

NERVOUS SYSTEM



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SYNOPSIS

- NEUROLOGY
- NEUROLOGIST
- NEURO SURGEON
- PSYCHIATRY
- PSYCHIATRIST
- DIVISIONS OF NERVOUS SYSTEM
- STRUCTURE AND FUNCTIONS OF NERVOUS SYSTEM
- EXAMINATION
- PATHOLOGY
- DIAGNOSTIC TESTS
- MEDICAL TERMS
- ABBREVIATIONS

GENERAL TERMS

- The **nervous system** is the part of the body that allows for thought and interaction with the outside world and is comprised of the brain, spinal cord, and other nerves which send and receive information throughout the body.
- **Neurology** is the medical study of the structure of the nervous system, along with related diseases and conditions and their treatment
- A physician who specializes in this area is a **neurologist**
- Physicians who specialize in neurologic surgery are called **neurosurgeons**

- **Psychiatry** encompasses the diagnosis, treatment, and prevention of mental illness.
- A physician who specializes in diagnosing, treating, and preventing mental illness is a **psychiatrist**.

DIVISIONS OF NERVOUS SYSTEM

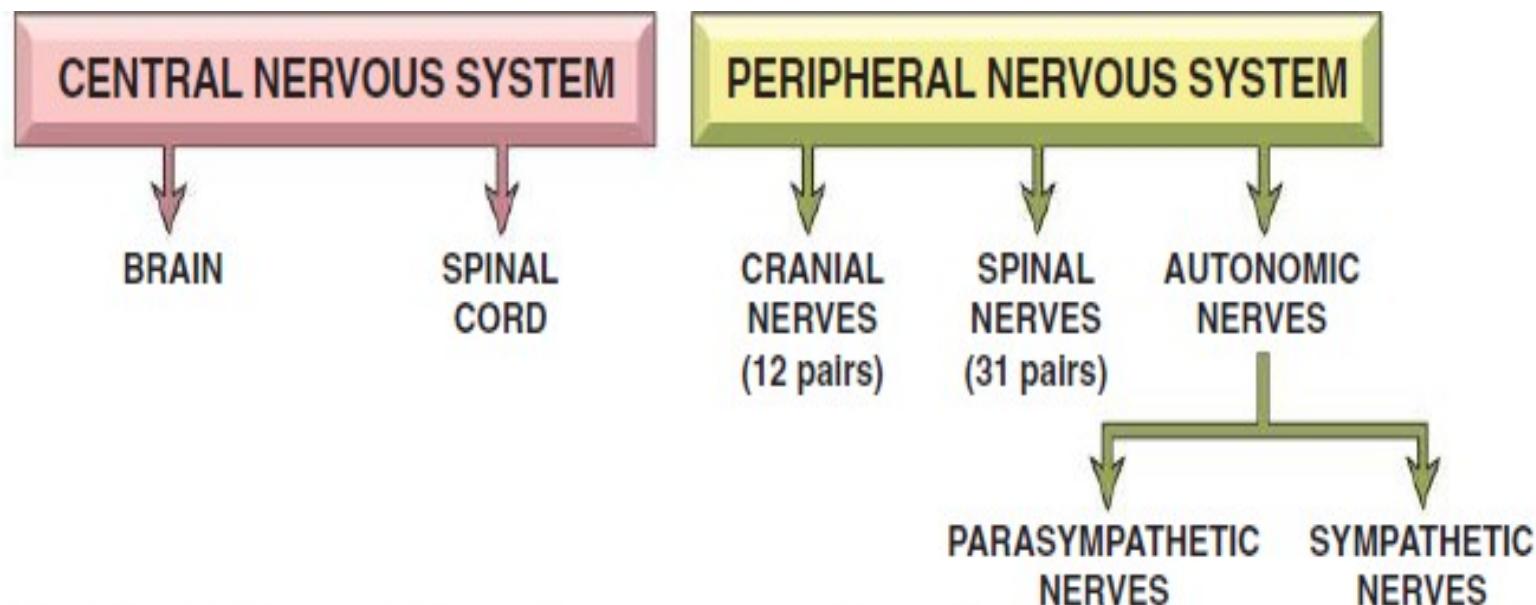


FIGURE 10-4 Divisions of the central nervous system (CNS) and peripheral nervous system (PNS). The autonomic nervous system is a part of the peripheral nervous system.

BRAIN , SPINAL CORD , NERVES

- The brain is responsible
 - for intelligence and thinking
 - response to sensation
 - control of all voluntary movement and many involuntary bodily functions.
 - center for memory and emotion.
- The spinal cord is a conduit for transmitting signals between the brain and peripheral nerves.
- Nerves are responsible for detecting and sending signals for sensation, movement, and involuntary control of bodily functions.
- The nervous system is vital for the proper function and safety of the individual.
- Problems with any part of the nervous system can lead to serious consequences and decreased quality of life.

NEURON

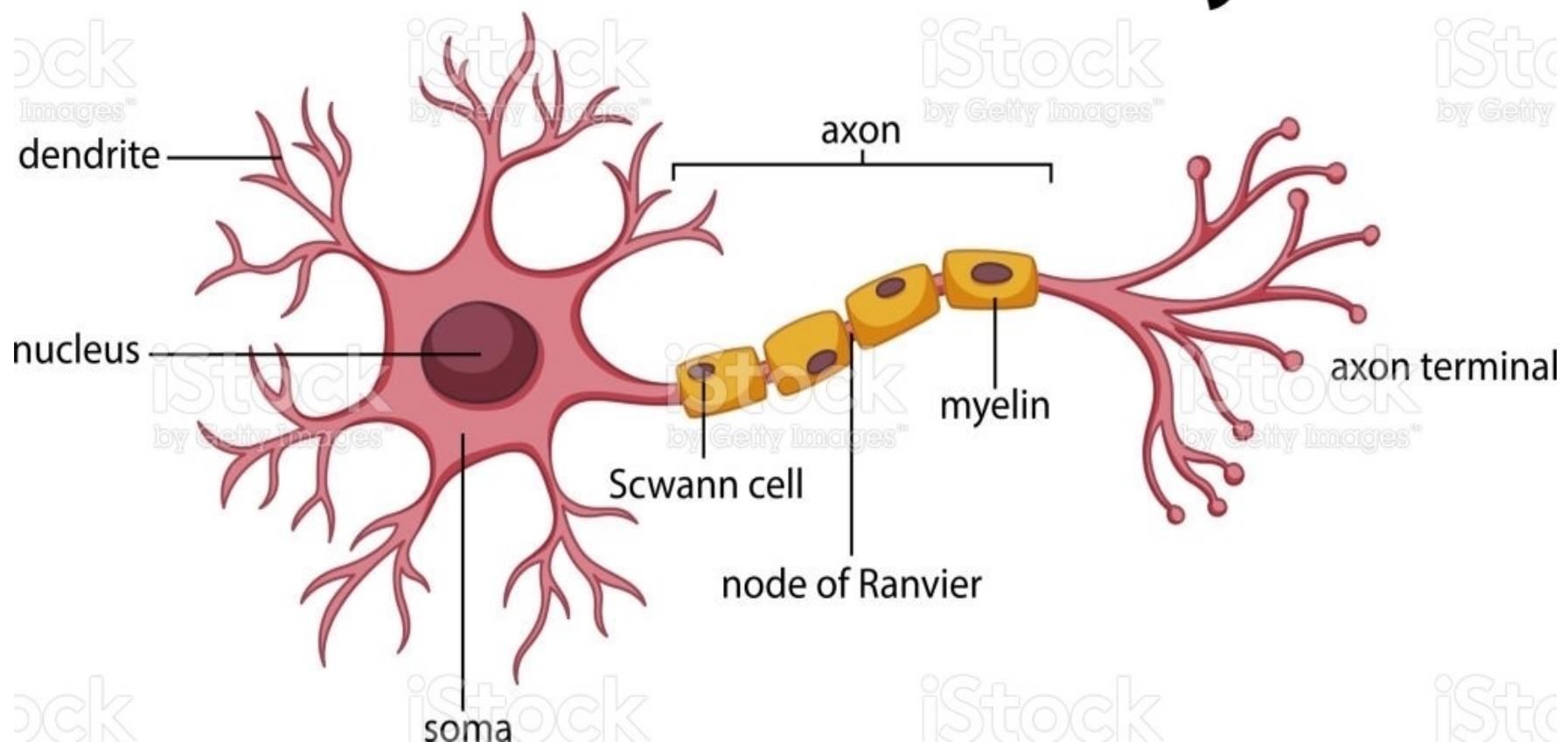
- All nerve tissue, regardless of where it occurs in the body, is comprised of nerve cells **called neurons (STRUCTURAL AND FUNCTIONAL UNIT)**
- Each neuron consists of:
 - a cell body
 - dendrites
 - an axon
- Each nerve cell body has a **single nucleus and several dendrites.**
- **Dendrites** are processes that branch from a cell body. The ends of dendrites have receptors that receive information from other neurons or sensory receptors.
- **An axon is a single long fiber** that extends from a cell body - conducts impulses either away from or toward the cell body.

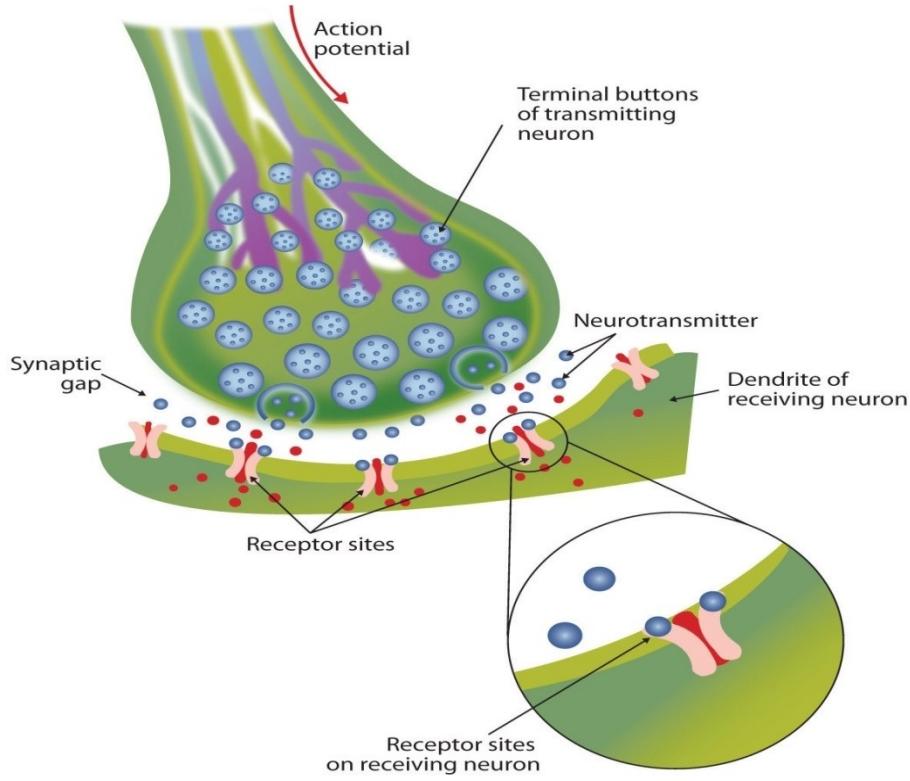
- Axons are typically covered by an insulating layer of fatty tissue called a **myelin sheath** (to insulate the axon and speed transmission of electrical impulses)
- A **synapse** is a communication between two neurons. The word also refers to the junction where one neuron transmits an impulse to another neuron or to an effector cell.
- **Effector tissue** is tissue that receives nerve impulses and reacts by secreting or contracting.
- **For example**, effector tissue in a muscle might cause the muscle to contract, whereas effector tissue in a gland might cause secretion of a hormone.

- Chemicals **called neurotransmitters** help transmit impulses across synaptic junctions.
- The neurotransmitter **is released by the axon** and travels across the junction to a receiving cell.
- Neurons are the “**working**” **cells** of the nervous system; whereas other cells called **neuroglia** **serve supportive and connective functions**.
- Unlike neurons, neuroglia do not transmit impulses.

- **FOUR TYPES OF SUPPORTING OR GLIAL CELLS**
- Astrocytes - blood-brain barrier (BBB)
- Microglial cells
- Oligodendroglial cells (oligodendrocytes)
- ependymal cells

Neuron Anatomy



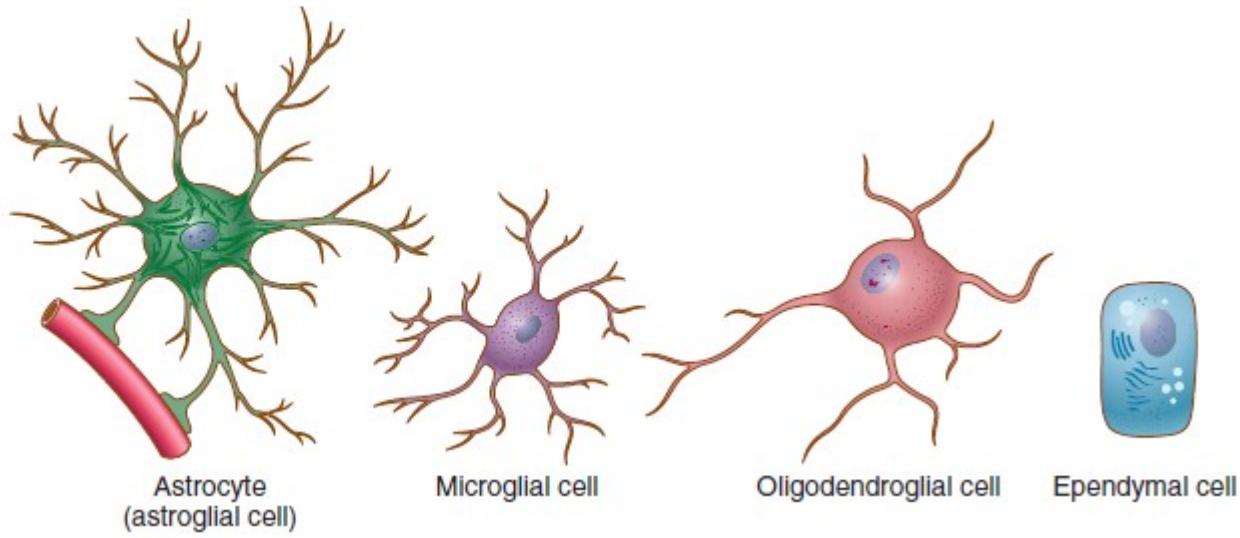


SYNAPSE

Acetylcholine, norepinephrine, epinephrine (adrenaline), dopamine, serotonin, and endorphins are examples of neurotransmitters

GLIAL CELLS

FIGURE 10-6 Glial cells (neuroglial cells). These are the supportive, protective, and connective tissue cells of the CNS. Glial cells are **stromal** (framework) **tissue**, whereas neurons carry nervous impulses.



THE BRAIN

- The brain is the most complex organ in the human body. It consists of four major components:
 - cerebrum
 - cerebellum
 - diencephalon
 - brainstem

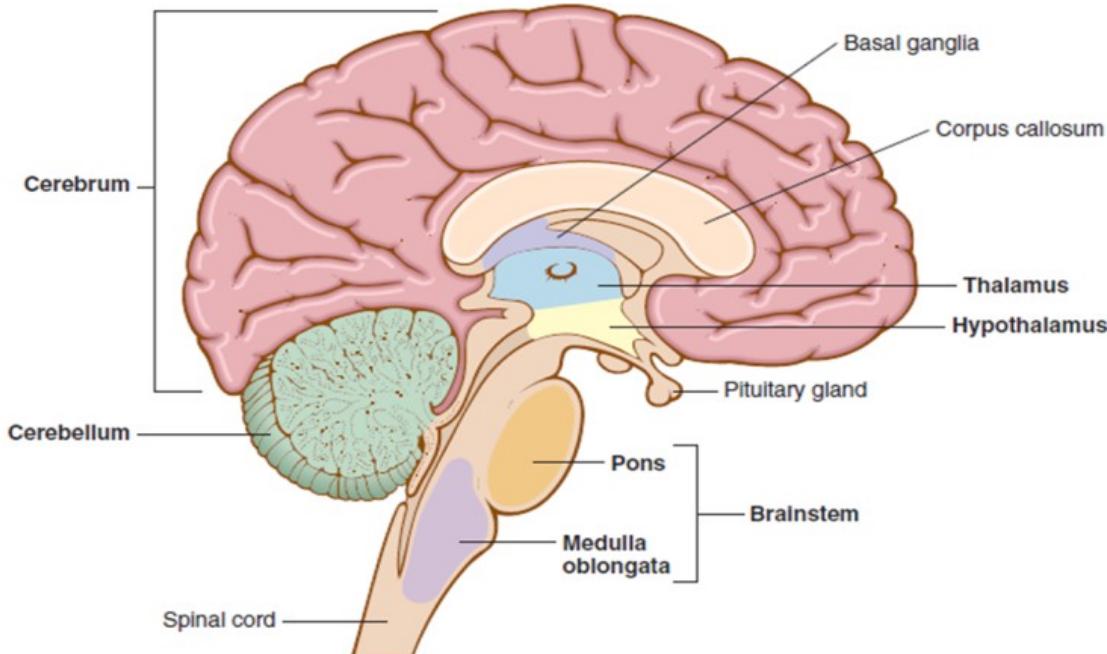
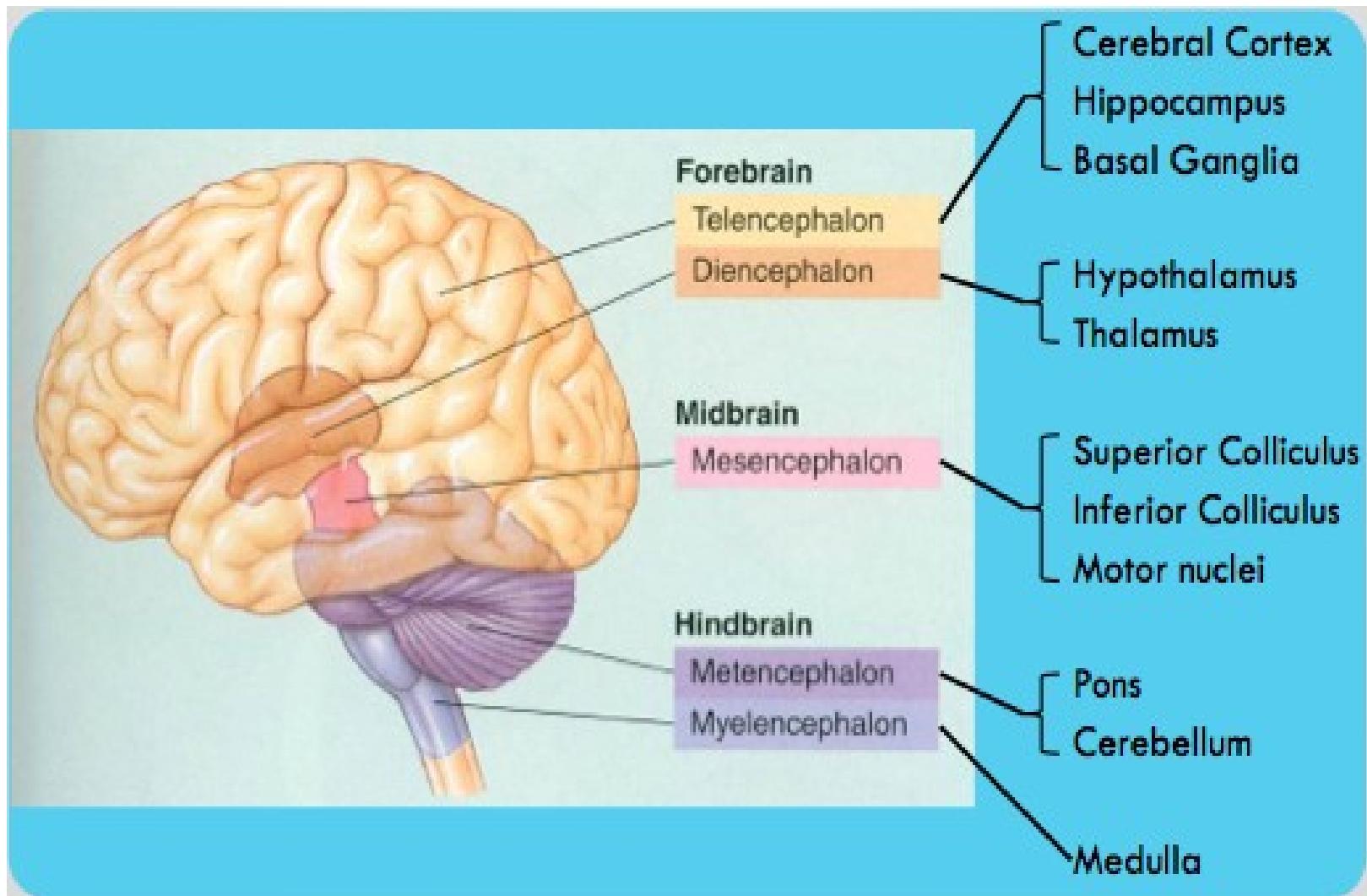


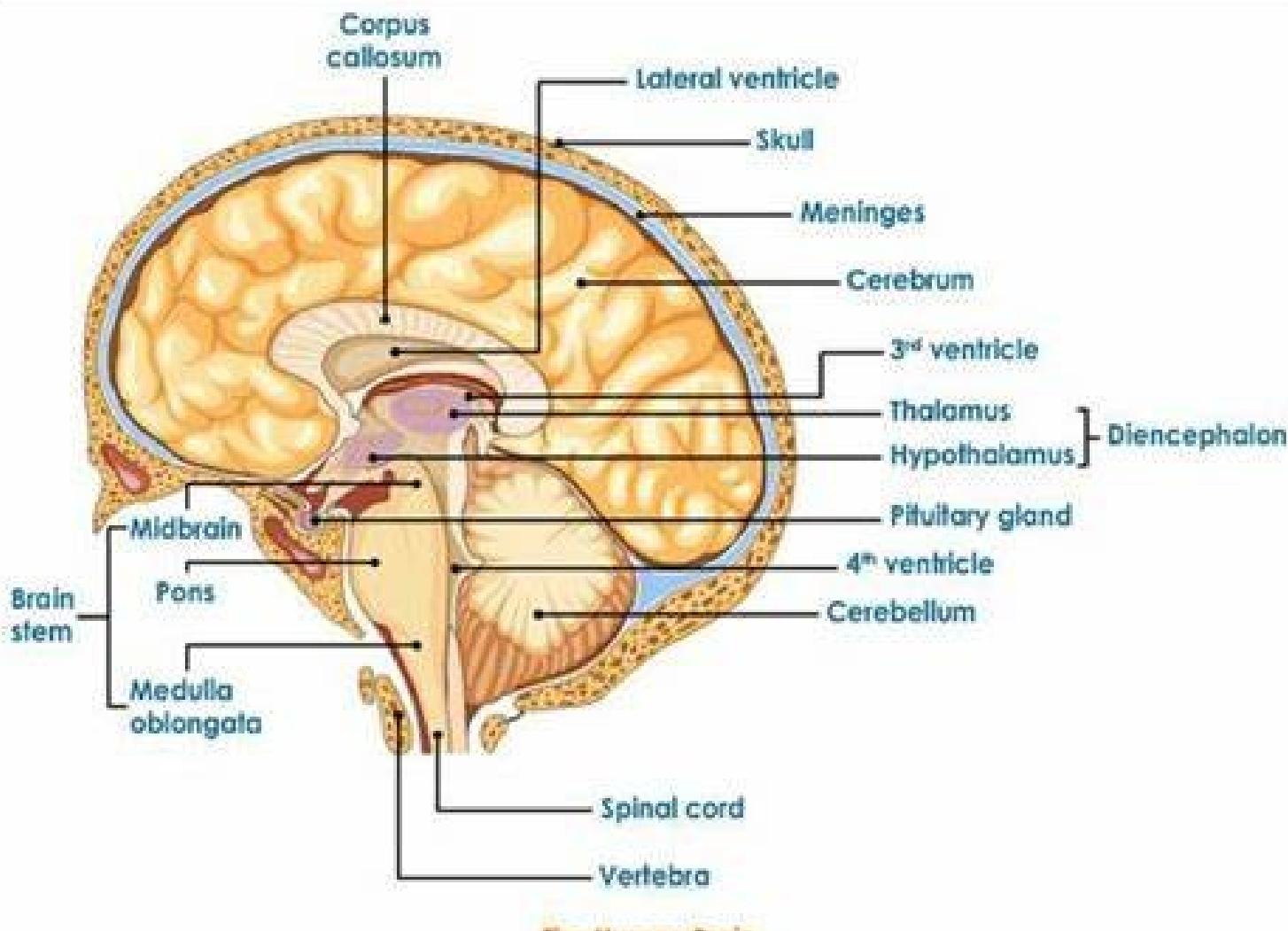
FIGURE 10-9 Parts of the brain: cerebrum, thalamus, hypothalamus, cerebellum, pons, and medulla oblongata. Note the location of the pituitary gland below the hypothalamus. The basal ganglia (a group of cells) regulate intentional movements of the body. The corpus callosum lies in the center of the brain and connects the two hemispheres (halves).

Five Major divisions of the Brain

Brainstem

- 1. Telencephalon] Forebrain
- 2. Diencephalon
- 3. Mesencephalon] Midbrain
- 4. Metencephalon]
- 5. Myelencephalon] Hindbrain





CEREBRUM

- Superior part of the brain and is the largest structure.
- The cerebrum is responsible for thought processes, memory, judgments, and voluntary movement.
- It is divided **into two halves called the right and left hemispheres.**
- These two hemispheres are partially **divided by a longitudinal fissure.**
- The two hemispheres are **joined by the corpus callosum**, allowing them to communicate with one another.
- Each hemisphere is divided into the frontal, parietal, temporal, and occipital lobes

- **The frontal lobe**
 - responsible for **voluntary movement**
 - **Smell**
 - a variety of thought processes including **perception, association, mood, and memory.**
 - **important role in speech**
- **The parietal lobe**
 - receives and evaluates a wide variety of **sensory input, including touch, pain, taste, and the sense of equilibrium.**
 - It also is **responsible for some aspects of speech**

- The temporal lobe
 - evaluates olfactory and auditory input
 - Important in memory.
- The occipital lobe
 - receives and integrates visual input.

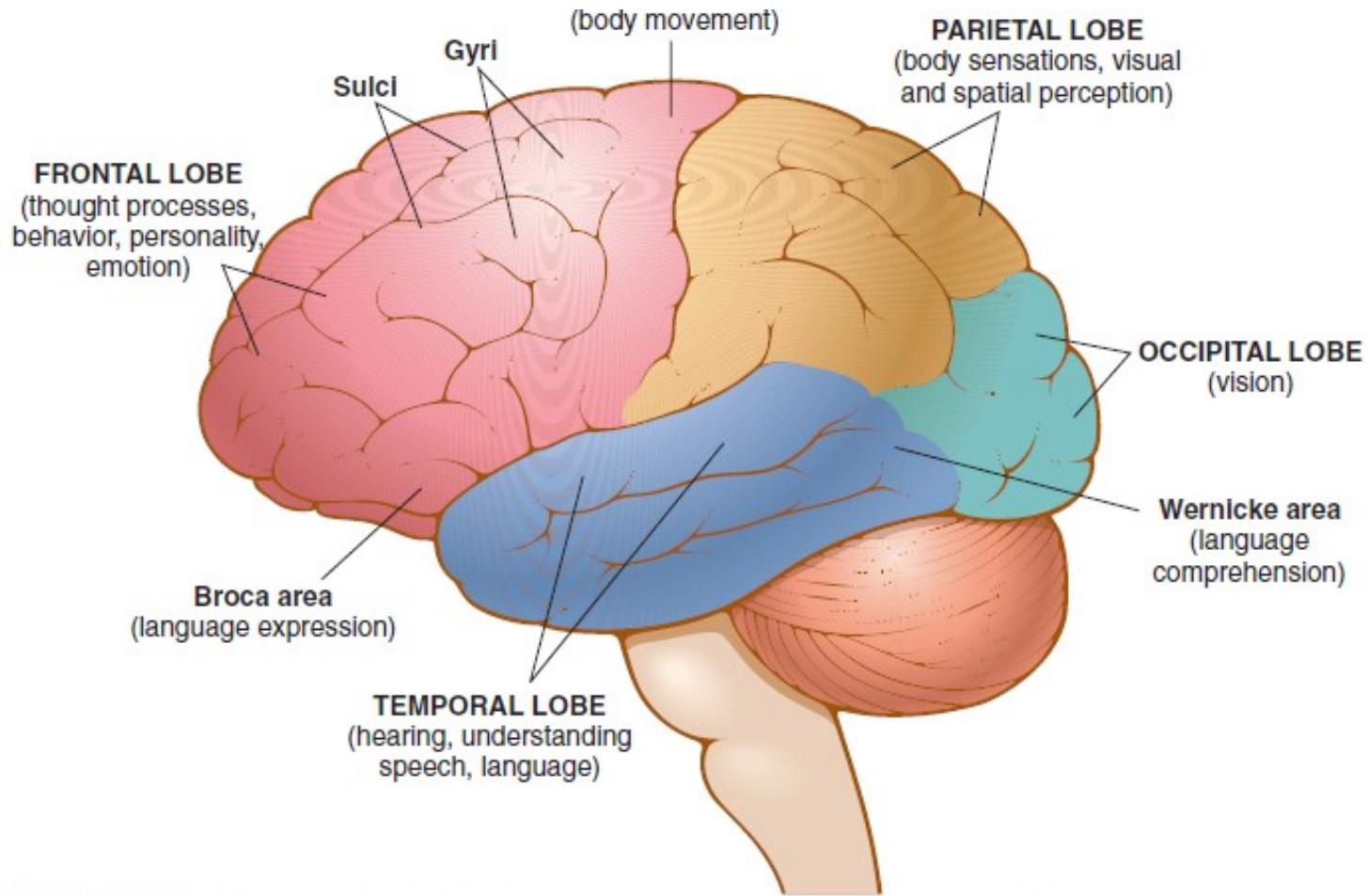
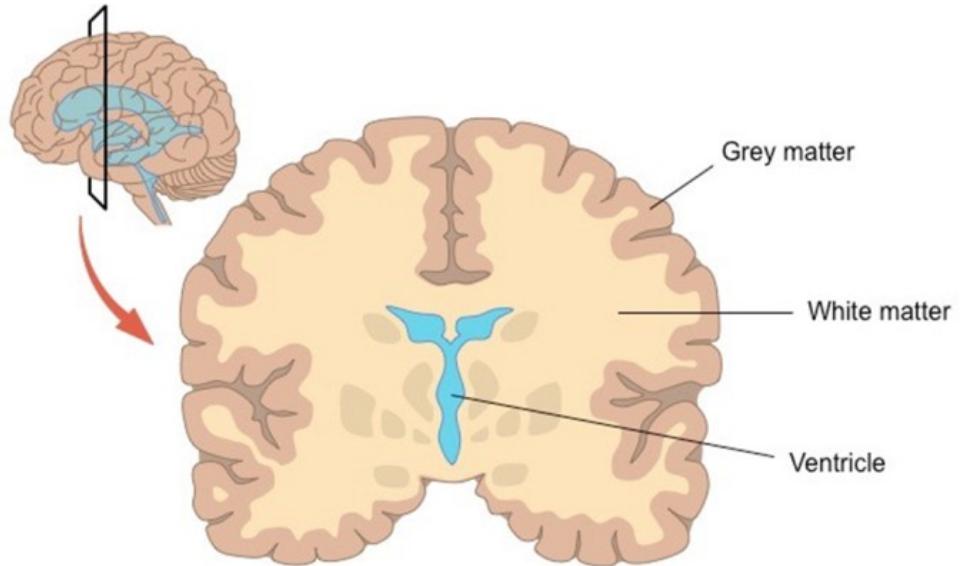
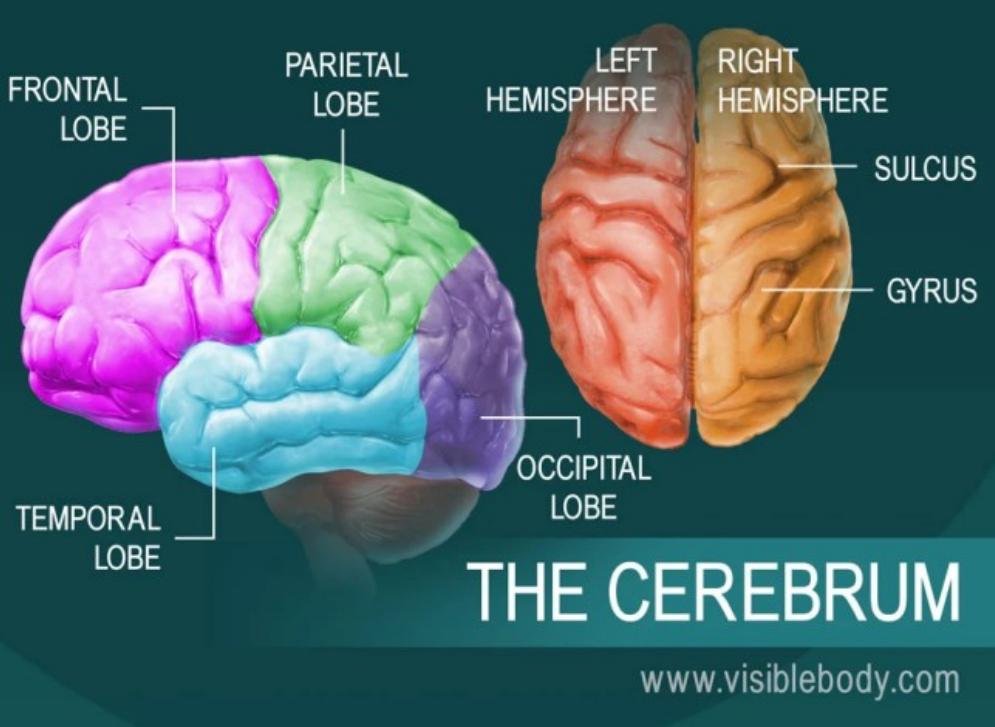


FIGURE 10-7 Left cerebral hemisphere (lateral view). Gyri (convolutions) and sulci (fissures) are indicated. Notice the lobes of the cerebrum and the functional centers that control speech, vision, movement, hearing, thinking, and other processes. Neurologists believe that the two hemispheres have different abilities. The **left brain** is more concerned with language, mathematical functioning, reasoning, and analytical thinking. The **right brain** is more active in spatial relationships, art, music, emotions, and intuition.

CEREBRAL CORTEX

- The entire cerebrum is covered by **the cerebral cortex, a thin layer of gray matter** containing the cell bodies of the brain cells in the cerebrum.
- The cerebral cortex contains **deep folds** called **gyri**, which are separated by **furrows called sulci**. Gyri greatly increase the surface area of the cerebral cortex.
- The brain tissue underneath the cerebral cortex is called **white matter**
- **white** because the numerous axons are covered with **myelin sheaths**.



CSF

- Within the cerebrum are open spaces called **ventricles** that contain a clear watery fluid called **cerebrospinal fluid (CSF)**.
- **CSF flows throughout the brain and spinal cord** and cushions these structures from shock.
- **CSF** is produced by the **choroid plexus** (tufts of small capillary vessels) located in the various ventricles in the brain.

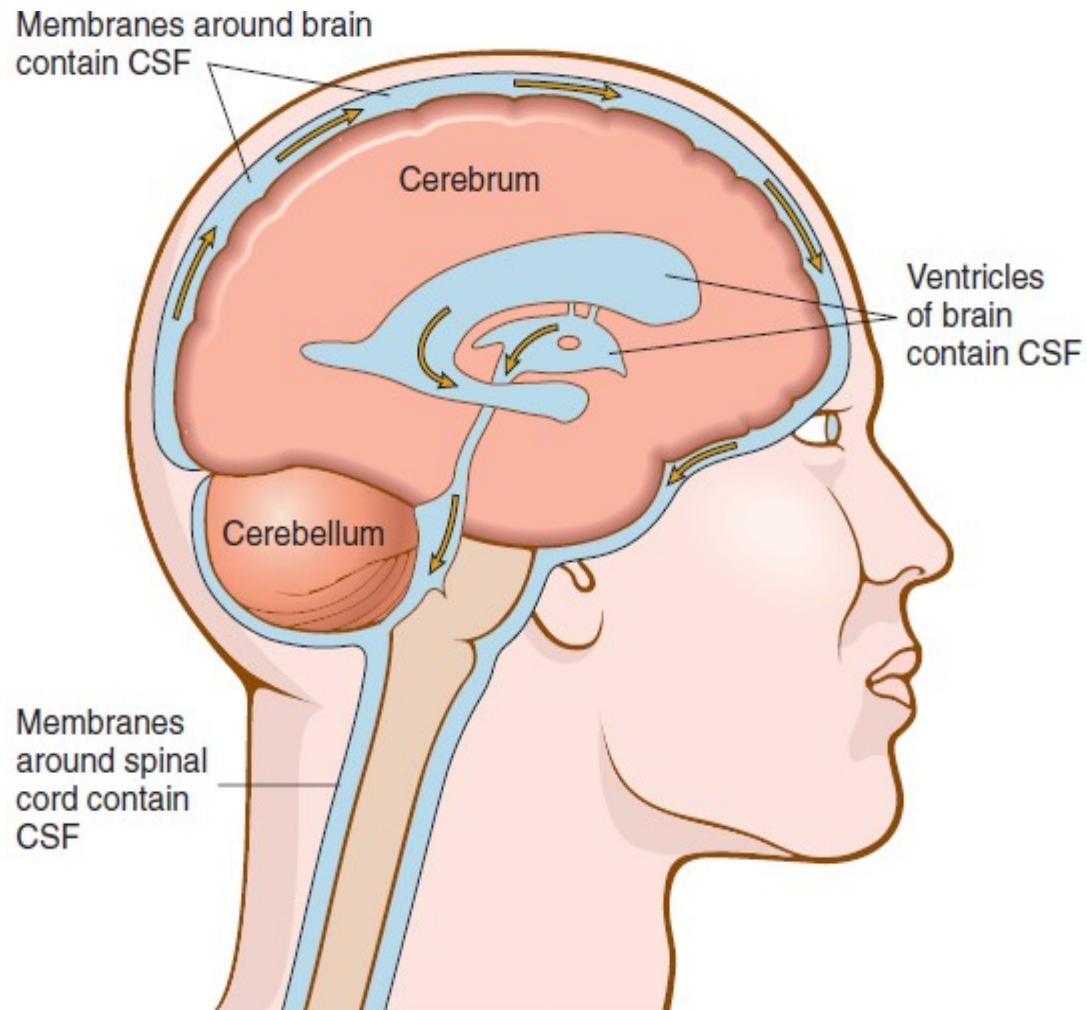


FIGURE 10-8 Circulation of cerebrospinal fluid (CSF) in the brain (ventricles) and around the spinal cord. CSF is formed within the ventricles and circulates between the membranes around the brain and within the spinal cord. CSF empties into the bloodstream through the membranes surrounding the brain and spinal cord.

CEREBELLUM

- The next largest portion of the brain is the **cerebellum**.
- It looks like a small ball of yarn, about the size of a golf ball.
- It is in **the posterior portion of the brain** and is responsible for **controlling movement** and **maintaining equilibrium**.

DIENCEPHALON :

- Deep within the brain is the structure known as the **diencephalon**, which has a number of components, including the **thalamus and hypothalamus**.
- The **thalamus** processes **sensory impulses** (except olfactory impulses) and then relays these impulses to the cerebral cortex.

HYPOTHALAMUS

- The **hypothalamus**, which is about the size of a **large pea**, is responsible for **regulating body temperature, blood pressure, and heart rate**.
- Hormones secreted by the hypothalamus are responsible for **controlling the pituitary gland**.
- The hypothalamus also governs **emotions and needs such as anger, pleasure, hunger, thirst, and sex drive**.

BRAIN STEM

- Brainstem consists of three components: the midbrain, the pons, and the medulla oblongata.
- The brainstem connects the lower part of the brain with the spinal cord.
- The midbrain (mesencephalon), the superior portion of the brainstem, helps in coordinating eye movements and controlling pupil diameter and lens shape.
- In addition, it provides pathways between the cerebrum and the spinal cord.
- Below the midbrain lies the pons, which relays information between the cerebrum and the cerebellum.

- **The medulla oblongata**
 - most inferior portion of the brainstem
 - 1. **Respiratory center**—controls muscles of respiration in response to chemicals or other stimuli
 - 2. **Cardiac center**—slows the heart rate when the heart is beating too rapidly
 - 3. **Vasomotor center**—affects (constricts or dilates) the muscles in the walls of blood vessels, thus influencing blood pressure
 - SWALLOWING

RAS

- Within the diencephalon and the upper part of the brainstem is a structure called **the reticular activating system (RAS)**
- This system interacts with the cerebrum to **Maintain consciousness.**
- If this system is not working properly, an individual can go into a **coma (a state of profound unconsciousness from which one cannot be aroused).**

TABLE 10-1

FUNCTIONS OF THE PARTS OF THE BRAIN

Structure	Function(s)
Cerebrum	Thinking, personality, sensations, movements, memory
Thalamus	Relay station ("triage center") for sensory impulses; control of awareness and consciousness
Hypothalamus	Body temperature, sleep, appetite, emotions, control of the pituitary gland
Cerebellum	Coordination of voluntary movements and balance
Pons	Connection of nerves (to the eyes and face)
Medulla oblongata	Nerve fibers cross over, left to right and right to left; contains centers to regulate heart, blood vessels, and respiratory system

THE SPINAL CORD

- The **spinal cord is a cylindrical mass of nerve tissue** that extends from the medulla oblongata to the upper lumbar vertebrae.
- It is **encased in the vertebral column**.
- **Motor and sensory nerve pathways** emerge from the spine via nerve roots that split and reorganize to become peripheral nerves.
- There are **31 pairs of spinal nerves** that emerge from the spinal cord.
- Most of the spinal nerves exit the vertebral column between adjacent vertebrae.

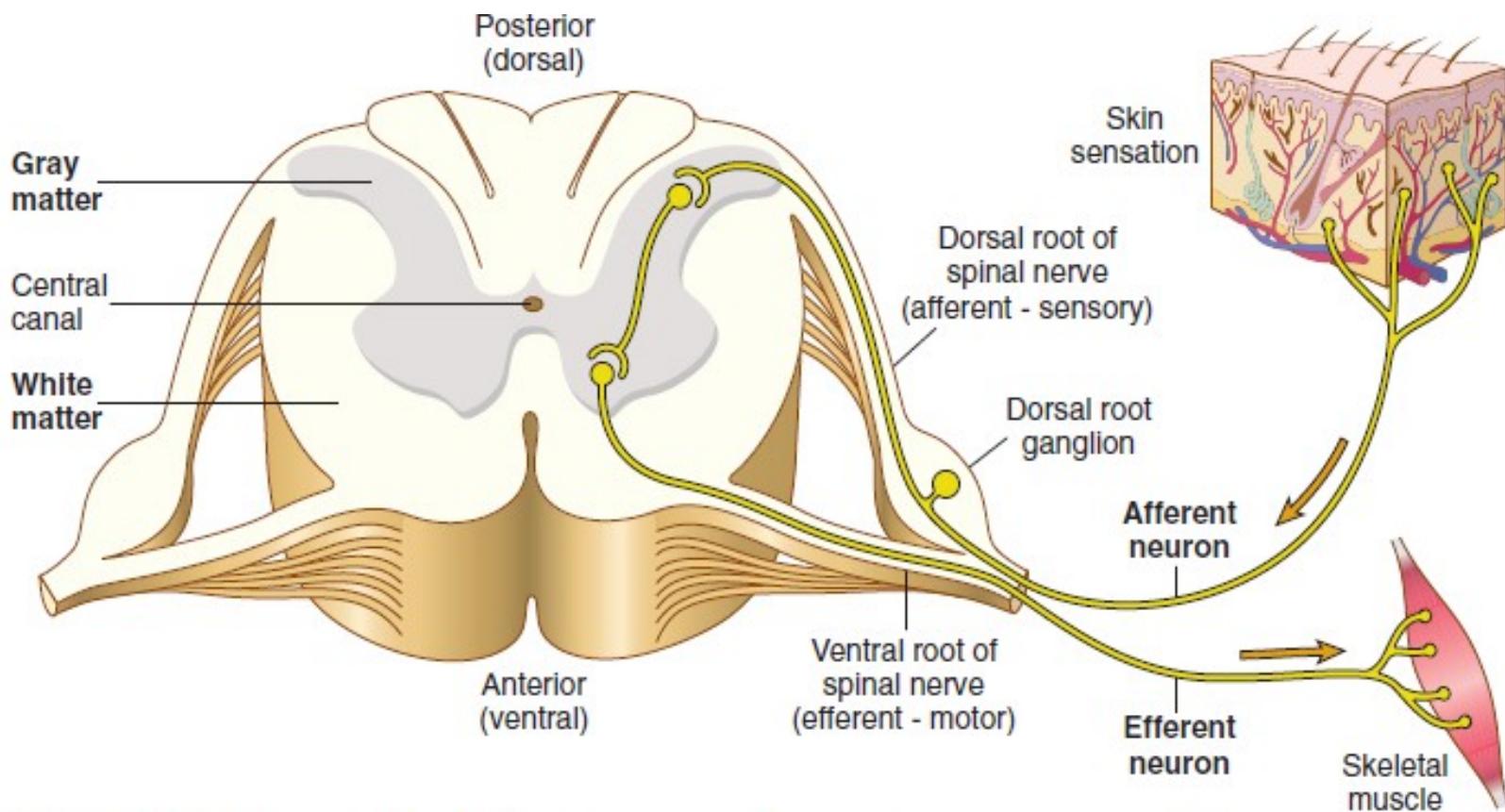


FIGURE 10-10 The spinal cord, showing gray and white matter (transverse view). Afferent neurons bring impulses from a sensory receptor (such as the skin) into the spinal cord. Efferent neurons carry impulses from the spinal cord to effector organs (such as skeletal muscle). The central canal is the space through which CSF travels.

MENINGES

- The brain and spinal cord are surrounded by **three layers** of connective tissue called **meninges**.
- The most superficial layer is the **dura mater, which is thick and protective.**
- The **second meningeal layer is the arachnoid membrane.**
- Arachnoid means “spiderlike.” This membrane is comprised of **web like fibers** that provide room for the movement of cerebrospinal fluid (CSF).
- Innermost meninges, **the pia mater**
- **subarachnoid space (b/w arachnoid & pia mater)** that is filled with CSF.
- The pia mater is tightly bound to the brain and spinal cord and contains a rich supply of blood vessels

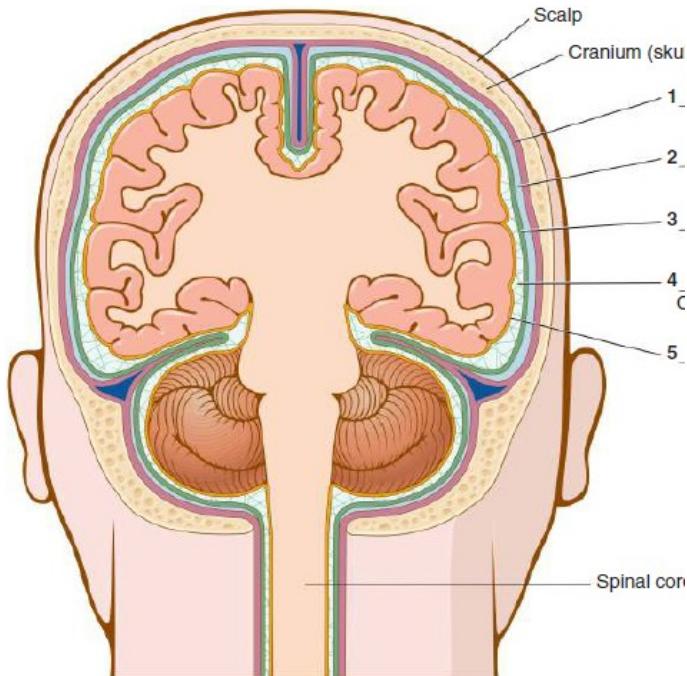
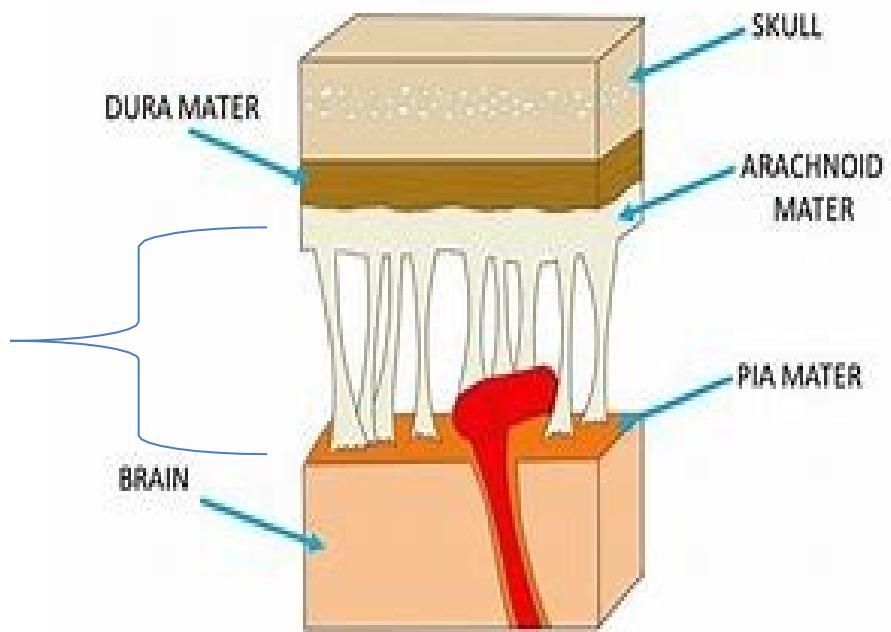


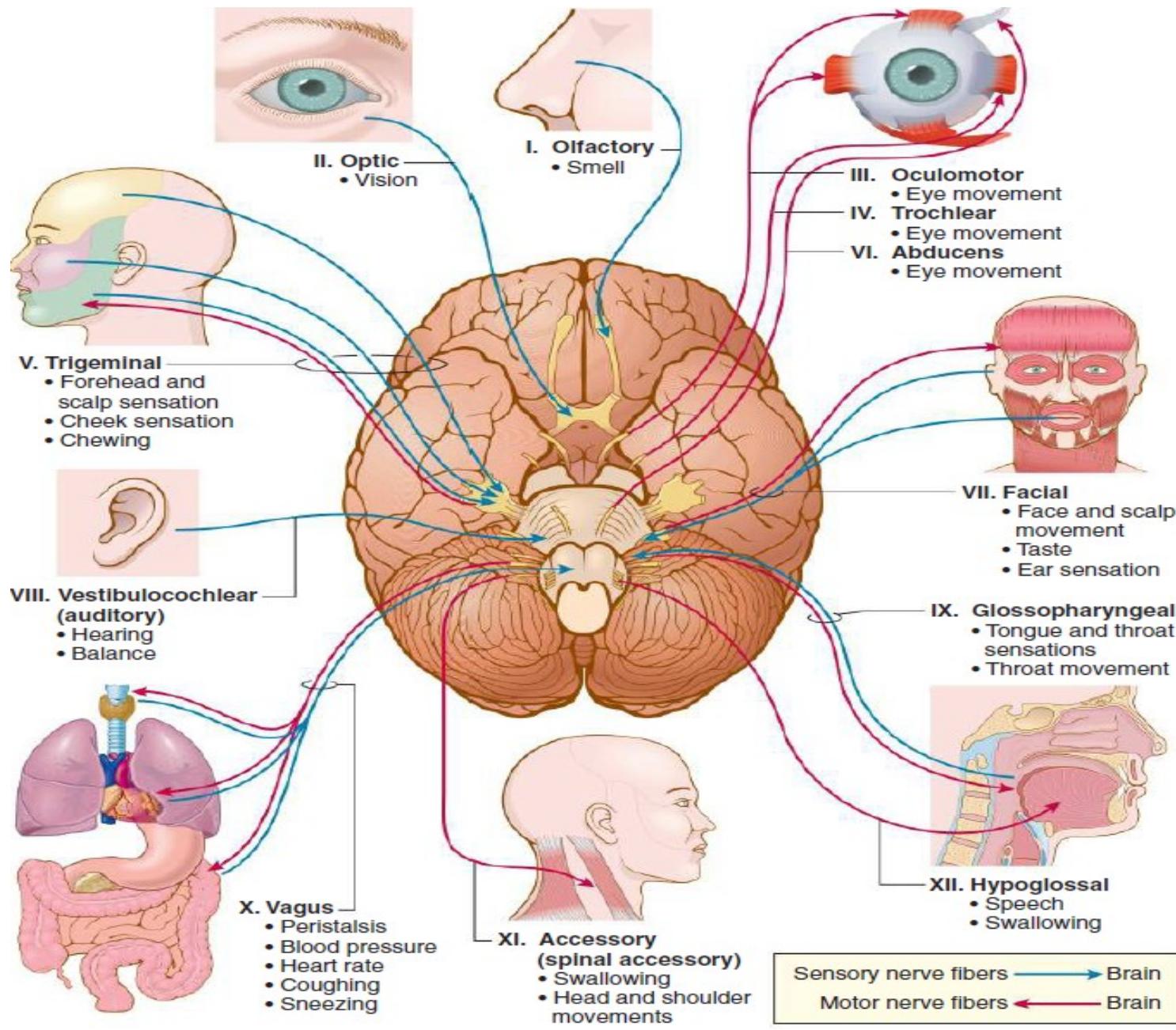
FIGURE 10-11 The meninges, posterior view

SUBARACHNOID SPACE



THE PERIPHERAL NERVOUS SYSTEM

- The peripheral nervous system
 - 12 pairs of cranial nerves that exit the base of the skull
 - 31 pairs of spinal nerves that exit the spinal cord.
- Most cranial nerves transmit impulses between the brain and the head and neck.
- However, **the tenth cranial nerve (the vagus nerve)** carries impulses to and from the chest and abdomen in addition to the head and neck.
- Cranial nerves are identified by the roman numerals I through XII.
- Spinal nerves are categorized by the region of the spinal column from which they emerge and are numbered accordingly.
- A **plexus** is a large network of nerves in the peripheral nervous system.



Number	Name	Function
I	olfactory	Receives sensory input for smell.
II	optic	Receives sensory input for vision.
III	oculomotor	Moves the eye, raises eyelids, changes pupil size, focuses the lens.
IV	trochlear	Moves the eye.
V	trigeminal	Receives sensory input from skin around the eyes, forehead, scalp, face, mouth, and lips. Also receives sensory input from teeth, and moves mastication muscles for chewing.
VI	abducens	Moves the eye.
VII	facial	Receives sensory input for taste and ear pain. Moves facial muscles. Innervates salivary and tear glands.
VIII	vestibulocochlear (acoustic)	Receives sensory input for hearing and equilibrium.
IX	glossopharyngeal	Receives sensory input for ear pain and temperature, tongue and throat sensations. Moves throat muscles for swallowing. Helps regulate blood pressure.
X	vagus	Receives sensory input from throat, chest, and abdomen. Moves muscles for speech, swallowing, and chest movement. Relays impulses to heart and smooth muscle of visceral organs.
XI	accessory	Moves neck and upper back.
XII	hypoglossal	Moves tongue.

SPINAL NERVES

- Cervical spinal nerves - C1 through C8
- Thoracic spinal nerves - T1 through T12
- Lumbar spinal nerves - L1 through L5
- Sacral spinal nerves - S1 through S5
- Coccygeal - Cx

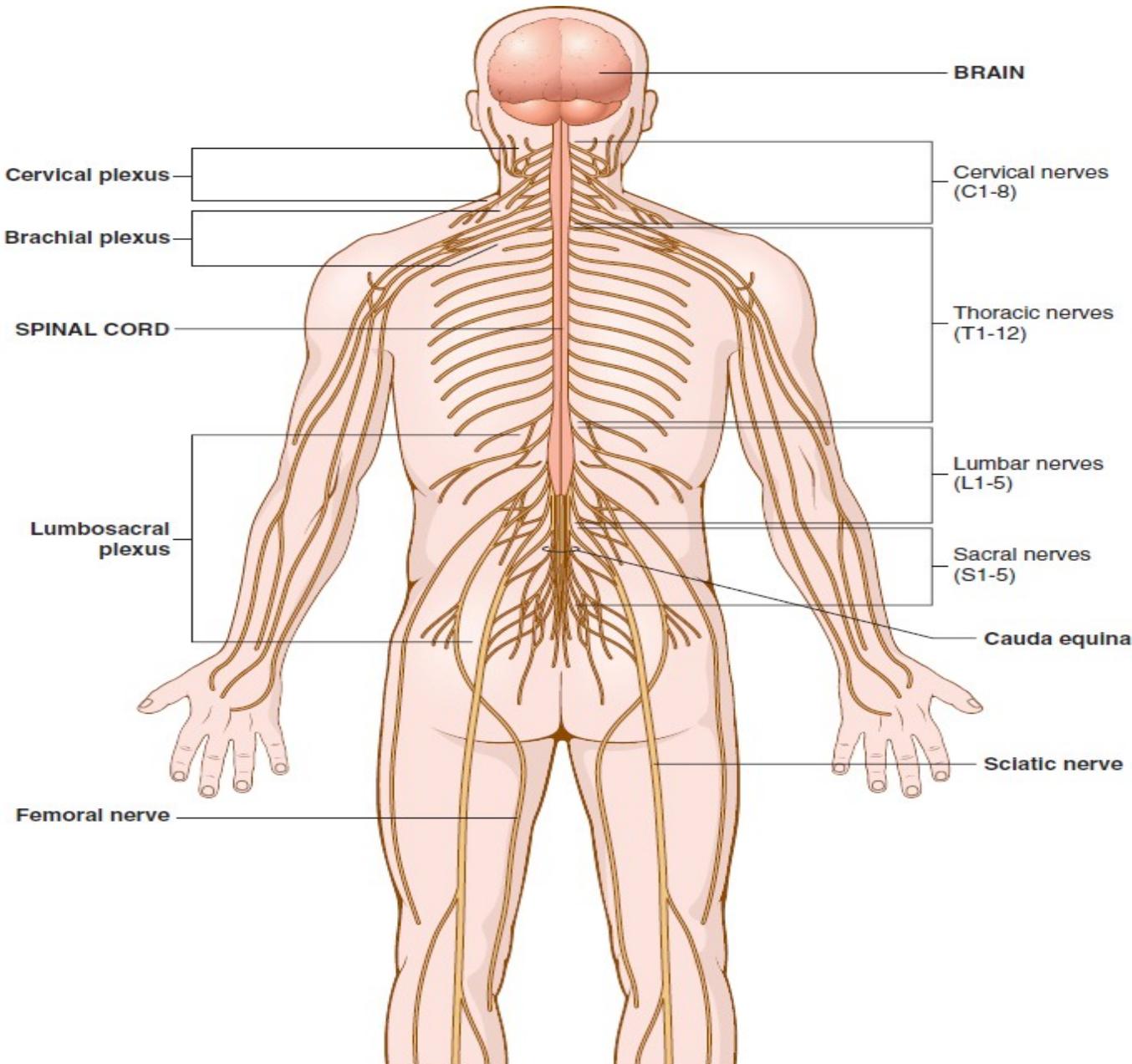
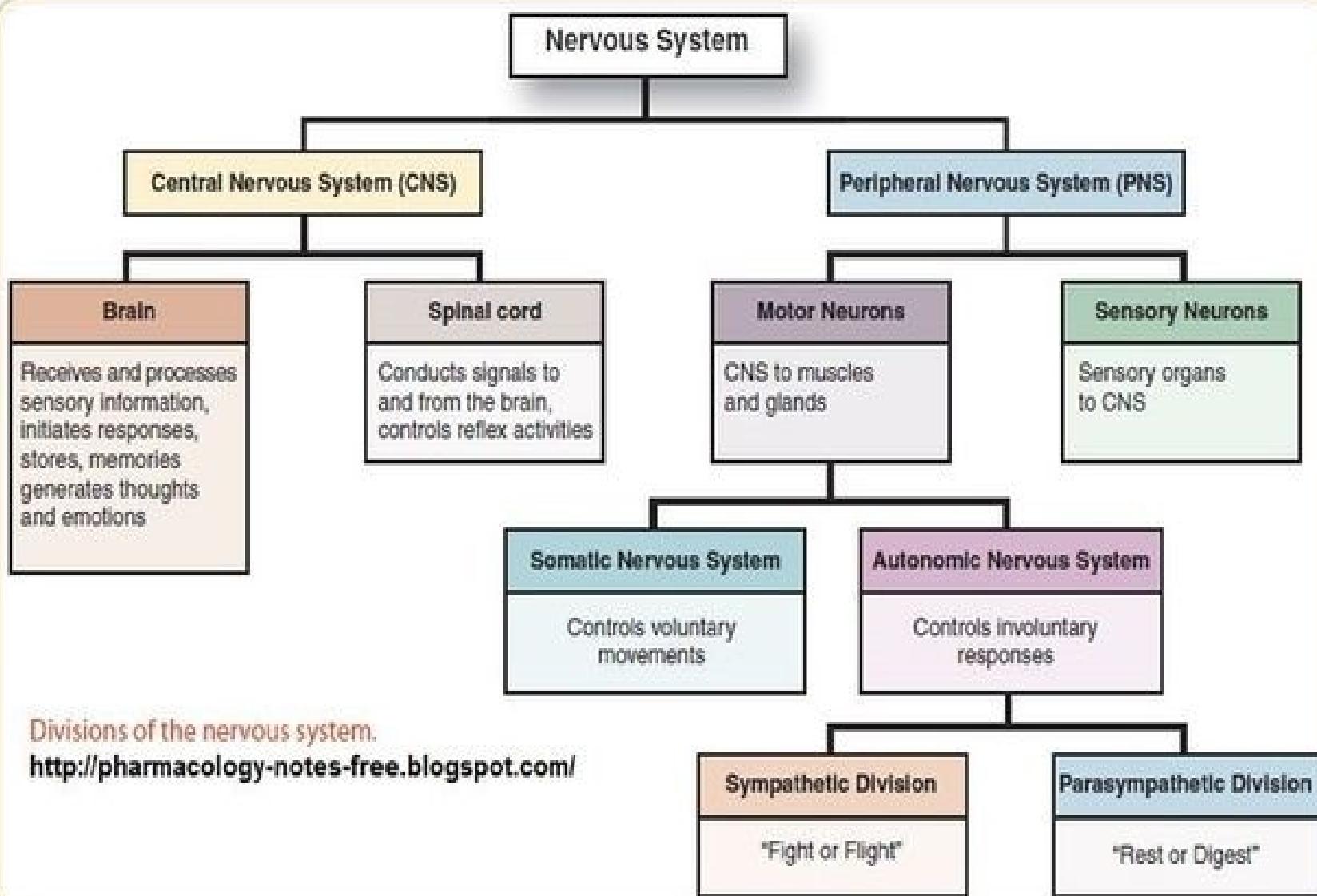


FIGURE 10-1 The brain and the spinal cord, spinal nerves, and spinal plexuses. The femoral nerve is a lumbar nerve leading to and from the thigh (femur). The sciatic nerve is a nerve beginning in a region of the hip. The cauda equina (Latin for “horse’s tail”) is a bundle of spinal nerves below the end of the spinal cord.

AFFERENT VS EFFERENT NERVES

- Nerve fibers can be divided into **two broad categories.**
- Those fibers that transmit impulses to the CNS are **afferent (sensory) nerve fibers.** These fibers conduct information from the sense organs such as the eyes, ears, skin, and tongue.
- **Efferent (motor) nerve fibers** transmit impulses from the CNS outward to muscles and glands.
- Some nerves are referred to as **mixed nerves,** because they contain both afferent and efferent fibers.

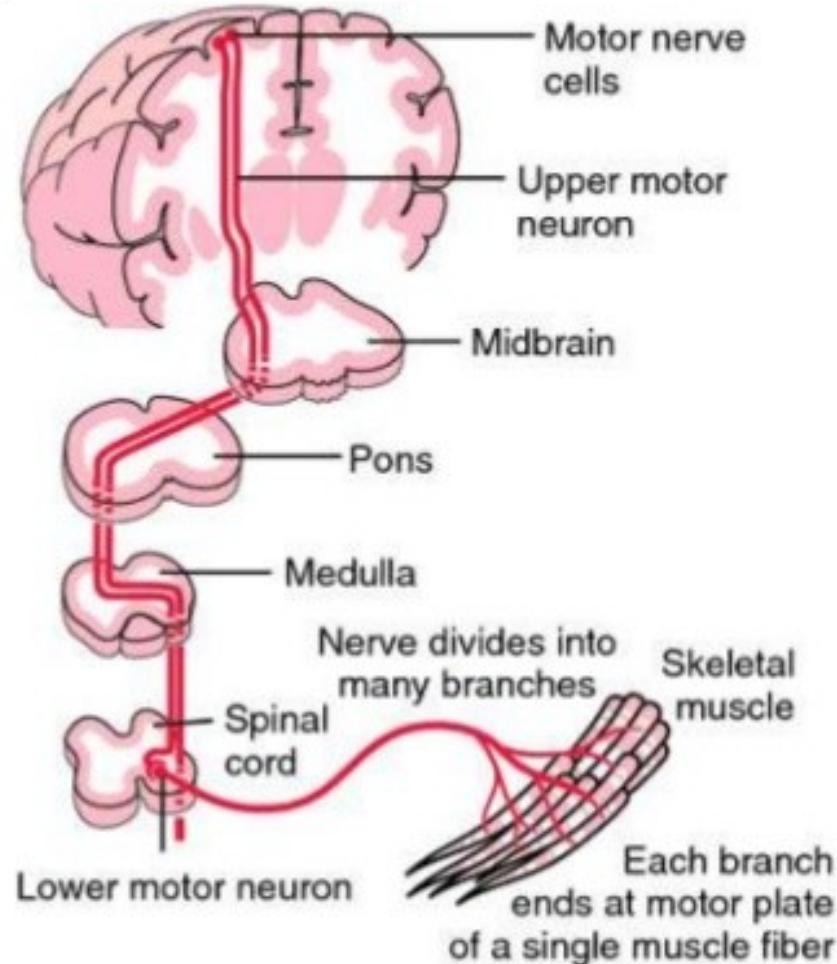


- The **peripheral nervous system** is divided into the **somatic nervous system (SNS)** and the **autonomic nervous system (ANS)**.
- The **somatic nervous system**
 - controls the skeletal muscles,
 - voluntary motion
 - responsible for parietal sensation.
 - two types of motor nerve pathways (or tracts):
 - **upper motor neurons** and **lower motor neurons**.

Types of Motor Neurons

**Upper
Motor
Neuron
(UMN)**

**Lower
Motor
Neuron
(LMN)**



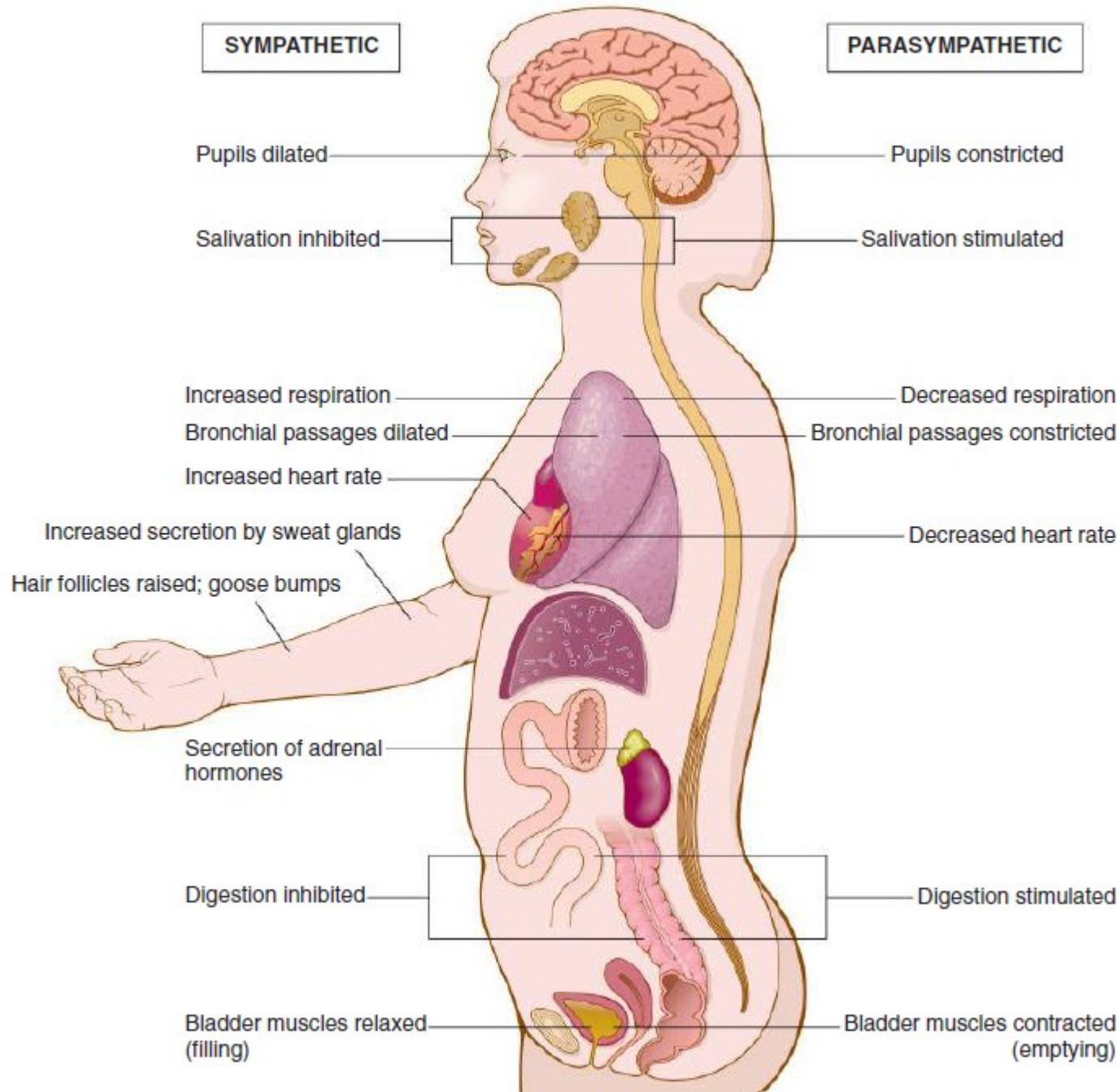
- The cell bodies of **upper motor neurons**
 - motor area of the cerebral cortex and in parts of the brainstem.
 - Upper motor neurons bundle together to form tracts that descend.
 - **The corticospinal (pyramidal) tract and the corticobulbar are two such upper motor neuron tracts.**

- The cell bodies of **lower motor neurons**
 - spinal cord and are called **anterior horn cells**.
 - The axons of these anterior horn cells transmit signals to the peripheral nerves, and are responsible for skeletal muscle innervation.
 - Nerves that transmit information to and from smooth muscles, cardiac muscles, and gland cells are part of the autonomic nervous system.

AUTONOMIC NERVOUS SYSTEM

- ANS is responsible for involuntary movement, visceral sensation, and the stimulation of gland secretion.
- The ANS
 - sympathetic
 - parasympathetic systems.
- the sympathetic system prepares the body for “fight or flight” responses that require quick energy.
 - increase the heart rate,
 - elevate blood pressure,
 - constrict blood vessels (vasoconstriction),
 - slow peristalsis,
 - increase the level of sugar in the bloodstream.

- The nerves of the **parasympathetic system** typically produce an **opposite effect**:
 - they lower blood pressure,
 - cause blood vessels to dilate (vasodilation),
 - and encourage the gastrointestinal system to function normally.
 - Their actions are associated with the body at rest



EXAMINATION

- **Cranial nerve I** is tested by asking the patient to identify a familiar **odor**, such as vanilla.
- Proper function of **cranial nerve II** can be assessed by visual acuity testing, funduscopic exam, and testing the visual fields
- **Cranial nerve III** is evaluated by testing papillary response to light - (**PERRLA**).
- Cranial nerve III also controls extraocular movements, along with **cranial nerves IV and VI**.
- The motor function of **cranial nerve V** is tested by asking the **patient to clench his or her teeth**, noting the strength of jaw muscle contraction.

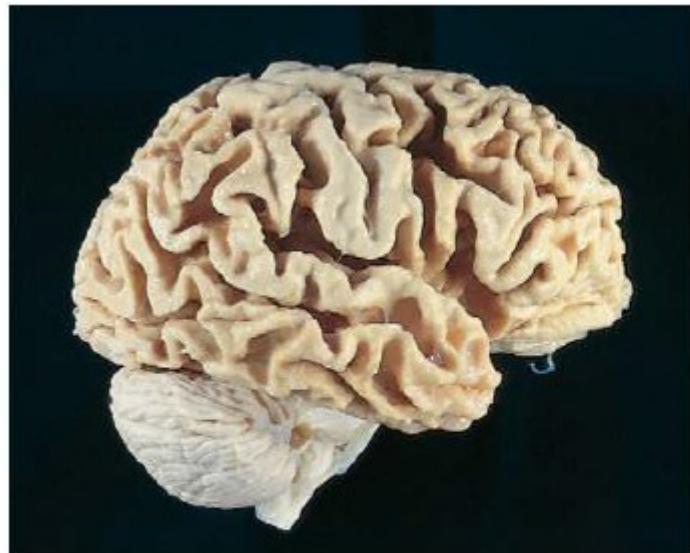
- The sensory portion of cranial nerve V is divided into three zones, designated **V1 for ophthalmic**, V2 for maxillary, and V3 for mandibular.
- **Zone V1 is tested with the corneal reflex**, while V2 and V3 are tested with various stimuli to the skin.
- **Cranial nerve VII** is tested by asking the patient to raise both eyebrows, frown, shut the eyes tightly, show the teeth, smile, and puff out the cheeks.
- **Asymmetry in performing these actions may indicate Bell palsy.**
- **Cranial nerve VIII has both an acoustic (hearing) and vestibular (balance) component.** The acoustic function of cranial nerve VIII is tested by assessing hearing.
- **Cranial nerves IX and X are** examined by listening for a normal voice, having the patient say “ah”, and eliciting **a gag reflex.**

- Cranial nerve XI is tested by asking the patient to **shrug the shoulders**, while cranial nerve XII is tested by movements of the tongue.
- **Romberg test ?**
- An abnormal plantar reflex in individuals past infancy, known as the **Babinski sign**, is indicative of an upper motor neuron lesion.
- **Deep tendon reflexes, or DTRs**, are an important subcategory of reflexes. DTRs are involuntary responses caused by striking a tendon

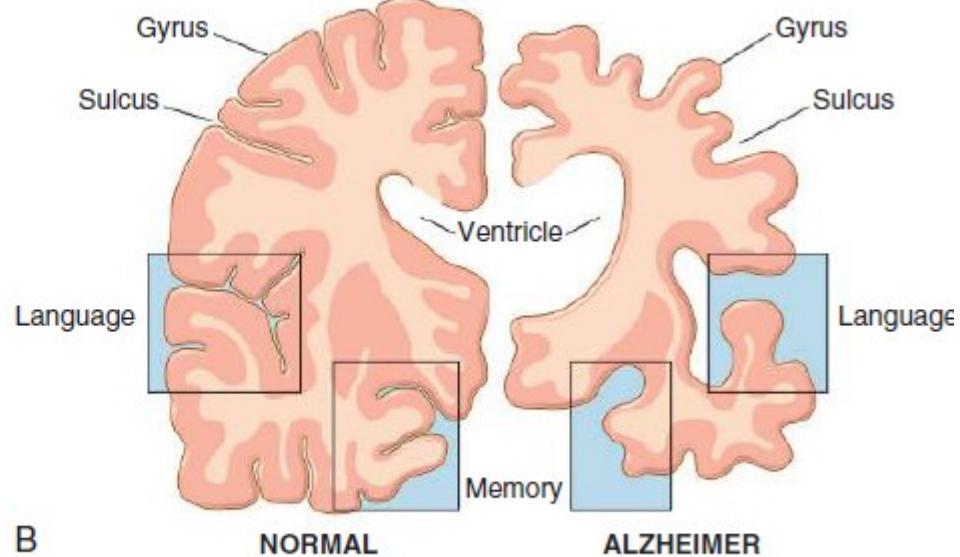
Reflex	Stimulus	Normal Response
Achilles (ankle)	strike Achilles tendon	plantar flexion at the ankle
biceps tendon	strike biceps tendon	flexion of elbow joint
brachioradialis (supinator)	strike brachioradialis tendon	supination and flexion of forearm
patellar (knee)	strike patellar tendon	extension of knee joint
triceps	lightly strike triceps tendon above the elbow	extension of elbow joint

PATHOLOGY

Condition or Disease	Description
absence seizure	A 10- to 30-second loss of consciousness, typically marked by eyelid fluttering. The patient abruptly stops activity but does not fall. After the seizure, the patient resumes activity without knowledge that the seizure even occurred. Formerly known as <i>petit mal seizures</i> .
agraphia	The inability to write properly in the absence of any physical problems associated with the limbs.
Alzheimer disease	A progressive loss of cognitive function, memory, and ability to calculate. The patient becomes confused and disoriented. Associated with loss of neurons and an excessive number of axonal plaques in the cerebral cortex and subcortical structures.
amnesia	Disturbance in long-term memory, characterized by a partial or total inability to recall past experiences.
amyotrophic lateral sclerosis (ALS)	A progressive disorder resulting in destruction of motor neurons. Also called <i>Lou Gehrig disease</i> .
aphasia	The inability to comprehend or express words due to injury or degeneration of language centers in the cerebral cortex. May affect speech, writing, or sign communication.
apraxia	The inability to perform skilled or purposeful motor acts that were previously learned, despite the willingness and physical ability to perform them. Due to cerebral disorders.



A

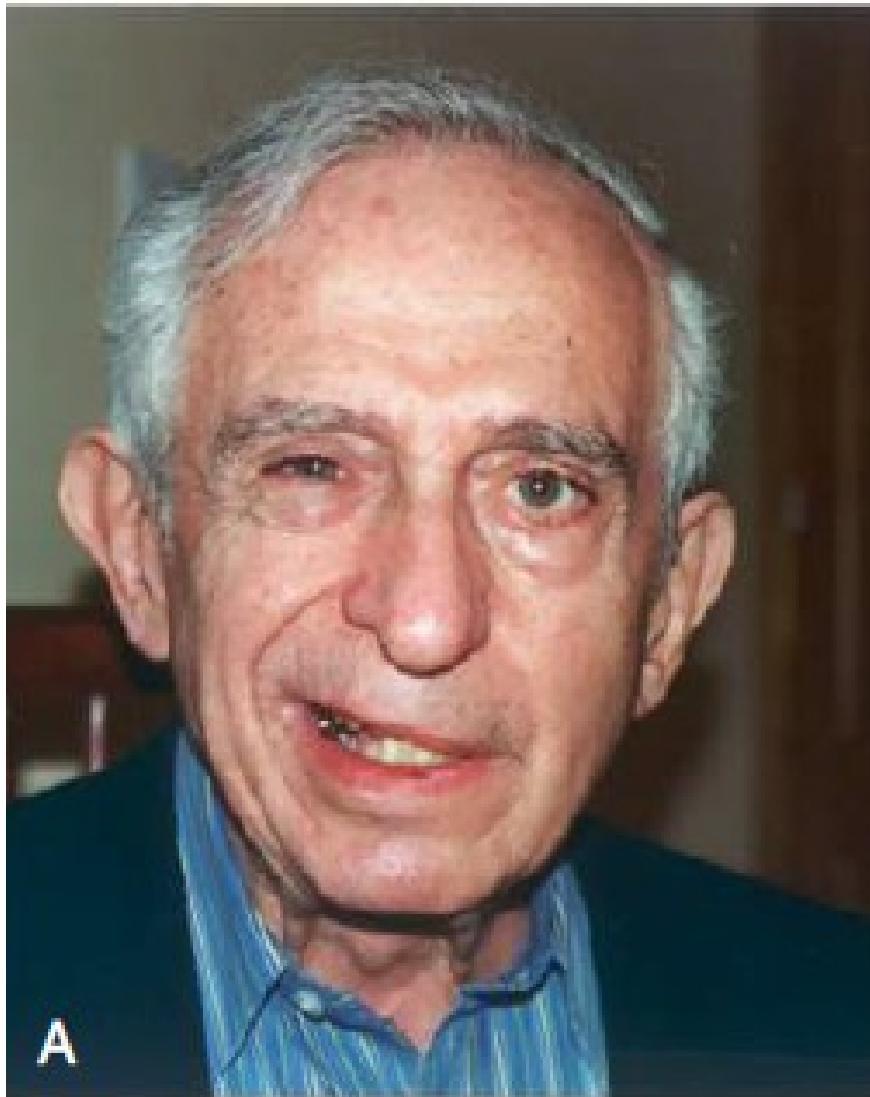


B

FIGURE 10-15 A, Alzheimer disease. Generalized loss of brain parenchyma (neuronal tissue) results in narrowing of the cerebral gyri and widening of the sulci. B, Cross-sectional comparison of a normal brain and a brain from a person with Alzheimer disease.

ataxia	The inability to control muscle activity during voluntary movement. Movements become jerky. Caused by disorders affecting the cerebellum or spinal cord.
Bell palsy	Sudden onset of facial paralysis that is typically unilateral and without any known cause. It is believed to be caused by immune disorder or viral disease that affects cranial nerve VII.
benign intracranial hypertension	An increase in intracranial pressure without any evidence of intracranial lesions, obstructions, or infections.
brain death	The complete loss of cerebral and brainstem function characterized by no response to stimuli, loss of reflexes, no spontaneous breathing, and no brain wave activity.
brain tumor	Any intracranial neoplasm. Can be benign or malignant. Symptoms include headaches, vomiting, and changes in mental status typically caused by increased intracranial pressure. Also called <i>intracranial neoplasm</i> .
carpal tunnel syndrome	Compression of the median nerve as it passes through the carpal tunnel in the wrist. It is frequently caused by repeated flexion and extension of the wrist. Can lead to pain, tingling, and numbness of the hand and fingers.

BELL PALSY, CEREBRAL PALSY



cerebral concussion	A brief loss of awareness or memory lasting from seconds to minutes with no apparent damage to brain structures. Caused by trauma to the head such as a blow or violent shaking.
cerebral contusion	A more severe injury to the head than a concussion. It is typically associated with a loss of consciousness. The skull may be fractured and intracranial bleeding may occur.
cerebral palsy (CP) syndromes	A group of motor disorders resulting in impaired voluntary movement. May be caused by prenatal developmental abnormalities or damage to the central nervous system occurring before 5 years of age.
cerebrovascular accident (CVA)	Disruption in blood supply to the brain due to either hemorrhage or occlusion. Sites in the body where symptoms are noted correlate to the affected areas of the brain that control those sites. Also called <i>cerebrovascular disease or stroke</i> .

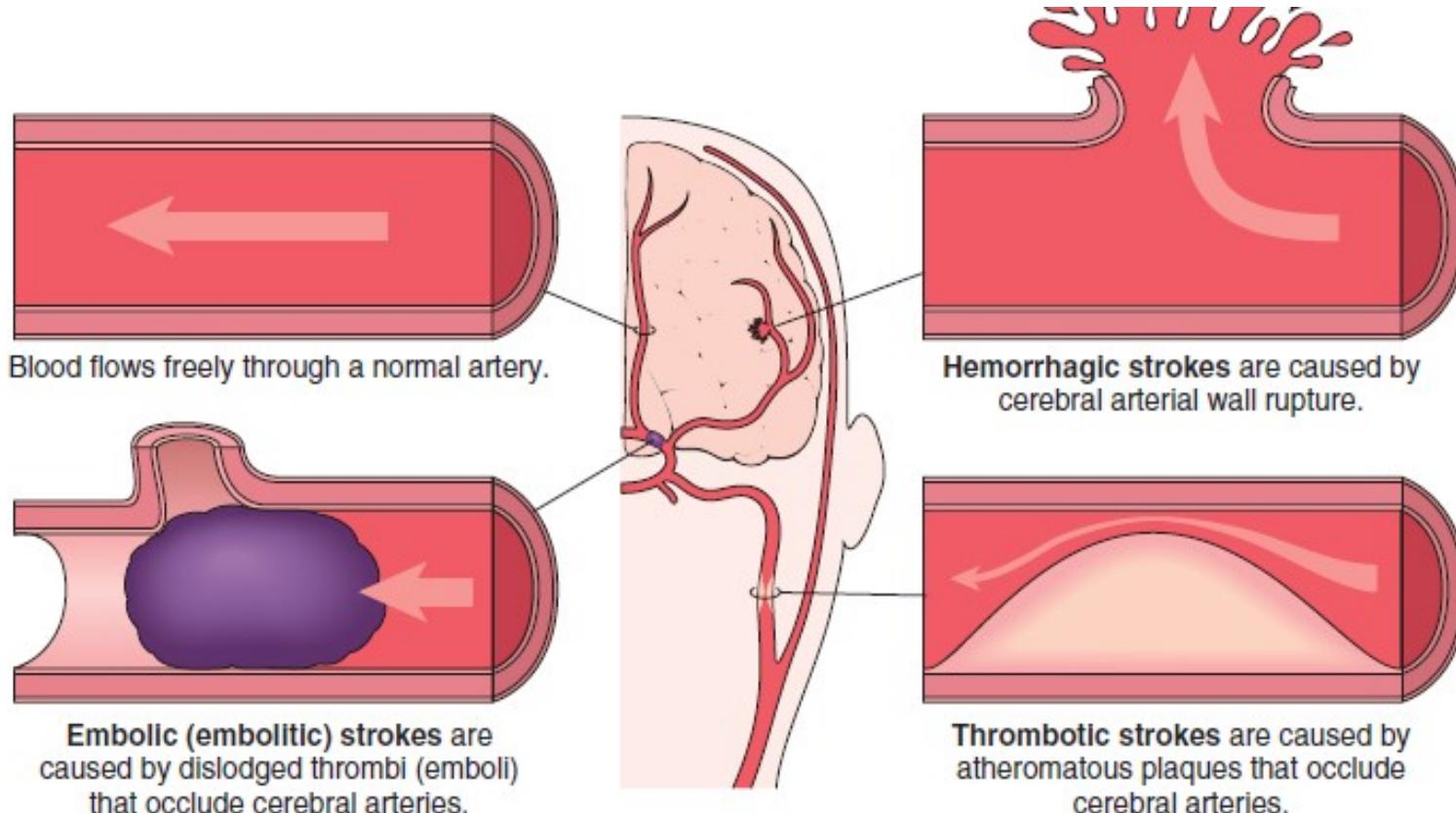


FIGURE 10-20 Three types of strokes: embolic, hemorrhagic, and thrombotic.

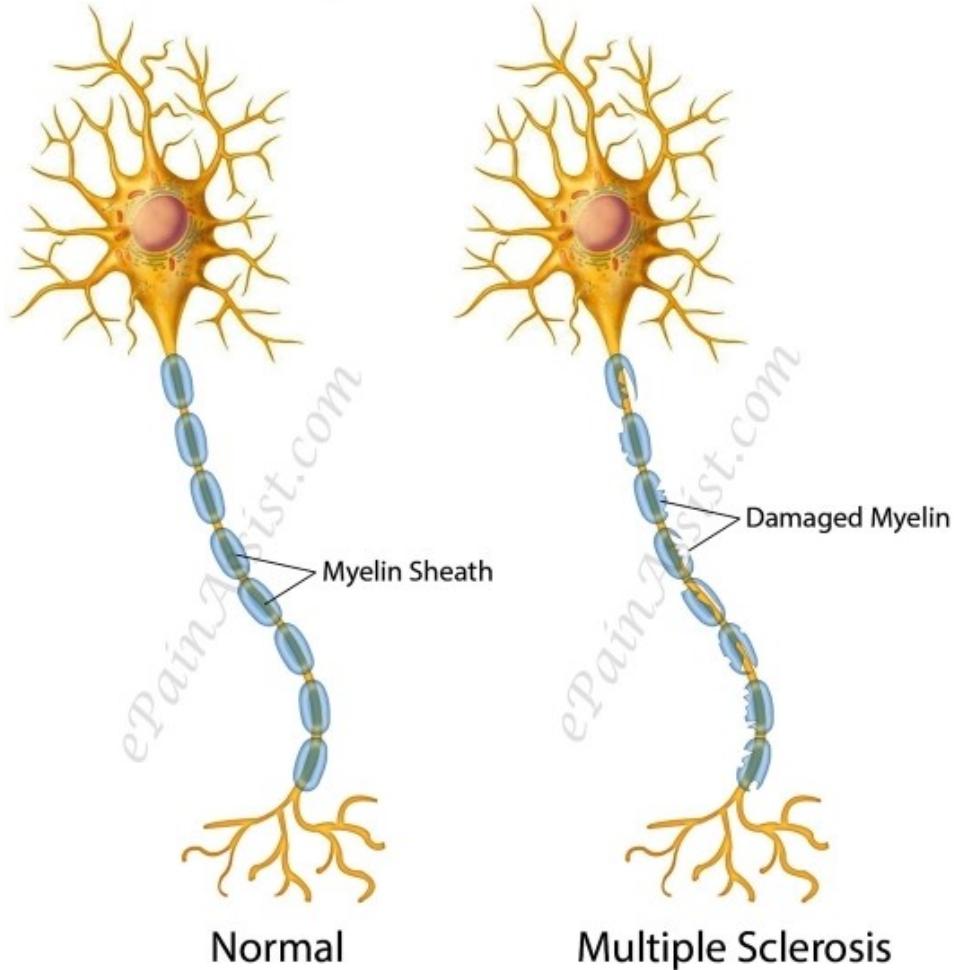
cluster headache	Severe, unilateral, periorbital and/or temporal headache that lasts 15 to 180 minutes and occurs up to 8 times a day. Associated with one or more of the following: tearing, stuffy nose, red eyes, contraction of the pupils, and facial sweating. Possibly caused by hypersensitivity to histamine.
coma	A state of profound unconsciousness. The person cannot be aroused and is unresponsive to repeated stimuli.
complex partial seizure	A seizure characterized by motor, sensory, or psychomotor symptoms. The patient also exhibits mental confusion and loses contact with the surroundings for 1 to 2 minutes.
convulsion	A severe spasm or jerking of the arms, legs, body, head, or face. Commonly occurs with various types of seizures.
demyelinating disease	Any disease that destroys or damages many of the myelin sheaths that insulate nerve fibers. Examples include Tay-Sachs and multiple sclerosis.

encephalitis	Inflammation of the brain. Most commonly caused by a virus. Can be caused by a bacterium.
Epilepsy	A chronic disorder characterized by recurrent, paroxysmal seizures caused by excessive firing of neurons in localized areas of the brain. Various types include absence seizures and tonic-clonic seizures.
headache	Pain in any part of the head not correlated to the distribution of any specific nerve. Typically a symptom of another condition. Types of headaches include migraine, cluster, and tension.
hemiparesis	Weakness or paralysis affecting only one side of the body.
herniated disk	A protrusion of the gelatinous central portion of a vertebral disk (nucleus pulposus) through a ruptured portion of the outer part of the disk. Can cause compression or irritation of a spinal nerve root, leading to pain or loss of sensation.

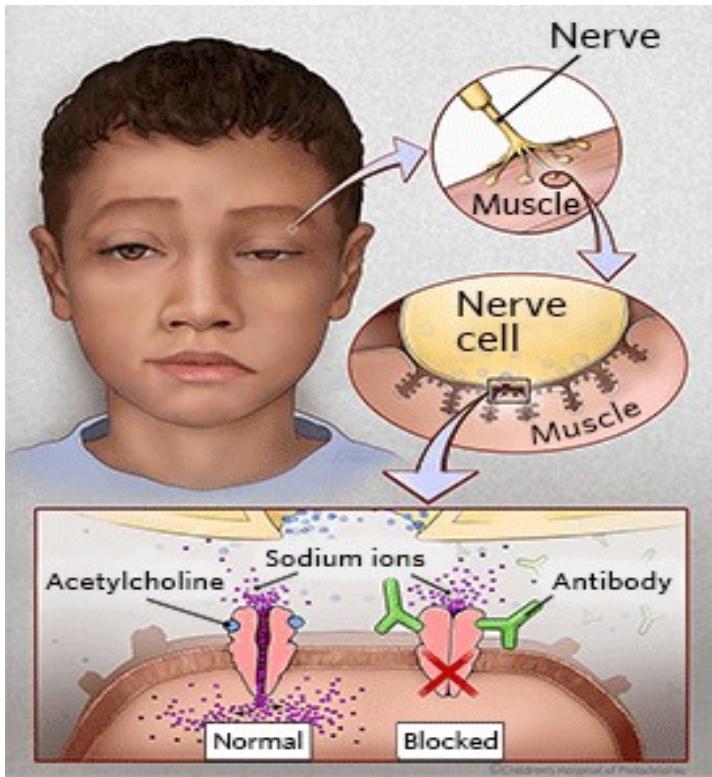
herpes zoster	A viral infection (varicella-zoster virus) of spinal nerve roots and/or nearby aggregations of nerve cell bodies, causing painful vesicles of the skin (blisters) distributed along the path (dermatome) of affected nerves. Also called <i>shingles</i> .
Huntington disease	An inherited disorder that affects movement and causes progressive intellectual degeneration. Usually appears from age 35 to 50 years. Also called <i>Huntington chorea</i> .
hydrocephalus	The presence of excess cerebrospinal fluid resulting in abnormally high intracranial pressure and cerebral ventricular enlargement. May lead to atrophy of the brain and an enlarged cranium.
hypersomnia	An abnormal increase in the amount of sleep by 25% or more above normal. The person functions normally between sleep intervals.
hypokinesia	Slower-than-normal movement. Also called <i>bradykinesia</i> .

insomnia	A sleep disorder in which it is difficult to fall asleep or to remain asleep, resulting in inadequate sleep.
intracerebral hemorrhage	Bleeding within the brain. If sudden, such as the bursting of a blood vessel, the result can lead to greatly increased intracranial pressure, coma, and death. Causes include head trauma, aneurysms, arteriosclerotic vessels exposed to hypertension, or thrombotic ischemia.
lower motor neuron lesion	Injury to an efferent neuron that is the last nerve to innervate a skeletal muscle.
meningitis	Inflammation of the meninges (membranes) of the brain or spinal cord. Can be caused by a bacterial or viral infection. Severe cases can lead to paralysis, coma, and death.
migraine	A headache lasting 4 to 72 hours with throbbing, intense, unilateral pain. Frequently associated with nausea, vomiting, and unusual sensitivity to light, sound, or smell.
multiple sclerosis (MS)	A slowly progressive disease of the central nervous system characterized by areas of demyelinated nerves (plaques) in the brain and/or spinal cord. Depending on the nerves affected, may cause a wide variety of neurological symptoms. There are typically periods of exacerbation followed by remissions.

Multiple Sclerosis



muscular dystrophy	A general term for a group of inherited progressive muscle disorders, resulting in selective muscle weakness. Symptoms typically appear from age 3 to 20 years.
myasthenia gravis	A neuromuscular disorder in which receptors for acetylcholine are destroyed or become dysfunctional due to autoimmune attacks. Leads to episodic muscle weakness. Eventually may cause complete paralysis.
myelocele	Abnormal protrusion of the spinal cord into an external sac. May occur in spina bifida.
narcolepsy	A sleep disorder characterized by sudden, involuntary episodes of sleep that occur during normal waking hours. Rare version of hypersomnia.
nerve root disorders	Any disorder of a spinal nerve root. Typically caused by chronic pressure or invasion of the root due to trauma, tumor, or degenerative diseases such as osteoarthritis. Symptoms may involve motor and/or sensory functions. Also called <i>radiculopathy</i> .
neuralgia	Severe, throbbing or stabbing pain along the path of a nerve.
neuritis	Inflammation of a nerve.
neurofibromatosis	A genetic disorder characterized by growth of neurofibromas (benign tumors) anywhere along peripheral nerves. May cause substantial disfigurement, bone erosion, and nerve compression.



Myasthenia Gravis

X HYPERVIBE
whole body vibration

chronic autoimmune neuromuscular disease characterized by varying degrees of weakness of the skeletal (voluntary) muscles of the body

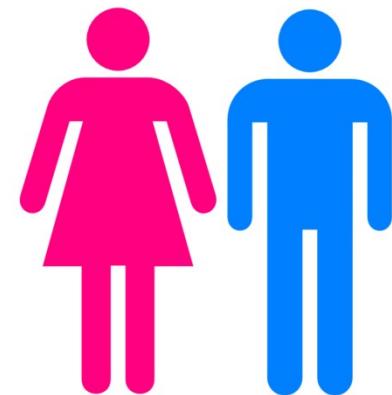
Dropping of one or both eyelids

Altered speaking

Limited facial expressions

Weakness in the neck, arms and legs

Double vision, which improves or resolves when one eye is closed



More common in adult women (under 40) and older men (over 60), but can occur at any age.

pain	An unpleasant, subjective sensation related to actual or potential damage to nerves and/or body tissue. The perception or response to pain is quite subjective and varies widely from individual to individual. Pain can be acute or chronic.
papilledema	Edema of the optic disk, usually caused by abnormally high intracranial pressure.
paralysis	Loss or impairment of motor function due to injury or disease affecting nerve supply. May also involve sensation and autonomic functions.
paraplegia	Paralysis of the lower limbs which may involve the lower trunk.
paresis	Partial or incomplete paralysis.
Parkinson disease	A slowly progressive neurologic disorder affecting the brain's ability to control movement. Caused by deficiency of the neuroinhibitor dopamine due to degenerative, vascular, or inflammatory changes in specialized gray matter structures in the brain. Characterized by slow and decreased movement, resting tremor, and muscular rigidity.
peripheral neuropathy	Any disorder or destruction of nerves of the PNS.
persistent vegetative state (PVS)	Loss of self-awareness due to cerebral damage or dysfunction, usually caused by trauma or stroke. Diencephalon and brainstem functions remain, preserving autonomic and motor reflexes

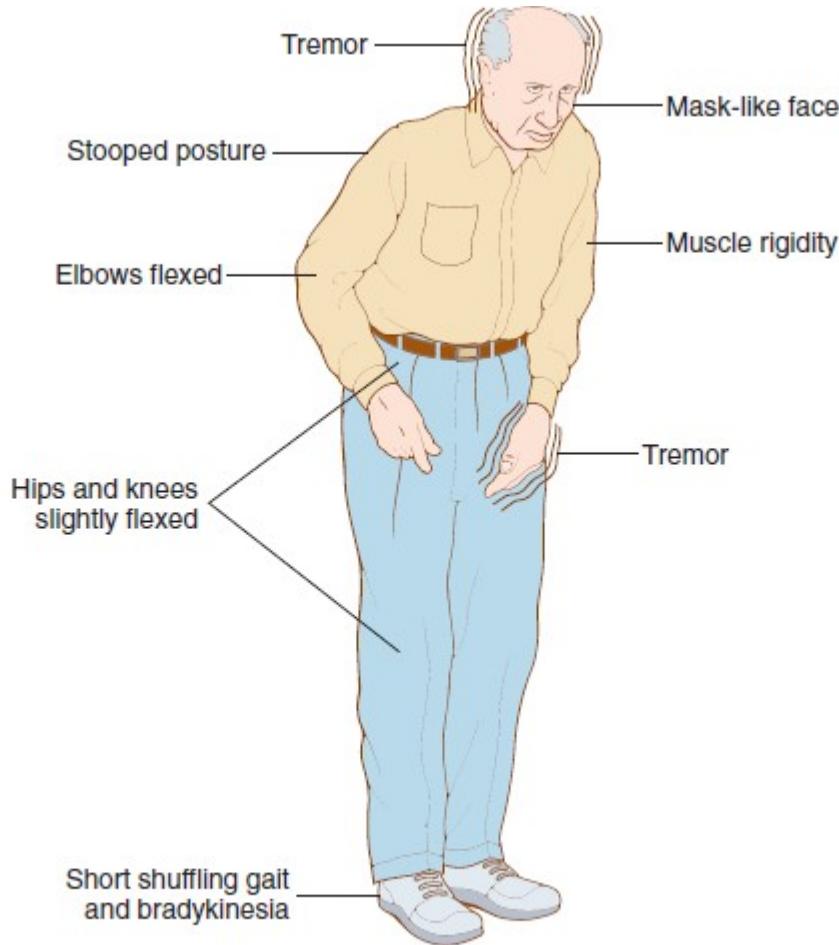
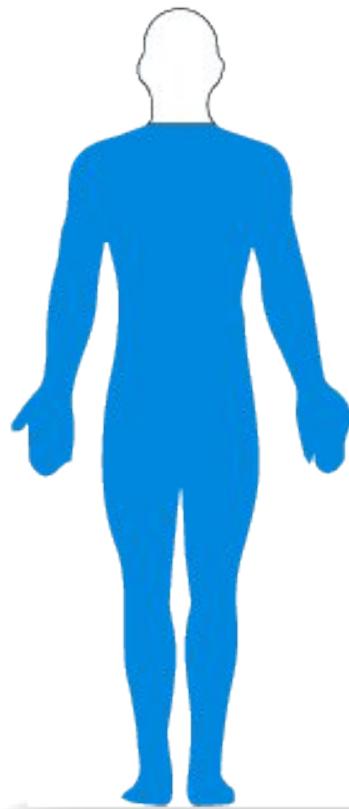
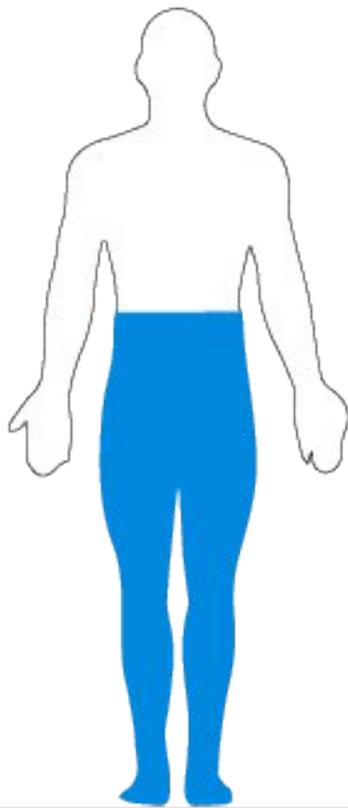


FIGURE 10-18 Primary symptoms of Parkinson disease are tremors in hands, arms, legs, jaw, and face; rigidity or stiffness of limbs and trunk; bradykinesia (shuffling gait), stooped posture, and masklike facies.

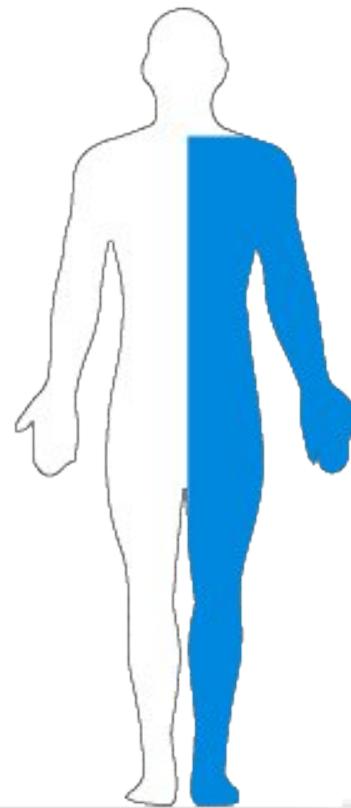
Quadriplegia



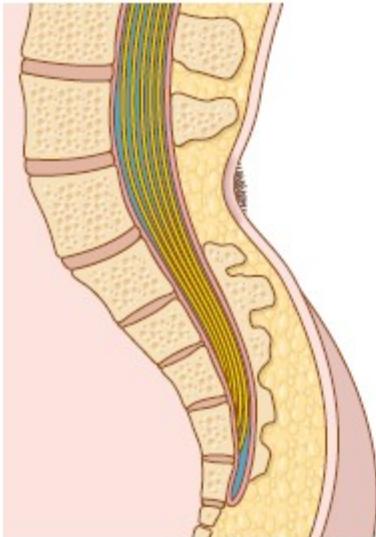
Paraplegia



Hemiplegia

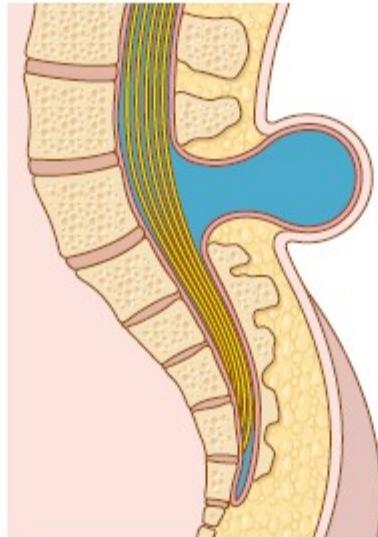


quadriplegia	Paralysis of all four limbs.
rabies	An acute infectious disease caused by a neurotropic virus often present in saliva and typically transmitted by the bite of an infected animal such as a dog, skunk, or bat. Affects the CNS, causing aggressiveness and
	madness. Eventually leads to paralysis and death.
sciatica	Pain in the lower back and hip that radiates down the back of the thigh.
simple partial seizure	A seizure characterized by motor, sensory, or psychomotor symptoms. The patient remains conscious.
sleep apnea	Sleep disorders in which breathing stops for 10 seconds or longer, typically occurring at least 20 times an hour. Causes a measurable drop in blood oxygenation level.
spina bifida	A congenital defect in which the vertebral column has not properly closed during embryological development. In some instances, a sac containing meninges and part of the spinal cord (myelocele) may protrude from the lower thoracic, lumbar, or sacral area. It typically causes varying degrees of paralysis below the involved area. Hydrocephalus and genitourinary problems are common associated conditions.
spinal cord compression	Any excessive pressure on the spinal cord. May be caused by trauma, bony protrusions into the spinal canal, or a neoplasm. Can cause pain, weakness, numbness, and paralysis.



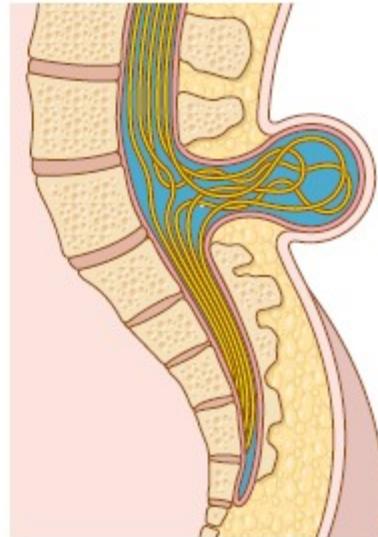
SPINA BIFIDA OCCULTA

Posterior vertebrae have not fused. No herniation of the spinal cord or meninges. There may be visible signs on the skin such as a mole, dimple, or patch of hair.



SPINA BIFIDA CYSTICA WITH MENINGOCELE

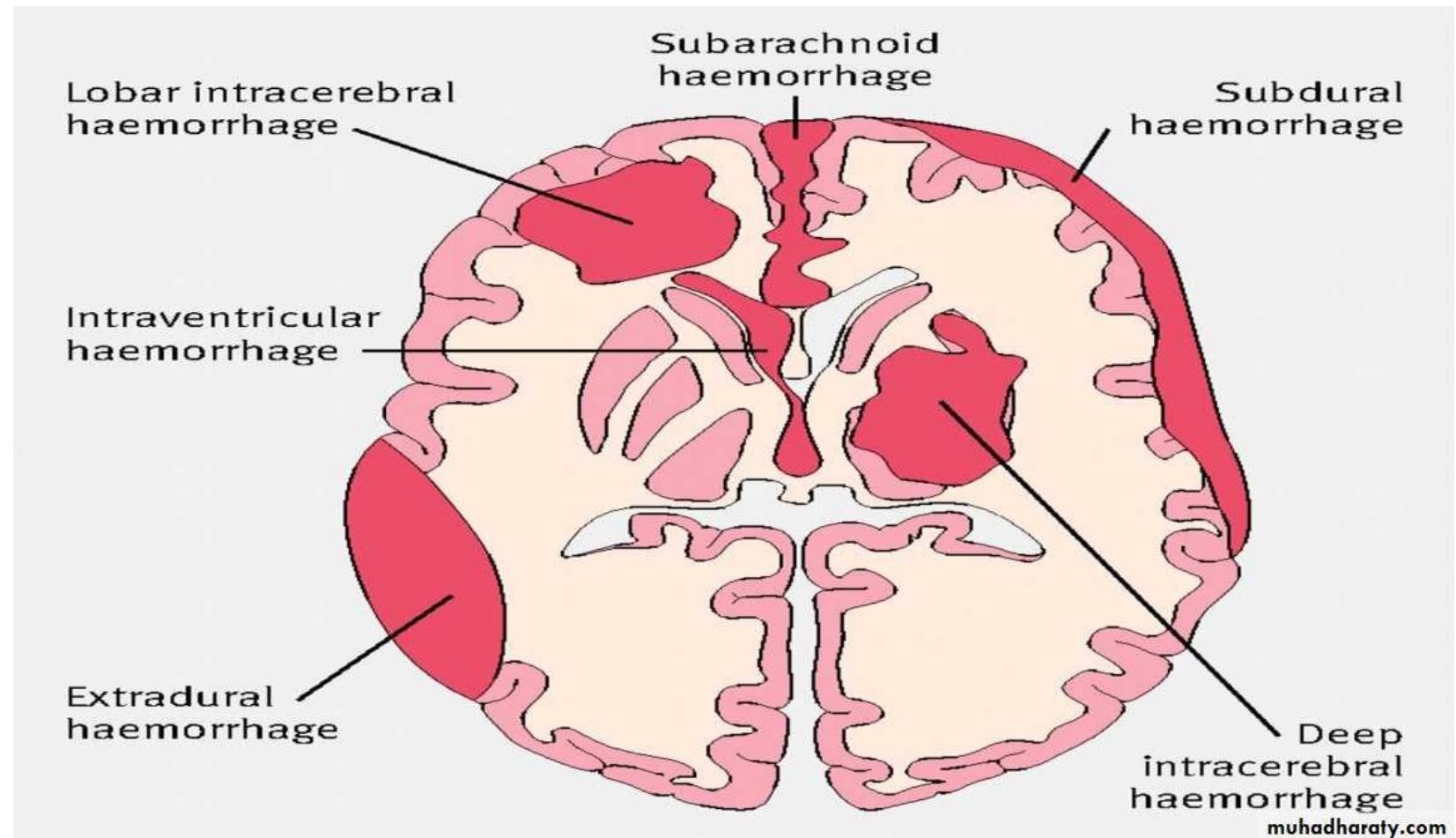
External protruding sac contains meninges and CSF.



SPINA BIFIDA CYSTICA WITH MYELOMENINGOCELE

External sac contains meninges, CSF, and the spinal cord. Often associated with hydrocephalus and paralysis.

spinal cord injury	Any damage to the spinal cord. May be temporary or permanent. Causes include hemorrhage, any injury that severs or damages the spinal cord, or any injury or condition that causes swelling around the spinal cord. Can result in partial or complete motor and sensory loss. Depending on the level of involvement, can cause paraplegia or quadriplegia.
spinal cord neoplasm	A tumor that compresses the spinal cord. Can be benign or malignant.
stupor	The state of impaired consciousness. Patient is markedly unreactive to the environment and can be temporarily aroused only by intense, repeated stimulation.
subarachnoid hemorrhage (SAH)	Sudden bleeding into the subarachnoid space, the open area filled with CSF located between the arachnoid membrane and pia mater. Most commonly caused by head trauma or rupture of a congenital aneurysm.
syncope	Loss of consciousness due to inadequate blood flow to the brain. Also called <i>fainting</i> .
Tay-Sachs disease	Inherited lipid disorder found in Jewish families of Eastern European origin. Caused by an enzyme deficiency, resulting in accumulation of specialized lipids in brain cells. Symptoms occur early in life and include retardation, paralysis, and blindness. Death may occur by age 3 or 4 years.
tension headache	A mild to moderately severe, bilateral headache that lasts 30 minutes to 7 days. Not associated with nausea, vomiting, or unusual sensitivity to light, sound, or smell.



tic	Repetitive, nonrhythmic, involuntary movements that can be suppressed voluntarily for only brief periods. Examples include involuntary blinking and so-called “nervous mannerisms.” Tend to be more prominent under stress.
tonic-clonic seizure	A seizure characterized by a sudden outcry followed by loss of consciousness, collapse, increased muscle tone, and then repetitive and rhythmical twitching and jerking of the limbs.
Tourette syndrome	An inherited disorder involving multiple motor and vocal tics. Begins in childhood. Vocal tics may include grunts, barks, and compulsory words.
transient ischemic attack (TIA)	A temporary neurologic abnormality caused by sudden and brief loss of blood flow to the brain due to emboli, thrombi, or stenosed artery. Symptoms are similar to stroke but are transient.
tremor	Rhythmic movement of a body part produced by alternating contraction and relaxation of opposing muscles. Usually involuntary.
trigeminal neuralgia	Severe lancing pain in the face. Lasts from seconds to 2 minutes. Typically follows distribution of one or more branches of the trigeminal nerve (cranial nerve V). Also called <i>tic douloureux</i> .
upper motor neuron lesion	Injury to an efferent neuron whose cell body is in the motor area of the cerebral cortex or in the brainstem.

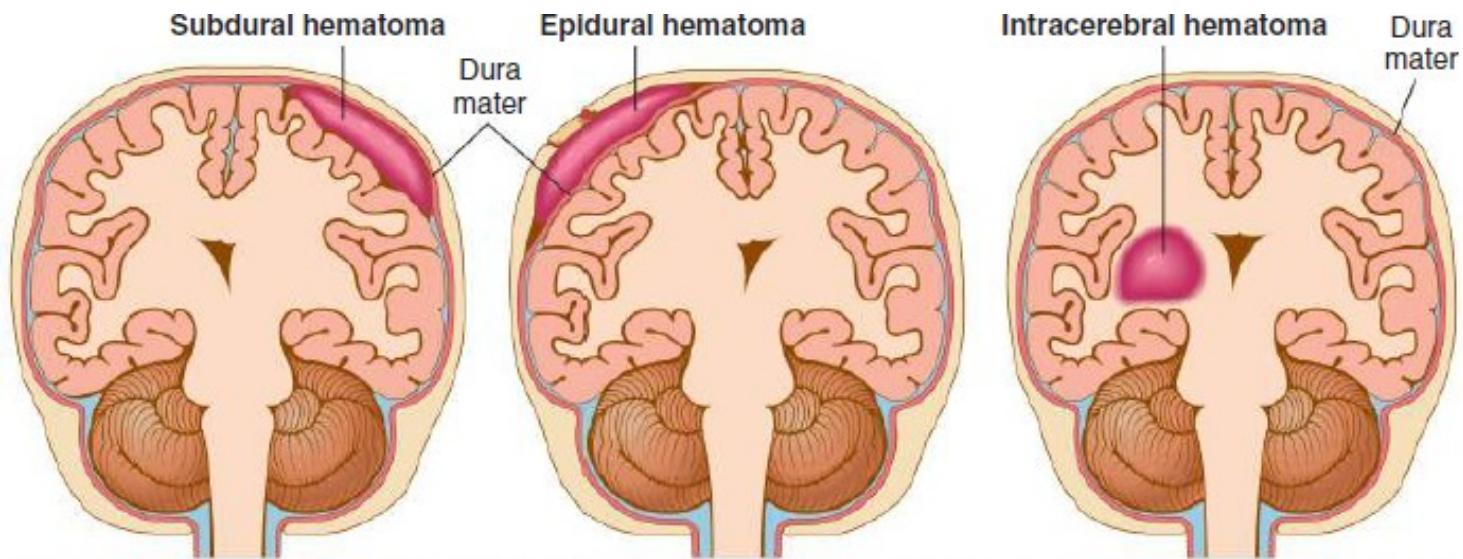


FIGURE 10-12 Hematomas. A **subdural hematoma** results from the tearing of veins between the dura and arachnoid membranes. It often is the result of blunt trauma, such as from blows to the head in boxers or in elderly patients who have fallen out of bed. An **epidural hematoma** occurs between the skull and the dura as the result of a ruptured meningeal artery, usually after a fracture of the skull. An **intracerebral hematoma** is caused by bleeding directly into brain tissue, such as can occur in the case of uncontrolled hypertension (high blood pressure).

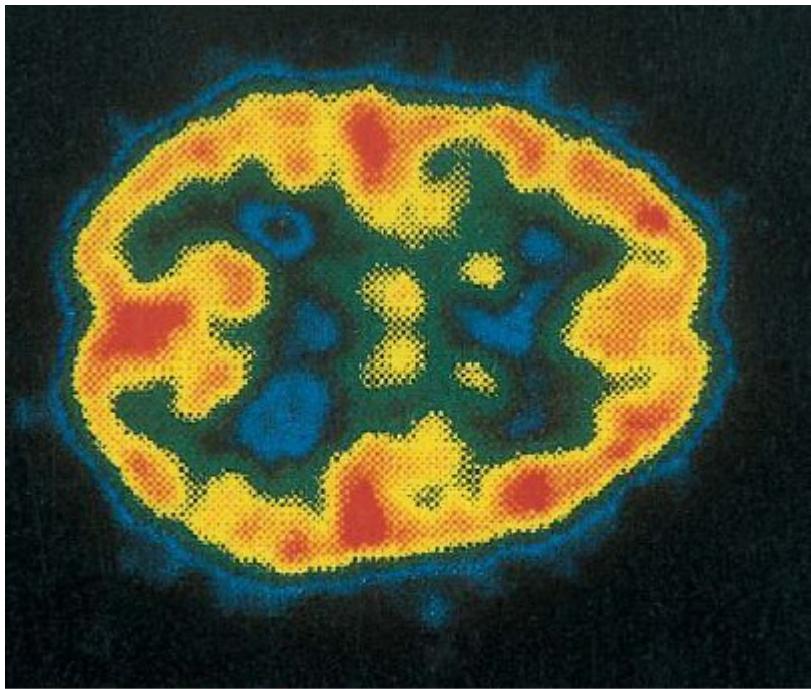


FIGURE 10-21 Cerebral aneurysm.



GLIOBLASTOMA- GLIAL CELLS

DIAG TESTS & PROCEDURES

Test	Description
biopsy of nerve tissue	A specimen of nerve tissue is collected and examined microscopically to establish a diagnosis. Commonly used to diagnosis malignant growths.
cerebral angiography	X-rays of the brain are taken after a radiopaque substance is injected into the cerebral circulatory system. Visualizes arterial and venous circulation in the brain.
cerebrospinal fluid (CSF) analysis	A sample of cerebrospinal fluid is analyzed for its composition, including the quantities of substances such as glucose, protein, albumin, and urea nitrogen present. White blood count and pH are obtained. It may be cultured for bacteria. Its color and clarity are noted (CSF is normally clear). These tests are useful in diagnosing trauma and abnormalities such as tumors and infections.
CT (computed tomography) of the brain	A computer-generated reconstruction of the brain is created from a series of x-ray images taken as cross-sections of the brain. These images (CT scans) are particularly valuable in differentiating the various tissues within the brain, such as tumors and lesions. In the case of a cerebrovascular accident (CVA), it can determine if a stroke is caused by blockage or hemorrhage.
Electroencephalography	The electrical potentials of the brain are recorded. Electrical

(EEG)	changes associated with epilepsy, sleep disorders, tumors, hemorrhages, etc., can be detected. Also used to determine “brain death,” which produces a flat or silent EEG pattern.
Electromyography (EMG)	Electrical activity in muscle is graphically recorded after electrical stimulation. Useful in evaluating neuromuscular disorders.
lumbar puncture (LP)	A needle is inserted between lumbar vertebrae into the subarachnoid space of the spinal column. Cerebrospinal fluid (CSF) can be withdrawn for analysis. A device can also be attached to the needle to measure CSF pressure. Also called <i>analysis of cerebrospinal fluid or spinal tap</i> .
MRI (magnetic resonance imaging)	Magnetic energy and radiofrequencies are used to stimulate body cells to emit radio signals that are converted to images. MRI can differentiate various tissues, such as tumors and inflammatory sites. In the case of cerebrovascular accident (CVA), it can determine if a stroke is caused by blockage or hemorrhage. It is also useful in identifying plaques associated with multiple sclerosis.
myelography	X-rays of the spinal cord are taken after injection of a contrast material into the spinal canal. Visualizes abnormalities such as a herniated disk or spinal cord tumors.
ultrasonography of the brain	Ultrasound is used to detect tumors, cerebral hemorrhages, and cerebral blood flow.

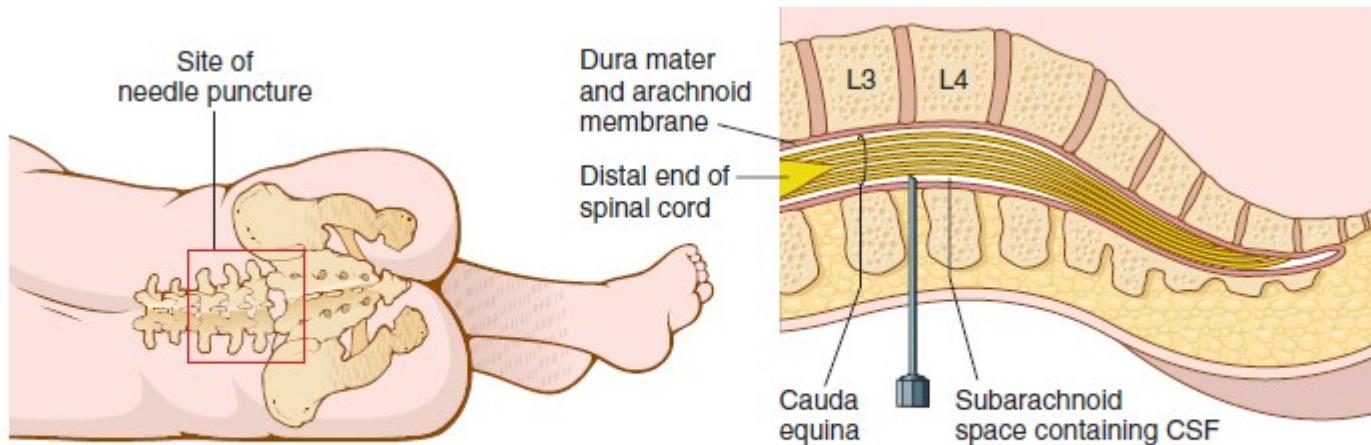


FIGURE 10-23 Lumbar puncture. The patient lies laterally, with the knees drawn up to the abdomen and the chin brought down to the chest. This position increases the spaces between the vertebrae. The lumbar puncture needle is inserted between the third and fourth (or the fourth and fifth) lumbar vertebrae and then is advanced to enter the subarachnoid space.

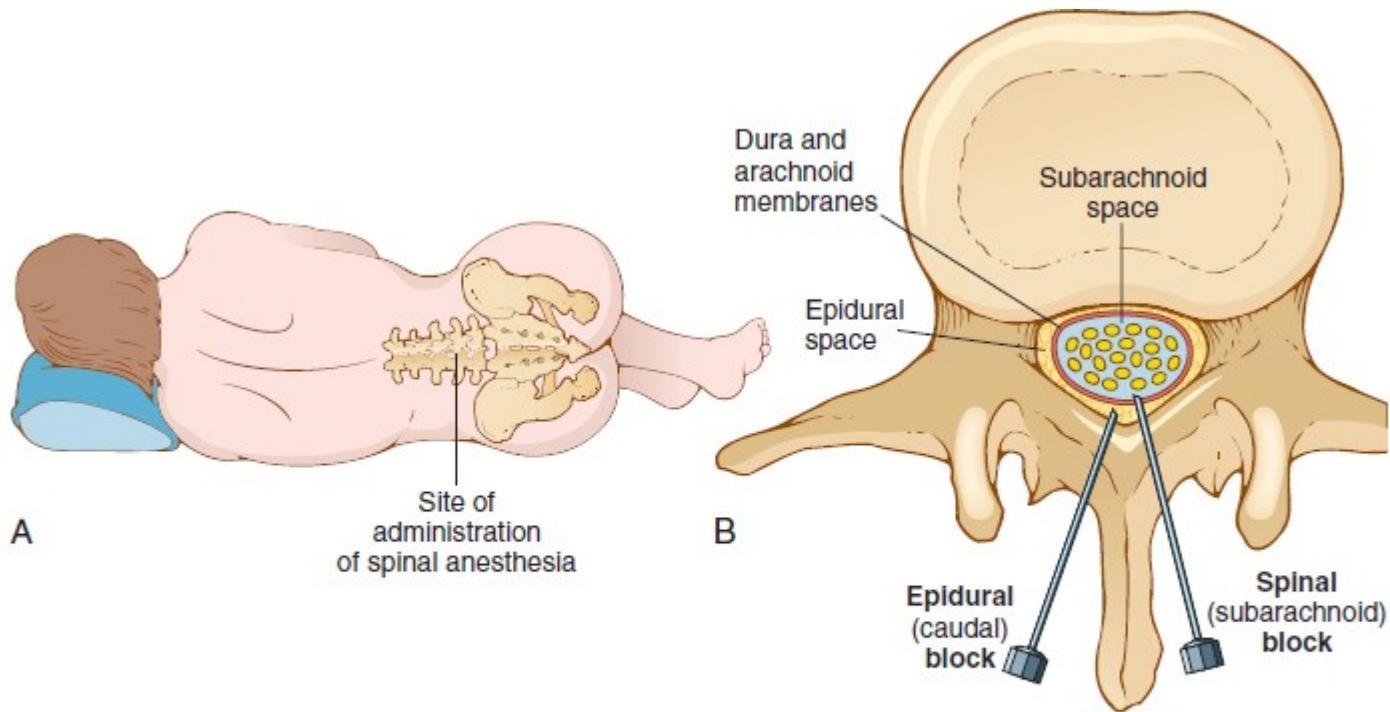


FIGURE 10-13 A, Positioning of a patient for spinal anesthesia. B, Cross-sectional view of the spinal cord showing injection sites for epidural and spinal blocks (anesthesia). Epidural (caudal) anesthesia is achieved by injecting an agent into the epidural space and is commonly used in obstetrics. Spinal anesthesia is achieved by injecting a local anesthetic into the subarachnoid space. Patients may experience loss of sensation and paralysis of feet, legs, and abdomen.

COMBINING FORMS

Form	Meaning	Example(s)
cerebr/o	cerebrum	cerebral, cerebrospinal
crani/o	cranium (skull)	craniotomy
encephal/o	brain	encephalitis
gangli/o	nervous	ganglion
mening/o	membranes; meninges	meningitis, meningocele
myel/o	spinal cord; bone marrow	myelogram
neur/o	nerve	neurology, neuropathology

- lept/o - thin, slender
- pont/o - pons
- neur/o - nerve
- radicul/o - nerve root (of spinal nerves)
- thec/o - sheath (refers to the meninges)
- vag/o - vagus nerve (10th cranial nerve)
- alges/o, -algesia - excessive sensitivity to pain
- caus/o - burning
- comat/o - deep sleep (coma)
- esthesi/o, -esthesia - feeling, nervous sensation
- kines/o, kinesi/o
- -kinesia, -kinesis, - kinetic movement

- -lepsy - seizure
- -lex/o - word, phrase
- -paresis - weakness
- -phasia -speech
- -plegia - paralysis (loss or impairment of the ability to move parts of the body)
- -praxia - action
- -sthenia - strength
- -tax/o - order,coordination

Abbreviation	Meaning
ADD	attention deficit disorder
ALS	amyotrophic lateral sclerosis
ANS	autonomic nervous system
CNS	central nervous system
CP	cerebral palsy
CSF	cerebrospinal fluid
CVA	cerebrovascular accident
CVD	cerebrovascular disease
DTR	deep tendon reflex
EEG	electroencephalogram, electroencephalography
EMG	electromyogram, electromyography
HNP	herniated nucleus pulposus
LOC	loss of consciousness
LP	lumbar puncture
MMSE	Mini-Mental Status Exam
MS	multiple sclerosis
PNS	peripheral nervous system
PVS	persistent vegetative state
RAS	reticular activating system
SAH	subarachnoid hemorrhage
SNS	somatic nervous system
TIA	transient ischemic attack

TABLE 18-9 Classifications of Psychiatric Conditions

Classification	Description	Examples
anxiety disorders	Conditions that occur in individuals suffering from severe anxiety.	panic attack, phobic disorders, obsessive-compulsive disorder, post-traumatic stress disorder, and anxiety due to a physical disorder or substance
dissociative disorders	Conditions in which one or more components of an individual's memory, perception, or identity become disconnected from other components.	amnesia, fugue, identity disorder, and depersonalization disorder
drug use and dependencies	Conditions characterized by physical and/or psychological dependencies caused by repeated drug use.	May involve various drugs, including alcohol, cocaine, opioids, amphetamine, hallucinogens, and cannabis (marijuana)
eating disorders	Disorders characterized by severely abnormal eating patterns and behaviors.	anorexia nervosa, bulimia, binge eating
mood disorders (affective disorders)	Recurrent and pervasive disturbances of an individual's mental state.	depression, bipolar disorder (swings between mania and depression), mania, dysthymic disorder
personality disorders	Conditions characterized by inflexible ongoing personality traits that deviate from cultural norms, causing stress and	various personality types, including paranoid, schizoid, antisocial, hysterical, dependent, obsessivecompulsive,

Combining Forms for Terms Used in Psychiatry

Form	Meaning	Example(s)
anxi/o	distressed; uneasy, anxious	anxiety, anxiolytic
hallucin/o	wander in mind	hallucinogen, hallucination
ment/o	mind	mentality
phren/o	mind	schizophrenia, phrenocardia
psych/o	mind	psychology, psychosis
schiz/o	split	schizoid, schizoaffective
somat/o	body	psychosomatic, somatoform

Psychiatric Abbreviations

Abbreviation	Meaning
ADD	attention deficit disorder
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
ECT	electroconvulsive therapy
IQ	intelligence quotient
MMPI	Minnesota Multiphasic Personality Inventory
SAD	seasonal affective disorder
TAT	Thematic Apperception Test
WAIS-R	Wechsler Adult Intelligence Scale- Revised
WISC-R	Wechsler Intelligence Scale for Children-Revised

THANK YOU