

# Nervous System

CHAPTER

14

## Chapter Outline

### Objectives

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  - Central Nervous System
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- Connecting Body Systems–Nervous System

#### Medical Word Elements

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- Cerebrovascular Disease
- Seizure Disorders
- Parkinson Disease
- Multiple Sclerosis
- Alzheimer Disease
- Mental Illness
- Oncology

##### Diagnostic, Symptomatic, and Related Terms

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##### Pharmacology

##### Abbreviations

##### Learning Activities

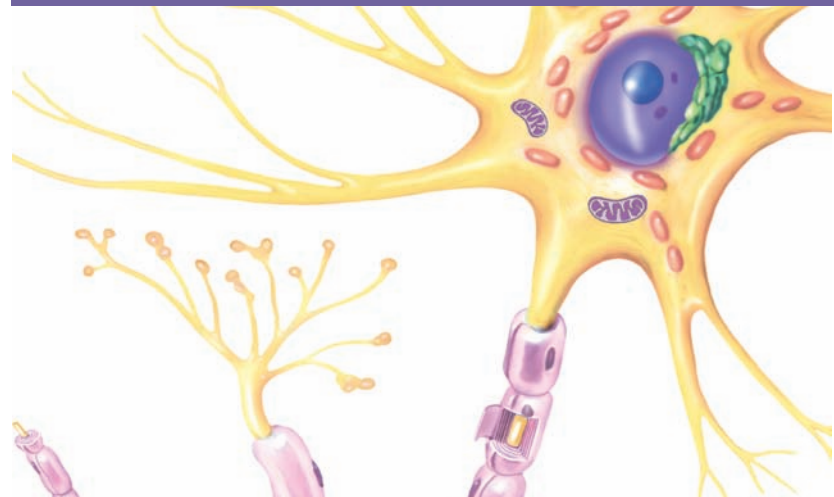
##### Medical Record Activities

- Discharge summary: Subarachnoid hemorrhage
- Consultation report: Acute onset paraplegia

## Objectives

Upon completion of this chapter, you will be able to:

- Locate and describe the structures of the nervous system.
- Describe the functional relationship between the nervous system and other body systems.
- Recognize, pronounce, spell, and build words related to the nervous system.
- Describe pathological conditions, diagnostic and therapeutic procedures, and other terms related to the nervous system.
- Explain pharmacology related to the treatment of nervous disorders.
- Demonstrate your knowledge of this chapter by completing the learning and medical record activities.



## Anatomy and Physiology

The nervous system is one of the most complicated systems of the body in both structure and function. It senses physical and chemical changes in the internal and external environments, processes them, and then responds to maintain homeostasis. Voluntary activities, such as walking and talking, and involuntary activities, such as digestion and circulation, are coordinated, regulated, and integrated by the nervous system. The entire neural network of the body relies on the transmission of nervous impulses. **Nervous impulses** are electrochemical stimuli that travel from cell to cell as they send information from one area of the body to another. The speed at which this occurs is almost instantaneous, thus providing an immediate response to change.

## Cellular Structure of the Nervous System

Despite its complexity, the nervous system is composed of only two principal types of cells: neurons and neuroglia. **Neurons** are cells that transmit impulses. They are commonly identified by the direction the impulse travels as **afferent** when the direction is toward the brain or spinal cord or **efferent** when the direction is away from the brain or spinal cord. **Neuroglia** are cells that support neurons and bind them to other neurons or other tissues of the body. Although they do not transmit impulses, they provide a variety of activities essential to the proper functioning of neurons. Along with neurons, neuroglia constitute the nervous tissue of the body.

### Anatomy and Physiology Key Terms

*This section introduces important nervous system terms and their definitions. Word analyses for selected terms are also provided.*

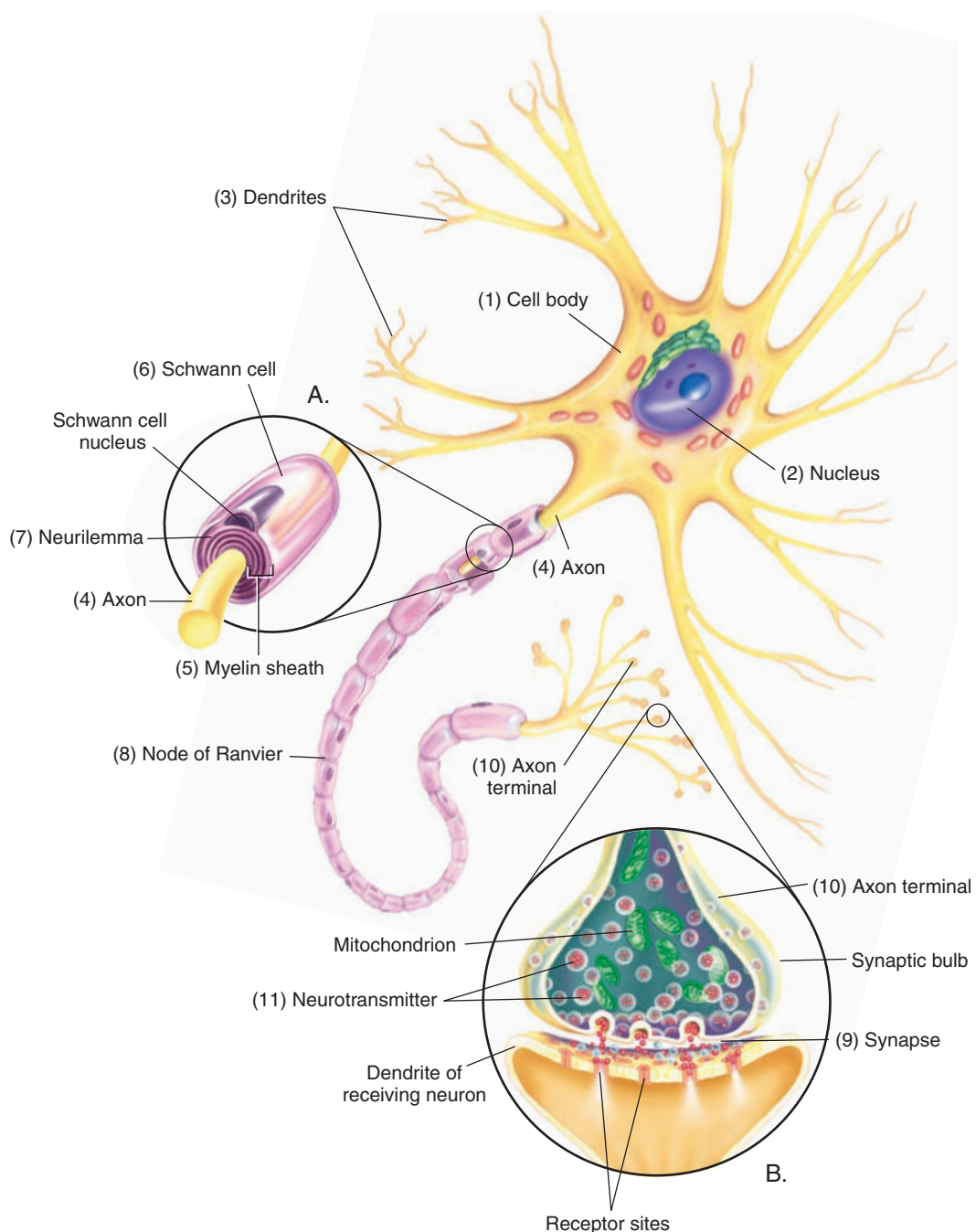
Term	Definition
<b>afferent</b> ĀF-ēr-ĕnt	Carry or move inward or toward a central structure <i>The term afferent refers to certain arteries, veins, lymphatic vessels, and nerves.</i>
<b>blood-brain barrier</b>	Protective mechanism that blocks specific substances found in the bloodstream from entering delicate brain tissue
<b>central nervous system (CNS)</b> NĒR-vēs	Network of nervous tissue found in the brain and spinal cord
<b>efferent</b> ĒF-ĕ-rĕnt	Carry or move away from a central structure <i>The term efferent refers to certain arteries, veins, lymphatic vessels, and nerves.</i>
<b>nerve fiber</b>	Projection of a neuron, especially the axon that transmits impulses
<b>neurilemma</b> nū-rī-LĒM-ă	Additional sheath external to myelin that is formed by Schwann cells and found only on axons in the peripheral nervous system <i>Because neurilemma does not disintegrate after injury to the axon, its enclosed hollow tube provides an avenue for regeneration of injured axons.</i>
<b>ventricle</b> VĒN-trīk-l <i>ventr</i> : belly, belly side <i>-ical</i> : pertaining to	Chamber or cavity of an organ that receives or holds a fluid
<b>Pronunciation Help</b>	Long Sound    ā—rate    ē—rebirth    ī—isle    ō—over    ū—unite Short Sound    ă—alone    ě—ever    ĩ—it    ȝ—not    ũ—cut

## Neurons

The three major structures of the neuron are the cell body, axon, and dendrites. (See Figure 14–1.) The (1) **cell body** is the enlarged structure of the neuron that contains the (2) **nucleus** of the cell and various organelles. Its branching cytoplasmic projections are (3) **dendrites** that carry impulses to the cell body and (4) **axons** that carry impulses from the cell body. Dendrites resemble tiny branches on

a tree, providing additional surface area for receiving impulses from other neurons. Axons are long, single projections ranging from a few millimeters to more than a meter in length. Axons transmit impulses to dendrites of other neurons as well as muscles and glands.

Axons in the **peripheral nervous system** and the **central nervous system** possess a white, lipid covering called (5) **myelin sheath**. This covering acts as an electrical insulator that reduces the possibility



**Figure 14-1.** Neuron. (A) Schwann cell. (B) Axon terminal synapse.

of an impulse stimulating adjacent nerves. It also accelerates impulse transmission through the axon. On nerves in the peripheral nervous system, myelin sheath is formed by a neuroglial cell called a (6) **Schwann cell** that wraps tightly around the axon. Its exterior surface forms a thin tube called (7) **neurilemma**, or **neurolemma**. The neurilemma does not disintegrate after an axon has been crushed or severed, as does the axon and myelin sheath, but remains intact. This intact sheath provides a pathway for possible neuron regeneration after injury.

The myelin sheath covering the axons in the central nervous system is formed by oligodendrocytes rather than Schwann cells. Oligodendrocytes do not produce neurilemma, thus injury or damage to neurons located in the central nervous system is irreparable. The short unmyelinated spaces between adjacent segments of myelin sheath are called (8) **nodes of Ranvier**. These nodes help speed the transmission of impulses down the axon because an impulse jumps across the nodes at a faster rate than it is able to travel through the myelinated axon.

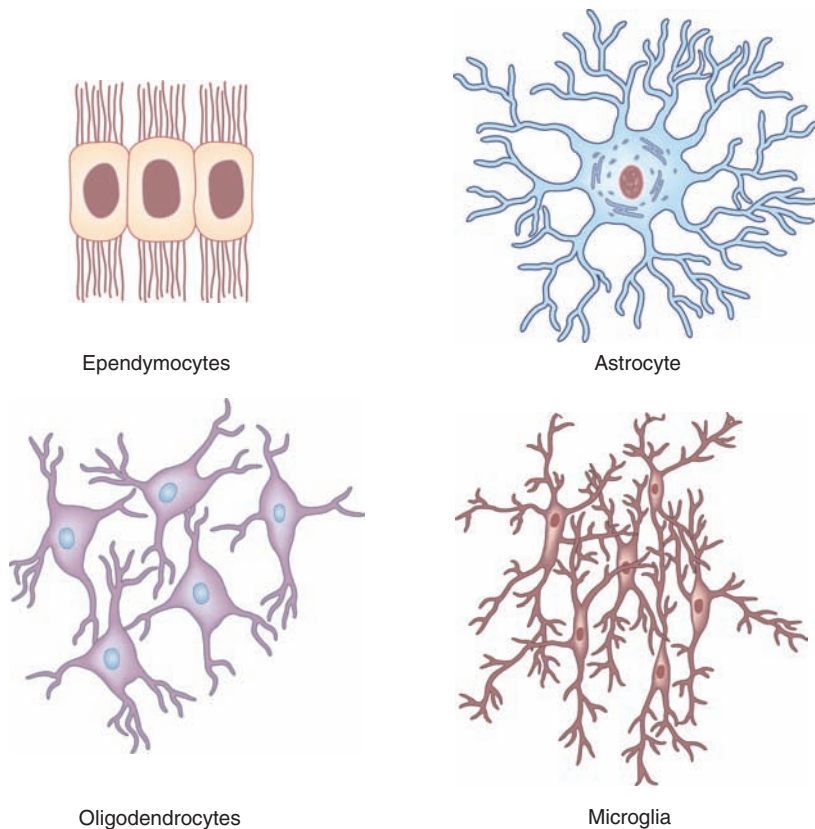
The functional connection between two neurons or between a neuron and its target (muscle or gland) is a gap or space called a (9) **synapse**. Impulses must travel from the (10) **axon terminal** of one neuron to the dendrite of the next neuron or

to its target by crossing this synapse. The impulse within the transmitting axon causes a chemical substance called a (11) **neurotransmitter** to be released at the end of its axon. The neurotransmitter diffuses across the synapse and attaches to the receiving neuron at specialized receptor sites. When sufficient receptor sites are occupied, it signals an acceptance “message” and the impulse passes to the receiving neuron. The receiving neuron immediately inactivates the neurotransmitter, and prepares the site for receiving another stimulus.

## Neuroglia

The term **neuroglia** literally means *nerve glue* because these cells were originally believed to serve only one function: to bind neurons to each other and to other structures. They are now known to supply nutrients and oxygen to neurons and assist in other metabolic activities. They also play an important role when the nervous system suffers injury or infection. The four major types of neuroglia include astrocytes, oligodendrocytes, microglia, and ependyma. (See Figure 14–2.)

**Astrocytes**, as their name suggests, are star-shaped neuroglia. They provide three-dimensional mechanical support for neurons and form tight sheaths around the capillaries of the brain. These



**Figure 14-2.** Four types of neuroglia.

sheaths provide an obstruction, called the **blood-brain barrier**, that keeps large molecular substances from entering the delicate tissue of the brain. Even so, small molecules, such as water, carbon dioxide, oxygen, and alcohol, readily pass from blood vessels through the barrier and enter the interstitial spaces of the brain. Researchers must take the blood-brain barrier into consideration when developing drugs for treatment of brain disorders. Astrocytes also perform mildly phagocytic functions in the brain and spinal cord. **Oligodendrocytes**, also called *oligodendroglia*, are responsible for developing myelin on neurons of the central nervous system. **Microglia**, the smallest of the neuroglia, possess phagocytic properties and may become very active during times of infection. **Ependyma** are ciliated cells that line fluid-filled cavities of the central nervous system, especially the **ventricles** of the brain. They assist in the circulation of cerebrospinal fluid (CSF).

## Nervous System Divisions

The nervous system consists of two main divisions: the central nervous system and the peripheral nervous system. The **central nervous system (CNS)** consists of the brain and spinal cord. The **peripheral nervous system (PNS)** includes all other nervous tissues of the body. (See Table 14–1.)

### Central Nervous System

The **central nervous system (CNS)** consists of the brain and spinal cord. Its nervous tissue is classified as *white matter* or *gray matter*. Bundles of axons with their white lipid myelin sheath constitutes white matter and unmyelinated fibers, dendrites, and nerve cell bodies make up gray matter

of the brain and spinal cord. The brain is protected by the bony skull and the spinal cord is protected by vertebrae.

### Brain

In addition to being one of the largest organs of the body, the brain is highly complex in structure and function. (See Figure 14–3.) It integrates almost every physical and mental activity of the body and is the center for memory, emotion, thought, judgment, reasoning, and consciousness. The four major structures of the brain are:

- cerebrum
- cerebellum
- diencephalon
- brainstem.

### Cerebrum

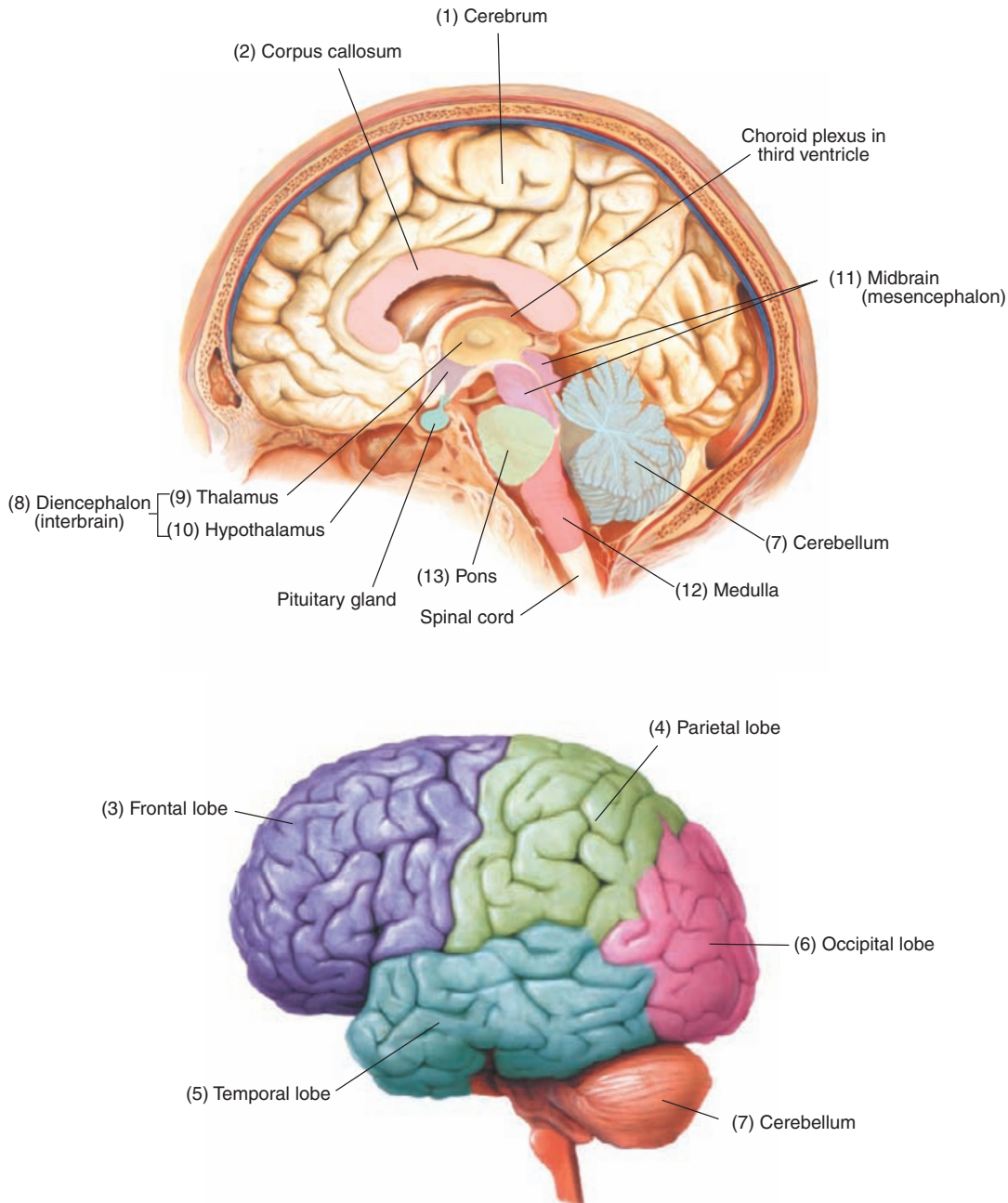
The (1) **cerebrum** is the largest and uppermost portion of the brain. It consists of two hemispheres divided by a deep longitudinal fissure, or groove. The fissure does not completely separate the hemispheres. A structure called the (2) **corpus callosum** joins these hemispheres, permitting communication between the right and left sides of the brain. Each hemisphere is divided into five lobes. Four of these lobes are named for the bones that lie directly above them: (3) **frontal**, (4) **parietal**, (5) **temporal**, and (6) **occipital**. The fifth lobe, the **insula** (not shown in Figure 14–3), is hidden from view and can be seen only upon dissection.

The cerebral surface consists of numerous folds, or convolutions, called **gyri**. The gyri are separated by furrows or fissures called **sulci**. A thin layer called the **cerebral cortex** covers the entire cerebrum and is composed of gray matter.

Table 14-1 Nervous System Structures and Functions

*This table lists the structures of the nervous system along with their functions.*

Structures	Function
<b>Central</b>	
Brain	Center for thought and emotion, interpretation of sensory stimuli, and coordination of body functions
Spinal cord	Main pathway for transmission of information between the brain and body
<b>Peripheral</b>	
Cranial nerves	Includes 12 pairs of nerves that emerge from the base of the skull and may act in either a motor capacity, sensory capacity, or both
Spinal nerves	Includes 31 pairs of nerves that emerge from the spine and act in both motor and sensory capacities



**Figure 14-3.** Brain structures.

The remainder of the cerebrum is primarily composed of white matter (myelinated axons). Major functions of the cerebrum include sensory perception and interpretation, language, voluntary movement, memory, and the emotional aspects of behavior.

### Cerebellum

The second largest structure of the brain, the (7) **cerebellum**, occupies the posterior portion of the skull. All functions of the cerebellum involve

movement. When the cerebrum initiates muscular movement, the cerebellum coordinates and refines it. The cerebellum also aids in maintaining equilibrium and balance.

### Diencephalon

The (8) **diencephalon** (also called *interbrain*) is composed of many smaller structures, including the thalamus and the hypothalamus. The (9) **thalamus** receives all sensory stimuli except olfactory and processes and transmits them to

the appropriate centers in the cerebral cortex. In addition, the thalamus receives impulses from the cerebrum and relays them to efferent nerves. The (10) **hypothalamus** regulates activities of the **autonomic nervous system (ANS)**, including impulses that regulate heartbeat, body temperature, and fluid balance. It also controls many endocrine functions.

### Brainstem

The brainstem completes the last major section of the brain. It is composed of three structures: the (11) **midbrain** (also called *mesencephalon*), separating the cerebrum from the brainstem; the (12) **medulla**, which attaches to the spinal cord; and (13) the **pons**, or “bridge,” connecting the midbrain to the medulla. In general, the brainstem is a pathway for impulse conduction between the brain and spinal cord. The brainstem is the origin of 10 of the 12 pairs of cranial nerves and controls respiration, blood pressure, and heart rate. Because the brainstem is the site that controls the beginning of life (the initiation of the beating heart in a fetus) and the end of life (the cessation of respiration and heart activity) it is sometimes called the *primary brain*.

### Spinal cord

The **spinal cord** transmits sensory impulses from the body to the brain and motor impulses from the brain to muscles and organs of the body. The sensory nerve tracts are called *ascending tracts* because the direction of the impulse is upward. Conversely, motor nerve tracts are called *descending tracts* because they carry impulses in a downward direction to muscles and organs. A cross-section of the spinal cord reveals an inner gray matter composed of cell bodies and dendrites and an outer white matter area composed of myelinated tissue of the ascending and descending tracts.

The entire spinal cord is located within the spinal cavity of the vertebral column, with spinal nerves exiting between the intervertebral spaces throughout almost the entire length of the spinal column. Unlike the cranial nerves, which have specific names, the spinal nerves are identified by the region of the vertebral column from which they exit.

### Meninges

The brain and spinal cord receive limited protection from three coverings called *meninges* (singular, *meninx*). These coverings include the dura mater, arachnoid, and pia mater.

The **dura mater** is the outermost covering of the brain and spinal cord. It is tough, fibrous, and

dense, and composed primarily of connective tissue. Because of its thickness, this membrane is also called the *pachymeninges*. Beneath the dura mater is a cavity called the *subdural space*, which is filled with serous fluid.

The **arachnoid** is the middle covering and, as its name suggests, has a spider-web appearance. It fits loosely over the underlying structures. A **sub-arachnoid space** contains **cerebrospinal fluid**, a colorless fluid that contains proteins, glucose, urea, salts, and some white blood cells. This fluid circulates around the spinal cord and brain and through ventricles located within the inner portion of the brain. It provides nutritive substances to the central nervous system and adds additional protection for the brain and spinal cord by acting as a shock absorber. Normally, cerebrospinal fluid is absorbed as rapidly as it is formed, maintaining a constant fluid volume. Any interference with its absorption results in a collection of fluid in the brain; a condition called *hydrocephalus*.

The **pia mater** is the innermost meninx. This membrane directly adheres to the brain and spinal cord. As it passes over the brain, it follows the contours of the gyri and sulci. It contains numerous blood vessels and lymphatics that nourish the underlying tissues. Because of the thinness and delicacy of the arachnoid and pia mater, these two meninges are collectively called the *leptomeninges*.

### Peripheral Nervous System

The **peripheral nervous system (PNS)** is composed of all nervous tissue located outside of the spinal column and skull. Its anatomical structures consist of 12 pairs of cranial nerves and 31 pairs of spinal nerves. Functionally, the PNS is subdivided into the somatic nervous system (SNS) and the autonomic nervous system (ANS).

The **somatic nervous system** consists of **nerve fibers** that transmit sensory information to the brain and spinal cord, and nerve fibers that transmit impulses from the brain and spinal cord to muscles under conscious or voluntary control, such as those required for walking and talking. The **autonomic nervous system** consists of nerves that control involuntary movement, such as digestion, heart contraction, and vasoconstriction. It also regulates secretion by glands.

The ANS is subdivided into the sympathetic and parasympathetic divisions. To a large extent, these subdivisions oppose the action of the other, although in certain instances, they may exhibit independent or complimentary action. In general, the **sympathetic** subdivision produces responses evident in “fight-or-flight” situations. It responds

when immediate actions are required. Blood flow increases in skeletal muscles to prepare an individual to either fight or retreat from a threatening situation. The **parasympathetic** subdivision generally responds when immediate action is not required or a threatening situation subsides. This subdivision is sometimes called the “rest and relax” or “rest and digest” condition. (See Table 14–2.)

### **Cranial Nerves**

The cranial nerves originate in the base of the brain and emerge through openings in the base of the skull. They are designated by name or number. (See Figure 14–4.) Cranial nerves may be sensory, motor, or a mixture of both. **Sensory nerves** are afferent, and receive impulses from the sense organs, including the eyes, ears, nose, tongue, and skin and transmit them to the CNS. **Motor nerves** conduct impulses to muscles and glands. Some cranial nerves are composed of both sensory and

motor fibers. They are called **mixed nerves**. An example of a mixed nerve is the facial nerve. It acts in a motor capacity by transmitting impulses for smiling or frowning. However, it also acts in a sensory capacity by transmitting taste impulses from the tongue to the brain.

### **Spinal Nerves**

The spinal nerves emerge from the intervertebral spaces in the spinal column. All 31 pairs of spinal nerves are mixed nerves. (See Figure 14–5.) They exit from the spinal canal between the vertebrae and extend to various parts of the body. Each of them is identified according to the vertebra from which they exit. Each of them has two points of attachment to the spinal cord: an anterior (ventral) root and a posterior (dorsal) root. The **anterior root** contains motor fibers and the **posterior root** contains sensory fibers. These two roots unite to form the spinal nerve that has both afferent and efferent qualities.

Table 14-2

## **Actions Regulated by Sympathetic and Parasympathetic Systems**

*This table summarizes some of the responses regulated by the sympathetic and parasympathetic divisions of the peripheral nervous system.*

### **Sympathetic Division**

Dilates pupils  
 Inhibits the flow of saliva  
 Relaxes bronchi  
 Accelerates heart rate  
 Slows digestive activities  
 Constricts visceral blood vessels

### **Parasympathetic Division**

Constricts pupils  
 Increases the flow of saliva  
 Constricts bronchi  
 Slows heart rate  
 Accelerates digestive activities  
 Dilates visceral blood vessels



## Connecting Body Systems–Nervous System

*The main function of the nervous system is to identify and respond to internal and external changes in the environment to maintain homeostasis. Specific functional relationships between the nervous system and other body systems are discussed below.*



### Blood, Lymph, and Immune

- Nervous system identifies changes in blood and lymph composition and provides the stimuli to maintain homeostasis.
- Nervous system identifies pathologically altered tissue and assists the immune system in containing injury and promoting healing.



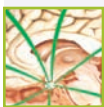
### Cardiovascular

- Nervous tissue, especially the conduction system of the heart, transmits a contraction impulse.
- Nervous system identifies pressure changes on vascular walls and responds to regulate blood pressure.



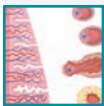
### Digestive

- Nervous stimuli of digestive organs propel food by peristalsis.
- Nerve receptors in the lower colon identify the need to defecate.



### Endocrine

- The hypothalamus regulates hormone production.



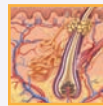
### Female reproductive

- Nervous system transmits contraction impulses needed for delivery of a fetus.
- Nervous system provides stimuli needed for lactation.
- Nervous system regulates hormones needed for the menstrual cycle.



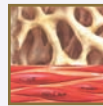
### Genitourinary

- Nervous tissue in reproductive organs receives pleasure responses.
- Nervous system responds to pressure changes in bladder walls that indicate the need to void.
- Nervous system stimulates the thirst reflex when body fluid levels are low.



### Integumentary

- Sensory nervous system supplies receptors in the skin that respond to environmental stimuli.
- Autonomic nervous system regulates body temperature by controlling shivering and sweating.



### Musculoskeletal

- Nervous system provides impulses for contraction resulting in voluntary and involuntary movement of muscles.
- Autonomic nervous tissue responds to positional changes.



### Respiratory

- Nervous system stimulates muscle contractions that create pressure changes necessary for ventilation.
- Nervous system regulates rate and depth of breathing.



*It is time to review nervous system structures by completing Learning Activity 14–1.*

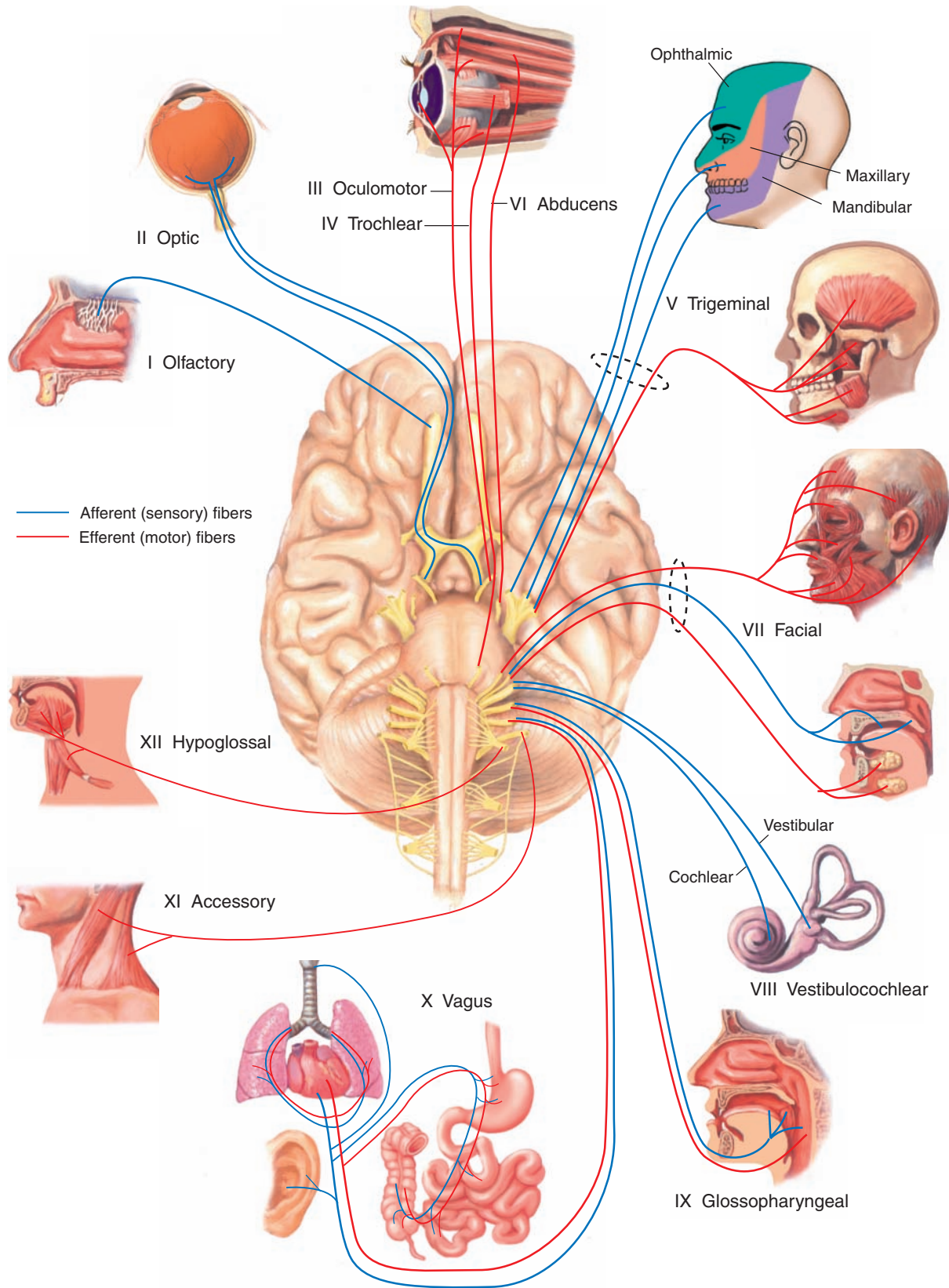
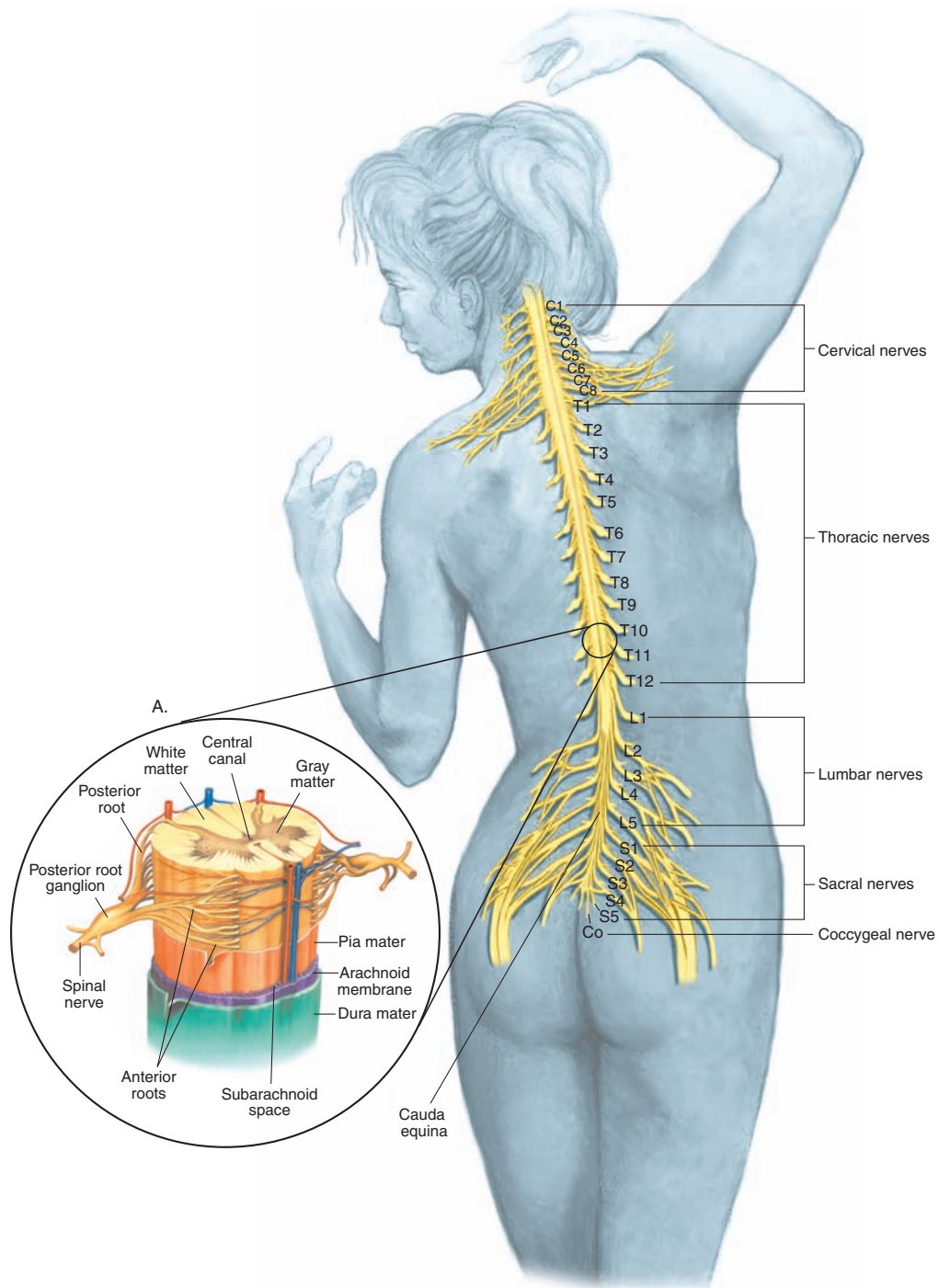


Figure 14-4. Cranial nerve distribution.



**Figure 14-5.** Spinal nerves. (A) Spinal cord enlargement.

## Medical Word Elements

This section introduces combining forms, suffixes, and prefixes related to the nervous system. Word analyses are also provided.

Element	Meaning	Word Analysis
<b>Combining Forms</b>		
cerebr/o	cerebrum	<b>cerebr/o</b> /tomy (sĕr-ĕ-BRŌT-ō-mĕ): incision of the cerebrum -tomy: incision
crani/o	cranium (skull)	<b>crani/o</b> /malacia (krā-nĕ-ō-mā-LĀ-shĕ-ă): softening of the cranium -malacia: softening
dendr/o	tree	<b>dendr/oid</b> (DĒN-droyd): resembling a (branching) tree -oid: resembling <i>Dendrons, the highly branched portion of the neuron, conduct nerve impulses toward the cell body.</i>
encephal/o	brain	<b>encephal/o</b> /cele (ĕn-SĔF-ă-lō-sĕl): herniation of the brain -cele: hernia, swelling <i>Encephalocele is a condition in which portions of the brain and meninges protrude through a bony midline defect in the skull. It is usually associated with a neural tube defect.</i>
gangli/o	ganglion (knot or knotlike mass)	<b>gangli/ectomy</b> (gāng-glĕ-ĔK-tō-mĕ): excision of a ganglion -ectomy: excision, removal <i>A ganglion is a mass of nerve cell bodies (gray matter) in the peripheral nervous system.</i>
gli/o	glue; neuroglial tissue	<b>gli/oma</b> (glī-Ō-mā): tumor (composed of) neuroglial tissue -oma: tumor <i>A glioma is a tumor composed of neuroglial or supporting tissue of the nervous system.</i>
kinesi/o	movement	<b>brady/kines/ia</b> (brăd-ĕ-kī-NĒ-sĕ-ă): condition of slow movement brady-: slow -ia: condition
lept/o	thin, slender	<b>lept/o</b> /mening/o/pathy (lĕp-tō-mĕn-ĭn-GŎP-ă-thĕ): disease of the meninges -mening/o: meninges (membranes covering brain and spinal cord) -pathy: disease <i>The leptomeninges include the pia mater and arachnoid, both of which are thin and delicate in structure, as opposed to the dura mater.</i>
lex/o	word, phrase	<b>dys/lex/ia</b> (dĭs-LĔK-sĕ-ă): difficulty using words dys-: bad; painful; difficult -ia: condition <i>Dyslexia is difficulty or inability with reading, including the tendency to reverse letters or words when reading or writing.</i>

## Medical Word Elements—cont'd

Element	Meaning	Word Analysis
mening/o	meninges (membranes covering brain and spinal cord)	<b>mening/o/cele</b> (měn-ĪN-gō-sēl): herniation of the meninges -cele: hernia, swelling
meningi/o		<b>meningi/oma</b> (měn-ĭn-jē-Ō-mă): tumor in the meninges -oma: tumor
myel/o	bone marrow; spinal cord	<b>poli/o/myel/itis</b> (pōl-ē-ō-mī-ēl-Ī-tīs): inflammation of the gray matter of the spinal cord <i>poli/o</i> : gray; gray matter (of brain or spinal cord) <i>-itis</i> : inflammation
narc/o	stupor; numbness; sleep	<b>narc/o/tic</b> (nār-KŌT-ĭk): relating to sleep -tic: pertaining to <i>Narcotics depress the central nervous system, thus relieving pain and producing sleep.</i>
neur/o	nerve	<b>neur/o/lysis</b> (nū-RŌL-ĭs-ĭs): destruction of a nerve -lysis: separation; destruction; loosening <i>Neurolysis is sometimes performed using cryoablation or radio-frequency techniques to relieve intractable pain as a temporary or permanent measure.</i>
radicul/o	nerve root	<b>radicul/algia</b> (ră-dĭk-ŭ-LĂL-jē-ă): pain in the nerve root -algia: pain
sthen/o	strength	<b>hyper/sthen/ia</b> (hī-pēr-STHĒ-nē-ă): condition of excessive strength <i>hyper-</i> : excessive, above normal <i>-ia</i> : condition <i>Hypersthenia is a condition of excessive strength or tonicity of the body or a body part.</i>
thalam/o	thalamus	<b>thalam/o/tomy</b> (thăl-ă-MŌT-ō-mē): incision of the thalamus -tomy: incision <i>Thalamotomy is performed to treat intractable pain or psychoses.</i>
thec/o	sheath (usually refers to meninges)	<b>intra/thec/al</b> (ĭn-tră-THĒ-kăl): pertaining to the space within a sheath <i>intra-</i> : in, within <i>-al</i> : pertaining to
ton/o	tension	<b>dys/ton/ia</b> (dĭs-TŌ-nē-ă): bad or poor (muscle) tone <i>dys-</i> : bad; painful; difficult <i>-ia</i> : condition <i>Dystonia usually refers to a movement disorder characterized by sustained muscle contractions resulting in a persistently abnormal posture.</i>
ventricul/o	ventricle (of heart or brain)	<b>ventricul/o/metry</b> (vēn-trĭk-ŭ-LŌM-ē-trē): measurement of ventricle (pressure) <i>-metry</i> : act of measuring
<b>Suffixes</b>		
-algnesia	pain	<b>an/algnesia</b> (ăn-ăl-JĒ-zē-ă): absence of (a normal sense of) pain <i>an-</i> : without, not
-algia		<b>syn/algia</b> (sĭn-ĂL-jē-ă): joined (referred) pain <i>syn-</i> : union, together, joined <i>Synalgia is pain experienced in a part of the body other than the place of pathology. For example, right shoulder pain is commonly associated with gallstones.</i>

(continued)

Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
-asthenia	weakness, debility	my/ <b>asthenia</b> (mī-ās-THĒ-nē-ă): muscle weakness <i>my</i> : muscle
-esthesia	feeling	hyper/ <b>esthesia</b> (hī-pĕr-ēs-THĒ-zē-ă): increased feeling <i>hyper-</i> : excessive, above normal <i>Hyperesthesia involves a marked sensitivity to touch, pain, or other sensory stimuli.</i>
-kinesia	movement	hyper/ <b>kinesia</b> (hī-pĕr-kī-NĒ-zē-ă): excessive movement; also called <i>hyperactivity</i> <i>hyper-</i> : excessive, above normal
-lepsy	seizure	narc/o/ <b>lepsy</b> (NĀR-kō-lĕp-sē): seizure of sleep <i>narc/o</i> : sleep <i>In narcolepsy, the individual has a sudden and uncontrollable urge to sleep at an inappropriate time, such as when driving.</i>
-paresis	partial paralysis	hemi/ <b>paresis</b> (hĕm-ē-PĀR-ĕ-sīs): paralysis of one-half (of the body); also called <i>hemiplegia</i> <i>hemi-</i> : one-half <i>When used alone, the term paresis means partial paralysis or motor weakness.</i>
-phasia	speech	a/ <b>phasia</b> (ă-FĀ-zē-ă): without speech <i>a-</i> : without, not
-plegia	paralysis	quadri/ <b>plegia</b> (kwōd-rī-PLĒ-jē-ă): paralysis of four (extremities) <i>quadri-</i> : four
-taxia	order, coordination	a/ <b>taxia</b> (ă-TĀK-sē-ă): without coordination <i>a-</i> : without, not <i>Ataxia refers to poor muscle coordination, especially when voluntary movements are attempted.</i>
Prefixes		
pachy-	thick	<b>pachy/mening/itis</b> (păk-ē-mĕn-ĭn-JĪ-tīs): inflammation of the dura mater <i>mening</i> : meninges (membranes covering brain and spinal cord) <i>-itis</i> : inflammation <i>The dura mater is a thick membrane that provides protection for the brain and spinal cord.</i>
para-	near, beside; beyond	<b>para/plegia</b> (păr-ă-PLĒ-jē-ă): paralysis of lower body and limbs <i>-plegia</i> : paralysis <i>Paraplegia is the paralysis of the lower limbs of the body.</i>
syn-	union, together, joined	<b>syn/algia</b> (sĭn-ĀL-jē-ă): referred pain <i>algia</i> : pain <i>Pain in a deteriorated hip commonly causes referred pain in a healthy knee.</i>
uni-	one	<b>uni/later/al</b> (ū-nī-LĀT-ĕr-ăl): pertaining to one side <i>later</i> : side, to one side <i>-al</i> : pertaining to



It is time to review medical word elements by completing Learning Activity 14–2. For audio pronunciations of the above-listed key terms, you can visit [www.davisplus.fadavis.com/gyls/systems](http://www.davisplus.fadavis.com/gyls/systems) to download this chapter's Listen and Learn! exercises or use the book's audio CD (if included).

## Pathology

Damage to the brain and spinal cord invariably causes signs and symptoms in other parts of the body. Common signs and symptoms for many neurological disorders include headache, insomnia, back or neck pain, weakness, and involuntary movement (**dyskinesia**). Careful observation of the patient during the history and physical examination may provide valuable clues about mental status and cognitive and motor ability. Muscle strength, coordination, gait, balance, and reflexes provide additional diagnostic clues. Lumbar puncture provides a sample of CSF for analysis and helps identify various types of meningitis and encephalitis. Radiology—especially computed tomography (CT) and magnetic resonance imaging (MRI) scans—provide detailed images that can locate cerebrovascular irregularities, lesions, and tumors.

## Radiculopathy

**Radiculopathy**, also called *radiculitis*, is an inflammation of the nerve root associated with the spinal column. Spinal nerves exit the spinal column at each level along the length of the spine. When pressure is applied to the nerve root (**compression**), the patient experiences tingling, numbness, weakness, or a radiating pain starting in the spine and moving outward. Pressure can be the result of a herniated disc, degenerative changes, arthritis, fractures, bone spurs, or tumors. The areas most commonly affected are the neck (**cervical radiculopathy**) and the lower back (**lumbar radiculopathy, sciatica**). The offending nerve root is commonly identified during the history and physical examination by evaluating the area of the skin known to be served by a specific nerve. MRIs and CT scans help to localize the site and nature of compression. Rest and anti-inflammatory medications are usually recommended. However, for disabling pain that lasts for several months or is accompanied by loss of bowel or bladder control, surgery to remove the cause of the pressure (**decompression surgery**) may be the only option.

## Cerebrovascular Disease

**Cerebrovascular disease** refers to any functional abnormality of the cerebrum caused by disorders of the blood vessels of the brain. It is most commonly associated with a **stroke**, also called *cerebrovascular accident (CVA)*. The three major types of strokes are ischemic stroke, intracerebral hemorrhage, and

subarachnoid hemorrhage. The most common type, which accounts for about 80% of all strokes, is ischemic stroke. **Ischemic stroke** is caused by a narrowing of the arteries of the brain or the arteries of the neck (**carotid**), generally due to atherosclerosis. (See Chapter 8, Figure 8–5.) This narrowing causes insufficient oxygen delivery to the brain tissue and, within a few minutes, the tissue begins to die. Occasionally, pieces of plaque break loose and travel to the narrower vessels of the brain, causing occlusion, also resulting in ischemia. An **intracerebral hemorrhage** is caused by the sudden rupture of an artery within the brain. After the rupture, released blood compresses brain structures and destroys them. In a **subarachnoid hemorrhage**, blood is released into the space surrounding the brain. This condition is commonly caused by a ruptured aneurysm and is usually fatal.

Signs and symptoms of stroke include weakness in one half of the body (**hemiparesis**), paralysis in one half of the body (**hemiplegia**), inability to speak (**aphasia**), lack of muscle coordination (**ataxia**), stupor, loss of consciousness (LOC), coma, or even death. If the CVA is mild, the patient may experience a brief “blackout,” blurred vision, or dizziness and may be unaware of the “minor stroke.” Stroke symptoms that resolve within 24 hours are known as a *transient ischemic attack (TIA)*. About one third of all strokes are preceded by a TIA. A family history of cerebrovascular disease and high blood pressure appears to be a contributing factor to stroke. Computed tomography (CT) is usually performed to determine the type of stroke. “Clot buster” (**thrombolytic**) medication is usually administered within 3 hours of symptom onset when ischemic stroke is diagnosed. Anti-hypertensives may also be administered to control blood pressure. Treatment involves speech, physical, and occupational therapy and various medications, depending on the type of stroke

## Seizure Disorders

**Seizure disorders** include any medical condition characterized by sudden changes in behavior or consciousness as a result of uncontrolled electrical activity in the brain. However, chronic or recurring seizure disorders are called *epilepsies*. Causes of epilepsy include brain injury, congenital anomalies, metabolic disorders, brain tumors, vascular disturbances, and genetic disorders.

Seizures are characterized by sudden bursts of abnormal electrical activity in neurons, resulting in temporary changes in brain function. Two major types of seizures are partial and generalized.

In **partial seizures**, only a portion of the brain is involved. There is a short alteration of consciousness of about 10 to 30 seconds with repetitive, unusual movements and confusion. In a **generalized seizure**, the entire brain is involved. The most common type of generalized seizure is the **tonic-clonic seizure**; also called *grand mal seizure*. In the **tonic phase** of a tonic-clonic seizure, the entire body becomes rigid; in the **clonic phase** there is uncontrolled jerking. Recovery may take minutes to hours and usually leaves the patient weak. In **status epilepticus**, tonic-clonic seizures follow one after another without an intervening period of recovery. It is a life-threatening emergency that involves the whole cortex and emergency medical attention is essential. Diagnosis and evaluation commonly rely on electroencephalography and magnetoencephalography to locate the affected area of the brain. Epilepsy can usually be controlled by antiepileptic medications.

## Parkinson Disease

**Parkinson disease**, also called *shaking palsy*, is a progressive neurological disorder affecting the portion of the brain responsible for controlling movement. As neurons degenerate, the patient develops uncontrollable nodding of the head, decreased speed of movement (**bradykinesia**, **hypokinesia**), tremors, large joint stiffness, and a shuffling gait. Muscle rigidity causes facial expressions to appear fixed and masklike with unblinking eyes. Sometimes the patient exhibits “pill rolling,” in which he or she inadvertently rubs the thumb against the index finger.

In patients with Parkinson disease, dopamine (a neurotransmitter that facilitates the transmission of impulses at synapses) is lacking in the brain. Management involves the administration of L-dopa, which can cross the blood-brain barrier. L-dopa is converted in the brain to dopamine. Even so, this treatment only reduces symptoms; it is not a cure for Parkinson disease.

## Multiple Sclerosis

**Multiple sclerosis (MS)** is a progressive, degenerative disease of the central nervous system. MS is characterized by inflammation, hardening and, finally, loss of myelin (**demyelination**) throughout the spinal cord and brain. As myelin deteriorates, the transmission of electrical impulses from one neuron to another is impeded. In effect, the conduction pathway develops “short circuits.”

Signs and symptoms of MS include tremors, muscle weakness, and bradykinesia. Occasionally, visual disturbances exist. During remissions, symptoms temporarily disappear, but progressive hardening of myelin areas leads to other attacks. Ultimately, most voluntary motor control is lost and the patient becomes bedridden. Death occurs anywhere from 7 to 30 years after the onset of the disease. Young adults, usually women, between ages 20 and 40 are the most common victims of MS. The etiology of the disease is unclear, but autoimmune disease or a slow viral infection is believed to be the most probable cause.

## Alzheimer Disease

**Alzheimer disease (AD)** is a progressive neurological disorder that causes memory loss and serious mental deterioration. Small lesions called *plaques* develop in the cerebral cortex and disrupt the passage of electrochemical signals between cells. The clinical manifestations of Alzheimer disease include memory loss and cognitive decline. There is also a decline in social skills and ability to carry out activities of daily living. Most patients undergo personality, emotional, and behavioral changes. As the disease progresses, loss of concentration and increased fatigue, restlessness, and anxiety are common. Alzheimer disease was once considered rare but is now identified as a leading cause of senile dementia. Although there is no specific treatment, moderate relief has been associated with medications that prevent a breakdown of brain chemicals required for neurotransmission.

## Mental Illness

**Mental illness** includes an array of psychological disorders, syndromes, and behavioral patterns that cause alterations in mood, behavior, and thinking. (See Table 14–3.) Its forms range from mild to serious. For example, anxiety may manifest as a slight apprehension or uneasiness lasting a few days to a more severe form involving intense fears lasting for months and even years.

**Psychosis** refers to a serious mental disorder commonly characterized by false beliefs despite overwhelming evidence to the contrary (**delusions**). The psychotic patient typically “hears voices” and “sees visions” in the absence of an actual stimulus (**hallucinations**). The patient’s speech is usually incoherent and disorganized and behavior is erratic.

**Neurosis** is a mental disorder caused by an emotion experienced in the past that overwhelmingly interferes or affects a present emotion. For example,



Table 14-3 Common Terms Associated with Mental Illness

*This table lists common terms or disorders associated with mental illness along with their definitions.*

Term	Definition
<b>affective disorder</b>	Psychological disorder in which the major characteristic is an abnormal mood, usually mania or depression
<b>anorexia nervosa</b>	Eating disorder characterized by a refusal to maintain adequate weight for age and height and an all-consuming desire to remain thin
<b>anxiety</b>	Psychological “worry” disorder characterized by excessive pondering or thinking “what if...” <i>Feelings of worry, dread, lack of energy, and a loss of interest in life are common signs associated with anxiety.</i>
<b>attention deficit hyperactivity disorder (ADHD)</b>	Disorder affecting children and adults characterized by impulsiveness, overactivity, and the inability to remain focused on a task <i>Behavioral modification, medical management, or a combination of both are commonly used in the treatment of ADHD.</i>
<b>bipolar disorder</b>	Mental disorder that causes unusual shifts in mood, emotion, energy, and ability to function; also called <i>manic-depressive illness</i>
<b>bulimia nervosa</b>	Eating disorder characterized by bingeing (overeating) and purging (vomiting or use of laxatives)
<b>depression</b>	Mood disorder associated with sadness, despair, discouragement, and, commonly, feelings of low self-esteem, guilt, and withdrawal
<b>mania</b>	Mood disorder characterized by mental and physical hyperactivity, disorganized behavior, and excessively elevated mood
<b>panic attack</b>	Sudden, intense, overwhelming feeling of fear that comes without warning and is not attributable to any immediate danger <i>A key symptom of a panic attack is the fear of its recurrence.</i>

a child bitten by a dog may show irrational fear of animals as an adult. Many mental disorders are forms of neuroses, including irrational fears (**phobias**), exaggerated emotional and reflexive behaviors (**hysterias**), or irrational, uncontrolled performance of ritualistic actions for fear of a dire consequence (**obsessive compulsive disorders**).

Research and education have removed much of the stigma attached to mental illness. Today, mental illness is becoming a more recognizable and treatable disorder. Many psychological disorders can be effectively treated or managed by family physicians, school psychologists, marriage counselors, family counselors, and even support groups such as grief support groups and Alcoholics Anonymous.

Diagnosis and treatment of serious mental disorders usually require the skills of a medical specialist called a **psychiatrist**. In the capacity of a physician, the psychiatrist is licensed to prescribe medications and perform medical procedures not available

to those who do not hold a medical license. Psychiatrists commonly work in association with **clinical psychologists**, who are individuals trained in evaluating human behavior, intelligence, and personality.

## Oncology

**Intracranial tumors** that originate directly in brain tissue are called **primary intracranial tumors**. They are commonly classified according to histological type and include those that originate in neurons and those that develop in glial tissue. Signs and symptoms of intracranial tumors include headaches, especially upon arising in the morning, during coughing episodes, and upon bending or sudden movement. Occasionally, the optic disc in the back of the eyeball swells (**papilledema**) because of increased intracranial pressure. Personality

changes are common and include depression, anxiety, and irritability.

Intracranial tumors can arise from any structure within the cranial cavity, including the pituitary and pineal glands, cranial nerves, and the arachnoid and pia mater (**leptomeninges**). In addition, all of these tissues may be the sites of metastatic spread from primary malignancies that occur outside of the nervous system. Metastatic tumors of the cranial cavity tend to exhibit growth characteristics similar to those of the primary malignancy but tend to grow more slowly than the

parent tumor. Metastatic tumors of the cranial cavity are usually easier to remove than primary intracranial tumors.

Computed tomography (CT) scans and magnetic resonance imaging (MRI) help establish a diagnosis but are not definitive. Surgical removal relieves pressure and confirms or rules out malignancy. Even after surgery, most intracranial tumors require radiation therapy as a second line of treatment. Chemotherapy combined with radiation therapy usually provides the best chance for survival and quality of life.

### Diagnostic, Symptomatic, and Related Terms

*This section introduces diagnostic, symptomatic, and related terms and their meanings. Word analyses for selected terms are also provided.*

Term	Definition
<b>agnosia</b> äg-NŌ-zē-ä <i>a-</i> : without, not <i>gnos</i> : knowing <i>-ia</i> : condition	Inability to comprehend auditory, visual, spatial, olfactory, or other sensations even though the sensory sphere is intact  <i>The type of agnosia is usually identified by the sense or senses affected, such as visual agnosia. Agnosia is common in parietal lobe tumors.</i>
<b>asthenia</b> äs-TĤĤĤ-nē-ä <i>a-</i> : without, not <i>sthen</i> : strength <i>-ia</i> : condition	Weakness, debility, or loss of strength  <i>Asthenia is a characteristic of multiple sclerosis (MS).</i>
<b>ataxia</b> ä-TÄK-sē-ä <i>a-</i> : without, not <i>tax</i> : order, coordination <i>-ia</i> : condition	Lack of muscle coordination in the execution of voluntary movement  <i>Ataxia may be the result of head injury, stroke, MS, alcoholism, or a variety of hereditary disorders.</i>
<b>aura</b> AW-rä	Premonitory awareness of an approaching physical or mental disorder; peculiar sensation that precedes seizures
<b>autism</b> AW-tīzm	Developmental disorder characterized by extreme withdrawal and an abnormal absorption in fantasy, usually accompanied by an inability to communicate even on a basic level  <i>A person with autism may engage in repetitive behavior, such as rocking or repeating words.</i>
<b>closed head trauma</b> TRAW-mä	Injury to the head in which the dura mater remains intact and brain tissue is not exposed  <i>In closed head trauma, the injury site may occur at the impact site, where the brain hits the inside of the skull (coup) or at the rebound site, where the opposite side of the brain strikes the skull (contrecoup).</i>

Diagnostic, Symptomatic, and Related Terms—cont'd	
Term	Definition
<b>coma</b> KŌ-mă	Abnormally deep unconsciousness with absence of voluntary response to stimuli
<b>concussion</b> kŏn-KŪSH-ŭn	Injury to the brain, occasionally with transient loss of consciousness as a result of injury or trauma to the head <i>Delayed symptoms of concussion may include headache, nausea, vomiting, and blurred vision.</i>
<b>convulsion</b> kŏn-VŪL-shŭn	Any sudden and violent contraction of one or more muscles
<b>dementia</b> dī-MĒN-shĕ-ă <i>de-</i> : cessation <i>ment</i> : mind <i>-ia</i> : condition	Broad term that refers to cognitive deficit, including memory impairment
<b>dyslexia</b> dīs-LĚK-sĕ-ă <i>dys-</i> : bad; painful; difficult <i>lex</i> : word, phrase <i>-ia</i> : condition	Inability to learn and process written language despite adequate intelligence, sensory ability, and exposure
<b>Guillain-Barré syndrome</b> gĕ-YĂ bār-RĂ SĪN-drŏm	Autoimmune condition that causes acute inflammation of the peripheral nerves in which myelin sheaths on the axons are destroyed, resulting in decreased nerve impulses, loss of reflex response, and sudden muscle weakness <i>This disease usually follows a viral gastrointestinal or respiratory infection, stress, or trauma. The muscle weakness involves the entire body and the patient may temporarily require respiratory support until the inflammation subsides.</i>
<b>herpes zoster</b> HĒR-pĕz ZŌS-tĕr	Painful, acute infectious disease of the posterior root ganglia of only a few segments of the spinal or cranial nerves; also called <i>shingles</i> <i>Herpes zoster is caused by the same organism (varicella-zoster) that causes chickenpox in children. The disease is self-limiting and usually resolves in 10 days to 5 weeks.</i>
<b>Huntington chorea</b> HŪNT-ĭng-tŭn kŏ-RĒ-ă	Inherited disease of the CNS characterized by quick, involuntary movements, speech disturbances, and mental deterioration. <i>Onset of Huntington chorea is commonly between ages 30 and 50.</i>
<b>hydrocephalus</b> hī-drŏ-SĔF-ă-lŭs	Accumulation of fluid in the ventricles of the brain, causing increased intracranial pressure (ICP), thinning of brain tissue, and separation of cranial bones
<b>lethargy</b> LĒTH-ăr-jĕ	Abnormal inactivity or lack of response to normal stimuli; also called sluggishness
<b>neurosis</b> nŭ-RŌ-sĭs <i>neur</i> : nerve <i>-osis</i> : abnormal condition; increase (used primarily with blood cells)	Nonpsychotic mental illness that triggers feelings of distress and anxiety and impairs normal behavior <i>A child who has been consistently been warned of “germs” by an over protective parent may later develop an irrational fear of using public restrooms, for example, or touching doorknobs or phones.</i>

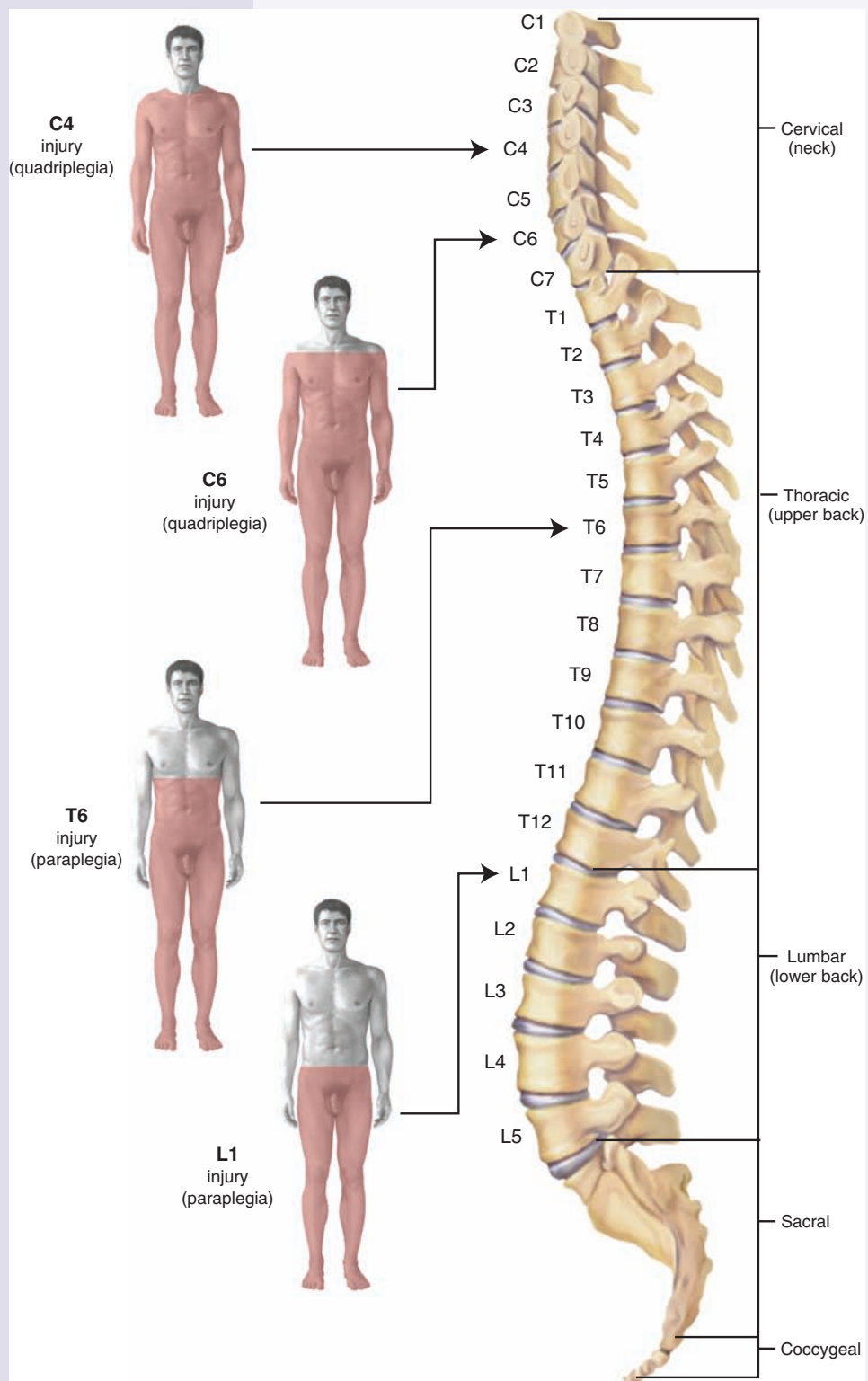
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### Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
<p>palsy PAWL-zē</p> <p>Bell</p> <p>cerebral sē-RĒ-brāl <i>cerebr:</i> cerebrum <i>-al:</i> pertaining to</p>	<p>Paralysis, usually partial, and commonly characterized by weakness and shaking or uncontrolled tremor</p> <p>Facial paralysis caused by a functional disorder of the seventh cranial nerve, associated with herpes virus <i>Bell palsy is self-limiting and usually spontaneously resolves in 3 to 5 weeks.</i></p> <p>Type of paralysis that affects movement and body position and, sometimes, speech and learning ability <i>Cerebral palsy (CP) commonly occurs as a result of trauma to the brain during the birthing process.</i></p>
<p>paralysis pā-RĀL-ī-sīs <i>para-:</i> near, beside; beyond <i>-lysis:</i> separation, destruction, loosening</p> <p>hemiplegia hēm-ē-PLĒ-jē-ā <i>hemi-:</i> one-half <i>-plegia:</i> paralysis</p> <p>paraplegia pār-ā-PLĒ-jē-ā <i>para-:</i> near, beside; beyond <i>-plegia:</i> paralysis</p> <p>quadriplegia kwōd-rī-PLĒ-jē-ā <i>quadri-:</i> four <i>-plegia:</i> paralysis</p>	<p>Loss of voluntary motion in one or more muscle groups with or without loss of sensation <i>Strokes and spinal cord injuries are the common causes of paralysis. Strokes usually affect only one side of the body. Spinal cord injuries result in paralysis below the site of the injury. (See Figure 14-6.)</i></p> <p>Paralysis of one side of the body, typically as the result of a stroke; also called <i>unilateral paralysis</i></p> <p>Paralysis of both lower limbs, typically as a result of trauma or disease of the lower spinal cord</p> <p>Paralysis of both arms and legs, typically as a result of trauma or disease of the upper spinal cord</p>
<p>psychosis sī-KŌ-sīs <i>psych:</i> mind <i>-osis:</i> abnormal condition; increase (used primarily with blood cells)</p>	<p>Major emotional disorder in which contact with reality is lost to the point that the individual is incapable of meeting challenges of daily life</p>
<p>spina bifida SPĪ-nā BĪ-fī-dā</p> <p>meningocele mēn-ĪN-gō-sēl <i>mening/o:</i> meninges (membranes covering brain and spinal cord) <i>-cele:</i> hernia, swelling</p>	<p>Defect in which the neural tube (tissue that forms the brain and spinal cord in the fetus) fails to close during embryogenesis <i>Spina bifida is a birth defect that includes meningocele, meningomyelocele, and occulta. (See Figure 14-7.)</i></p> <p>Form of spina bifida in which the spinal cord develops properly but the meninges protrude through the spine</p>

**Diagnostic, Symptomatic, and Related Terms—cont'd**

Term	Definition
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**Figure 14-6.** Spinal cord injuries showing extent of paralysis.

(continued)

### Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
<p>myelomeningocele  mī-ē-lō-mĕn-ĪN-gō-sĕl  <i>myel/o</i>: bone marrow; spinal cord  <i>mening/o</i>: meninges (membranes covering brain and spinal cord)  <i>-cele</i>: hernia, swelling</p>	<p>Most severe form of spina bifida in which the spinal cord and meninges protrude through the spine</p>
<p>occulta  ō-KŪL-tă</p>	<p>Form of spina bifida in which one or more vertebrae are malformed and the spinal cord is covered with a layer of skin</p>
<p><b>Figure 14-7.</b> Spina bifida.</p>	
<p>paresthesia  pār-ĕs-THĒ-zĕ-ă</p>	<p>Sensation of numbness, prickling, tingling, or heightened sensitivity  <i>Paresthesia can be caused by disorders affecting the central nervous system, such as stroke, transient ischemic attack, multiple sclerosis, transverse myelitis, and encephalitis.</i></p>
<p>poliomyelitis  pōl-ē-ō-mī-ĕl-Ī-tĭs  <i>poli/o</i>: gray; gray matter (of brain or spinal cord)  <i>myel</i>: bone marrow; spinal cord  <i>-itis</i>: inflammation</p>	<p>Inflammation of the gray matter of the spinal cord caused by a virus, commonly resulting in spinal and muscle deformity and paralysis  <i>Polio is preventable with standard vaccinations administered to children.</i></p>
<p>Reye syndrome  RĪ SĪN-drōm</p>	<p>Acute encephalopathy and fatty infiltration of the brain, liver and, possibly, the pancreas, heart, kidney, spleen, and lymph nodes  <i>Reye syndrome is usually seen in children younger than age 15 who had an acute viral infection. Mortality in Reye syndrome may be as high as 80%. The use of aspirin by children experiencing chickenpox or influenza may induce Reye syndrome.</i></p>
<p>sciatica  sī-ĀT-i-kă</p>	<p>Severe pain in the leg along the course of the sciatic nerve felt at the base of the spine, down the thigh, and radiating down the leg due to a compressed nerve</p>

## Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
<b>syncope</b> SĪN-kō-pē  vasovagal vās-ō-VĀ-gāl	Temporary loss of consciousness due to the sudden decline of blood flow to the brain; <i>also called fainting</i>  Syncope due to a drop in blood pressure brought on by the response of the nervous system to abrupt emotional stress, pain, or trauma
<b>tonic-clonic seizure</b>	General type of seizure characterized by the loss of consciousness and stiffening of the body (tonic phase) followed by rhythmic, jerking movements (clonic phase)
<b>transient ischemic attack (TIA)</b> TRĀN-zē-ĕnt ĩs-KĒ-mĭk	Temporary interference with blood supply to the brain lasting from a few minutes to a few hours  <i>Symptoms of TIA may include numbness or weakness in the extremities, especially on one side of the body; confusion or difficulty in talking or understanding speech; visual impairment; dizziness; loss of balance; and difficulty walking.</i>



It is time to review pathological, diagnostic, symptomatic, and related terms by completing Learning Activity 14–3.

## Diagnostic and Therapeutic Procedures

This section introduces procedures used to diagnose and treat nervous disorders. Descriptions are provided as well as pronunciations and word analyses for selected terms.

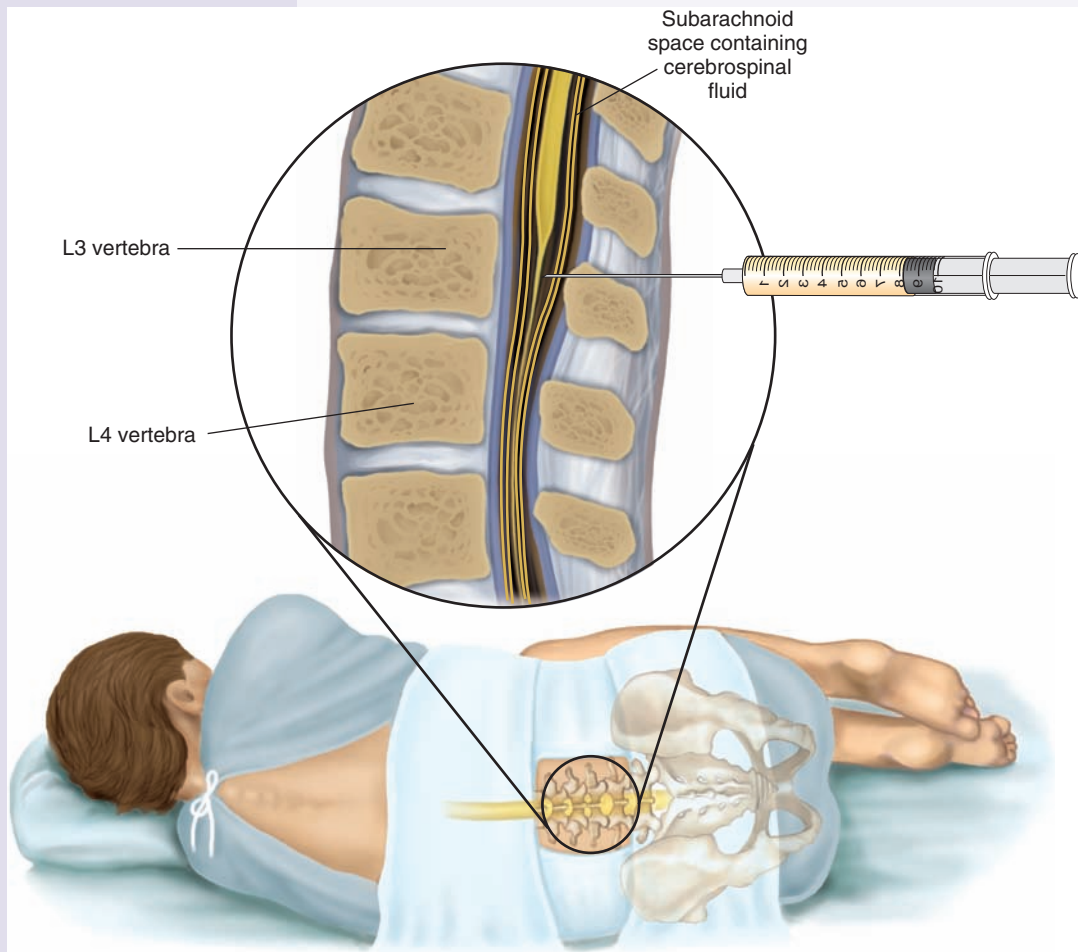
Procedure	Description
<b>Diagnostic Procedures</b>	
<b>Clinical</b>	
<b>electroencephalography (EEG)</b> ē-lĕk-trō-ĕn-sĕf-ă-LŌG-ră-fĕ <i>electr/o:</i> electricity <i>encephal/o:</i> brain <i>-graphy:</i> process of recording	Recording of electrical activity in the brain, whose cells emit distinct patterns of rhythmic electrical impulses  <i>Different wave patterns in the EEG are associated with normal and abnormal waking and sleeping states. They help diagnose such conditions as tumors, infections, and seizure disorders.</i>
<b>electromyography (EMG)</b> ē-lĕk-trō-mĭ-ŌG-ră-fĕ <i>electr/o:</i> electricity <i>my/o:</i> muscle <i>-graphy:</i> process of recording	Recording of electrical signals (action potentials) that occur in a muscle when it is at rest and during contraction to assess nerve damage  <i>In the EMG, an electrode inserted into a muscle records impulses and displays them on a monitor called an oscilloscope.</i>
<b>lumbar puncture</b> LŪM-bār PŪNK-chūr	Needle puncture of the spinal cavity to extract spinal fluid for diagnostic purposes, introduce anesthetic agents into the spinal canal, or remove fluid to allow other fluids (such as radiopaque substances) to be injected; also called <i>spinal puncture</i> and <i>spinal tap</i> (See Figure 14–8.)

(continued)

## Diagnostic and Therapeutic Procedures—cont'd

### Procedure

### Description



**Figure 14-8.** Lumbar puncture.

### nerve conduction velocity (NCV)

NĚRV kŏn-DŮK-shŭn  
vĕ-LŮ-sĭ-tĕ

Test that measures the speed at which impulses travel through a nerve  
*In NCV, one electrode stimulates a nerve while other electrodes, placed over different areas of the nerve record an electrical signal (action potential) as it travels through the nerve. This test is used for diagnosing muscular dystrophy and neurological disorders that destroy myelin.*

### Laboratory

### cerebrospinal fluid (CSF) analysis

sĕr-ĕ-brŏ-SPĪ-nāl, ā-NĀL-ĭ-sĭs  
*cerebr/o:* cerebrum  
*spin:* spine  
*-al:* pertaining to

Series of chemical, microscopic, and microbial tests used to diagnose disorders of the central nervous system, including viral and bacterial infections, tumors, and hemorrhage



## Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
<b>Radiographic</b>	
<b>angiography</b> ăn-jē-ŎG-ră-fē <i>angi/o</i> : vessel (usually blood or lymph) <i>-graphy</i> : process of recording	Radiography of the blood vessels after introduction of a contrast medium <i>Angiography is used to visualize vascular abnormalities. The contrast medium may be injected into an artery or vein or administered through a catheter inserted in a peripheral artery, run through the vessel, and positioned at a visceral site.</i>
cerebral sér-Ē-brăł <i>cerebr/o</i> : cerebrum <i>-al</i> : pertaining to	Angiography of blood vessels of the brain after injection of a contrast medium; also called <i>cerebral arteriography</i> <i>Vascular tumors, aneurysms, and occlusions are identified using cerebral angiography, which is usually performed when intracranial procedures are being considered.</i>
<b>computed tomography (CT)</b> kôm-PŪ-těd tō-MŎG-ră-fē <i>tom/o</i> : to cut <i>-graphy</i> : process of recording	Imaging technique achieved by rotating an x-ray emitter around the area to be scanned and measuring the intensity of transmitted rays from different angles <i>CT of the brain can be performed with or without contrast media. It is effective in visualizing tumors, abscesses, hemorrhage, trauma and fractures.</i>
<b>myelography</b> mī-ĕ-LŎG-ră-fē <i>myel/o</i> : bone marrow; spinal cord <i>-graphy</i> : process of recording	Diagnostic radiological examination of the spinal canal, nerve roots, and spinal cord after injection of contrast medium into the spinal canal <i>Myelography is usually performed in conjunction with CT and when an MRI is not possible because the patient has a pacemaker or other implantable device.</i>
<b>positron emission tomography (PET)</b> PŎZ-ĭ-trŏn ĕ-MĬSH-ŭn tō-MŎG-ră-fē	Scan using computed tomography to record the positrons (positively charged particles) emitted from a radiopharmaceutical and produce a cross-sectional image of metabolic activity in body tissues to determine the presence of disease <i>PET is especially useful in scanning the brain and nervous system to diagnose disorders that involve abnormal tissue metabolism, such as schizophrenia, brain tumors, epilepsy, stroke, and Alzheimer disease.</i>
<b>ultrasonography (US)</b> ũl-tră-sŏn-ŎG-ră-fē <i>ultra-</i> : excess, beyond <i>son/o</i> : sound <i>-graphy</i> : process of recording	Imaging procedure using high-frequency sound waves (ultrasound) that display the reflected “echoes” on a monitor; also called <i>ultrasound, sonography, echo, and echogram</i>
echoencephalography ĕk-ŏ-ĕn-sĕf-ă-LŎG-ră-fē <i>echo-</i> : repeated sound <i>encephal/o</i> : brain <i>-graphy</i> : process of recording	Ultrasound technique used to study intracranial structures of the brain and, especially, diagnose conditions that cause a shift in the midline structures of the brain
<b>Therapeutic Procedures</b>	
<b>Surgical</b>	
<b>cryosurgery</b> krĭ-ŏ-SĒR-jĕr-ĕ	Technique that exposes abnormal tissue to extreme cold to destroy it <i>Cryosurgery is sometimes used to destroy malignant tumors of the brain.</i>

(continued)

## Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
<b>stereotaxic radiosurgery</b> stĕr-ĕ-ō-TĀK-sĭk rā-dĕ-ō-SŪR-jĕr-ĕ	Precise method of locating and destroying sharply circumscribed lesions on specific, tiny areas of pathological tissue in deep-seated structures of the central nervous system; also called <i>stereotaxy</i> or <i>stereotactic surgery</i> . <i>Stereotaxic radiosurgery is used in the treatment of seizure disorders, aneurysms, brain tumors, and many other neuropathological conditions and is performed without a surgical incision. The pathological site is localized with three-dimensional coordinates, and high doses of radiation are used to destroy it.</i>
<b>thalamotomy</b> thāl-ă-MŌT-ō-mĕ <i>thalam/o</i> : thalamus <i>-tomy</i> : incision	Partial destruction of the thalamus to treat intractable pain, involuntary movements, or emotional disturbances. <i>Thalamotomy produces few neurological deficits or changes in personality.</i>
<b>tractotomy</b> trāk-TŌT-ō-mĕ	Transection of a nerve tract in the brainstem or spinal cord. <i>Tractotomy is sometimes used to relieve intractable pain.</i>
<b>trephination</b> trĕf-ĭn-Ā-shŭn	Technique that cuts a circular opening into the skull to reveal brain tissue and decrease intracranial pressure.
<b>vagotomy</b> vā-GŌT-ō-mĕ	Interruption of the function of the vagus nerve to relieve peptic ulcer. <i>Vagotomy is performed when ulcers in the stomach and duodenum do not respond to medication or changes in diet.</i>

## Pharmacology

Neurological agents are used to relieve or eliminate pain, suppress seizures, control tremors, and reduce muscle rigidity. (See Table 14-4.) Hypnotics, a class of drugs used as sedatives, depress CNS function to relieve agitation and

induce sleep. Anesthetics are capable of producing a complete or partial loss of feeling and are used for surgery. Psychotherapeutic agents alter brain chemistry to treat mental illness. These drugs are used as mood stabilizers in various mental disorders. They also reduce symptoms of depression and treat ADHD and narcolepsy.

Table 14-4 **Drugs Used to Treat Neurological and Psychiatric Disorders**

*This table lists common drug classifications used to treat neurological and psychiatric disorders, their therapeutic actions, and selected generic and trade names.*

Classification	Therapeutic Action	Generic and Trade Names
<b>Neurological anesthetics</b>	Produce partial or complete loss of sensation, with or without loss of consciousness. <i>Anesthetics may be classified as general or local.</i>	
general	Act upon the brain to produce complete loss of feeling with loss of consciousness. <i>General anesthetics are delivered by the blood stream to all areas of the body, including the brain. Since they suppress all reflexes including coughing, and swallowing, breathing tubes are usually required.</i>	<b>propofol</b> PRŌ-pō-fōl Diprivan

Table 14-4 Drugs Used to Treat Neurological and Psychiatric Disorders—cont'd

Classification	Therapeutic Action	Generic and Trade Names
local	Act upon nerves or nerve tracts to affect a local area only. <i>Local anesthetics are injected directly into the area involved in the local surgery. Patients may remain fully alert unless additional medications to induce sleep are given.</i>	<b>procaine</b> PRŌ-kān Novocain <b>lidocaine</b> LĪ-dō-kān Xylocaine
anticonvulsants	Prevent uncontrolled neuron activity associated with seizures by altering electrical transmission along neurons or altering the chemical composition of neurotransmitters; also called <i>antiepileptics</i> . <i>Many anticonvulsants are also used as mood stabilizers.</i>	<b>carbamazepine</b> kā-r-bā-MĀZ-ě-pēn Tegretol <b>valproate</b> vāl-PRŌ-āt Depacon
antiparkinsonian agents	Control tremors and muscle rigidity associated with Parkinson disease by increasing dopamine in the brain	<b>levodopa</b> lē-vō-DŌ-pā L-dopa, Larodopa <b>levodopa/carbidopa</b> kā-r-bĭ-DŌ-pā Sinemet, Sinemet CR
<b>Psychiatric</b>		
antipsychotics	Treat psychosis, paranoia, and schizophrenia by altering chemicals in the brain, including the limbic system (group of brain structures), which controls emotions	<b>clozapine</b> CLŌ-zā-pēn Clozaril <b>risperidone</b> rĭs-PĒR-ĭ-dōn Risperdal
antidepressants	Treat multiple symptoms of depression by increasing levels of specific neurotransmitters <i>Antidepressants fall under different classifications and some are also used to treat anxiety and pain.</i>	<b>paroxetine</b> pā-RŌK-sě-tēn Paxil <b>fluoxetine</b> floo-ŌK-sě-tēn Prozac
hypnotics	Depress central nervous system (CNS) functions, promote sedation and sleep, and relieve agitation, anxiousness, and restlessness <i>Hypnotics may be nonbarbiturates or barbiturates. Barbiturate hypnotics carry a risk of addiction.</i>	<b>secobarbital</b> sē-kō-BĀR-bĭ-tōl Seconal <b>temazepam</b> tě-MĀZ-ě-pām Restoril
psychostimulants	Reduce impulsive behavior by increasing the level of neurotransmitters <i>Psychostimulants have a calming effect on people with attention deficit hyperactivity disorder (ADHD) and are also used to treat narcolepsy.</i>	<b>dextroamphetamine</b> děks-trō-ām-FĒT-ā-mēn Dexedrine <b>methylphenidate</b> mēth-ĭl-FĒN-ĭ-dāt Ritalin

## Abbreviations

*This section introduces nervous system–related abbreviations and their meanings.*

Abbreviation	Meaning	Abbreviation	Meaning
ADAD	Alzheimer disease	ICP	intracranial pressure
ADHD	attention-deficit hyperactivity disorder	LOC	loss of consciousness
ALS	amyotrophic lateral sclerosis; also called <i>Lou Gehrig disease</i>	LP	lumbar puncture
ANS	autonomic nervous system	MRA	magnetic resonance angiogram; magnetic resonance angiography
BEAM	brain electrical activity mapping	MRI	magnetic resonance imaging
CNS	central nervous system	MS	musculoskeletal; multiple sclerosis; mental status; mitral stenosis
CP	cerebral palsy	NCV	nerve conduction velocity
CSF	cerebrospinal fluid	PET	positron emission tomography
CT	computed tomography	PNS	peripheral nervous system
CVA	cerebrovascular accident	SNS	sympathetic nervous system; somatic nervous system
EEG	electroencephalography	TIA	transient ischemic attack
EMG	electromyography		



*It is time to review procedures, pharmacology, and abbreviations by completing Learning Activity 14–4.*

# LEARNING ACTIVITIES

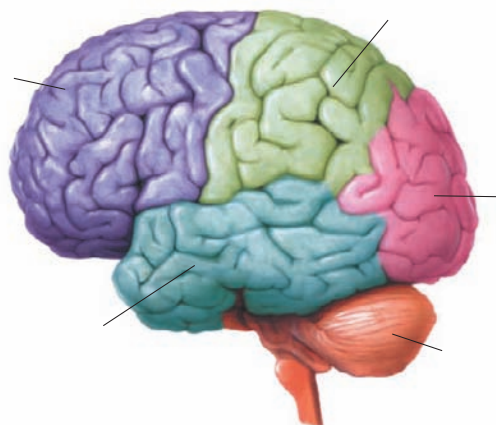
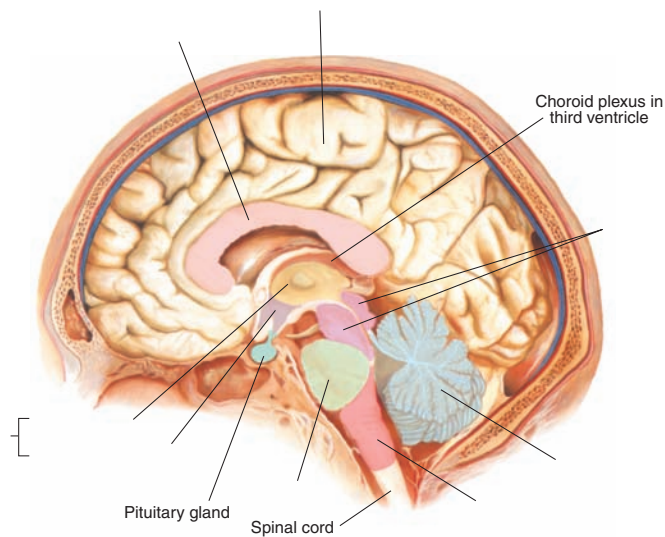
The activities that follow provide a review of the nervous system terms introduced in this chapter. Complete each activity and review your answers to evaluate your understanding of the chapter.

## Learning Activity 14-1

### Identifying Structures of the Brain

Label the following illustration using the terms listed below.

cerebellum	diencephalon (interbrain)	hypothalamus	occipital lobe	temporal lobe
cerebrum	frontal lobe	medulla	parietal lobe	thalamus
corpus callosum		midbrain (mesencephalon)	pons	



Check your answers by referring to Figure 14-3 on page 430. Review material that you did not answer correctly.



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## Learning Activity 14-2

**Building Medical Words**

---

Use *encephal/o* (brain) to build words that mean:

1. disease of the brain \_\_\_\_\_
2. herniation of the brain \_\_\_\_\_
3. radiography of the brain \_\_\_\_\_

Use *cerebr/o* (cerebrum) to build words that mean:

4. disease of the cerebrum \_\_\_\_\_
5. inflammation of the cerebrum \_\_\_\_\_

Use *crani/o* (cranium [skull]) to build words that mean:

6. herniation (through the) cranium \_\_\_\_\_
7. instrument for measuring the skull \_\_\_\_\_

Use *neur/o* (nerve) to build words that mean:

8. pain in a nerve \_\_\_\_\_
9. specialist in the study of the nervous system \_\_\_\_\_
10. crushing a nerve \_\_\_\_\_

Use *myel/o* (bone marrow; spinal cord) to build words that mean:

11. herniation of the spinal cord \_\_\_\_\_
12. paralysis of the spinal cord \_\_\_\_\_

Use *psych/o* (mind) to build words that mean:

13. pertaining to the mind \_\_\_\_\_
14. abnormal condition of the mind \_\_\_\_\_

Use the suffix *-kinesia* (movement) to build words that mean:

15. movement that is slow \_\_\_\_\_
16. painful or difficult movement \_\_\_\_\_

Use the suffix *-plegia* (paralysis) to build words that mean:

17. paralysis of one half (of the body) \_\_\_\_\_
18. paralysis of four (limbs) \_\_\_\_\_

Use the suffix *-phasia* (speech) to build words that mean:

19. difficult speech \_\_\_\_\_
20. lacking or without speech \_\_\_\_\_

Build surgical terms that mean:

21. destruction of a nerve \_\_\_\_\_

22. incision of the skull \_\_\_\_\_

23. surgical repair of the skull \_\_\_\_\_

24. suture of a nerve \_\_\_\_\_

25. incision of the brain \_\_\_\_\_



*Check your answers in Appendix A. Review material that you did not answer correctly.*

**Correct Answers** \_\_\_\_\_  $\times 4 =$  \_\_\_\_\_ % Score

## Learning Activity 14-3

## Matching Pathological, Diagnostic, Symptomatic, and Related Terms

Match the following terms with the definitions in the numbered list.

<i>Alzheimer disease</i>	<i>bulimia nervosa</i>	<i>Guillain-Barré syndrome</i>	<i>multiple sclerosis</i>	<i>phobias</i>
<i>aphasia</i>	<i>clonic phase</i>	<i>hemiparesis</i>	<i>myelomeningocele</i>	<i>poliomyelitis</i>
<i>autism</i>	<i>concussion</i>	<i>ischemic stroke</i>	<i>paraplegia</i>	<i>radiculopathy</i>
<i>bipolar disorder</i>	<i>epilepsies</i>	<i>lethargy</i>	<i>Parkinson disease</i>	<i>shingles</i>

1. \_\_\_\_\_ weakness in one half of the body
2. \_\_\_\_\_ inability to speak
3. \_\_\_\_\_ pathological condition associated with formation of small plaques in the cerebral cortex
4. \_\_\_\_\_ eating disorder characterized by bingeing and purging
5. \_\_\_\_\_ part of the grand mal seizure characterized by uncontrolled jerking of the body
6. \_\_\_\_\_ autoimmune condition that causes acute inflammation of peripheral nerves
7. \_\_\_\_\_ type of neurosis characterized by irrational fears
8. \_\_\_\_\_ mental disorder that causes unusual shifts in mood, emotion, and energy
9. \_\_\_\_\_ chronic or recurring seizure disorders
10. \_\_\_\_\_ commonly caused by narrowing of the carotid arteries
11. \_\_\_\_\_ disease caused by the same organism that causes chickenpox in children
12. \_\_\_\_\_ disease of the nerve root associated with the spinal cord
13. \_\_\_\_\_ paralysis of the lower portion of the trunk and both legs
14. \_\_\_\_\_ disease that causes inflammation of the gray matter of the spinal cord
15. \_\_\_\_\_ abnormal inactivity or lack of response to normal stimuli
16. \_\_\_\_\_ most severe form of spina bifida where the spinal cord and meninges protrude through the spine
17. \_\_\_\_\_ mental disorder characterized by extreme withdrawal and abnormal absorption in fantasy
18. \_\_\_\_\_ disease characterized by head nodding, bradykinesia, tremors, and shuffling gait
19. \_\_\_\_\_ disease characterized by demyelination in the spinal cord and brain
20. \_\_\_\_\_ loss of consciousness caused by trauma to the head



*Check your answers in Appendix A. Review any material that you did not answer correctly.*

**Correct Answers** \_\_\_\_\_ × 5 = \_\_\_\_\_ % Score



## Learning Activity 14-4

## Matching Procedures, Pharmacology, and Abbreviations

Match the following terms with the definitions in the numbered list.

<i>antipsychotics</i>	<i>CSF analysis</i>	<i>general anesthetics</i>	<i>myelography</i>	<i>psychostimulants</i>
<i>cerebral angiography</i>	<i>echoencephalography</i>	<i>hypnotics</i>	<i>NCV</i>	<i>tractotomy</i>
<i>cryosurgery</i>	<i>electromyography</i>	<i>lumbar puncture</i>	<i>PET</i>	<i>trephination</i>

- \_\_\_\_\_ tests the speed at which impulses travel through a nerve
- \_\_\_\_\_ reduce impulsive behavior by increasing the level of neurotransmitters; treat ADHD and narcolepsy
- \_\_\_\_\_ treat psychosis, paranoia, and schizophrenia by altering chemicals in the brain, including the limbic system, which controls emotions
- \_\_\_\_\_ act upon the brain to produce complete loss of feeling with loss of consciousness
- \_\_\_\_\_ ultrasound technique used to study the intracranial structures of the brain
- \_\_\_\_\_ technique that employs extreme cold to destroy tissue
- \_\_\_\_\_ radiological examination of the spinal canal, nerve roots, and spinal cord
- \_\_\_\_\_ visualization of the cerebrovascular system after injection of radiopaque dye
- \_\_\_\_\_ laboratory test used to diagnose viral and bacterial infections, tumors, and hemorrhage
- \_\_\_\_\_ recording of electrical signals when a muscle is at rest and during contraction to assess nerve damage
- \_\_\_\_\_ procedure to extract spinal fluid for diagnostic purposes, introduce anesthetic agents, or remove fluid to allow other fluids to be injected
- \_\_\_\_\_ scan using computed tomography to record the positrons emitted from a radiopharmaceutical
- \_\_\_\_\_ transection of a nerve tract in the brainstem or spinal cord
- \_\_\_\_\_ agents that depress central nervous system (CNS) functions, promote sedation and sleep, and relieve agitation, anxiousness, and restlessness
- \_\_\_\_\_ cutting a circular opening into the skull to reveal brain tissue and decrease intracranial pressure



*Check your answers in Appendix A. Review any material that you did not answer correctly.*

**Correct Answers** \_\_\_\_\_  $\times 6.67 =$  \_\_\_\_\_ **% Score**

## MEDICAL RECORD ACTIVITIES

The two medical records included in the following activities use common clinical scenarios to show how medical terminology is used to document patient care. Complete the terminology and analysis sections for each activity to help you recognize and understand terms related to the nervous system.

### Medical Record Activity 14-1

### Discharge Summary: Subarachnoid Hemorrhage

#### Terminology

Terms listed below come from *Discharge Summary: Subarachnoid Hemorrhage* that follows. Use a medical dictionary such as *Taber's Cyclopedic Medical Dictionary*, the appendices of this book, or other resources to define each term. Then review the pronunciations for each term and practice by reading the medical record aloud.

Term	Definition
aneurysm ĀN-ū-rīzm	
cerebral MRI	
cisterna subarachnoidalis sīs-TĒR-nā sūb-ā-rāk- NOYD-ā-līs	
CSF	
CT	
hydrocephalus hī-drō-SĔF-ā-lūs	
lumbar puncture LŪM-bār PŪNK-chūr	
meningismus mēn-in-JĪS-mūs	
occipital ōk-SĪP-ī-tāl	
R/O	
subarachnoid sūb-ā-RĀK-noyd	



Listen and Learn Online! *will help you master the pronunciation of selected medical words from this medical record activity. Visit [www.davisplus.com/gyls/systems](http://www.davisplus.com/gyls/systems) to find instructions on completing the Listen and Learn Online! exercise for this section and to practice pronunciations.*

## DISCHARGE SUMMARY: SUBARACHNOID HEMORRHAGE

### General Hospital

1511 Ninth Avenue ■■ Sun City, USA 12345 ■■ (555) 8022-1887

### DISCHARGE SUMMARY

ADMISSION DATE: July 5, 20xx      DISCHARGE DATE: July 16, 20xx

ADMITTING DIAGNOSIS: Severe headaches associated with nausea and vomiting.

DISCHARGE DIAGNOSIS: Subarachnoid hemorrhage.

HISTORY OF PRESENT ILLNESS: Patient is a 61-year-old woman who presents at this time complaining of an “extreme severe headache while swimming.” She also complains of associated neck pain, occipital pain, nausea, and vomiting.

A CT scan was obtained that showed blood in the cisterna subarachnoidalis consistent with subarachnoid hemorrhage. The patient also had mild acute hydrocephalus. Neurologically, the patient was found to be within normal limits. A cerebral MRI was performed and no aneurysm was noted.

HOSPITAL COURSE: The patient was hospitalized on 7/5/xx. On 7/7/xx, she had sudden worsening of her headache, associated with nausea and vomiting. Also, she was noted to have meningismus on examination. A lumbar puncture was performed to R/O possible rebleed. At the time of the lumbar puncture, CSF in four tubes was read as consistent with recurrent subarachnoid hemorrhage. A repeat MRI was performed without evidence of an aneurysm.

PROCEDURE: On 7/9/xx, the patient underwent repeat MRI, which again showed no aneurysm. The patient was deemed stable for discharge on 7/10/xx.

ACTIVITY: Patient instructed to avoid any type of activity that could result in raised pressure in the head. The patient was advised that she should undergo no activity more vigorous than walking.

*Michael R. Saadi, MD*  
Michael R. Saadi, MD

MRS:dp

D: 7-16-20xx

T: 7-16-20xx

Patient: Gomez, Anna  
Room #: 609 P

Physician: Michael R. Saadi, MD  
Patient ID#: 920276

## Analysis

Review the medical record *Discharge Summary: Subarachnoid Hemorrhage* to answer the following questions.

1. In what part of the head did the patient feel pain?

---

2. What imaging tests were performed, and what was the finding in each test?

---

3. What was the result of the lumbar puncture?

---

4. What was the result of the repeat MRI?

---

5. Regarding activity, what limitations were placed upon the patient?

---

### Medical Record Activity 14-2

## Consultation Report: Acute Onset Paraplegia

### Terminology

Terms listed below come from *Consultation Report: Acute Onset Paraplegia* that follows. Use a medical dictionary such as *Taber's Cyclopedic Medical Dictionary*, the appendices of this book, or other resources to define each term. Then review the pronunciations for each term and practice by reading the medical record aloud.

Term	Definition
abscess ĀB-sēs	
acute ä-KŪT	
clonidine KLŌ-nī-dēn	
epidural ēp-ī-DOO-rāl	
fluoroscopy floo-or-ŌS-kō-pē	
infarct ĪN-fārkt	

Term	Definition
L2-3	
lumbar LŪM-bār	
methadone MĒTH-ă-dŏn	
myelitis mī-ĕ-LĪ-tīs	
paraplegia pār-ă-PLĒ-jē-ă	
paresthesia pār-ĕs-TĒ-zē-ă	
subarachnoid sŭb-ă-RĀK-noyd	
T10-11	
transverse trāns-VĒRS	



Listen and Learn Online! *will help you master the pronunciation of selected medical words from this medical record activity. Visit [www.davisplus.com/gyls/systems](http://www.davisplus.com/gyls/systems) to find instructions on completing the Listen and Learn Online! exercise for this section and to practice pronunciations.*

## CONSULTATION REPORT: ACUTE ONSET PARAPLEGIA

### Physician Center

2422 Rodeo Drive ■■ Sun City, USA 12345 ■■ (555)788-2427

### CONSULTATION

August 15, 20xx  
Jacobs, Elaine

**CHIEF COMPLAINT:** Low back pain and lower extremity weakness.

**HISTORY OF PRESENT ILLNESS:** This is a 41-year-old right-handed white female with a history of low back pain for the past 15 to 20 years after falling at work. She has had four subsequent lumbar surgeries, with the most recent in 7/20/xx. She was admitted to the hospital for pain management. The patient had a subarachnoid catheter placement for pain control and management on 7/28/xx, at the L10–11 level. This was followed by trials of clonidine for hypertension and methadone for pain control, with bladder retention noted after clonidine administration. Upon catheter removal, the patient noted the subacute onset of paresis, paresthesias, and pain in the legs approximately 2 ½ to 3 hours later. We were consulted neurologically for assessment of the lower extremity weakness.

**IMPRESSION:** Patient has symptoms of acute-onset paraplegia. Differential diagnoses include a subarachnoid hemorrhage, epidural abscess, and transverse myelitis.

**PLAN:** Patient will be placed on IV steroids with compression stockings for lymphedema should physical therapy be cleared by cardiology for manipulation of that region. Documentation of spinal fluid will be obtained under fluoroscopy. Her glucose and blood pressures must be carefully monitored.

*Jake S. Domer, MD*  
Jake S. Domer, MD

JSD:st

## Analysis

Review the medical record *Consultation report: acute onset paraplegia* to answer the following questions.

1. What was the original cause of the patient's current problems and what treatments were provided?

---

2. Why was the patient admitted to the hospital?

---

3. What medications did the patient receive and why was each given?

---

4. What was the cause of bladder retention?

---

5. What occurred after the catheter was removed?

---

6. What three disorders were listed in the differential diagnosis?

---

7. How will lymphedema be controlled should physical therapy be undertaken?

---

