A. Types of Nerves
    - 1. Cranial Nerves
    - 2. Spinal Nerves
  - B. Somatic Nervous System
  - C. Autonomic Nervous System
    - 1. Sympathetic Division
    - 2. Parasympathetic Division
- IV. Effects of Aging
- V. Homeostasis

*Suggested Student Activities*

1. Demonstrate some simple reflexes.
2. Using a model of the brain, locate all the major regions and structures.
3. Give reports on infections that affect the brain and meninges.
4. Discuss how various illicit drugs affect the functioning of the nervous system.

*Answers to Objective Questions*

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|----------------------------------|-----------------------|
| 1. axon                          | 15. a. sensory neuron |
| 2. sodium, inside                | b. interneuron        |
| 3. synaptic cleft                | c. motor neuron       |
| 4. acetylcholinesterase          | d. sensory receptor   |
| 5. effector organs               | e. cell body          |
| 6. interneuron                   | f. dendrites          |
| 7. cerebellum                    | g. axon               |
| 8. cerebrum                      | h. myelin sheath      |
| 9. meninges                      | i. node of Ranvier    |
| 10. cranial, internal organs     | j. effector (muscle)  |
| 11. brain, spinal cord, nerves   |                       |
| 12. learning, memory             |                       |
| 13. sympathetic, parasympathetic |                       |
| 14. electroencephalogram (EEG)   |                       |

*Answers to Medical Terminology Reinforcement Exercise*

1. neuro/patho/genesis - development of disease of the nervous system
2. an/esthesia - without sensation
3. encephalo/myelo/neuro/pathy - disease involving the brain, spinal cord, and nerves
4. hemi/plegia - half paralyzed (paralysis of one half of the body)
5. glio/blast/oma - tumor of germ (developing) glial (glue) cells—brain tumor
6. sub/dural hemo/rrhage - bursting forth of blood beneath the dura—bleeding into the spinal fluid between the dura and arachnoid layers of the meninges
7. cephalo/meter - an instrument to measure the head
8. meningo/encephalo/cele - hernia of meninges (coverings) and brain through a defect in the skull
9. neuro/rrhaphy - to stitch a nerve
10. atax/ia/phasia - inability to arrange words into sentences
11. cerebro/vascular accident - occlusion of a blood vessel in the brain
12. dura/plasty - formation at the dura mater
13. brachy/cephalic - abnormally short skull
14. arachnoid/itis - inflammation of the arachnoid

*Audiovisual Materials*

1. Filmstrip - Nervous System in the Human Body (Career Aids)
2. Transparencies - Nervous System (Career Aids)
3. Anatomical Charts - Nervous System (Career Aids)
4. Filmstrip - Our Human Brain: A Grand Tour (Career Aids)
5. Model - Nervous System (Concept Media)