



# THE NERVOUS SYSTEM

The nervous system is the master coordinating system of the body. Every thought, action, and sensation reflects its activity. The structures of the nervous system are described in terms of two principal divisions—the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS (brain and spinal cord) interprets incoming sensory information and issues instructions based on past experience. The PNS (cranial and spinal nerves and ganglia) provides the communication lines between the CNS and the body's muscles, glands, and sensory receptors. The nervous system is also divided functionally in terms of motor activities into the somatic and autonomic divisions. It is important, however, to recognize that these classifications are made for the sake of convenience and that the nervous system acts in an integrated manner both structurally and functionally.

Student activities provided in this chapter review neuron anatomy and physiology, identify the various structures of the central and peripheral nervous system, consider reflex and sensory physiology, and summarize autonomic nervous system anatomy and physiology. Because every body system is controlled, at least in part, by the nervous system, these understandings are extremely important to understanding how the body functions as a whole.

**1.** List the three major functions of the nervous system.

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_

## ORGANIZATION OF THE NERVOUS SYSTEM

2. Choose the key responses that best correspond to the descriptions provided in the following statements. Insert the appropriate letter or term in the answer blanks.

### *Key Choices*

- A. Autonomic nervous system                      C. Peripheral nervous system (PNS)  
B. Central nervous system (CNS)                D. Somatic nervous system

- \_\_\_\_\_ 1. Nervous system subdivision that is composed of the brain and spinal cord
- \_\_\_\_\_ 2. Subdivision of the PNS that controls voluntary activities such as the activation of skeletal muscles
- \_\_\_\_\_ 3. Nervous system subdivision that is composed of the cranial and spinal nerves and ganglia
- \_\_\_\_\_ 4. Subdivision of the PNS that regulates the activity of the heart and smooth muscle, and of glands; it is also called the involuntary nervous system
- \_\_\_\_\_ 5. A major subdivision of the nervous system that interprets incoming information and issues orders
- \_\_\_\_\_ 6. A major subdivision of the nervous system that serves as communication lines, linking all parts of the body to the CNS

## NERVOUS TISSUE—STRUCTURE AND FUNCTION

3. This exercise emphasizes the difference between neurons and neuroglia. Indicate which cell type is identified by the following descriptions. Insert the appropriate letter or term in the answer blanks.

### *Key Choices*

- A. Neurons                      B. Neuroglia

- \_\_\_\_\_ 1. Support, insulate, and protect cells
- \_\_\_\_\_ 2. Demonstrate irritability and conductivity, and thus transmit electrical messages from one area of the body to another area
- \_\_\_\_\_ 3. Release neurotransmitters
- \_\_\_\_\_ 4. Are amitotic
- \_\_\_\_\_ 5. Able to divide; therefore are responsible for most brain neoplasms

4. Relative to neuron anatomy, match the anatomical terms given in Column B with the appropriate descriptions of functions provided in Column A. Place the correct term or letter response in the answer blanks.

<b>Column A</b>	<b>Column B</b>
_____ 1. Releases neurotransmitters	A. Axon
_____ 2. Conducts electrical currents toward the cell body	B. Axon terminal
_____ 3. Increases the speed of impulse transmission	C. Dendrite
_____ 4. Location of the nucleus	D. Myelin sheath
_____ 5. Generally conducts impulses away from the cell body	E. Cell body

5. Certain activities or sensations are listed below. Using the key choices, select the specific receptor type that would be activated by the activity or sensation described. Insert the correct term(s) or letter response(s) in the answer blanks. Note that more than one receptor type may be activated in some cases.

**Key Choices**

- |                              |                         |                       |
|------------------------------|-------------------------|-----------------------|
| A. Bare nerve endings (pain) | C. Meissner's corpuscle | E. Pacinian corpuscle |
| B. Golgi tendon organ        | D. Muscle spindle       |                       |

**Activity or Sensation**

**Receptor Type**

Walking on hot pavement	1. (Identify two) _____ and _____
Feeling a pinch	2. (Identify two) _____ and _____
Leaning on a shovel	3. _____
Muscle sensations when rowing a boat	4. (Identify two) _____ and _____
Feeling a caress	5. _____

6. Using the key choices, select the terms identified in the following descriptions by inserting the appropriate letter or term in the spaces provided.

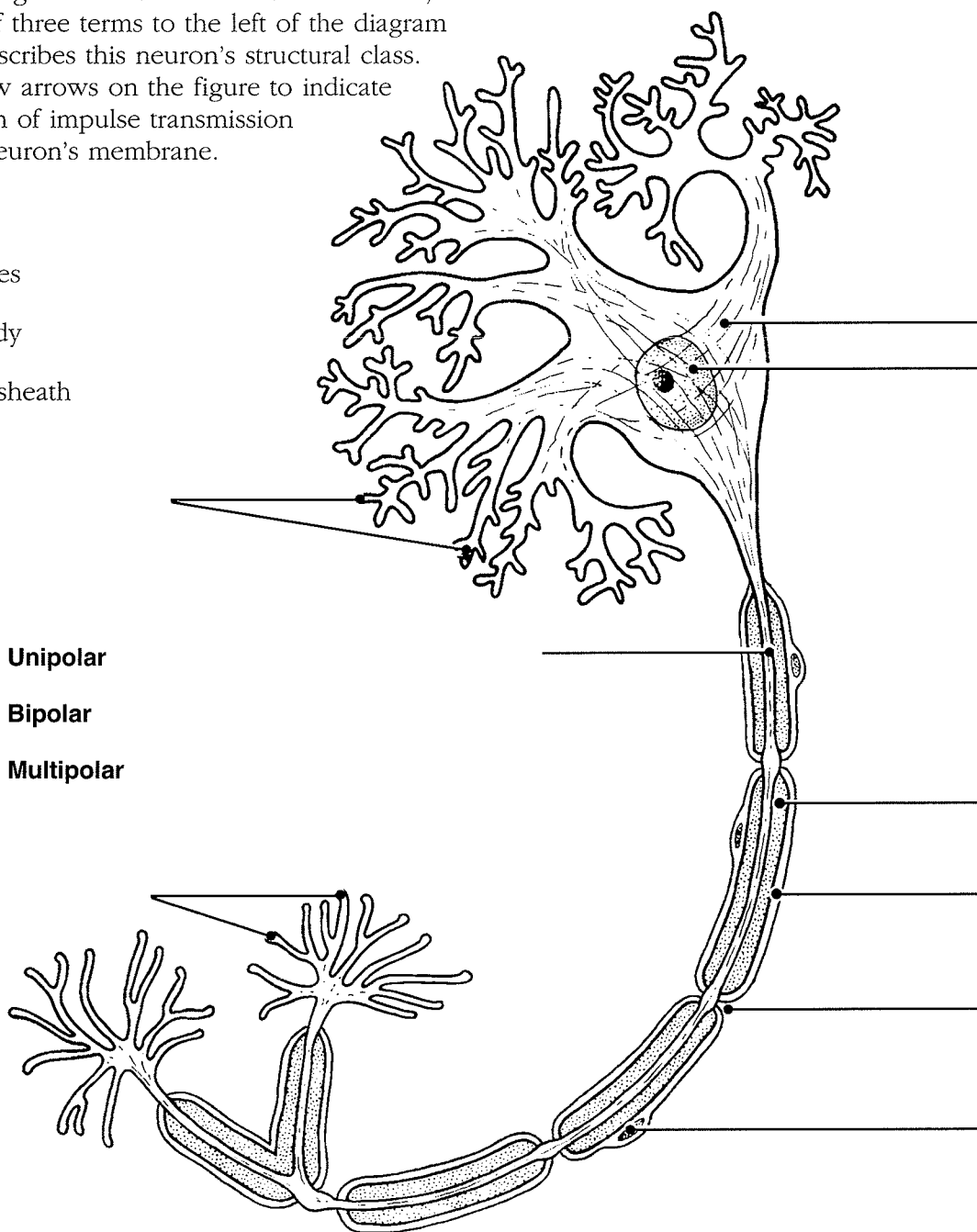
*Key Choices*

- |                                        |                      |                   |
|----------------------------------------|----------------------|-------------------|
| A. Afferent neuron                     | F. Neuroglia         | K. Proprioceptors |
| B. Association neuron (or interneuron) | G. Neurotransmitters | L. Schwann cells  |
| C. Cutaneous sense organs              | H. Nerve             | M. Synapse        |
| D. Efferent neuron                     | I. Nodes of Ranvier  | N. Stimuli        |
| E. Ganglion                            | J. Nuclei            | O. Tract          |

- \_\_\_\_\_ 1. Sensory receptors found in the skin, which are specialized to detect temperature, pressure changes, and pain
- \_\_\_\_\_ 2. Specialized cells that myelinate the fibers of neurons found in the PNS
- \_\_\_\_\_ 3. Junction or point of close contact between neurons
- \_\_\_\_\_ 4. Bundle of nerve processes inside the CNS
- \_\_\_\_\_ 5. Neuron, serving as part of the conduction pathway between sensory and motor neurons
- \_\_\_\_\_ 6. Gaps in a myelin sheath
- \_\_\_\_\_ 7. Collection of nerve cell bodies found outside the CNS
- \_\_\_\_\_ 8. Neuron that conducts impulses away from the CNS to muscles and glands
- \_\_\_\_\_ 9. Sensory receptors found in muscle and tendons that detect their degree of stretch
- \_\_\_\_\_ 10. Changes, occurring within or outside the body, that affect nervous system functioning
- \_\_\_\_\_ 11. Neuron that conducts impulses toward the CNS from the body periphery
- \_\_\_\_\_ 12. Chemicals released by neurons that stimulate other neurons, muscles, or glands

7. Figure 7-1 is a diagram of a neuron. First, label the parts indicated on the illustration by leader lines. Then choose different colors for each of the structures listed below and use them to color in the coding circles and corresponding structures in the illustration. Next, circle the term in the list of three terms to the left of the diagram that best describes this neuron's structural class. Finally, draw arrows on the figure to indicate the direction of impulse transmission along the neuron's membrane.

- Axon
- Dendrites
- Cell body
- Myelin sheath



**Figure 7-1**

8. List in order the *minimum* elements in a reflex arc from the stimulus to the activity of the effector. Place your responses in the answer blanks.

- |             |                   |
|-------------|-------------------|
| 1. Stimulus | 4. _____          |
| 2. _____    | 5. Effector organ |
| 3. _____    |                   |

9. Using the key choices, identify the terms defined in the following statements. Place the correct term or letter response in the answer blanks.

*Key Choices*

- A. Action potential
- B. Depolarization
- C. Polarized
- D. Potassium ions
- E. Refractory period
- F. Repolarization
- G. Sodium ions
- H. Sodium-potassium pump

- \_\_\_\_\_ 1. Period of repolarization of the neuron during which it cannot respond to a second stimulus
- \_\_\_\_\_ 2. State in which the resting potential is reversed as sodium ions rush into the neuron
- \_\_\_\_\_ 3. Electrical condition of the plasma membrane of a resting neuron
- \_\_\_\_\_ 4. Period during which potassium ions diffuse out of the neuron
- \_\_\_\_\_ 5. Transmission of the depolarization wave along the neuron's membrane
- \_\_\_\_\_ 6. The chief positive intracellular ion in a resting neuron
- \_\_\_\_\_ 7. Process by which ATP is used to move sodium ions out of the cell and potassium ions back into the cell; completely restores the resting conditions of the neuron

10. Using the key choices, identify the types of reflexes involved in each of the following situations.

*Key Choices*

- A. Somatic reflex(es)
- B. Autonomic reflex(es)

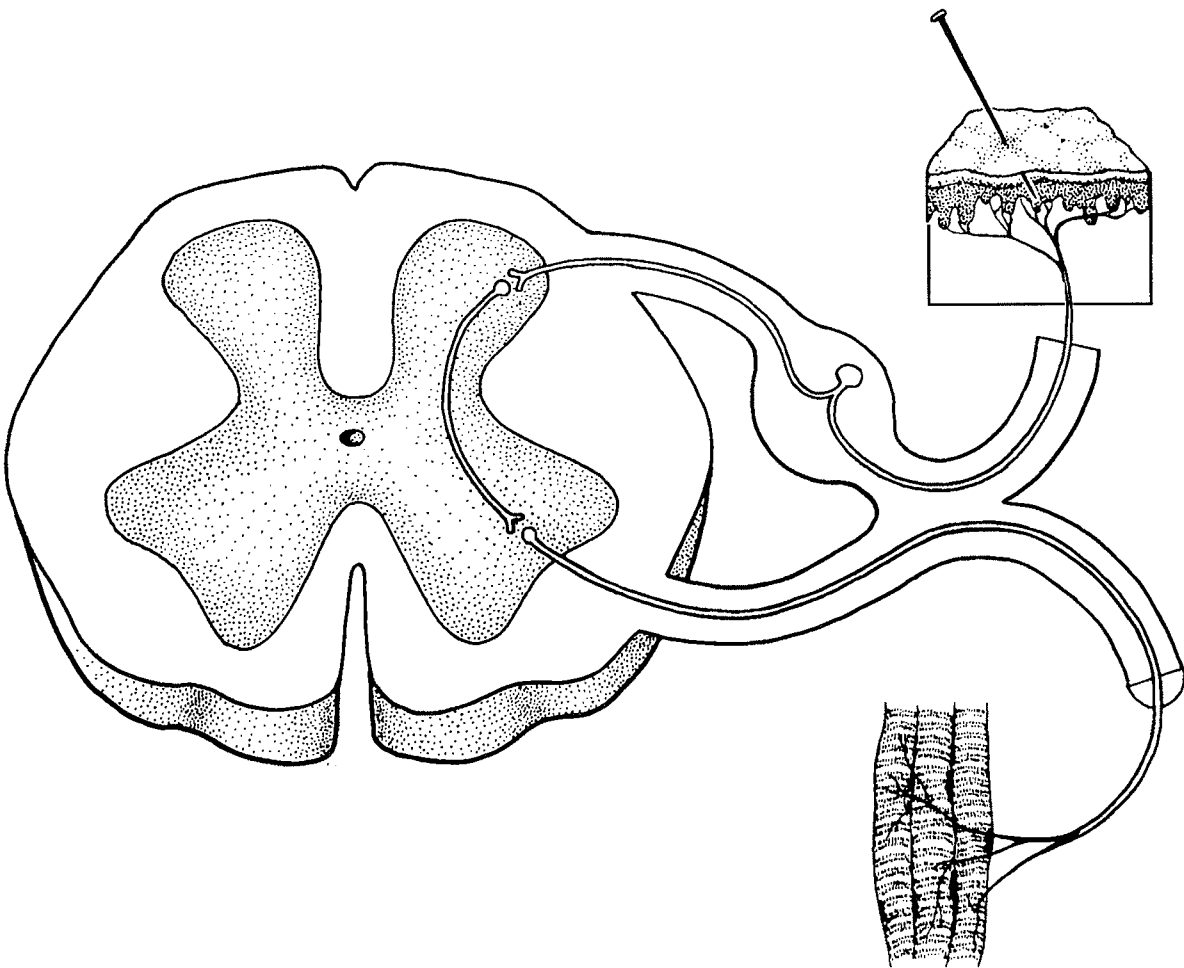
- \_\_\_\_\_ 1. Patellar (knee-jerk) reflex
- \_\_\_\_\_ 2. Pupillary light reflex
- \_\_\_\_\_ 3. Effectors are skeletal muscles
- \_\_\_\_\_ 4. Effectors are smooth muscle and glands
- \_\_\_\_\_ 5. Flexor reflex
- \_\_\_\_\_ 6. Regulation of blood pressure
- \_\_\_\_\_ 7. Salivary reflex

**11.** Refer to Figure 7-2, showing a reflex arc, as you complete this exercise. First, briefly answer the following questions by inserting your responses in the spaces provided.

1. What is the stimulus? \_\_\_\_\_
2. What tissue is the effector? \_\_\_\_\_
3. How many synapses occur in this reflex arc? \_\_\_\_\_

Next, select different colors for each of the following structures and use them to color in the coding circles and corresponding structures in the diagram. Finally, draw arrows on the figure indicating the direction of impulse transmission through this reflex pathway.

- |                                       |                                       |
|---------------------------------------|---------------------------------------|
| <input type="radio"/> Receptor region | <input type="radio"/> Interneuron     |
| <input type="radio"/> Afferent neuron | <input type="radio"/> Efferent neuron |
| <input type="radio"/> Effector        |                                       |



**Figure 7-2**

12. Circle the term that does not belong in each of the following groupings.

1. Astrocytes                  Neurons                  Oligodendrocytes                  Microglia
2.  $K^+$  enters the cell                   $K^+$  leaves the cell                  Repolarization                  Refractory period
3. Nodes of Ranvier                  Myelin sheath                  Unmyelinated                  Saltatory conduction
4. Predictable response                  Voluntary act                  Involuntary act                  Reflex
5. Oligodendrocytes                  Schwann cells                  Myelin                  Microglia
6. Cutaneous receptors                  Free dendritic endings                  Stretch                  Pain and touch
7. Cell interior                  High  $Na^+$                   Low  $Na^+$                   High  $K^+$

## CENTRAL NERVOUS SYSTEM

### Brain

13. Complete the following statements by inserting your answers in the answer blanks.

- \_\_\_\_\_ 1. The largest part of the human brain is the (paired) (1). The other major subdivisions of the brain are the (2) and the (3). The cavities found in the brain are called (4). They contain (5).
- \_\_\_\_\_ 2. \_\_\_\_\_
- \_\_\_\_\_ 3. \_\_\_\_\_
- \_\_\_\_\_ 4. \_\_\_\_\_
- \_\_\_\_\_ 5. \_\_\_\_\_

14. Circle the terms indicating structures that are *not* part of the brain stem.

- |                      |            |              |
|----------------------|------------|--------------|
| Cerebral hemispheres | Midbrain   | Medulla      |
| Pons                 | Cerebellum | Diencephalon |

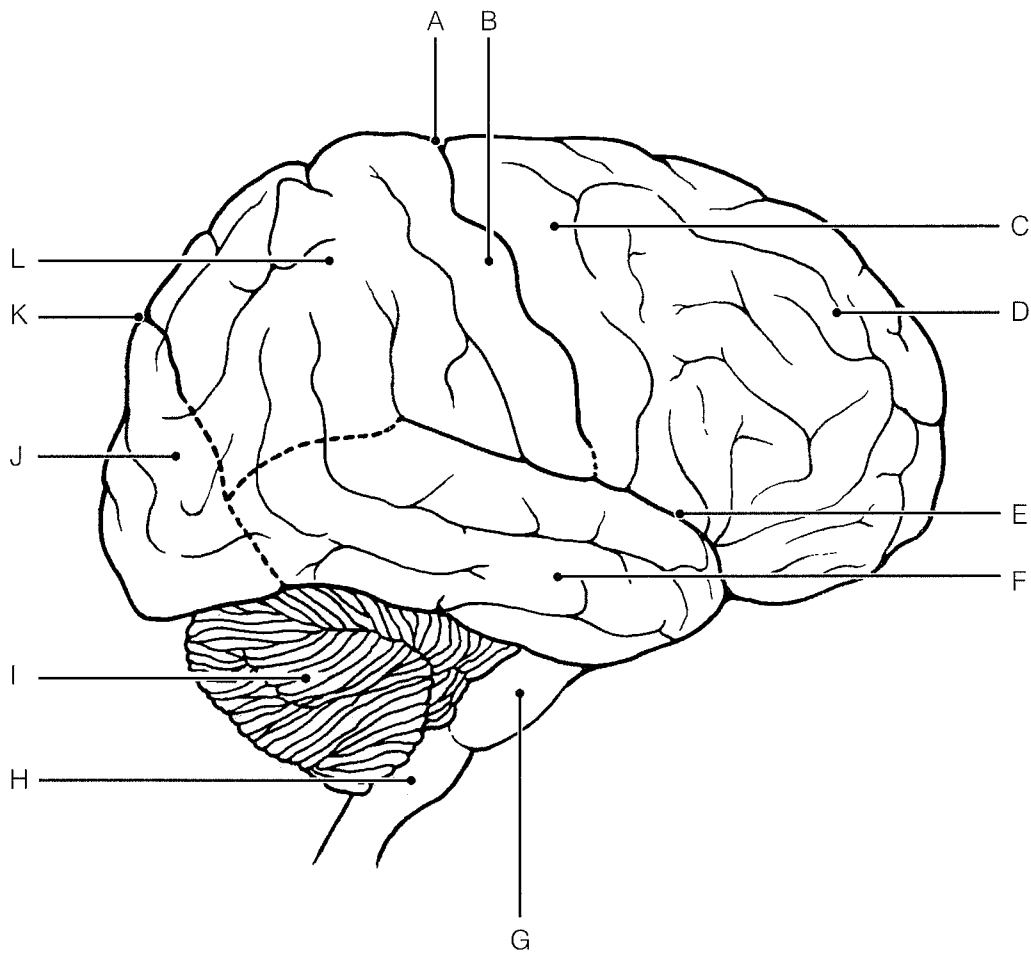
15. Complete the following statements by inserting your answers in the answer blanks.

- \_\_\_\_\_ 1. A (1) is an elevated ridge of cerebral cortex tissue. The convolutions seen in the cerebrum are important because they increase the (2). Gray matter is composed of (3). White matter is composed of (4), which provide for communication between different parts of the brain as well as with lower CNS centers. The lentiform nucleus, the caudate, and other nuclei are collectively called the (5).
- \_\_\_\_\_ 2. \_\_\_\_\_
- \_\_\_\_\_ 3. \_\_\_\_\_
- \_\_\_\_\_ 4. \_\_\_\_\_
- \_\_\_\_\_ 5. \_\_\_\_\_



**16.** Figure 7-3 is a diagram of the right lateral view of the human brain. First, match the letters on the diagram with the following list of terms and insert the appropriate letters in the answer blanks. Then, select different colors for each of the areas of the brain provided with a color-coding circle and use them to color in the coding circles and corresponding structures in the diagram. If an identified area is part of a lobe, use the color you selected for the lobe but use *stripes* for that area.

- |                                |                           |                                 |                |
|--------------------------------|---------------------------|---------------------------------|----------------|
| _____ 1. <input type="radio"/> | Frontal lobe              | _____ 7. <input type="radio"/>  | Lateral sulcus |
| _____ 2. <input type="radio"/> | Parietal lobe             | _____ 8. <input type="radio"/>  | Central sulcus |
| _____ 3. <input type="radio"/> | Temporal lobe             | _____ 9. <input type="radio"/>  | Cerebellum     |
| _____ 4. <input type="radio"/> | Precentral gyrus          | _____ 10. <input type="radio"/> | Medulla        |
| _____ 5. <input type="radio"/> | Parieto-occipital fissure | _____ 11. <input type="radio"/> | Occipital lobe |
| _____ 6. <input type="radio"/> | Postcentral gyrus         | _____ 12. <input type="radio"/> | Pons           |



**Figure 7-3**

17. Figure 7-4 is a diagram of the sagittal view of the human brain. First, match the letters on the diagram with the following list of terms and insert the appropriate letter in each answer blank. Then, color the brain-stem areas blue and the areas where cerebrospinal fluid is found yellow.

- |                               |                             |
|-------------------------------|-----------------------------|
| _____ 1. Cerebellum           | _____ 9. Mammillary body    |
| _____ 2. Cerebral aqueduct    | _____ 10. Medulla oblongata |
| _____ 3. Cerebral hemisphere  | _____ 11. Optic chiasma     |
| _____ 4. Cerebral peduncle    | _____ 12. Pineal body       |
| _____ 5. Choroid plexus       | _____ 13. Pituitary gland   |
| _____ 6. Corpora quadrigemina | _____ 14. Pons              |
| _____ 7. Corpus callosum      | _____ 15. Thalamus          |
| _____ 8. Fourth ventricle     |                             |

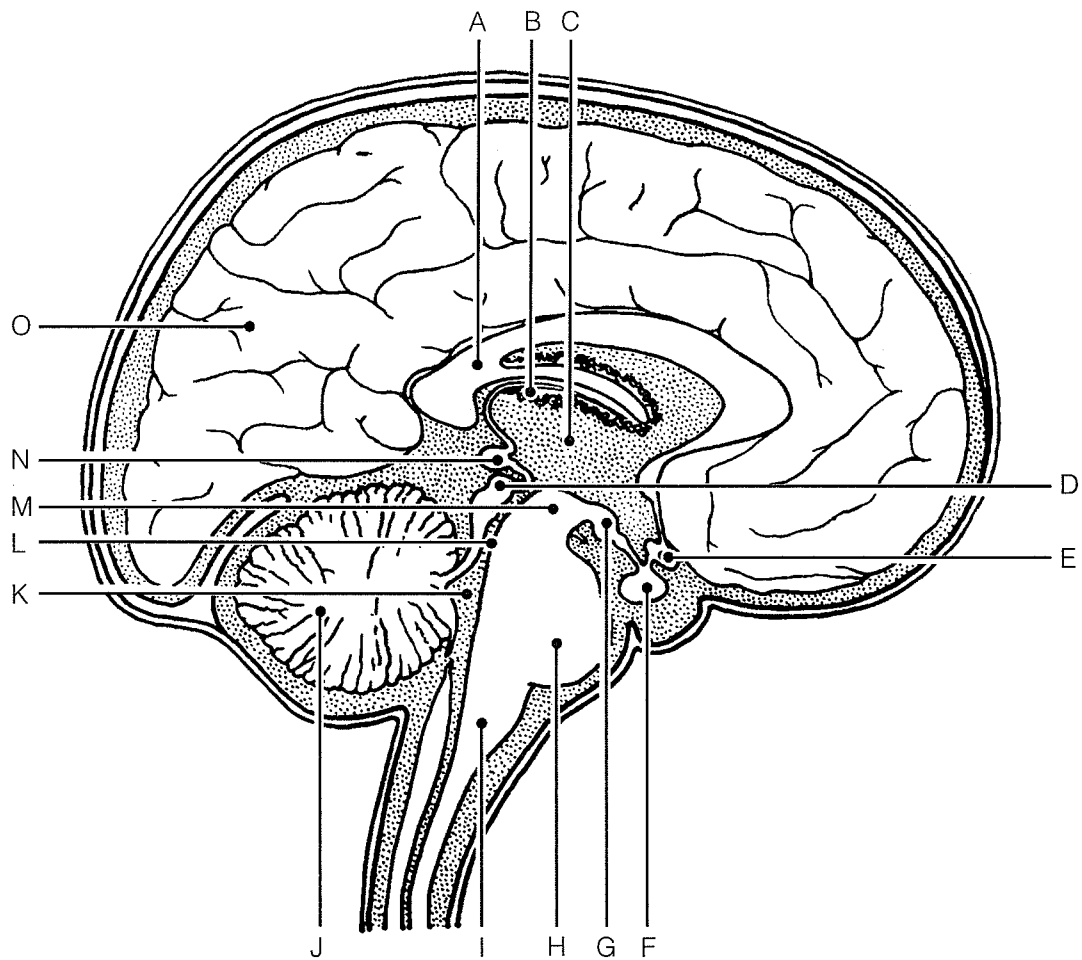


Figure 7-4

**18.** Referring to the brain areas listed in Exercise 17, match the appropriate brain structures with the following descriptions. Insert the correct terms in the answer blanks.

- \_\_\_\_\_ 1. Site of regulation of water balance and body temperature
- \_\_\_\_\_ 2. Contains reflex centers involved in regulating respiratory rhythm in conjunction with lower brain-stem centers
- \_\_\_\_\_ 3. Responsible for the regulation of posture and coordination of skeletal muscle movements
- \_\_\_\_\_ 4. Important relay station for afferent fibers traveling to the sensory cortex for interpretation
- \_\_\_\_\_ 5. Contains autonomic centers, which regulate blood pressure and respiratory rhythm, as well as coughing and sneezing centers
- \_\_\_\_\_ 6. Large fiber tract connecting the cerebral hemispheres
- \_\_\_\_\_ 7. Connects the third and fourth ventricles
- \_\_\_\_\_ 8. Encloses the third ventricle
- \_\_\_\_\_ 9. Forms the cerebrospinal fluid
- \_\_\_\_\_ 10. Midbrain area that is largely fiber tracts; bulges anteriorly
- \_\_\_\_\_ 11. Part of the limbic system; contains centers for many drives (rage, pleasure, hunger, sex, etc.)

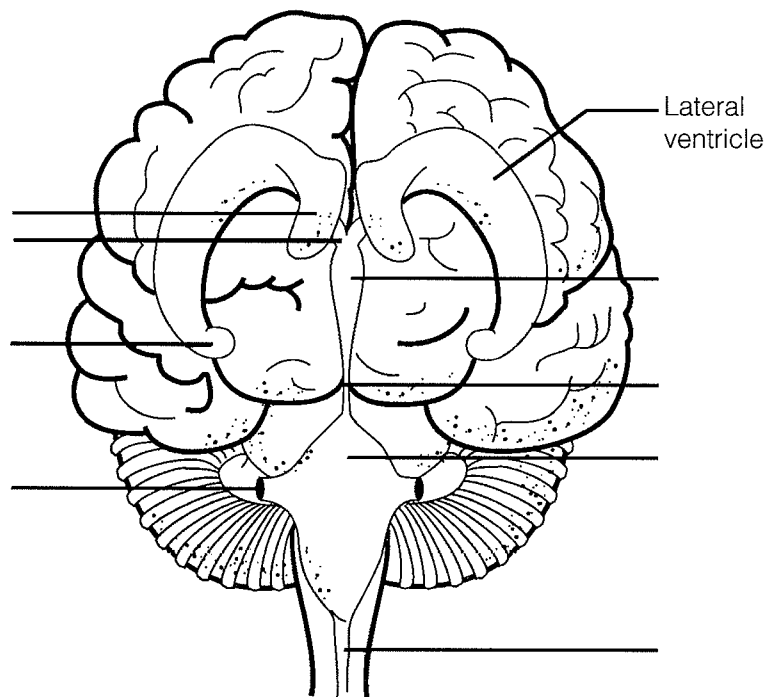
**19.** Some of the following brain structures consist of gray matter; others are white matter. Write G (for gray) or W (for white) as appropriate.

- |                               |                              |
|-------------------------------|------------------------------|
| _____ 1. Cortex of cerebellum | _____ 5. Pyramids            |
| _____ 2. Basal nuclei         | _____ 6. Thalamic nuclei     |
| _____ 3. Anterior commissure  | _____ 7. Cerebellar peduncle |
| _____ 4. Corpus callosum      |                              |

20. Figure 7-5 illustrates a “see-through” brain showing the positioning of the ventricles and connecting canals or apertures. Correctly identify all structures having leader lines by using the key choices provided below. One of the lateral ventricles has already been identified. Color the spaces filled with cerebrospinal fluid blue.

*Key Choices*

- |                      |                             |                     |
|----------------------|-----------------------------|---------------------|
| A. Anterior horn     | D. Fourth ventricle         | G. Lateral aperture |
| B. Central canal     | E. Inferior horn            | H. Third ventricle  |
| C. Cerebral aqueduct | F. Interventricular foramen |                     |



**Figure 7-5**

21. If a statement is true, write the letter *T* in the answer blank. If a statement is false, correct the underlined word(s) and write the correct word(s) in the answer blank.

- \_\_\_\_\_ 1. The primary somatosensory area of the cerebral hemisphere(s) is found in the precentral gyrus.
- \_\_\_\_\_ 2. Cortical areas involved in audition are found in the occipital lobe.
- \_\_\_\_\_ 3. The primary motor area in the temporal lobe is involved in the initiation of voluntary movements.
- \_\_\_\_\_ 4. The specialized motor speech area is located at the base of the precentral gyrus in an area called Wernicke's area.
- \_\_\_\_\_ 5. The right cerebral hemisphere receives sensory input from the right side of the body.
- \_\_\_\_\_ 6. The pyramidal tract is the major descending voluntary motor tract.
- \_\_\_\_\_ 7. The primary motor cortex is located in the postcentral gyrus.
- \_\_\_\_\_ 8. Centers for control of repetitious or stereotyped motor skills are found in the primary motor cortex.
- \_\_\_\_\_ 9. The largest parts of the motor homunculi are the lips, tongue, and toes.
- \_\_\_\_\_ 10. Sensations such as touch and pain are integrated in the primary sensory cortex.
- \_\_\_\_\_ 11. The primary visual cortex is in the frontal lobe of each cerebral hemisphere.
- \_\_\_\_\_ 12. In most humans, the area that controls the comprehension of language is located in the left cerebral hemisphere.
- \_\_\_\_\_ 13. A flat EEG is evidence of clinical death.
- \_\_\_\_\_ 14. Beta waves are recorded when an individual is awake and relaxed.

## Protection of the CNS

22. Identify the meningeal (or associated) structures described here.

- \_\_\_\_\_ 1. Outermost covering of the brain, composed of tough fibrous connective tissue
- \_\_\_\_\_ 2. Innermost covering of the brain; delicate and vascular
- \_\_\_\_\_ 3. Structures that return cerebrospinal fluid to the venous blood in the dural sinuses
- \_\_\_\_\_ 4. Middle meningeal layer; like a cobweb in structure
- \_\_\_\_\_ 5. Its outer layer forms the periosteum of the skull

23. Figure 7-6 shows a frontal view of the meninges of the brain at the level of the superior sagittal (dural) sinus. First, label the *arachnoid villi* on the figure. Then, select different colors for each of the following structures and use them to color the coding circles and corresponding structures in the diagram.

- Dura mater
- Arachnoid mater
- Pia mater
- Subarachnoid space

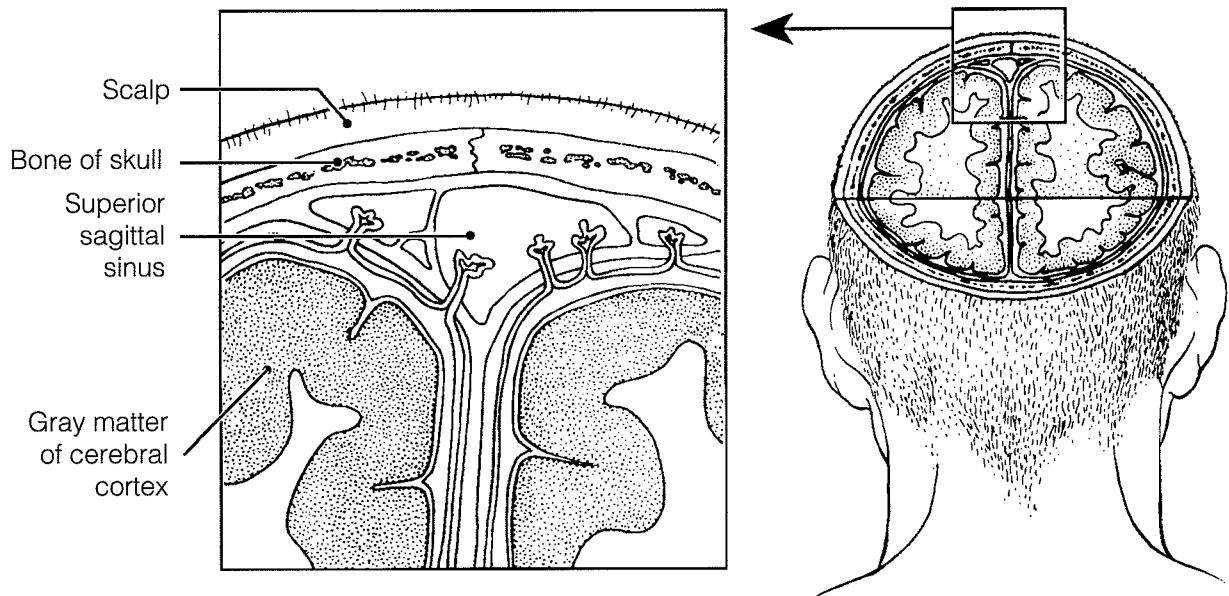


Figure 7-6

24. Complete the following statements by inserting your answers in the answer blanks.

- \_\_\_\_\_ 1. Cerebrospinal fluid is formed by capillary knots called (1), which hang into the (2) of the brain. Ordinarily, cerebrospinal fluid flows from the lateral ventricles to the third ventricle and then through the (3) to the fourth ventricle.
- \_\_\_\_\_ 2. \_\_\_\_\_ 3. Some of the fluid continues down the (4) of the spinal cord, but most of it circulates into the (5) by passing through three tiny openings in the walls of the (6). As a rule, cerebrospinal fluid is formed and drained back into the venous blood at the same rate. If its drainage is blocked, a condition called (7) occurs, which results in increased pressure on the brain.
- \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_ 6. \_\_\_\_\_ 7.

## Brain Dysfunctions

25. Match the brain disorders listed in Column B with the conditions described in Column A. Place the correct answers in the answer blanks.

- | <b>Column A</b>                                                                            | <b>Column B</b>                    |
|--------------------------------------------------------------------------------------------|------------------------------------|
| _____ 1. Slight and transient brain injury                                                 | A. Alzheimer's disease             |
| _____ 2. Traumatic injury that destroys brain tissue                                       | B. Cerebral edema                  |
| _____ 3. Total nonresponsiveness to stimulation                                            | C. Cerebrovascular accident (CVA)  |
| _____ 4. May cause medulla oblongata to be wedged into foramen magnum by pressure of blood | D. Coma                            |
| _____ 5. After head injury, retention of water by brain                                    | E. Concussion                      |
| _____ 6. Results when a brain region is deprived of blood or exposed to prolonged ischemia | F. Contusion                       |
| _____ 7. Progressive degeneration of the brain with abnormal protein deposits              | G. Intracranial hemorrhage         |
| _____ 8. Autoimmune disorder with extensive demyelination                                  | H. Multiple sclerosis              |
| _____ 9. A ministroke; fleeting symptoms of a CVA                                          | I. Transient ischemic attack (TIA) |

## Spinal Cord

26. Complete the following statements by inserting your responses in the answer blanks.

- \_\_\_\_\_ 1. The spinal cord extends from the (1) of the skull to the  
\_\_\_\_\_ (2) region of the vertebral column. The meninges, which  
\_\_\_\_\_ 2. cover the spinal cord, extend more inferiorly to form a sac  
\_\_\_\_\_ 3. from which cerebrospinal fluid can be withdrawn without  
\_\_\_\_\_ 4. damage to the spinal cord. This procedure is called a (3).  
\_\_\_\_\_ (4) pairs of spinal nerves arise from the cord. Of these,  
\_\_\_\_\_ 5. (5) pairs are cervical nerves, (6) pairs are thoracic  
\_\_\_\_\_ 6. nerves, (7) pairs are lumbar nerves, and (8) pairs are  
\_\_\_\_\_ 7. sacral nerves. The tail-like collection of spinal nerves at the  
\_\_\_\_\_ 8. inferior end of the spinal cord is called the (9).  
\_\_\_\_\_ 9.

27. Using the key choices, select the appropriate terms to respond to the following descriptions referring to spinal cord anatomy. Place the correct term or letter in the answer blanks.

### *Key Choices*

- |             |                                       |
|-------------|---------------------------------------|
| A. Afferent | C. Both afferent and efferent         |
| B. Efferent | D. Association neurons (interneurons) |

- \_\_\_\_\_ 1. Neuron type found in the dorsal horn  
\_\_\_\_\_ 2. Neuron type found in the ventral horn  
\_\_\_\_\_ 3. Neuron type in a dorsal root ganglion  
\_\_\_\_\_ 4. Fiber type in the ventral root  
\_\_\_\_\_ 5. Fiber type in the dorsal root  
\_\_\_\_\_ 6. Fiber type in a spinal nerve  
\_\_\_\_\_ 7. Fiber type in the anterior ramus  
\_\_\_\_\_ 8. Damage to this fiber type would lead to a loss of sensory  
function  
\_\_\_\_\_ 9. Damage to this fiber type results in a loss of motor function



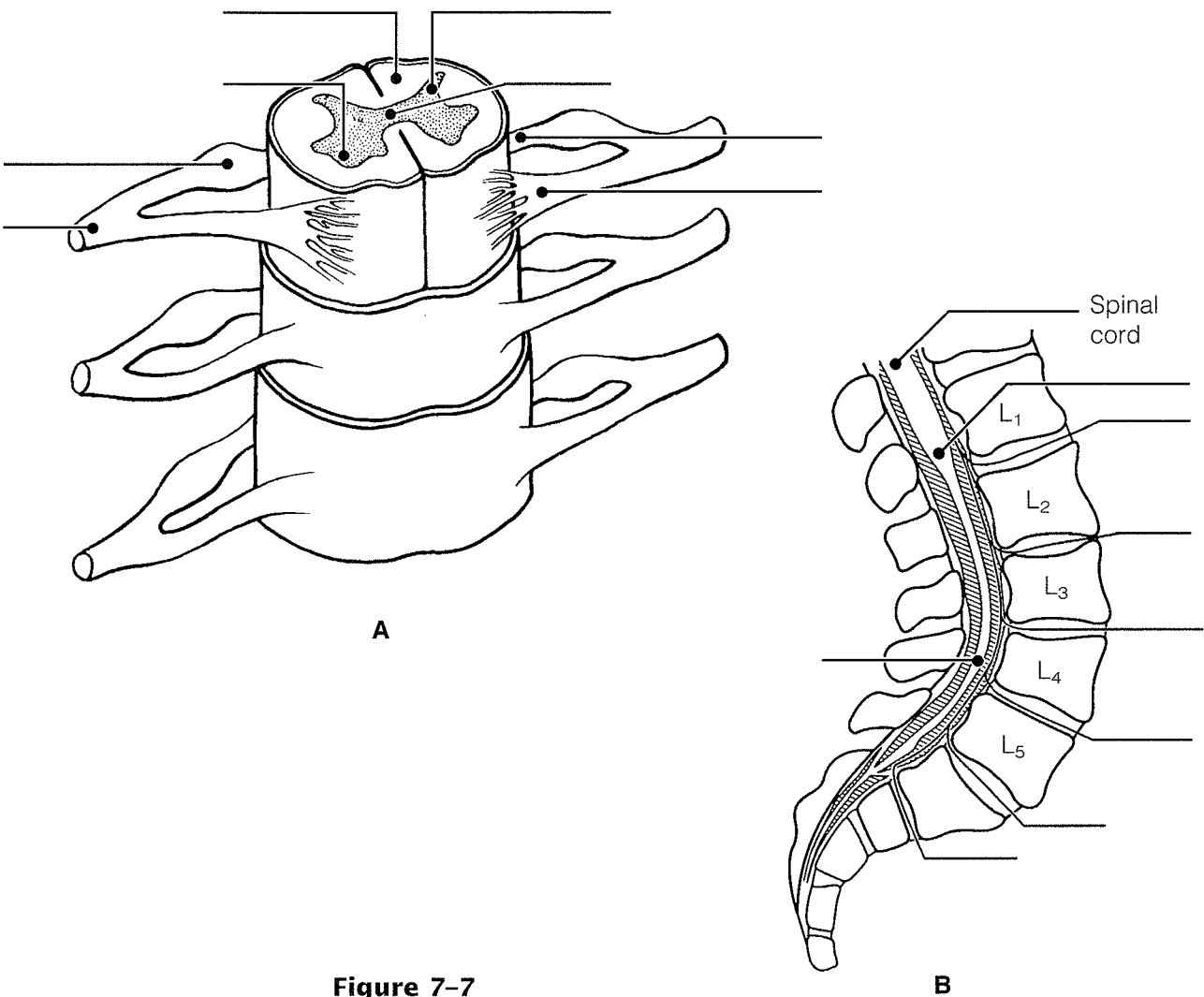
28. Figure 7-7 is a cross-sectional view of the spinal cord. First identify the areas listed in the key choices by inserting the correct letters next to the appropriate leader lines on parts A and B of the figure. Then, color the bones of the vertebral column in part B gold.

**Key Choices**

- |                            |                         |                 |
|----------------------------|-------------------------|-----------------|
| A. Central canal           | E. Dorsal root          | I. Ventral horn |
| B. Columns of white matter | F. Dorsal root ganglion | J. Ventral root |
| C. Conus medullaris        | G. Filum terminale      |                 |
| D. Dorsal horn             | H. Spinal nerve         |                 |

On part A, color the butterfly-shaped gray matter gray, and color the spinal nerves and roots yellow. Finally, select different colors to identify the following structures and use them to color the figure.

- |                                 |                                  |                                       |
|---------------------------------|----------------------------------|---------------------------------------|
| <input type="radio"/> Pia mater | <input type="radio"/> Dura mater | <input type="radio"/> Arachnoid mater |
|---------------------------------|----------------------------------|---------------------------------------|



**Figure 7-7**

## PERIPHERAL NERVOUS SYSTEM

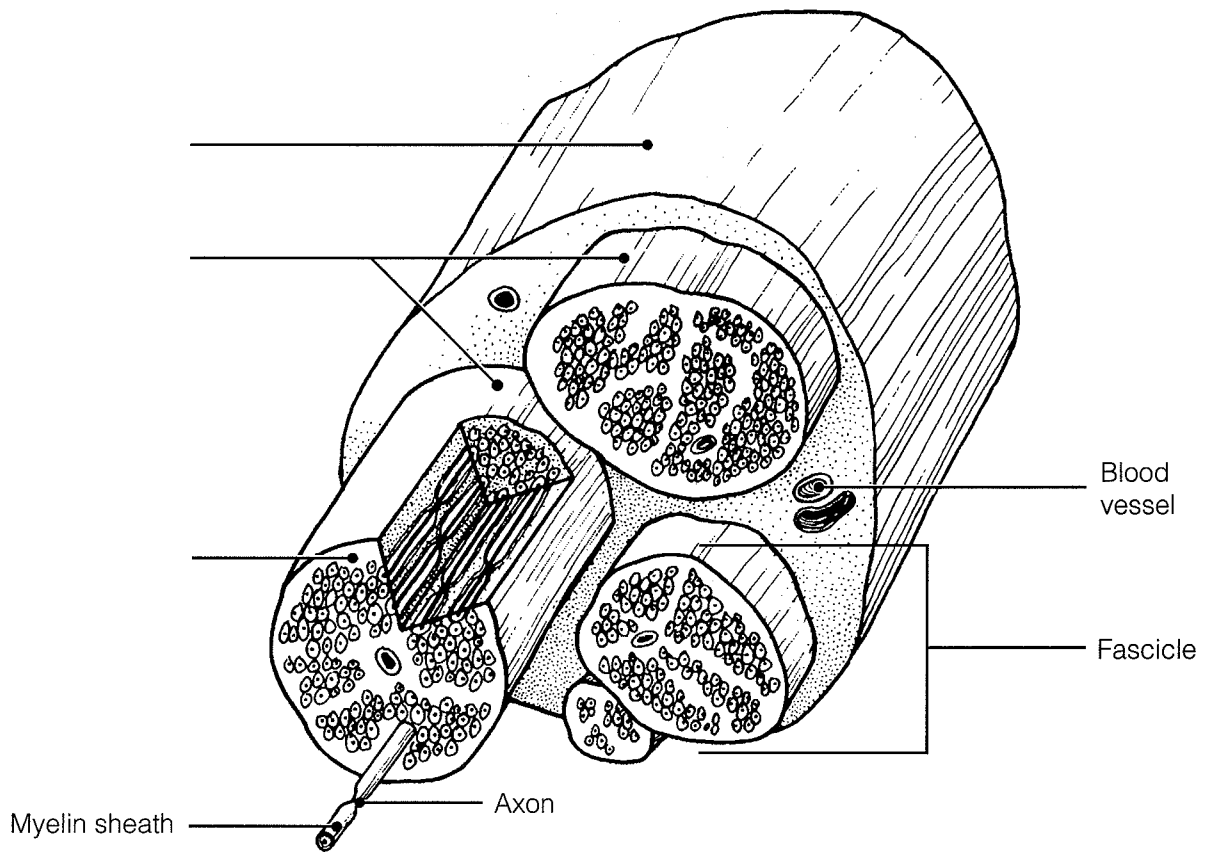
### Structure of a Nerve

29. Figure 7-8 is a diagrammatic view of a nerve wrapped in its connective tissue coverings. Select different colors to identify the following structures and use them to color the coding circles and corresponding structures in the figure. Then, label each of the sheaths indicated by leader lines on the figure.

Endoneurium

Perineurium

Epineurium



**Figure 7-8**

30. Complete the following statements by inserting your responses in the answer blanks.

- \_\_\_\_\_ 1. Another name for a bundle of nerve fibers is (1). Nerves carrying both sensory and motor fibers are called (2)
- \_\_\_\_\_ 2. nerves, whereas those carrying just sensory fibers are referred to as sensory, or (3), nerves.
- \_\_\_\_\_ 3.

## Cranial Nerves

31. The 12 pairs of cranial nerves are indicated by leader lines in Figure 7-9. First, label each by name and Roman numeral on the figure and then color each nerve with a different color.

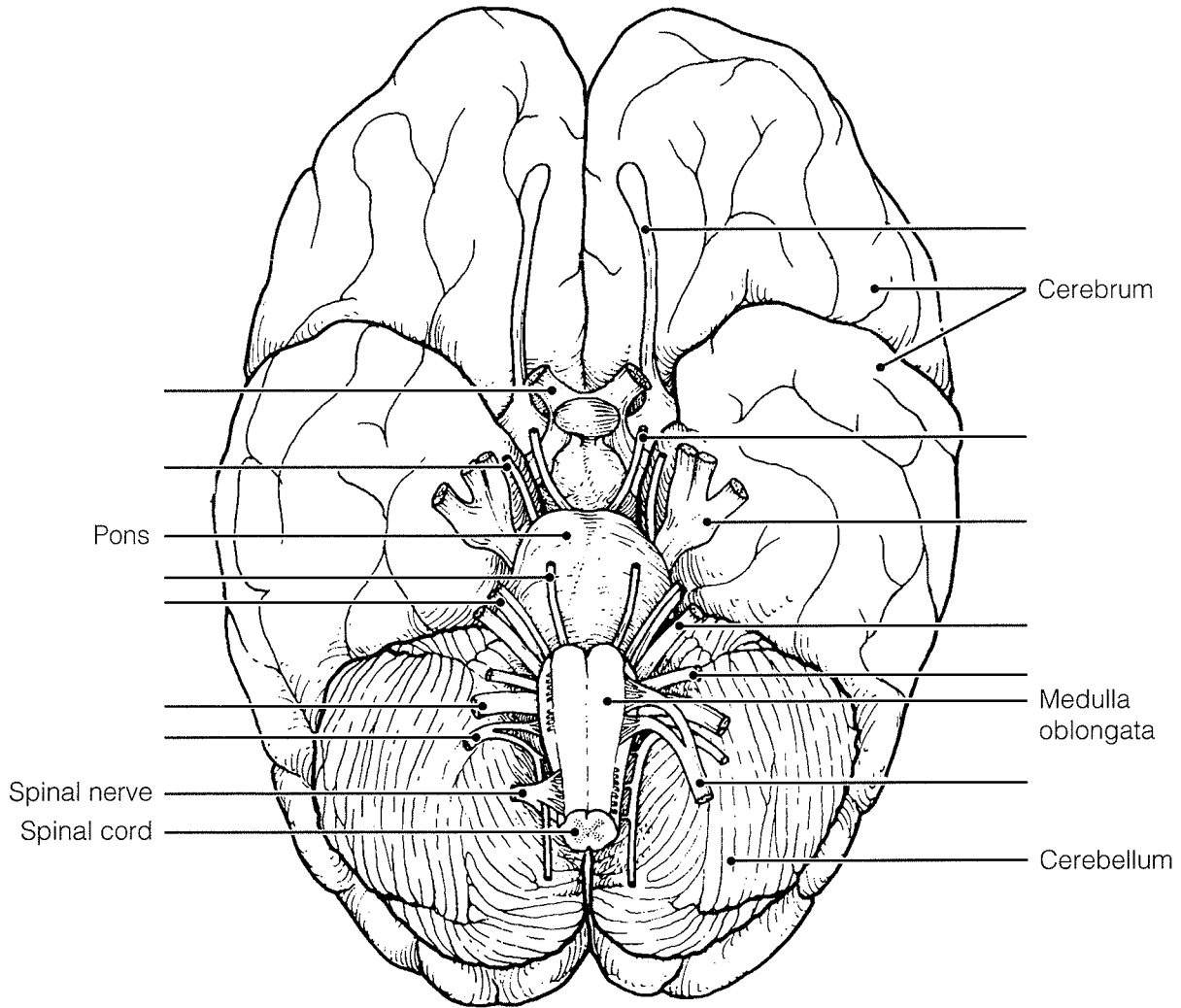


Figure 7-9

32. Provide the name and number of the cranial nerves involved in each of the following activities, sensations, or disorders. Insert your response in the answer blanks.

- \_\_\_\_\_ 1. Shrugging the shoulders
- \_\_\_\_\_ 2. Smelling a flower
- \_\_\_\_\_ 3. Raising the eyelids and focusing the lens of the eye for accommodation; constriction of the eye pupils
- \_\_\_\_\_ 4. Slows the heart; increases the mobility of the digestive tract
- \_\_\_\_\_ 5. Involved in smiling
- \_\_\_\_\_ 6. Involved in chewing gum
- \_\_\_\_\_ 7. Listening to music; seasickness
- \_\_\_\_\_ 8. Secretion of saliva; tasting well-seasoned food
- \_\_\_\_\_ 9. Involved in "rolling" the eyes (three nerves—provide numbers only)
- \_\_\_\_\_ 10. Feeling a toothache
- \_\_\_\_\_ 11. Reading *Tennis* magazine or this study guide
- \_\_\_\_\_ 12. Purely sensory (three nerves—provide numbers only)

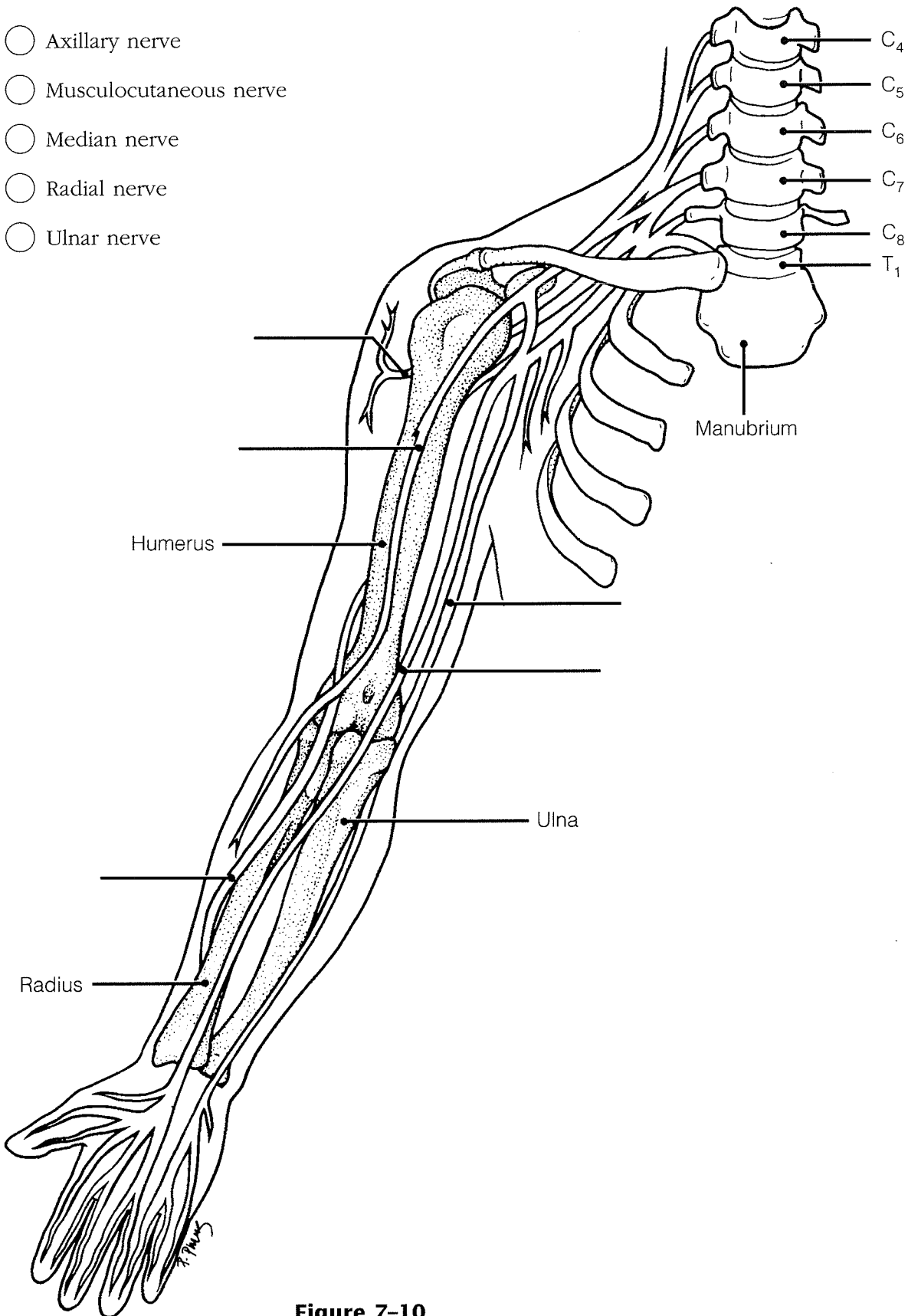
### Spinal Nerves and Nerve Plexuses

33. Complete the following statements by inserting your responses in the answer blanks.

- \_\_\_\_\_ 1. The ventral rami of spinal nerves C<sub>1</sub> through T<sub>1</sub> and L<sub>1</sub> through S<sub>4</sub> take part in forming (1), which serve the (2) of the
- \_\_\_\_\_ 2. body. The ventral rami of T<sub>1</sub> through T<sub>12</sub> run between the ribs to serve the (3). The posterior rami of the spinal nerves
- \_\_\_\_\_ 3. serve the (4).
- \_\_\_\_\_ 4.

34. Figure 7-10 is an anterior view of the principal nerves arising from the brachial plexus. Select five different colors and color the coding circles and the nerves listed below. Also, label each nerve by inserting its name at the appropriate leader line.

- Axillary nerve
- Musculocutaneous nerve
- Median nerve
- Radial nerve
- Ulnar nerve



**Figure 7-10**

35. Name the major nerves that serve the following body areas. Insert your responses in the answer blanks.

- \_\_\_\_\_ 1. Neck and shoulders (plexus only)
- \_\_\_\_\_ 2. Abdominal wall (plexus only)
- \_\_\_\_\_ 3. Anterior thigh
- \_\_\_\_\_ 4. Diaphragm
- \_\_\_\_\_ 5. Posterior thigh
- \_\_\_\_\_ 6. Leg and foot (2)

### Autonomic Nervous System (ANS)

36. Identify, by color coding and coloring, the following structures in Figure 7-11, which depicts the major anatomical differences between the somatic and autonomic motor divisions of the PNS. Also identify by labeling all structures provided with leader lines.

- Somatic motor neuron
- ANS preganglionic neuron
- ANS ganglionic neuron
- Autonomic ganglion
- Gray matter of spinal cord (CNS)
- Effector of the somatic motor neuron
- Effector of the autonomic motor neuron
- Myelin sheath
- White matter of spinal cord (CNS)

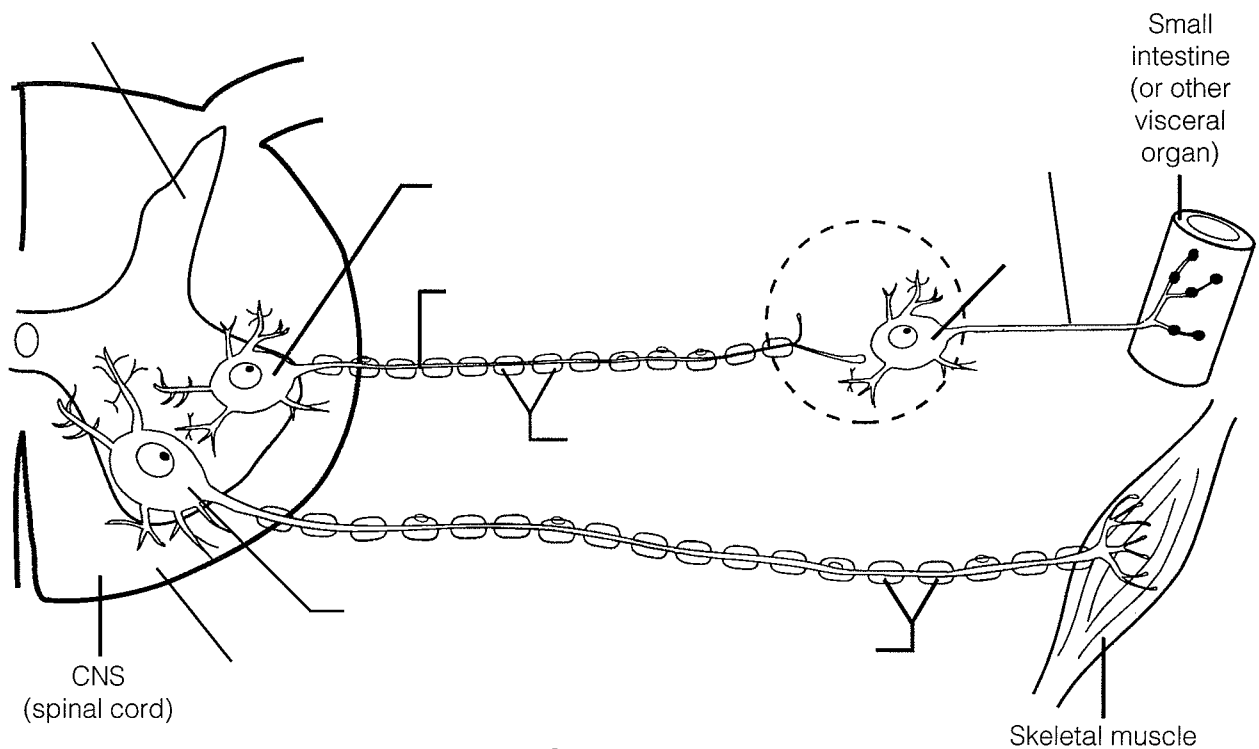


Figure 7-11

37. The following table indicates a number of conditions. Use a check (✓) to show which division of the autonomic nervous system is involved in each condition. Then, respond to the true-to-life situation below the chart.

Condition	Sympathetic	Parasympathetic
1. Postganglionic axons secrete norepinephrine; adrenergic fibers		
2. Postganglionic axons secrete acetylcholine; cholinergic fibers		
3. Long preganglionic axon, short postganglionic axon		
4. Short preganglionic axon, long postganglionic axon		
5. Arises from cranial and sacral nerves		
6. Arises from spinal nerves T <sub>1</sub> to L <sub>3</sub>		
7. Normally in control		
8. Fight-or-flight system		
9. Has more specific control		
10. Causes a dry mouth, dilates bronchioles		
11. Constricts eye pupils, decreases heart rate		

You are alone in your home late in the evening, and you hear an unfamiliar sound in your backyard. In the spaces provided, list four physiologic events promoted by the sympathetic nervous system that would help you to cope with this rather frightening situation.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_