Vocabulary Related to the Nervous System

Terms marked with the ❖ symbol are pronounced on the Student Activity CD-ROM that accompanies this text.

KEY WORD PARTS

- ☐ **ambul/o**
- ☐ **cephal/o**
- ☐ **concuss/o**
- ☐ **contus/o**
- ☐ **ech/o**
- ☐ **encephal/o**
- ☐ **-esthesia**
- ☐ **klept/o**
- ☐ **mening/o**
- ☐ **myel/o**
- ☐ **narc/o**
- ☐ **neur/i, neur/o**
- ☐ **-phobia**
- ☐ **psych/o**
- ☐ **somn/o**

KEY MEDICAL TERMS

- ☐ **acrophobia** (**ack**-roh-**FOH**-bee-ah) ❖
- ☐ **Alzheimer's disease** (**ALTZ**-high-merz) ❖
- ☐ **amnesia** (am-**NEE**-zee-ah) ❖
- ☐ **amobarbital** (**am**-oh-**BAR**-bih-tal) ❖
- ☐ **amyotrophic lateral sclerosis** (ah-**my**-oh-**TROH**-fick) ❖
- ☐ **analgesic** (**an**-al-**JEE**-zick) ❖
- ☐ **anesthesia** (**an**-es-**THEE**-zee-ah) ❖
- ☐ **anesthesiologist** (**an**-es-**thee**-zee-**OL**-oh-jist) ❖
- ☐ **anesthetic** (**an**-es-**THET**-ick) ❖
- ☐ **anesthetist** (ah-**NES**-theh-tist) ❖
- ☐ **anxiety state**
- ☐ **aphasia** (ah-**FAY**-zee-ah)
- ☐ **autistic** (aw-**TISS**-tick)
- ☐ **barbiturate** (bar-**BIT**-you-rayt)
- ☐ **Bell's palsy**
- ☐ **catatonic** (**kat**-ah-**TON**-ick)
- ☐ **cerebral** (**SER**-eh-bral *or* seh-**REE**-bral) ❖
- ☐ **cerebral palsy** (**SER**-eh-bral *or* seh-**REE**-bral **PAWL**-zee) ❖
- ☐ **cerebrovascular accident** (**ser**-eh-broh-**VAS**-kyou-lar) ❖
- ☐ **claustrophobia** (**klaws**-troh-**FOH**-bee-ah) ❖
- ☐ **cognition** (kog-**NISH**-un)
- ☐ **comatose** (**KOH**-mah-tohs)
- ☐ **concussion** (kon-**KUSH**-un) ❖
- ☐ **contusion** (kon-**TOO**-zhun) ❖
- ☐ **cranial hematoma** (**hee**-mah-**TOH**-mah) ❖
- ☐ **craniocele (KRAY-nee-oh-seel)** ❖
- ☐ **delirium** (dee-**LIR**-ee-um) ❖
- ☐ **delirium tremens** (dee-**LIR**-ee-um **TREE**-mens)
- ☐ **delusion** (dee-**LOO**-zhun) ❖
- ☐ **dementia** (dee-**MEN**-shee-ah) ❖
- ☐ **dyslexia** (dis-**LECK**-see-ah) ❖
- ☐ **echoencephalography** (**eck**-oh-en-**sef**-ah-**LOG**-rah-fee) ❖
- ☐ **electroconvulsive therapy** (ee-**leck**-troh-kon-**VUL**-siv) ❖
- ☐ **electroencephalography** (ee-**leck**-troh-en-**sef**-ah-**LOG**-rah-fee) ❖
- ☐ **empathy** (**EM**-pah-thee) ❖
- ☐ **encephalitis** (**en**-sef-ah-**LYE**-tis) ❖
- ☐ **encephalography** (en-**sef**-ah-**LOG**-rah-fee) ❖
- ☐ **epidural anesthesia** (**ep**-ih-**DOO**-ral **an**-es-**THEE**-zee-ah) ❖
- ☐ **grand mal epilepsy** (**GRAN MAHL EP**-ih-**lep**-see) ❖
- ☐ **Guillain-Barré syndrome** (gee-**YAHN**-bah-**RAY**) ❖
- ☐ **hallucination** (hah-**loo**-sih-**NAY**-shun) ❖
- ☐ **hemorrhagic** (**hem**-oh-**RAJ**-ick) ❖
- ☐ **hydrocephalus** (high-droh-**SEF**-ah-lus) ❖
- ☐ **hyperesthesia** (**high**-per-es-**THEE**-zee-ah)
- ☐ **hypochondriasis** (**high**-poh-kon-**DRY**-ah-sis) ❖
- ☐ **kleptomania** (**klep**-toh-**MAY**-nee-ah) ❖
- ☐ **malingering** (mah-**LING**-ger-ing)
- ☐ **meningitis** (**men**-in-**JIGH**-tis) ❖
- ☐ **meningocele** (meh-**NING**-goh-**seel**) ❖
- ☐ **migraine headache** (**MY**-grayn) ❖
- ☐ **multiple sclerosis** (skleh-**ROH**-sis) ❖
- ☐ **Munchausen syndrome** (**MUHN**-chow-zen) ❖
- ☐ **myelitis** (**my**-eh-**LYE**-tis) ❖
- ☐ **myelography** (**my**-eh-**LOG**-rah-fee) ❖
- ☐ **myelosis** (**my**-eh-**LOH**-sis) ❖
- ☐ **narcissistic** (**nahr**-sih-**SIS**-tick) ❖
- ☐ **narcolepsy** (**NAR**-koh-**lep**-see) ❖
- ☐ **neurologist** (new-**ROL**-oh-jist) ❖
- ☐ **paresthesia** (**par**-es-**THEE**-zee-ah) ❖
- ☐ **Parkinson's disease**
- ☐ **peripheral neuropathy** (new-**ROP**-ah-thee) ❖
- ☐ **petit mal epilepsy** (peh-**TEE MAHL EP**-ih-**lep**-see) ❖
- ☐ **poliomyelitis** (**poh**-lee-oh-**my**-eh-**LYE**-tis) ❖
- ☐ **posttraumatic stress disorder**
- ☐ **psychiatrist** (sigh-**KYE**-ah-trist) ❖
- ☐ **psychologist** (sigh-**KOL**-oh-jist) ❖
- ☐ **pyromania** (**pye**-roh-**MAY**-nee-ah) ❖
- ☐ **schizophrenia** (**skit**-soh-**FREE**-nee-ah) ❖
- ☐ **sciatica** (sigh-**AT**-ih-kah) ❖
- ☐ **seizure** (**SEE**-zhur)
- ☐ **syncope** (**SIN**-koh-pee) ❖
- ☐ **tetanus** (**TET**-ah-nus)
- ☐ **thalamotomy** (**thal**-ah-**MOT**-oh-mee) ❖
- ☐ **tic douloureux** (**TICK** doo-loo-**ROO**) ❖
- ☐ **transient ischemic attack** (iss-**KEE**-mick) ❖

Objectives

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

1. Describe the functions and structures of the nervous system.
2. Identify the major divisions of the nervous system and describe the structures of each by location and function.
3. Identify the medical specialists who treat disorders of the nervous system.
4. Recognize, define, spell, and pronounce terms related to the pathology and diagnostic and treatment procedures of the nervous system.
5. Recognize, define, spell, and pronounce terms related to the pathology and diagnostic and treatment procedures of mental health disorders.

FUNCTIONS OF THE NERVOUS SYSTEM

The nervous system, with the brain as its center, coordinates and controls all bodily activities. When the brain ceases functioning, the body dies.

STRUCTURES OF THE NERVOUS SYSTEM

The major structures of the nervous system are the brain, spinal cord, nerves, and sensory organs. For descriptive purposes, the nervous system is divided into three parts: the central, peripheral, and autonomic nervous systems (Figure 10.1).

- The **central nervous system (CNS)** includes the brain and spinal cord.
- The **peripheral nervous system (PNS)** includes the 12 pairs of cranial nerves extending from the brain and the 31 pairs of spinal nerves extending from the spinal cord.
- The **autonomic nervous system (ANS)** includes the peripheral nerves and ganglia on either side of the spinal cord. (*Note:* Some textbooks include the ANS as a division of the peripheral nervous system. Both ways are correct.)

THE NERVES

A **nerve** is one or more bundles of neuron cells (impulse carrying fibers) that connect the brain and the spinal cord with other parts of the body.

- A **tract** is a bundle or group of nerve fibers located within the brain or spinal cord. **Ascending tracts** carry nerve impulses *toward* the brain. **Descending tracts** carry nerve impulses *away from* the brain.
- A **ganglion** (**GANG**-glee-on) is a knotlike mass or group of nerve cell bodies located outside the central nervous system (plural, **ganglia** or **ganglions**).

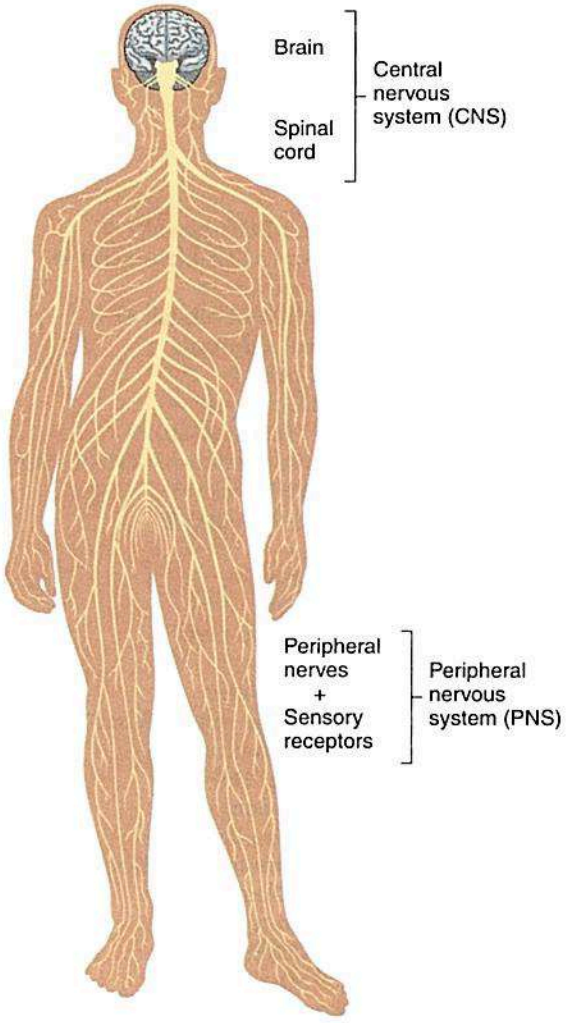

FIGURE 10.1 Structural organization of the central and peripheral nervous systems.

- A **plexus** (**PLECK**-sus) is a network of intersecting nerves and blood or lymphatic vessels (see Figure 10.10).

- **Innervation** (**in**-err-**VAY**-shun) is the supply of nerves to a body part. It also means the stimulation of a body part through the action of nerves.
- **Receptors** are sites in the sensory organs (eyes, ears, skin, nose, and taste buds) that receive external stimulation. The receptors send the stimulus through the sensory neurons to the brain for interpretation. Eyes and ears are discussed further in Chapter 11.
- A **stimulus** is anything that excites or activates a nerve and causes an impulse (plural, **stimuli**).
- An **impulse** is a wave of excitation transmitted through nerve fibers and neurons.

THE REFLEXES

A **reflex** (**REE**-flecks) is an automatic, involuntary response to some change, either inside or outside the body. Deep tendon reflexes are discussed in Chapter 4.

- Maintenance of the heart rate, breathing rate, and blood pressure are reflex actions.
- Coughing, sneezing, and reactions to painful stimuli are also reflex actions.

THE NEURONS

A **neuron** (**NEW**-ron) is the basic cell of the nervous system. The three types of neurons are described according to their function. These are summarized in Table 10.1.

- The mnemonic **ACE** can help you remember the types of neurons and their roles: **A**fferent (sending), **C**onnecting (associative), **E**fferent (motor). (A *mnemonic* is a device intended to aid memory.)

Table 10.1

TYPES OF NEURONS

Afferent neurons (**AF**-er-ent)
Also known as **sensory neurons,** they emerge from the skin or sense organs and carry impulses toward the brain and spinal cord.

Connecting neurons Also known as **associative neurons,** they carry impulses from one neuron to another.

Efferent neurons (**EF**-er-ent)
Also known as **motor neurons,** they carry impulses away from the brain and spinal cord and toward the muscles and glands.

Neuron Parts

- Each neuron consists of a cell body, several dendrites, a single axon, and terminal end fibers (Figure 10.2).

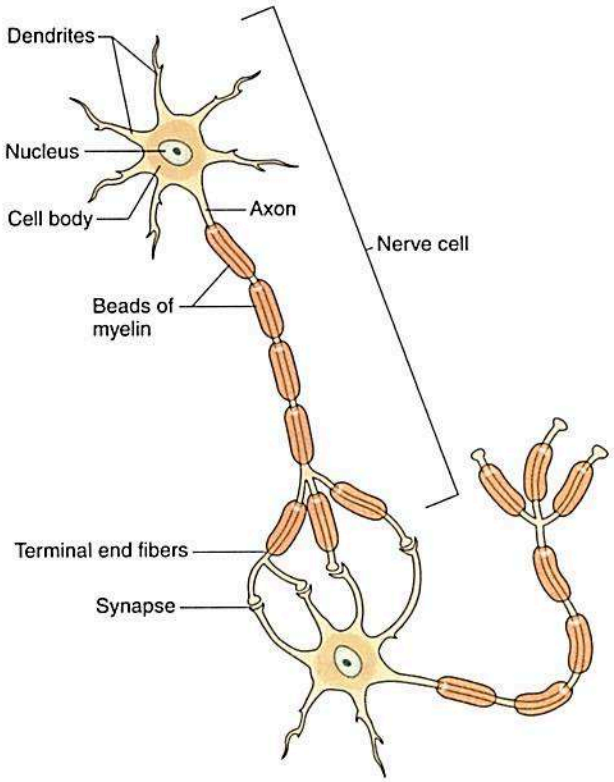

FIGURE 10.2 The structures of a neuron.

- The **dendrites** (**DEN**-drytes) are rootlike structures that receive impulses and conduct them to the cell body.
- The **axon** (**ACK**-son) extends away from the cell body and conducts impulses away from the nerve cell. Some axons, but not all, are protected by a white fatty tissue covering called **myelin** (**MY**-eh-lin).
- **Terminal end fibers** are the branching fibers of the neuron that lead the nervous impulse away from the axon and toward the synapse.

SYNAPSES

A **synapse** (**SIN**-apps) is the space between two neurons or between a neuron and a receptor organ.

NEUROTRANSMITTERS

A **neurotransmitter** (**new**-roh-trans-**MIT**-er) is a chemical messenger that transmits messages between nerve cells by making it possible for the nerve impulse to jump across the synapse from one neuron to another.

- At least 30 neurotransmitters have been identified. Each neurotransmitter is located within a specific group of neurons and has specific functions. Examples are shown in Table 10.2.

Table 10.2

EXAMPLES OF NEUROTRANSMITTERS AND THEIR FUNCTIONS

Acetylcholine (**ass**-eh-til-**KOH**-leen)	Released at some synapses in the spinal cord and at neuromuscular junctions; influences muscle action.
Dopamine (**DOH**-pah-meen)	Released within the brain; is thought to cause some forms of psychosis and abnormal movement disorders such as Parkinson's disease.
Endorphins (en-**DOR**-fins)	Released within the spinal cord in the pain condition pathway; inhibit the conduction of pain impulses and act as natural pain relievers.
Serotonin (**sehr**-oh-**TOH**-nin or **seer**-oh-**TOH**-nin)	Released in the brain; has roles in sleep and pleasure recognition.

NEUROGLIA

The **neuroglia** (new-**ROG**-lee-ah), also known as **glial cells,** are the supportive and connective cells of the nervous system. *Glial* means pertaining to glue, and neuroglia is sometimes referred to as *nerve glue.*

MYELIN SHEATH

A **myelin sheath** is the white protective covering over some nerve cells including parts of the spinal cord, white matter of the brain, and most peripheral nerves (Figure 10.3).

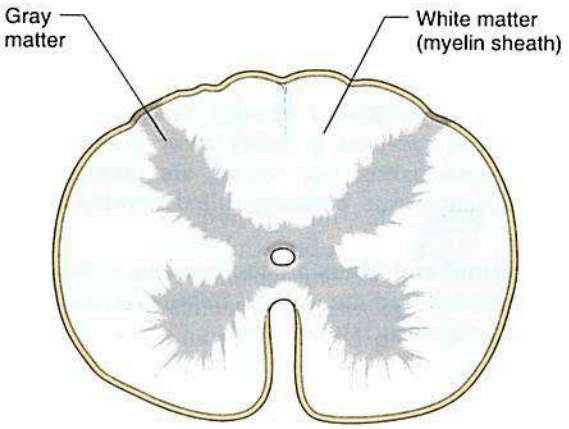

FIGURE 10.3 A cross section of the spinal cord showing the white matter (myelin sheath) that protects the gray matter (nerve tissue).

- **White matter.** The myelin sheath gives nerve fibers a white color, and the myelinated axons of nerves are referred to as *white matter.* The term **myelinated** (**MY**-eh-lih-**nayt**-ed) means having a myelin sheath.
- **Gray matter.** Those portions of nerves that *do not* have a myelin sheath are gray and make up the *gray matter* of the brain and spinal cord.

THE CENTRAL NERVOUS SYSTEM

The **central nervous system (CNS)** is made up of the brain and spinal cord. These structures are protected externally by the bones of the cranium and spinal column (see Chapter 3). Within these bony structures, the brain and spinal cord are protected by the meninges and cerebrospinal fluid.

The brain parts are shown in Figure 10.4. The body functions controlled by these brain parts are summarized in Table 10.3. Notice that the functions vital to life support are located in the most protected portion of the brain.

THE MENINGES

The **meninges** (meh-**NIN**-jeez) are three layers of connective tissue membrane that enclose the brain and spinal cord (singular, **meninx**). These are the dura mater, arachnoid membrane, and pia mater (Figure 10.5).

The Dura Mater

The **dura mater** (**DOO**-rah **MAY**-ter) is the thick, tough, outermost membrane of the meninges.

- The **epidural space** (**ep**-ih-**DOO**-ral) is located *above* the dura mater and within the surrounding bone walls (**epi-** means above and **-dural** means pertaining to dura mater). It contains fat and supportive connective tissues to cushion the dura mater.
- The **subdural space** (sub-**DOO**-ral) is located *below* the dura membrane and above the arachnoid membrane (**sub-** means below and **-dural** means pertaining to dura mater).

The Arachnoid Membrane

The **arachnoid membrane** (ah-**RACK**-noid), which resembles a spider web, is the second layer surrounding the brain and spinal cord.

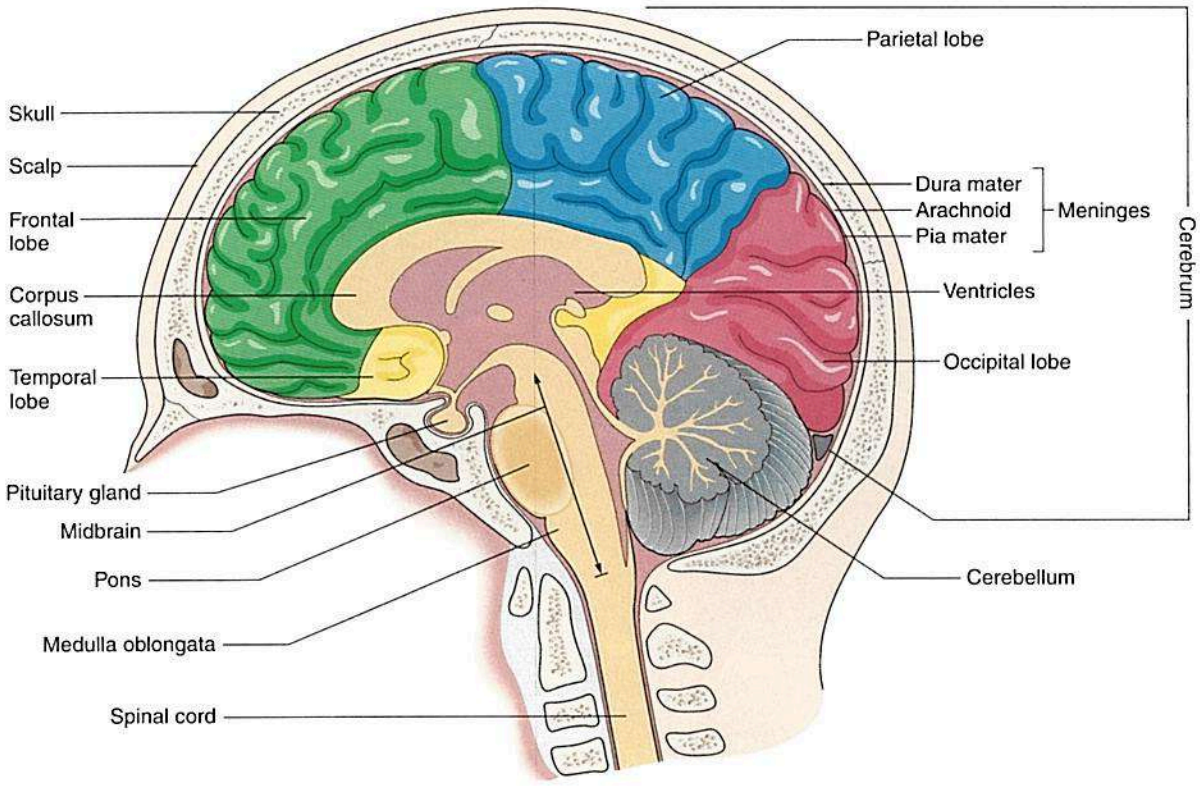

FIGURE 10.4 A cross section showing the major parts of the brain.

Table 10. 3

BRAIN PARTS AND WHAT THEY CONTROL

Brain Part	Controls
Cerebrum—uppermost and least protected layer of the brain	Is responsible for the highest level of thought including judgment, memory, association, and critical thinking.
Thalamus—located below the cerebrum	Monitors sensory stimuli by suppressing some and magnifying others.
Hypothalamus—located below the thalamus.	Controls vital bodily functions (see Table 10.4).
Cerebellum—located in the lower back of the cranium below the cerebrum	Coordinates muscular activity for smooth and steady movements.
Pons—located in the brainstem at the base of the brain	Nerves cross over so that one side of the brain controls the opposite side of the body.
Medulla oblongata—most protected part of the brain	Controls the basic vital functions of life.

- The arachnoid membrane is loosely attached to the other meninges to allow space for fluid between the layers.
- The **subarachnoid space,** located below the arachnoid membrane and above the pia mater, contains cerebrospinal fluid.

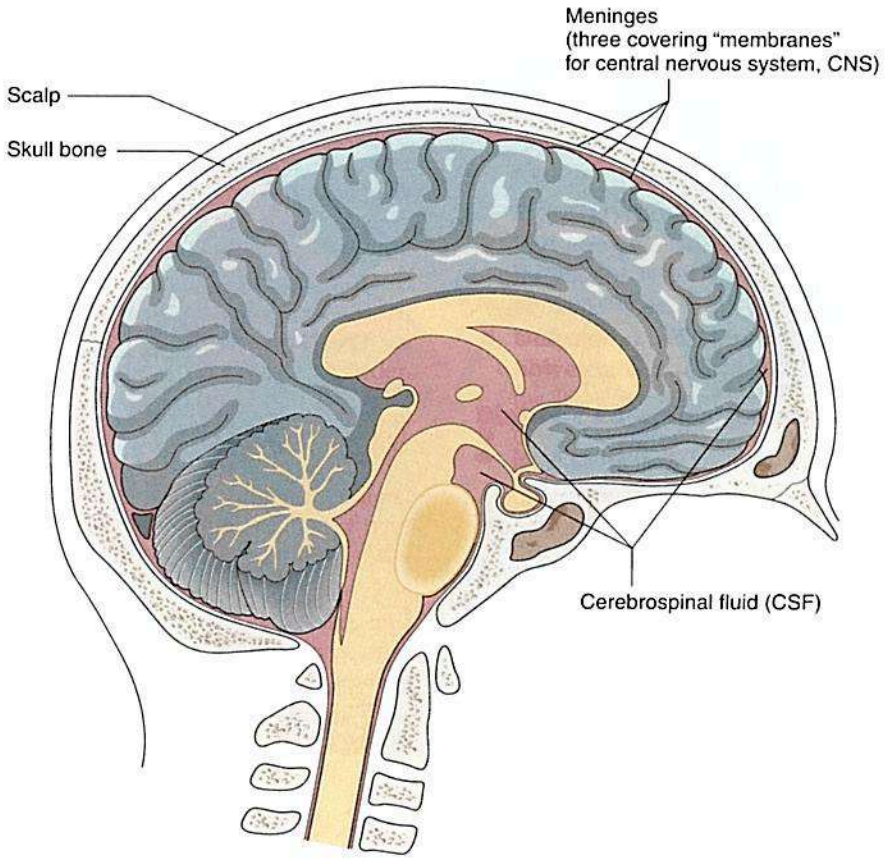

FIGURE 10.5 A cross section of the brain showing the protective coverings. The cerebrospinal fluid is shown in pink.

The Pia Mater

The **pia mater,** the third layer of the meninges, is located nearest to the brain and spinal cord. It consists of delicate connective tissue with a rich supply of blood vessels.

CEREBROSPINAL FLUID

Cerebrospinal fluid (CSF) is a clear, colorless, watery fluid produced by special capillaries within the ventricles of the brain.

- The CFS flows throughout the brain and around the spinal cord, and its functions are to nourish, cool, and cushion these organs from shock or injury.

THE CEREBRUM

The **cerebrum** (seh-**REE**-brum) is the largest and uppermost portion of the brain. It is responsible for all thought, judgment, memory, association, and discrimination.

- The term **cerebral** (**SER**-eh-bral *or* seh-**REE**-bral) means pertaining to the cerebrum or brain.
- The **cerebral cortex,** made up of gray matter, is the outer layer of the cerebrum and is arranged in folds.

The Cerebral Hemispheres

The cerebrum is divided into the **left hemisphere** and the **right hemisphere** (Figure 10.6). These are also referred to as the left brain and right brain.

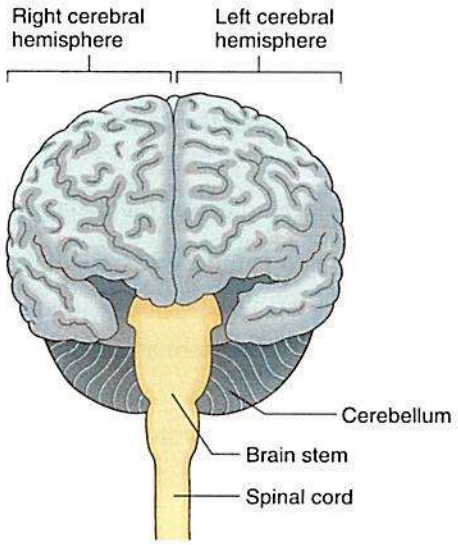

FIGURE 10.6 An anterior view showing the brain divided into right and left hemispheres.

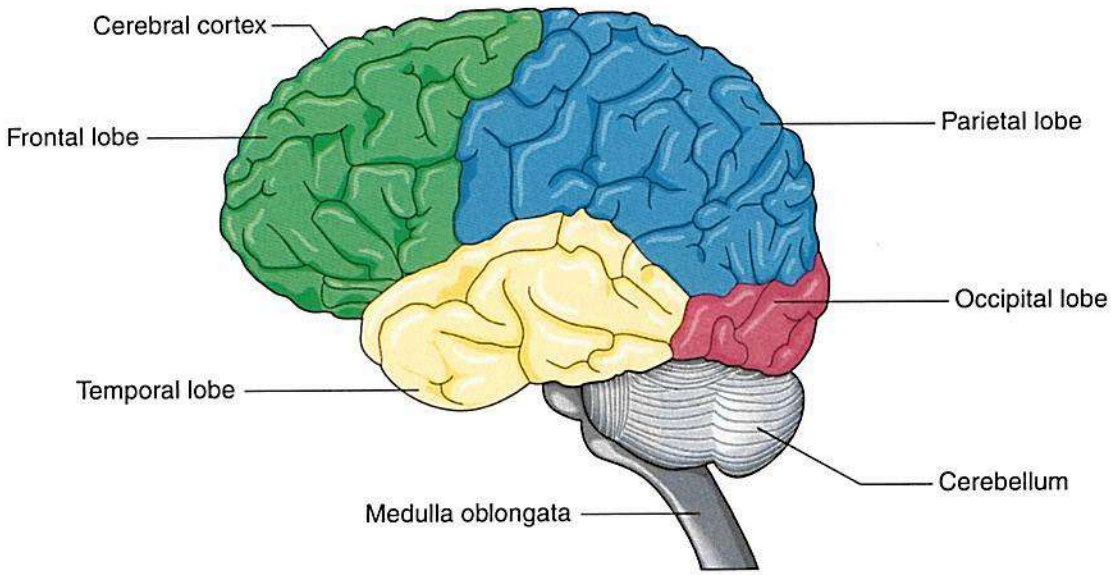

FIGURE 10.7 A left lateral view of the exterior of the brain with the lobes shown in color.

- The two cerebral hemispheres are connected at the lower midpoint by the **corpus callosum** (**KOR**-pus kah-**LOH**-sum). See Figures 10.4 and 10.8.

The Lobes of the Brain

Each hemisphere of the cerebrum is divided into four **lobes,** and each lobe is named for the bone of the cranium covering it (Figure 10.7).

- The **frontal lobe** controls motor functions.
- The **parietal lobe** receives and interprets nerve impulses from the sensory receptors.
- The **occipital lobe** controls eyesight.
- The **temporal lobe** controls the senses of hearing and smell.

The Ventricles

The four **ventricles** located within the middle region of the cerebrum contain CFS. (A *ventricle* is a small cavity, such as the ventricles of the brain and of the heart.)

THE THALAMUS

The **thalamus** (**THAL**-ah-mus), which is located below the cerebrum, produces sensations by relaying impulses to and from the cerebral cortex and the sense organs of the body (Figure 10.8).

The Hypothalamus

The **hypothalamus** (**high**-poh-**THAL**-ah-mus), located below the thalamus, has seven major regulatory functions. These are summarized in Table 10.4.

- The hypothalamus communicates with other parts of the body by secreting neurohormones. (A *neurohormone* is a hormone secreted by, or acting on, a part of the nervous system.)

Table 10.4

REGULATORY FUNCTIONS OF THE HYPOTHALAMUS

1. Regulates and integrates the autonomic nervous system, thereby controlling heart rate, blood pressure, respiratory rate, and digestive tract activity.
2. Regulates emotional responses and behavior.
3. Regulates body temperature.
4. Regulates food intake by controlling hunger sensations.
5. Regulates water balance and thirst.
6. Regulates sleep-wakefulness cycles.
7. Regulates endocrine system activity.

THE CEREBELLUM

The **cerebellum** (**ser**-eh-**BELL**-um) is the second largest part of the brain. It is located at the back of the head below the posterior part of the cerebrum.

- The cerebellum receives incoming messages regarding movement within joints, muscle tone, and positions of the body. From here, messages are relayed to the different parts of the brain that control skeletal muscles.

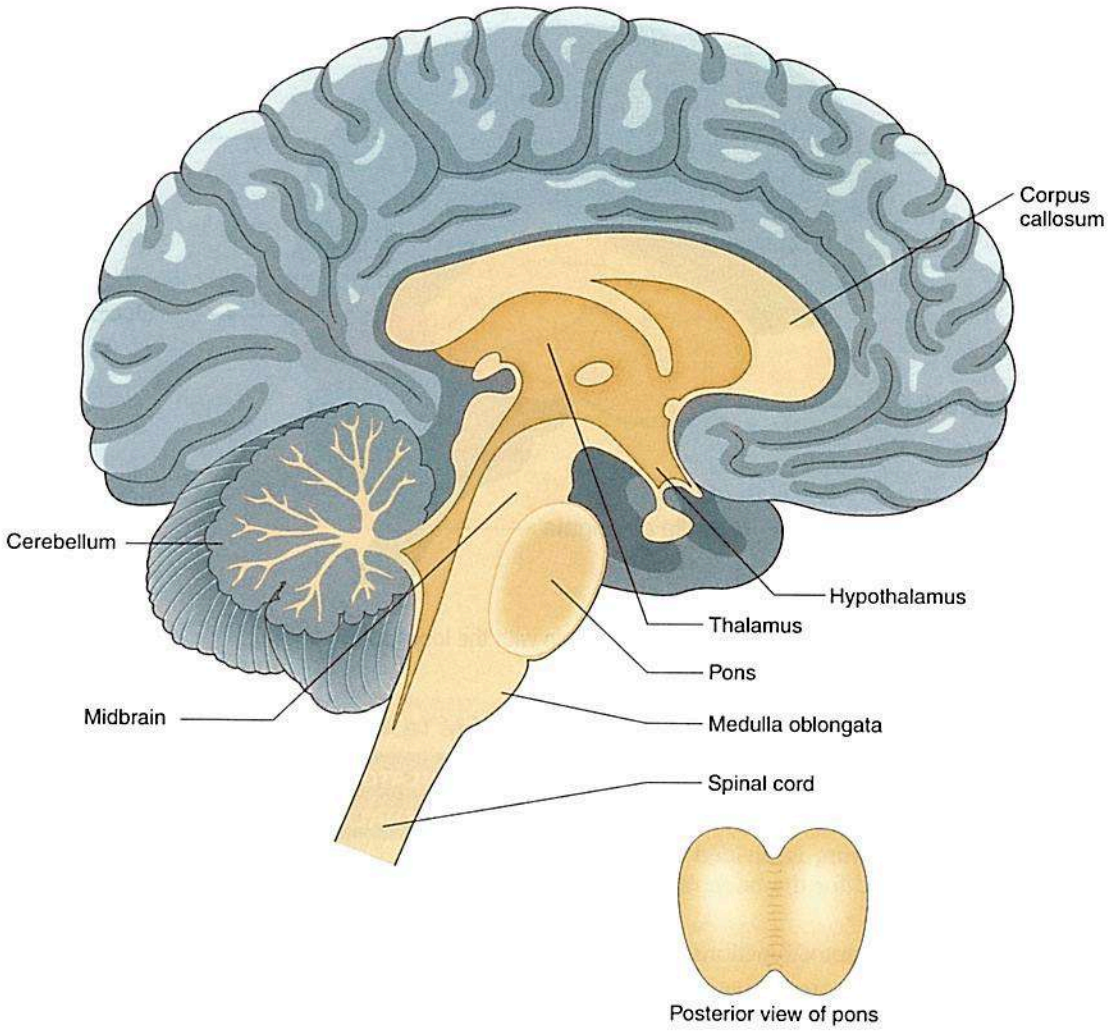

FIGURE 10.8 A schematic representation of the inner structures of the brain.

THE BRAINSTEM

The **brainstem** is the stalklike portion of the brain that connects the cerebral hemispheres with the spinal cord. It is made up of the midbrain, pons, and medulla oblongata.

The Midbrain

The **midbrain** extends from the lower surface of the cerebrum to the pons. It is a short narrow segment that provides conduction pathways to and from higher and lower centers.

The Pons

The **pons** (**PONZ**), which means bridge, is situated at the base of the brain. It is here that nerve cells cross from one side of the brain to control the opposite side of the body.

- The nerves that control the left side of the body are found in the right side of the brain. Because the nerves cross at the pons, an injury to the right side of the brain affects the left side of the body.
- The nerves that control the right side of the body are found in the left side of the brain. Because the nerves cross at the pons, an injury to the left side of the brain affects the right side of the body.

The Medulla Oblongata

The **medulla oblongata** (meh-**DULL**-ah **ob**-long-**GAH**-tah) is located at the lowest part of the brainstem. It controls basic life functions including the muscles of respiration, heart rate, and blood pressure.

THE SPINAL CORD

The **spinal cord (SC)** is the pathway for impulses going to and from the brain.

- The spinal cord contains all the nerves that affect the limbs and lower part of the body.
- The spinal cord is protected by CFS and is surrounded by the three meninges.
- The gray matter in the spinal cord, which is not protected by a myelin sheath, is located in the internal section. The myelinated white matter composes the outer portion of the spinal cord (see Figure 10.3).

THE PERIPHERAL NERVOUS SYSTEM

The **peripheral nervous system (PNS)** consists of the cranial nerves (extending from the brain) and the spinal nerves (extending from the spinal cord).

THE CRANIAL NERVES

The 12 pairs of **cranial nerves** originate from the undersurface of the brain. Each nerve of a pair serves half of the body, and the two nerves are identical in function and structure.

- The cranial nerves are identified by Roman numerals and are named for the area or function they serve (Figure 10.9).

THE SPINAL NERVES

The 31 pairs of **spinal nerves** are usually named for the artery they accompany or the body part they innervate (Figure 10.10).

- For example, the femoral nerve innervates muscles associated with the femur (the bone of the upper leg).

THE AUTONOMIC NERVOUS SYSTEM

The **autonomic nervous system (ANS)** controls the involuntary actions of the body (Figure 10.11).

- The ANS is subdivided into two divisions: the **sympathetic** and **parasympathetic nervous systems.**
- As shown in Table 10.5, one division balances the activity of the other to maintain homeostasis. **Homeostasis** (**hoh**-mee-oh-**STAY**-sis) is the process of maintaining the constant internal environment of the body.

MEDICAL SPECIALTIES RELATED TO THE NERVOUS SYSTEM

- An **anesthesiologist** (**an**-es-**thee**-zee-**OL**-oh-jist) is a physician who specializes in administering anesthetic agents before and during surgery (**an-** means without, **esthesi** means feeling, and **-ologist** means specialist).

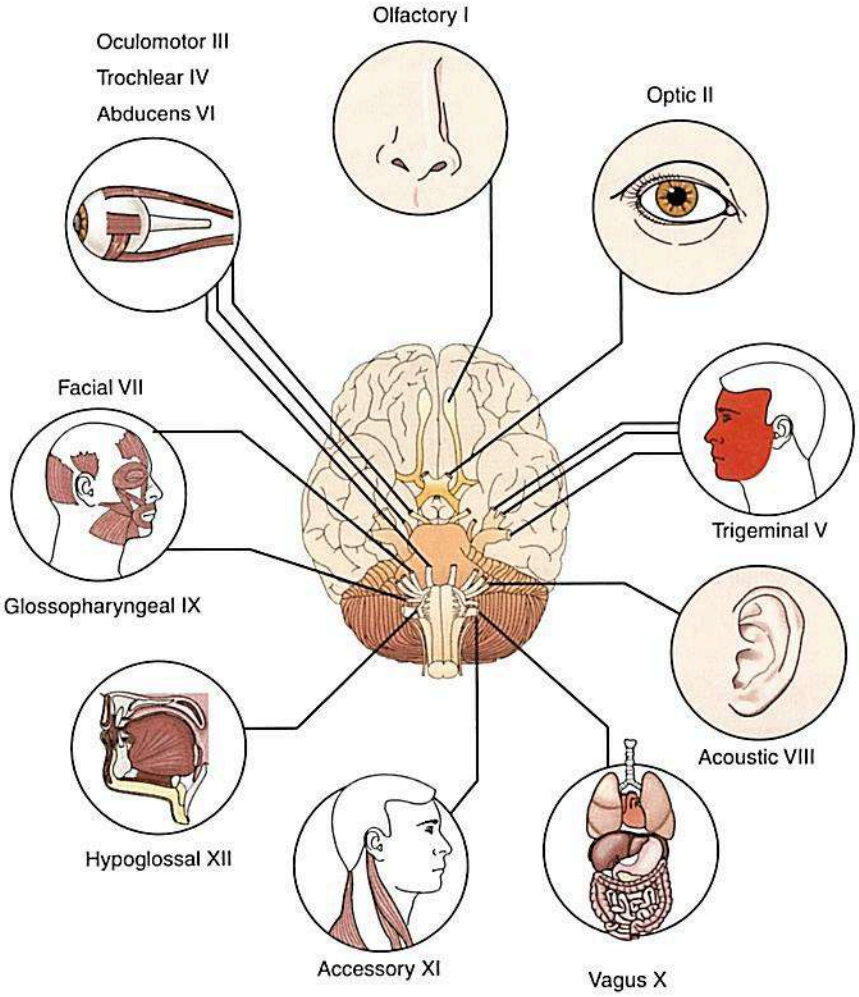

FIGURE 10.9 Cranial nerves are identified with Roman numerals and are named for the area or function they serve.

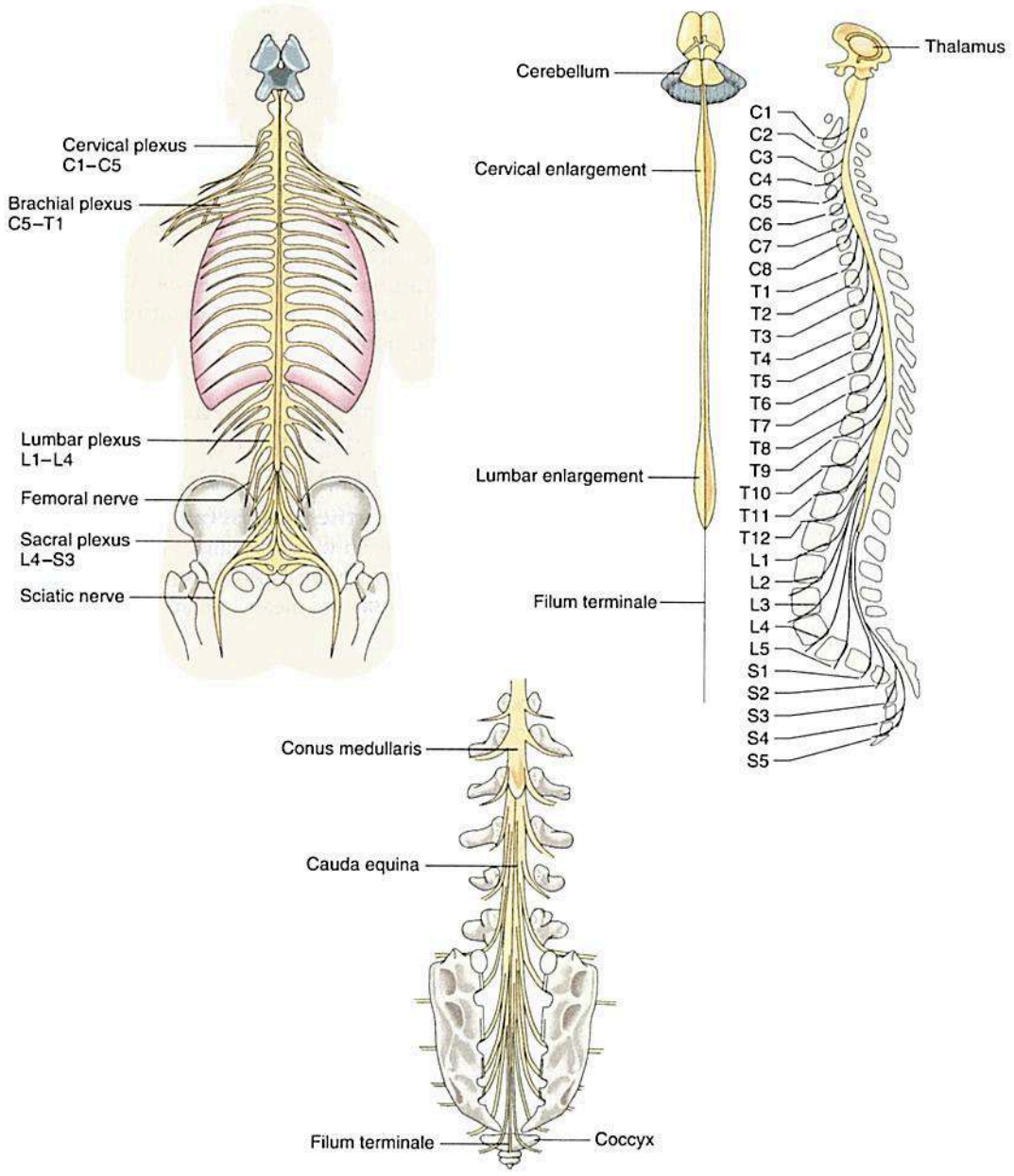

FIGURE 10.10 The spinal cord and nerves. Most spinal nerves are named for the corresponding vertebrae.

Table 10.5

DIVISIONS OF THE AUTONOMIC NERVOUS SYSTEM AND THEIR CONTRASTING ACTIONS

Sympathetic Nervous System	Parasympathetic Nervous System
Prepares the body for emergency and stressful situations by increasing the breathing rate, heart rate, and blood flow to muscles.	Returns the body to normal after a stressful response. It also maintains normal body functions during ordinary circumstances that are not emotionally or physically stressful.

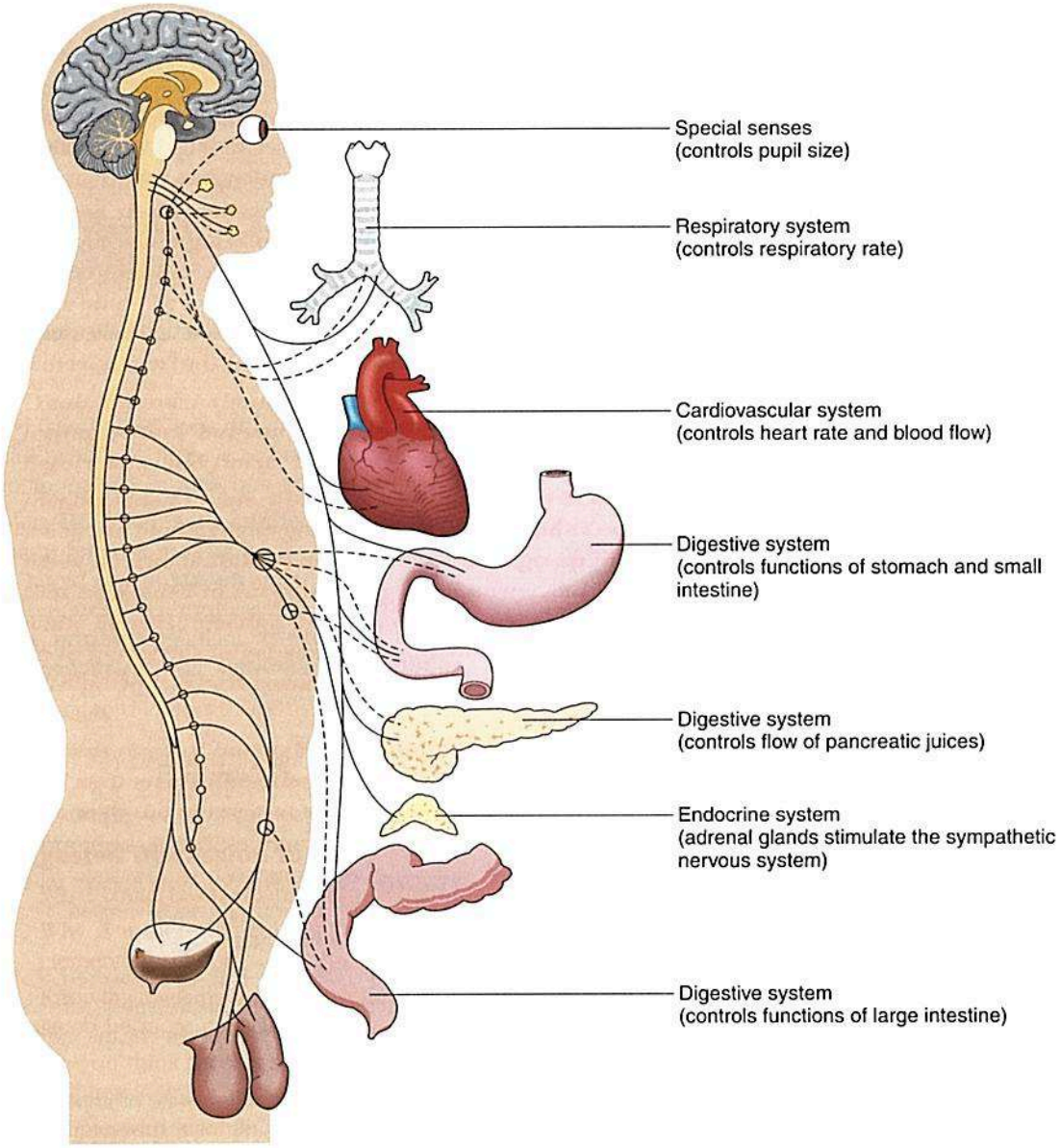

FIGURE 10.11 The autonomic nervous system controls the involuntary actions of the body. Shown here are examples of this interaction with the major body systems.

- An **anesthetist** (ah-**NES**-theh-tist) is a person trained in administering anesthesia but who is not necessarily a physician, for example, a nurse anesthetist (**an-** means without, **esthet** means feeling, and **-ist** means specialist).
- A **neurologist** (new-**ROL**-oh-jist) specializes in diagnosing and treating diseases and disorders of the nervous system (**neur** means nerve and **-ologist** means specialist).
- A **neurosurgeon** is a physician who specializes in surgery of the nervous system.
- A **psychiatrist** (sigh-**KYE**-ah-trist) holds a Medical Doctor (MD) degree and specializes in diagnosing and treating chemical dependencies, emotional problems, and mental illness (**psych** means mind and **-iatrist** means specialist).
- A **psychologist** (sigh-**KOL**-oh-jist) holds an advanced degree, other than a medical degree, and specializes in evaluating and treating emotional problems (**psych** means mind and **-ologist** means specialist).

PATHOLOGY OF THE NERVOUS SYSTEM

HEAD AND MENINGES

- **Cephalalgia** (**sef**-ah-**LAL**-jee-ah), also known as a **headache,** is pain in the head (**cephal** means head and **-algia** means pain). It is also known as **cephalodynia** (**sef**-ah-loh-**DIN**-ee-ah).

- A **migraine headache** (**MY**-grayn) is a syndrome characterized by sudden, severe, sharp headache usually present on only one side.
- An **encephalocele** (en-**SEF**-ah-loh-**seel**), also known as a **craniocele** (**KRAY**-nee-oh-**seel**), is a congenital gap in the skull with herniation of brain substance (**encephal/o** means brain and **-cele** means hernia). Compare this with a meningocele.
- **Hydrocephalus** (high-droh-**SEF**-ah-lus) is an abnormally increased amount of CFS within the brain (**hydr/o** means water, **cephal** means head, and **-us** is a singular noun ending).
- A **meningocele** (meh-**NING**-goh-**seel**) is the protrusion of the membranes of the brain or spinal cord through a defect in the skull or spinal column (**mening/o** means meninges and **-cele** means hernia). Compare this with an encephalocele.
- **Meningitis** (**men**-in-**JIGH**-tis) is an inflammation of the meninges of the brain or spinal cord (**mening** means meninges and **-itis** means inflammation) (plural, **meningitides**). Compare with *encephalitis*.

DISORDERS OF THE BRAIN

- **Alzheimer's disease** (**ALTZ**-high-merz) **(AD)** is a group of disorders associated with degenerative changes in the brain structure that lead to characteristic symptoms including progressive memory loss, impaired cognition, and personality changes.
- **Cognition** (kog-**NISH**-un) describes the mental activities associated with thinking, learning, and memory.
- **Encephalitis** (**en**-sef-ah-**LYE**-tis) is an inflammation of the brain (**encelphal** means brain and **-itis** means inflammation) (plural, **encephalitides**). Compare with *meningitis*.
- **Parkinson's disease (PD)** is a chronic, slowly progressive, degenerative CNS disorder. It is characterized by fine muscle tremors, a masklike facial expression, and a shuffling gait. (*Gait* means manner of walking.)
- **Tetanus** (**TET**-ah-nus), also known as **lockjaw,** is an acute and potentially fatal bacterial infection of the CNS caused by the tetanus bacillus. Tetanus can be prevented through immunization.

BRAIN INJURIES

- **Amnesia** (am-**NEE**-zee-ah) is a disturbance in the memory marked by a total or partial inability to recall past experiences. The cause may be a brain injury, illness, or psychological disturbance.
- A **concussion** (kon-**KUSH**-un), also called a **cerebral concussion,** is a violent shaking up or jarring of the brain (**concuss** means shaken together and **-ion** means condition) (Figure 10.12).

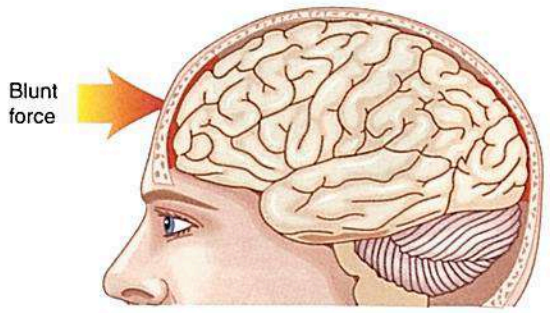

FIGURE 10.12 A concussion is the violent shaking up or jarring of the brain.

- A **cerebral contusion** (kon-**TOO**-zhun) is the bruising of brain tissue as a result of a head injury (**contus** means bruise and **-ion** means condition).
- A **cranial hematoma** (**hee**-mah-**TOH**-mah *or* **hem**-ah-**TOH**-mah) is a collection of blood trapped in the tissues of the brain (**hemat** means blood and **-oma** means tumor). Named for their location, the types of cranial hematomas include **epidural hematoma, subdural hematoma,** and **intracerebral hematoma** (Figure 10.13).

LEVELS OF CONSCIOUSNESS

- **Conscious,** also known as **alert,** means being awake, aware, and responding appropriately.
- **Syncope** (**SIN**-koh-pee), also known as **fainting,** is the brief loss of consciousness caused by a brief lack of oxygen in the brain.
- **Lethargy** (**LETH**-ar-jee) is a lowered level of consciousness marked by listlessness, drowsiness, and apathy. As used here, *apathy* means indifference and a reduced level of activity.
- A **stupor** (**STOO**-per) is a state of impaired consciousness marked by a lack of responsiveness to environmental stimuli.
- A **coma** (**KOH**-mah) is a profound (deep) state of unconsciousness marked by the absence of spontaneous eye movements, no response to painful stimuli, and no vocalization (speech). **Comatose** (**KOH**-mah-tohs) refers to a person who is in a coma.

Delirium and Dementia

- **Delirium** (dee-**LIR**-ee-um) is a potentially reversible condition often associated with a high fever that comes on suddenly. A *delirious* patient is confused, disoriented, and unable to think clearly.
- **Dementia** (dee-**MEN**-shee-ah) is a slowly progressive decline in mental abilities including memory, thinking, judgment, and the ability to pay attention.

BRAIN TUMORS

A **brain tumor** is an abnormal growth within the brain that may be either benign (not life threatening) or malig-

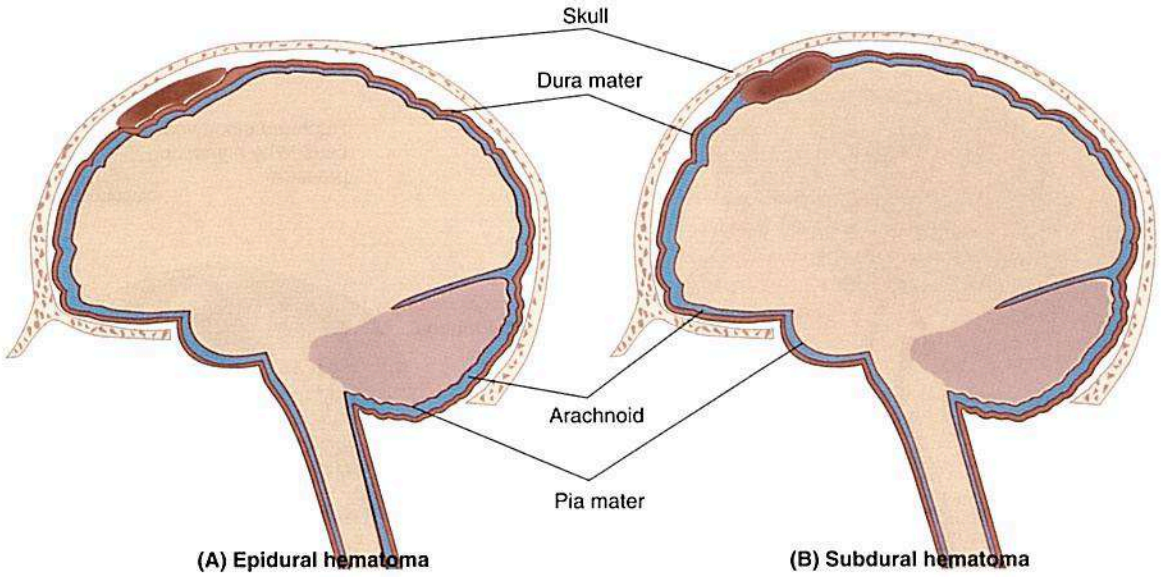

FIGURE 10.13 Cranial hematomas. (Left) Epidural hematoma. (Right) Subdural hematoma.

nant (life threatening). A malignant brain tumor may originate in the brain as the primary site, or it may spread from a secondary site in another part of the body.

- Any abnormal growth in the brain can cause damage in two ways. First, if the tumor is invasive, it destroys brain tissue. Second, because the skull is hard, the tumor can damage the brain by causing pressure on it (Figure 10.14).

STROKES

A **stroke,** also known as a **cerebrovascular accident** (**ser**-eh-broh-**VAS**-kyou-lar) **(CVA)**, is damage to the brain that occurs when the blood flow to the brain is disrupted because a blood vessel supplying it either is blocked or has ruptured (Figure 10.15).

Ischemic Attacks

- A **transient ischemic attack** (iss-**KEE**-mick) **(TIA)** is the temporary interruption in the blood supply to the brain. Symptoms include weakness, dizziness, or loss of balance. These pass within a few minutes. However, a TIA may be a warning of an impending stroke.
- The most common type of stroke in older people is an **ischemic stroke** in which the flow of blood in the brain is blocked. This may be caused by a narrowing of the carotid artery or by a **cerebral thrombosis** in which a thrombus (clot) blocks the artery. This disruption of blood flow usually affects the cerebrum and damages the controls of movement, language, and senses.

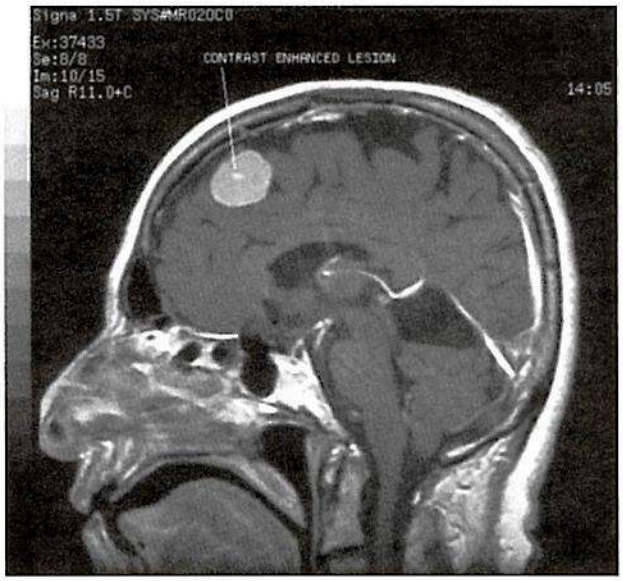

FIGURE 10.14 A brain tumor visualized by magnetic resonance imaging (MRI).

- **Aphasia** (ah-**FAY**-zee-ah) is the loss of the ability to speak, write, or comprehend the written or spoken word (**a-** means without and **-phasia** means speech). Aphasia is often due to brain damage associated with a stroke.
- A carotid endarterectomy, described in Chapter 5, may be performed to prevent an ischemic stroke by opening a blocked artery before a stroke occurs.

Hemorrhagic Stroke

In a **hemorrhagic stroke** (**hem**-oh-**RAJ**-ick), also known as a **bleed,** a blood vessel in the brain leaks or ruptures.

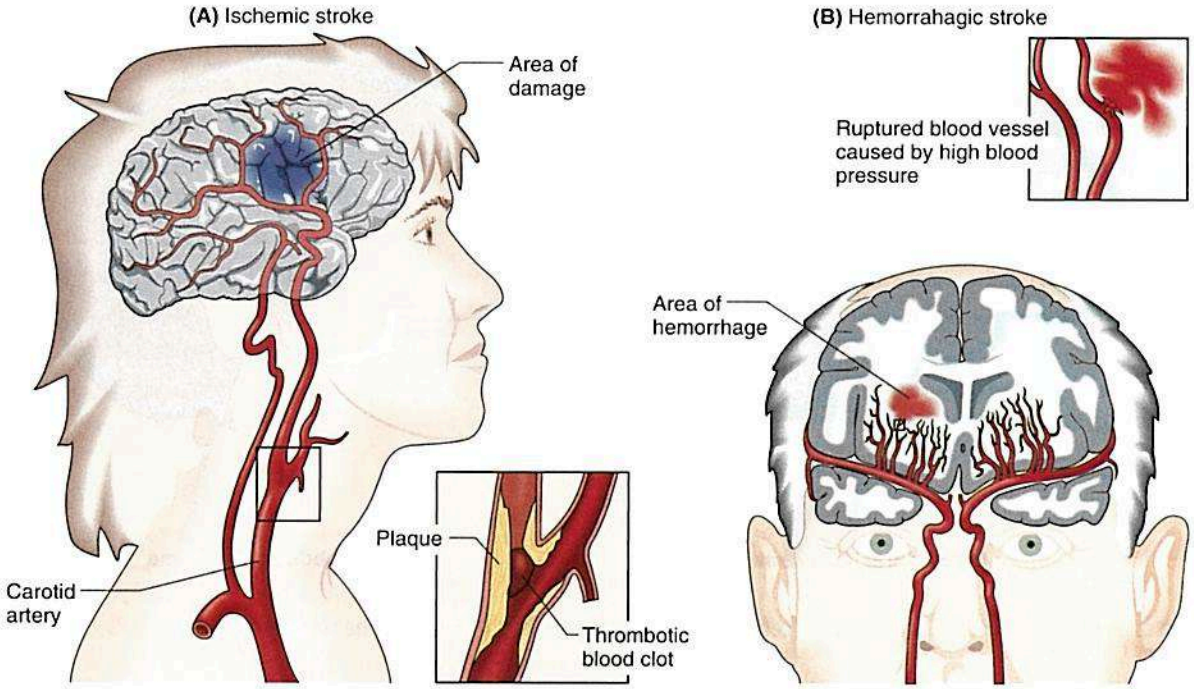

FIGURE 10.15 Stroke damage reflects the affected area of the brain. (A) Ischemic stroke. (B) Hemorrhagic stroke. *(By permission of Mayo Foundation; from June 1995 "Medical Essay,"* Supplement to Mayo Clinic Health Letter.)

This type of stroke is less common than ischemic strokes, but is more deadly. A hemorrhagic stroke affects the area of the brain damaged by the leaking blood (Figure 10.16).

SLEEP DISORDERS

- **Insomnia** is the prolonged or abnormal inability to sleep. This condition is usually a symptom of another problem such as depression, pain, or excessive caffeine.
- **Narcolepsy** (**NAR**-koh-**lep**-see) is a syndrome characterized by recurrent uncontrollable seizures of drowsiness and sleep (**narc/o** means stupor and **-lepsy** means seizure).
- **Somnambulism** (som-**NAM**-byou-lizm), also known as **noctambulism** or **sleepwalking,** is the condition of walking without awakening (**somn** means sleep, **ambul** means to walk, and **-ism** means condition of).
- **Somnolence** (**SOM**-noh-lens) is a condition of unnatural sleepiness or semiconsciousness approaching coma. A *somnolent* person usually can be aroused by verbal stimuli.

THE SPINAL CORD

- **Myelitis** (**my**-eh-**LYE**-tis) is an inflammation of the spinal cord (**myel** means spinal cord [and bone marrow] and **-itis** means inflammation). Myelitis also means inflammation of bone marrow.
- A **myelosis** (**my**-eh-**LOH**-sis) is a tumor of the spinal cord (**myel** means spinal cord [and bone marrow] and **-osis** means abnormal condition). Myelosis also means an abnormal proliferation of bone marrow tissue.
- **Multiple sclerosis** (skleh-**ROH**-sis) **(MS)** is a progressive autoimmune disorder characterized by scattered patches of demyelination of nerve fibers of the brain

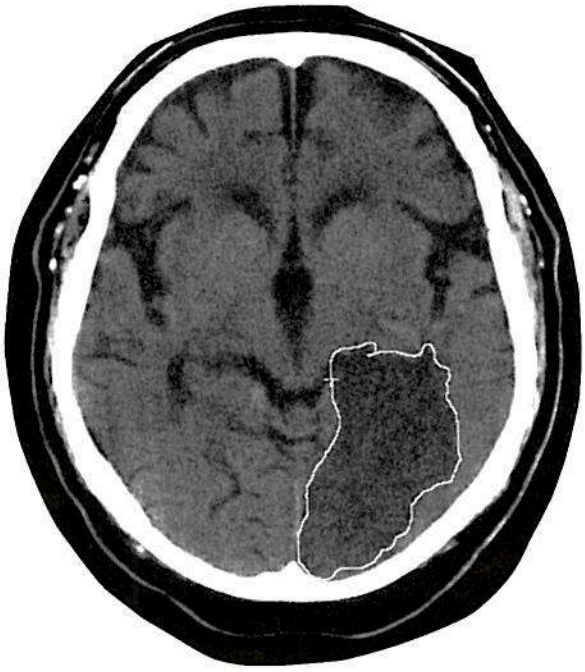

FIGURE 10.16 MRI of a brain, with the area of a bleed visible in the lower right.

and spinal cord. Demyelination, which is the loss of this protective myelin covering, disrupts the transmission of nerve impulses and causes symptoms including tremors, paralysis, and speech disturbances.

- **Poliomyelitis** (**poh**-lee-oh-**my**-eh-**LYE**-tis), also known as **polio,** is a viral infection of the gray matter of the spinal cord that may result in paralysis. This can be prevented through immunization (**poli/o** means gray, **myel** means spinal cord, and **-itis** means inflammation).
- **Postpolio syndrome** is the recurrence later in life of some polio symptoms in individuals who have had poliomyelitis and have recovered from it.
- **Radiculitis** (rah-**dick**-you-**LYE**-tis), also known as a **pinched nerve,** is an inflammation of the root of a spinal nerve (**radicul** means root or nerve root and **-itis** means inflammation). This term usually applies to that portion of the root that lies between the spinal cord and the intervertebral canal of the spinal column.
- **Spinal cord injuries (SCIs)** are discussed in Chapter 4 under Paralysis.

NERVES

- **Amyotrophic lateral sclerosis** (ah-**my**-oh-**TROH**-fick) **(ALS)**, also known as **Lou Gehrig's disease,** is a degenerative disease of the motor neurons in which patients become progressively weaker until they are completely paralyzed. Intellect, eye motion, bladder function, and sensations are spared.
- **Bell's palsy** is paralysis of the facial (seventh cranial) nerve that causes drooping only on the affected side of the face. Compare with *tic douloureux.*
- **Guillain-Barré syndrome** (gee-**YAHN**-bah-**RAY**) **(GBS)**, also known as **acute ascending polyneuritis,** is characterized by rapidly worsening muscle weakness that may lead to temporary paralysis. GBS is presumed to be an autoimmune reaction that may occur after a mild infection, surgery, or an immunization.
- **Peripheral neuropathy** (new-**ROP**-ah-thee), also known as **peripheral neuritis** (new-**RYE**-tis), is a painful condition of the nerves of the hands and feet due to peripheral nerve damage that may be caused by disease such as diabetes, alcoholism, autoimmune diseases, and exposure to toxic substances.
- **Tic douloureux** (**TICK** doo-loo-**ROO**), also known as **trigeminal neuralgia,** is inflammation of the trigeminal (fifth cranial) nerve. It is characterized by sudden, intense, sharp pain on one side of the face. Compare with *Bell's palsy.*
- **Sciatica** (sigh-**AT**-ih-kah) is inflammation of the sciatic nerve that results in pain along the course of the nerve through the thigh and leg.

ABNORMAL SENSATIONS

- **Causalgia** (kaw-**ZAL**-jee-ah) is an intense burning pain after an injury to a sensory nerve (**caus** means burning and **-algia** means pain).
- **Hyperesthesia** (**high**-per-es-**THEE**-zee-ah) means a condition of excessive sensitivity to stimuli (**hyper-** means excessive and **-esthesia** means sensation or feeling).
- **Paresthesia** (**par**-es-**THEE**-zee-ah) is an abnormal sensation, such as burning, tingling, or numbness, for no apparent reason (**par-** means abnormal and **-esthesia** means sensation or feeling).

CEREBRAL PALSY

Cerebral palsy (**SER**-eh-bral *or* seh-**REE**-bral **PAWL**-zee) **(CP)** is a condition characterized by poor muscle control, spasticity, and other neurologic deficiencies caused by an injury to the part of the brain that controls muscle movements. This injury occurs during pregnancy, birth, or soon after birth. CP occurs most often in premature or low-birthweight infants.

CONVULSIONS AND SEIZURES

The terms **convulsion** and **seizure** (**SEE**-zhur) are used interchangeably to describe a sudden, violent, involuntary contraction of a group of muscles caused by a disturbance in brain function. Convulsions have many causes including brain injury, lesions, or extreme high fever.

- A **generalized seizure,** also known as a **generalized tonic-clonic seizure,** is characterized by a loss of consciousness with tonic convulsions followed by clonic convulsions. (These are sometimes described as tonic and clonic phases of a generalized seizure.)
- A **tonic convulsion** is a state of continuous muscular contraction that results in rigidity and violent spasms.
- A **clonic convulsion** is a state marked by the alternate contraction and relaxation of muscles, resulting in jerking movements of the face, trunk, or extremities.
- A **partial seizure,** also known as a **localized seizure,** begins with specific motor, sensory, or psychomotor phenomena without loss of consciousness.

EPILEPSY

Epilepsy (**EP**-ih-**lep**-see) is a group of neurologic disorders characterized by recurrent episodes of seizures.

- **Grand mal epilepsy** (**GRAN MAHL EP**-ih-**lep**-see), which is the more severe form, is characterized by generalized tonic-clonic seizures.
- **Petit mal epilepsy** (peh-**TEE MAHL EP**-ih-**lep**-see), also known as **absence epilepsy,** is the milder form in which there is a sudden, temporary loss of consciousness, lasting only a few seconds. Seizures are very mild, do not include convulsive movements, and may not be noticed.

- An **epileptic aura** is a manifestation, such as a particular smell or light, which may be experienced just before a seizure.

MENTAL HEALTH

Although described as mental disorders, the following conditions are often caused by physical changes, substance abuse, medications, or any combination of those factors.

DEVELOPMENTAL DISORDERS

- **Mental retardation** is significantly below average general intellectual functioning that is accompanied by a significant limitation in adaptive functioning.
- An **autistic disorder** (aw-**TISS**-tick), also known as **autism** (**AW**-tizm), is a disorder in which a young child cannot develop normal social relationships, behaves in compulsive and ritualistic ways, and frequently has poor communication skills.
- **Attention deficit disorder (ADD)** is a short attention span and impulsiveness that is inappropriate for the child's developmental age.
- An **attention deficit/hyperactivity disorder (ADHD)** is a pattern of inattention and hyperactivity that is inappropriate for the child's developmental age. This condition may persist into adulthood.
- **Dyslexia** (dis-**LECK**-see-ah), also known as a **reading disorder,** is a learning disability characterized by reading achievement that falls substantially below that expected given the individual's chronological age, measured intelligence, and age-appropriate education.

SUBSTANCE-RELATED DISORDERS

An **addiction** is the compulsive and overwhelming involvement with a specific activity despite the fact that it causes significant health hazards plus recurrent legal and social problems. The addiction may be to actions such as gambling or smoking. Abused substances include alcohol, medications, and illegal drugs (Figure 10.17).

- For example, **alcoholism** (**AL**-koh-hol-izm) is chronic alcohol dependence or abuse with specific signs and symptoms of withdrawal. *Withdrawal* is a psychological or physical syndrome (or both) caused by the abrupt cessation (stopping) of the use of a drug in a habituated individual.
- **Delirium tremens** (dee-**LIR**-ee-um **TREE**-mens) **(DTs)** is a form of acute organic brain syndrome due to alcohol withdrawal and is characterized by sweating, tremor, restlessness, anxiety, mental confusion, and hallucinations.

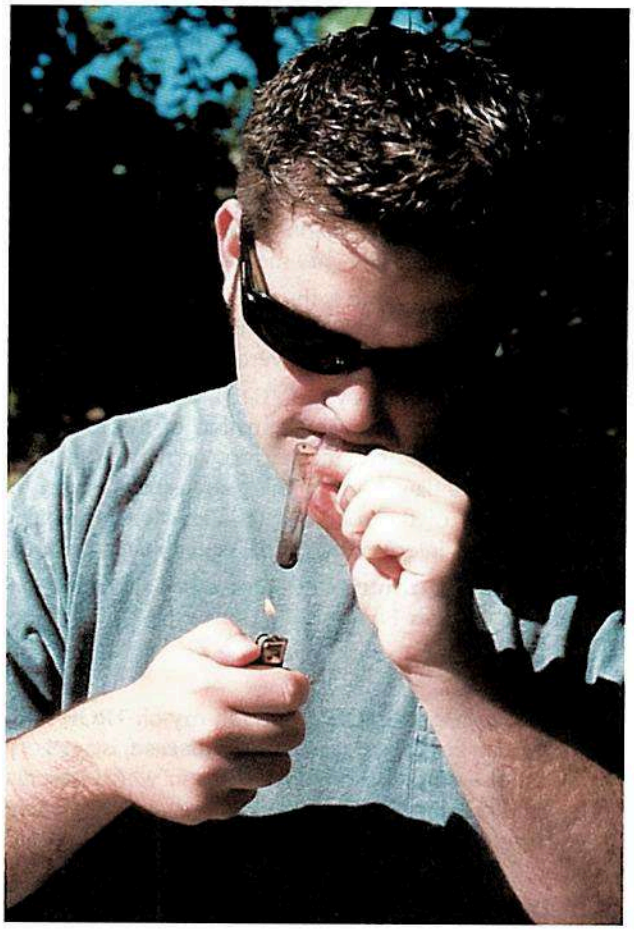

FIGURE 10.17 Substance abuse includes the use of illegal drugs.

SCHIZOPHRENIA AND OTHER PSYCHOTIC DISORDERS

- A **psychotic disorder** (sigh-**KOT**-ick) is characterized by the derangement of personality, loss of contact with reality, and deterioration of normal social functioning.
- **Schizophrenia** (**skit**-soh-**FREE**-nee-ah) is a psychotic disorder characterized by delusions, hallucinations, disorganized speech that is often incoherent, and disruptive or catatonic behavior.
- A **delusion** (dee-**LOO**-zhun) is a false personal belief that is maintained despite obvious proof or evidence to the contrary.
- A **hallucination** (hah-**loo**-sih-**NAY**-shun) is a sense perception (sight, touch, sound, smell, or taste) that has no basis in external stimulation.
- **Catatonic behavior** (**kat**-ah-**TON**-ick) is marked by a lack of responsiveness, stupor, and a tendency to remain in a fixed posture.

MOOD DISORDERS

- A **manic episode** is a distinct period during which there is an abnormally, and persistently elevated, expansive and irritable mood.
- A **major depressive episode** is a prolonged period during which there is either a depressed mood or the loss of interest or pleasure in nearly all activities.
- A **bipolar disorder,** also known as a **manic-depressive episode,** is a clinical course characterized by the occurrence of manic episodes alternating with depressive episodes.

PANIC DISORDERS

- **Panic disorders** are characterized by the sudden, unanticipated recurrence of a group of symptoms known as a panic attack. Once a person has experienced a panic attack, he or she will go to great lengths to avoid having it happen again.
- A **panic attack** includes intense feelings of apprehension, fearfulness, terror, and impending doom. Physical symptoms include shortness of breath, profuse sweating, heart palpitations, chest pain, and choking sensations.

ANXIETY DISORDERS

- An **anxiety state** is a feeling of apprehension, tension, or uneasiness that stems from the anticipation of danger, the source of which is largely unknown or unrecognized.
- An **obsessive-compulsive disorder** is a pattern of specific behaviors such as repeated hand washing. *Obsessions* are persistent ideas, thoughts, or images that cause the individual anxiety or distress. *Compulsions* are repetitive behaviors the goal of which is to prevent or reduce anxiety or stress.
- **Posttraumatic stress disorder (PTSD)** is the development of characteristic symptoms after a psychologically traumatic event such as witnessing a shooting, surviving a natural disaster, or being held as a hostage. Symptoms include numbed responsiveness to external stimuli, anxiety, sleep disorders, restlessness, difficulty concentrating, and depression.

PHOBIAS

- A **phobia** (**FOH**-bee-ah) is a persistent irrational fear of a specific thing or situation. This fear is strong enough to cause avoidance of that thing or situation.
- **Acrophobia** (**ack**-roh-**FOH**-bee-ah) is an excessive fear of being in high places (**acr/o** means top and **-phobia** means abnormal fear).
- **Agoraphobia** (**ag**-oh-rah-**FOH**-bee-ah) is an overwhelming and irrational fear of leaving the familiar setting of home or venturing into the open (**agor/a** means market place and **-phobia** means abnormal fear).
- **Claustrophobia** (**klaws**-troh-**FOH**-bee-ah) is an abnormal fear of being in narrow or enclosed spaces (**claustr/o** means barrier and **-phobia** means abnormal fear).

SOMATOFORM DISORDERS

- **Somatoform** (soh-**MAT**-oh-**form**) is the term used to describe the presence of physical symptoms that suggest general medical conditions not explained by the patient's actual medical condition.
- A **conversion disorder,** such as paralysis of an arm or disturbance of vision, is characterized by a change in function that suggests a physical disorder but has no physical cause. Apparently these symptoms are an expression of the patient's psychological problems that he has converted into physical symptoms.
- **Hypochondriasis** (**high**-poh-kon-**DRY**-ah-sis) is characterized by a preoccupation with fears of having, or the idea that one does have, a serious disease based on misinterpretation of one or more bodily signs or symptoms.

IMPULSE-CONTROL DISORDERS

- **Kleptomania** (**klep**-toh-**MAY**-nee-ah) is a disorder characterized by a recurrent failure to resist impulses to steal objects not for immediate use or their monetary value (**klept/o** means to steal and **-mania** means madness).
- **Pyromania** (**pye**-roh-**MAY**-nee-ah) is a disorder characterized by a recurrent failure to resist impulses to set fires (**pyr/o** means fire and **-mania** means madness).

PERSONALITY DISORDERS

- A **personality disorder** is an enduring pattern of inner experience and behavior that deviates markedly from the expectations of the individual's culture. This pattern is pervasive and inflexible, has an onset in adolescence or early adulthood, is stable over time, and leads to distress or impairment.
- An **antisocial personality disorder** is a pattern of disregard for, and violation of, the rights of others. This pattern brings the individual into continuous conflict with society.
- A **narcissistic personality disorder** (**nahr**-sih-**SIS**-tick) is a pattern of an exaggerated need for admiration and complete lack of empathy. *Empathy* (**EM**-pah-thee) is the ability to understand another person's mental and emotional state without becoming personally involved.

OTHER CONDITIONS

- **Malingering** (mah-**LING**-ger-ing) is characterized by the intentional creation of false or grossly exaggerated

physical or psychological symptoms, motivated by external incentives such as avoiding work.

- **Munchausen syndrome** (**MUHN**-chow-zen), named for a German nobleman in the 1700s, is a condition in which the "patient" repeatedly makes up clinically convincing simulations of disease for the purpose of gaining medical attention.
- **Munchausen syndrome by proxy** is a form of child abuse. Although seeming very concerned about the child's well-being, the abusive parent will falsify an illness in a child by making up or creating symptoms and then seeking medical treatment for the child.

DIAGNOSTIC PROCEDURES OF THE NERVOUS SYSTEM

- **Computed tomography,** also known as a **CT scan,** and **magnetic resonance imaging (MRI)** are important diagnostic tools of the nervous system because they can image the soft tissue structures of the brain and spinal cord (see Figures 10.14 and 10.16). These diagnostic techniques are discussed further in Chapter 15.
- **Echoencephalography** (**eck**-oh-en-**sef**-ah-**LOG**-rah-fee) is the use of ultrasound imaging to diagnose a shift in the midline structures of the brain (**ech/o** means sound, **encephal/o** means brain, and **-graphy** means the process of recording).
- **Electroencephalography** (ee-**leck**-troh-en-**sef**-ah-**LOG**-rah-fee) **(EEG)** is the process of recording the electrical activity of the brain through the use of electrodes attached to the scalp (**electr/o** means electric, **encephal/o** means brain, and **-graphy** means the process of recording). The resulting record is called an **electroencephalogram.** This electrical activity may also be displayed on a monitor as brain waves.
- **Encephalography** (en-**sef**-ah-**LOG**-rah-fee) is a radiographic study demonstrating the intracranial fluid-containing spaces of the brain (**encephal/o** means brain and **-graphy** means the process of recording). The resulting record is called an **encephalogram.**
- **Myelography** (**my**-eh-**LOG**-rah-fee) is a radiographic study of the spinal cord after the injection of a contrast medium (**myel/o** means spinal cord and **-graphy** means the process of recording). The resulting record is called a **myelogram.**
- Determining the patient's **level of consciousness (LOC)** is an important part of a neurologic evaluation. The LOC is established by observing the patient and evaluating his or her reactions to stimuli.

TREATMENT PROCEDURES OF THE NERVOUS SYSTEM

MEDICATIONS TO TREAT MENTAL DISORDERS

- **Tranquilizers,** also known as **antianxiety drugs,** suppress anxiety and relax muscles.
- An **antidepressant** prevents or relieves depression.
- An **antipsychotic** (**an**-tih-sigh-**KOT**-ick) is used to treat symptoms of severe psychiatric disorders.
- **Psychotropic drugs** (**sigh**-koh-**TROP**-pick) are capable of affecting the mind, emotions, and behavior and are used in the treatment of mental illnesses.

PAIN CONTROL

- **Transcutaneous electronic nerve stimulation (TENS)** is a method of pain control by the application of electronic impulses to the nerve endings through the skin.
- An **analgesic** (**an**-al-**JEE**-zick) is a drug that relieves pain without affecting consciousness.
- **Nonnarcotic analgesics** such as aspirin are used for mild to moderate pain.
- **Narcotic analgesics** such as morphine, Demerol, and codeine are used to relieve severe pain. However, they may cause physical dependence or addiction.

SEDATIVE AND HYPNOTIC MEDICATIONS

- A **sedative** depresses the CNS to produce calm and diminished responsiveness without producing sleep. **Sedation** is the effect produced by a sedative.
- A **hypnotic** depresses the CNS and usually produces sleep.
- A **barbiturate** (bar-**BIT**-you-rayt) is a class of drugs whose major action is a calming or depressed effect on the CNS.
- **Amobarbital** (**am**-oh-**BAR**-bih-tal) is a barbiturate used as a sedative and hypnotic.
- **Phenobarbital** (**fee**-noh-**BAR**-bih-tal) is a barbiturate used as a sedative and as an anticonvulsant.
- An **anticonvulsant** (**an**-tih-kon-**VUL**-sant) prevents seizures and convulsions.

ANESTHESIA

Anesthesia (**an**-es-**THEE**-zee-ah) is the absence of normal sensation, especially sensitivity to pain (**an-** means without and **-esthesia** means feeling).

- An **anesthetic** (**an**-es-**THET**-ick) is the medication used to induce anesthesia. The anesthetic may be topical, local, regional, or general.
- **Topical anesthesia** numbs only the tissue surface and is applied as a liquid, ointment, or spray.
- **Local anesthesia** is the loss of sensation in a limited area and is produced by injecting an anesthetic solution near that area.
- **Regional anesthesia,** the temporary interruption of nerve conduction, is produced by injecting an anesthetic solution near the nerves to be blocked.
- **Epidural anesthesia** (**ep**-ih-**DOO**-ral **an**-es-**THEE**-zee-ah) is regional anesthesia produced by injecting a local anesthetic into the epidural space of the lumbar or sacral region of the spine.
- **Spinal anesthesia** is produced by injecting an anesthetic into the subarachnoid space that is located below the arachnoid membrane and above the pia mater that surrounds the spinal cord.
- **General anesthesia** involves the total loss of body sensation and consciousness as induced by various anesthetic agents, given primarily by inhalation or intravenous injection.

BRAIN AND HEAD

- **Electroshock therapy,** also known as **electroconvulsive therapy** (ee-**leck**-troh-kon-**VUL**-siv) **(ECT),** is a controlled convulsion produced by the passage of an electric current through the brain. ECT is used primarily in the treatment of depression and mental disorders that do not respond to other forms of therapy.
- A **lobectomy** (loh-**BECK**-toh-mee) is surgical removal of a portion of the brain to treat brain cancer or seizure disorders that cannot be controlled with medication.
- A **thalamotomy** (**thal**-ah-**MOT**-oh-mee) is a surgical incision into the thalamus (**thalam** means thalamus and **-otomy** means surgical incision). This procedure, which destroys brain cells, is performed to quiet the tremors of Parkinson's disease, to treat some psychotic disorders, or to stop intractable pain.

NERVES

- A **neurectomy** (new-**RECK**-toh-mee) is the surgical removal of a nerve (**neur** means nerve and **-ectomy** means surgical removal).
- **Neuroplasty** (**NEW**-roh-**plas**-tee) is the surgical repair of a nerve or nerves (**neur/o** means nerve and **-plasty** means surgical repair).
- **Neurorrhaphy** (new-**ROR**-ah-fee) is suturing together of the ends of a severed nerve (**neur/o** means nerve and **-rrhaphy** means to suture).
- A **neurotomy** (new-**ROT**-oh-mee) is a surgical incision or the dissection of a nerve (**neur** means nerve and **-otomy** means a surgical incision).

Career Opportunities

In addition to the medical specialties already discussed, some of the health occupations involving the treatment of the nervous system include

- **Electroencephalographic (EEG) technologist:** operates an electroencephalograph, recording the electrical activity of the brain for diagnosis and evaluation
- **Electroneurodiagnostic technologist:** in addition to performing EEGs, performs nerve conduction tests, measures sensory and physical responses to specific stimuli, and conducts sleep studies and ambulatory monitoring
- **Polysomnographic technologist:** administers sleep disorder evaluations
- **Social worker:** trained to help people make adjustments in their lives or to refer them to community resources for assistance; also called case managers, counselors, or sociologists. Some specialties include

Child welfare and family counseling	Health care social work
Correctional (prison) counseling	Occupational social work
Geriatrics and hospice work	Psychiatric social work

- **Social services assistant:** aids social workers by maintaining records and performing other administrative tasks, often for a government agency
- **Psychiatric** or **mental health technician, assistant,** and **aide:** work under the supervision of a psychiatrist or psychologist to help patients with care and rehabilitation. They may also observe and report behavior.
- **Art, music,** and **dance therapists:** use creative arts for nonverbal expression of feelings, for communication, and for social integration. They may work with patients suffering from mental disorders, emotional trauma, or other social, psychological, or physical problems.
- **Recreational therapist:** uses creative arts and other activities such as sports and field trips to improve the patient's physical, emotional, and mental well-being.

Health Occupation Profile: Mental Health Worker

Shawn Goldwyn, 28, is a mental health worker in a psychiatric hospital. "In my job, I help people who are experiencing some form of mental crisis. Some of my patients have hallucinations or hear voices telling them to hurt themselves or others. Others have experienced severe trauma in their lives, have chemical imbalances that make them extremely aggressive or uninhibited, or are so profoundly depressed that suicide feels like the only option. My job is to make sure they are in a safe and supportive environment. Sometimes, I help run groups to teach different coping skills and ways to manage anger, anxiety, or depression. Most of the time, I sit and listen to them talk."

"I have always been a good listener. In high school, friends would seek me out to tell me their problems. This job is perfect for someone with lots of patience and understanding. It also helps to be flexible. Some days are very chaotic, and I never know what will happen next; other days are quieter and more predictable. Every day is different, and I like that."

STUDY BREAK

We all know that hitting your funny bone is not really funny.

The sudden, sharp pain we associate with the "funny bone" comes from the *ulnar nerve*. Why does it hurt so much when it is hit? The ulnar nerve is a long one running from the spinal cord to the fingertips. In most places along the way, it is protected by muscle or fat. But when it runs past the elbow joint, it is close to the skin. When you accidentally hit your elbow (which is easy to do, because it sticks out), you hit the ulnar nerve against the bone, causing a sharp pain or tingling sensation.

The ankle also has a nerve that runs close to the surface and can cause similar pain. But, because the ankle doesn't move about as widely as the elbow, it is less likely to be bumped sharply.

And why do we call the bone that carries the ulnar nerve to the elbow a funny bone? Because its scientific name, the *humerus*, sounds a lot like the word *humorous*.

Review Time

Write the answers to the following questions on a separate piece of paper or in your notebook. In addition, be prepared to take part in the classroom discussion.

1. **Written assignment:** Using terms a physician would understand, describe the difference between an **encephalocele** and a **meningocele.**

   Discussion assignment: Discuss how the word parts tell you what these terms mean.

2. **Written assignment:** Describe the difference between a **concussion** and a **contusion.**

   Discussion assignment: How could each type of injury occur?

3. **Written assignment:** Using terms a patient would understand, describe the difference between a **panic attack** and an **anxiety state.**

   Discussion assignment: How would each condition affect the quality of life for the patient?

4. **Written assignment:** Research and report on the full name and dates of the person for whom **Alzheimer's disease** is named.

   Discussion assignment: Mr. Greene has just been diagnosed with Alzheimer's disease. What should his family be prepared to face in the months and years ahead?

5. **Written assignment:** Describe the difference between an **ischemic stroke** and a **hemorrhagic stroke.**

   Discussion assignment: Why is receiving treatment quickly so important for a stroke patient?

Optional Internet Activity

The goal of this activity is to help you learn more about medical terminology while improving your Internet skills. Select **one** of these two options and follow the instructions.

1. **Internet Search:** Search for information about **Alzheimer's disease.** Write a brief (one- or two-paragraph) report on something new you learned here and include the address of the web site where you found this information.
2. **Web Site:** To learn more about **brain injuries** go to this web address: **http://www.braincenter.org/**. Explore the site and then write a brief (one- or two-paragraph) report on something new you learned here.

The Human Touch: Critical Thinking Exercise

The following story and questions are designed to stimulate critical thinking through class discussion or as a brief essay response. There are no right or wrong answers to these questions.

Calle Washington read the information Dr. Thakker gave her with numb disbelief. "Multiple sclerosis is a neurological disorder characterized by demyelination of nerve fibers in the brain and spinal column. This disease may be progressively debilitating with symptoms that could include numbness, paralysis, ataxia, pain, and blindness. Some patients do experience life-threatening complications. This disease attacks young adults. It affects more women than men."

"Well, I sure fit the profile," thought Calle bitterly. She took a deep breath, trying to quiet the fluttering in her stomach. How could this happen now? Everything was so perfect. Her wedding gown was getting its last alterations, and the tickets for her honeymoon in Jamaica were in the desk drawer. Gabe was putting the final touches on the house where they planned on raising their family. Suddenly, her fairy tale life was turning into a nightmare.

She couldn't expect Gabe to waste his future caring for someone in a wheelchair, could she? And what would happen once her fellow teachers at the day care center noticed that her balance was sometimes off? She couldn't risk hurting one of the children, but if she lost her job she'd lose her health insurance. Dr. Thakker had said there were new drugs for MS, but he'd mentioned that they were very expensive. And what about the children that she and Gabe both wanted? Could she still have a baby and take care of it?

"Maybe I should take out an ad that says 'Twenty-five year old female seeks cure for deadly disease before marrying Prince Charming,'" she thought, trying to laugh through her tears.

Suggested Discussion Topics

1. Discuss whether Calle and Gabe should go ahead with the wedding.
2. How might Calle's condition affect her job? Should she be asked to resign?
3. If Calle loses her job at the day care center and tries to find work elsewhere, should she disclose the fact that she has MS?
4. Insurance companies want the people they insure to have a physical examination and provide information about previous illnesses and diseases. Discuss whether you think this is an ethical practice. If you think it is not ethical, why do you think the insurance companies do it?
5. What federal legislation is designed to help disabled individuals? Do you think this law would apply to Calle's situation?

Student Workbook and Student Activity CD-ROM

1. Go to your **Student Workbook** and complete the Learning Exercises for this chapter.
2. Go to the **Student Activity CD-ROM** and have fun with the exercises and games for this chapter.

CHAPTER

11

Special Senses: The Eyes and Ears

Overview of Structures, Word Parts, and Functions of the Eyes and Ears

Major Structures	Related Word Parts	Primary Functions
Eyes	**opt/i, opt/o, optic/o, ophthalm/o**	Receptor organs for the sense of sight.
Adnexa of the eye		Accessory structures that provide external protection and movement for the eyes.
Lacrimal apparatus	**lacrim/o, dacry/o**	Produces, stores, and removes tears.
Iris	**ir/i, ir/o, irid/o, irit/o**	Controls the amount of light entering the eye.
Lens	**phac/o**	Focuses rays of light on the retina.
Retina	**retin/o**	Converts light images into electrical impulses and transmits them to the brain.
Ears	**acous/o, acout/o, audi/o, audit/o, ot/o**	Receptor organs for the sense of hearing; also help to maintain balance.
Outer ear	**pinn/i**	Transmits sound waves to the middle ear.
Middle ear	**myring/o, tympan/o**	Transmits sound waves to the inner ear.
Inner ear	**labyrinth/o**	Receives sound vibrations and transmits them to the brain.