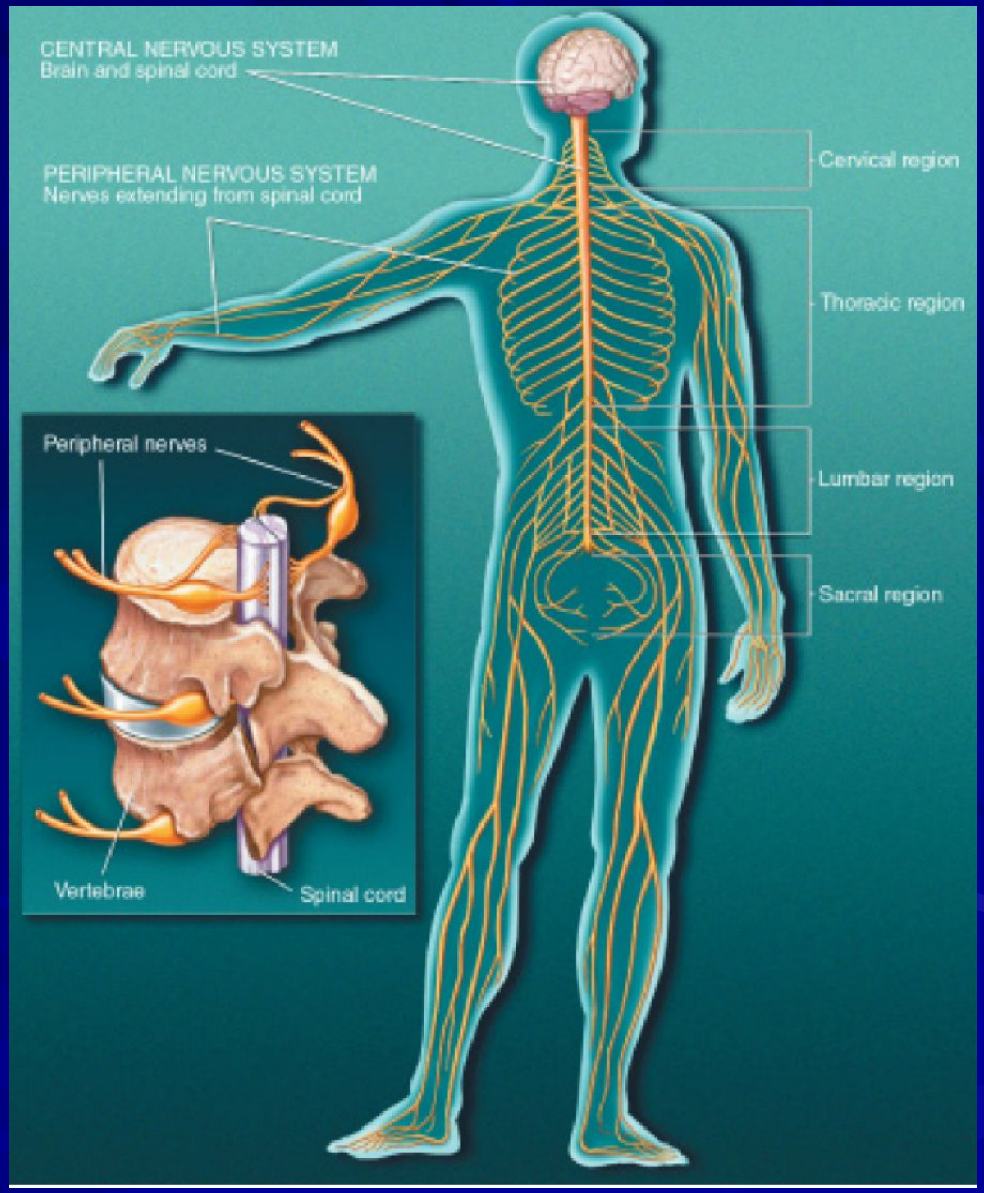
The Structure of the Nervous System

The central nervous system (CNS) consists of two parts of the nervous system that are encased in bone:

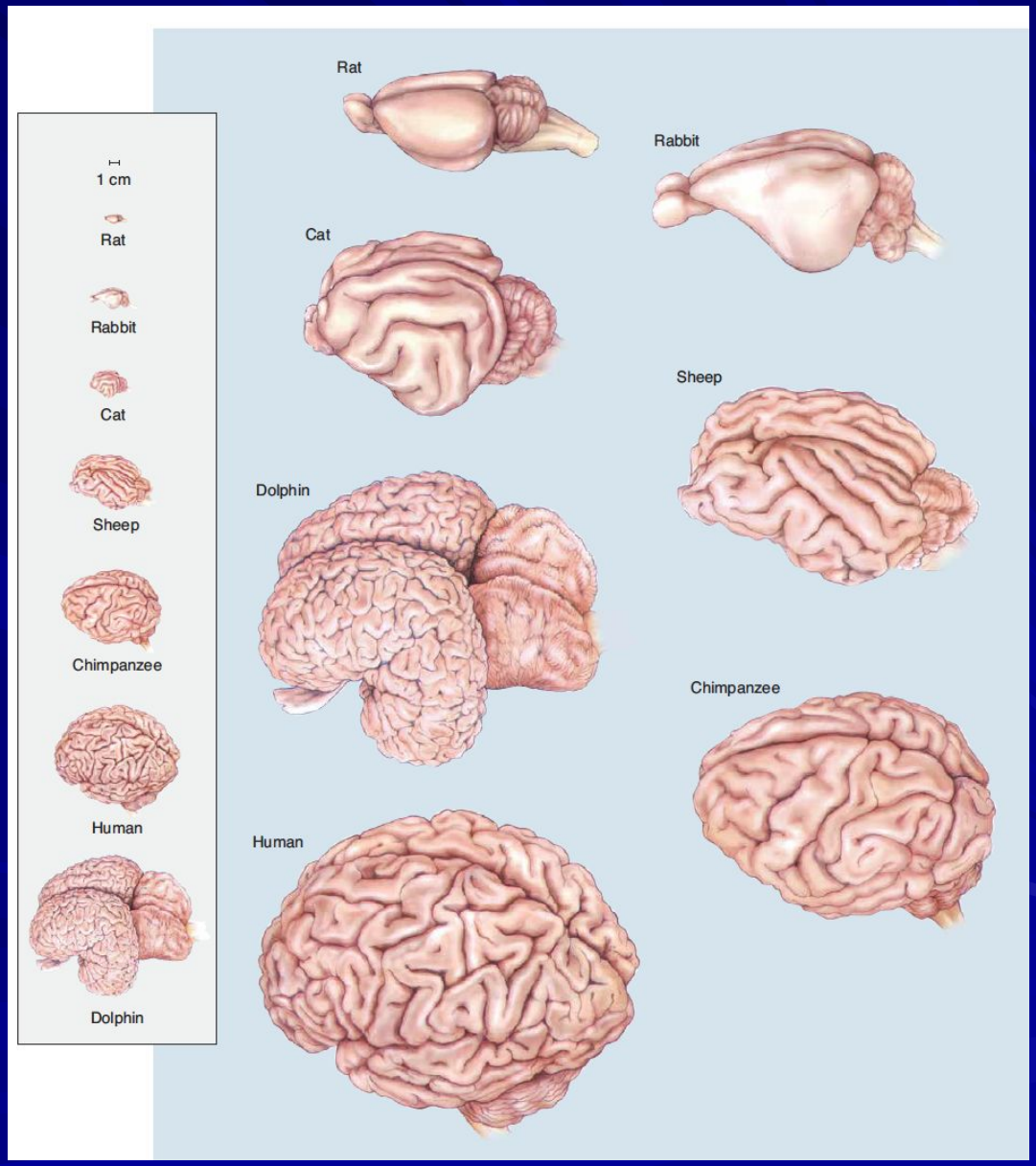
- the brain
- the spinal cord

The brain lies entirely within the skull.



The Structure of the Nervous System

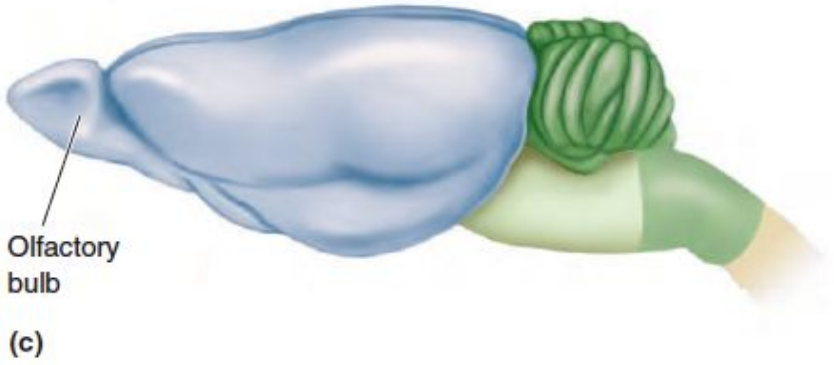
- The human brain is merely a variation on a plan that is common to the brains of all mammals



The Structure of the Nervous System

Three parts that are common to all mammals:

- the cerebrum
- the cerebellum
- the brain stem



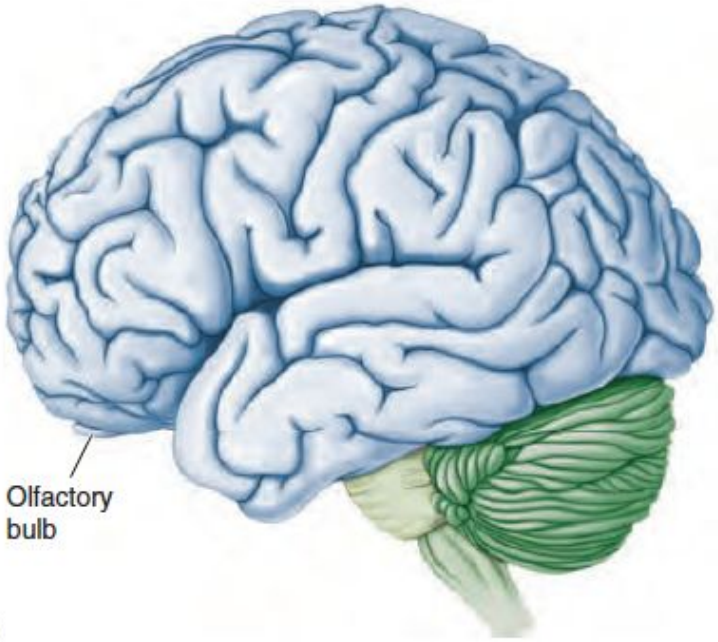
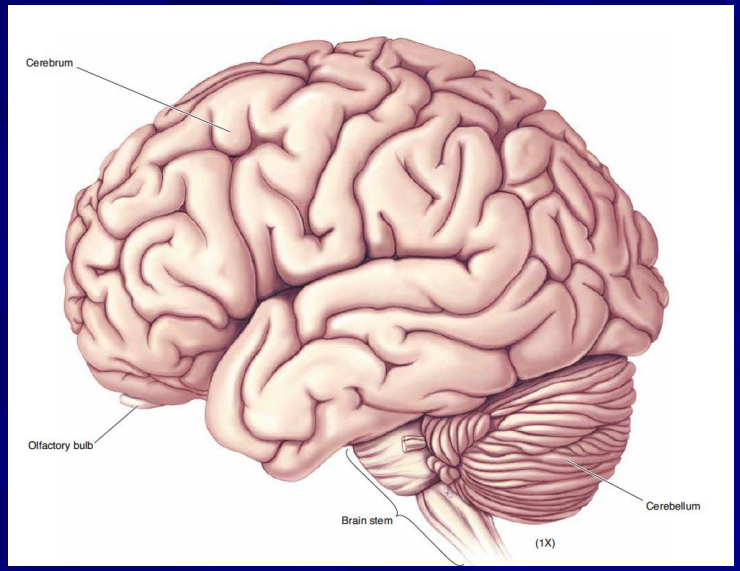


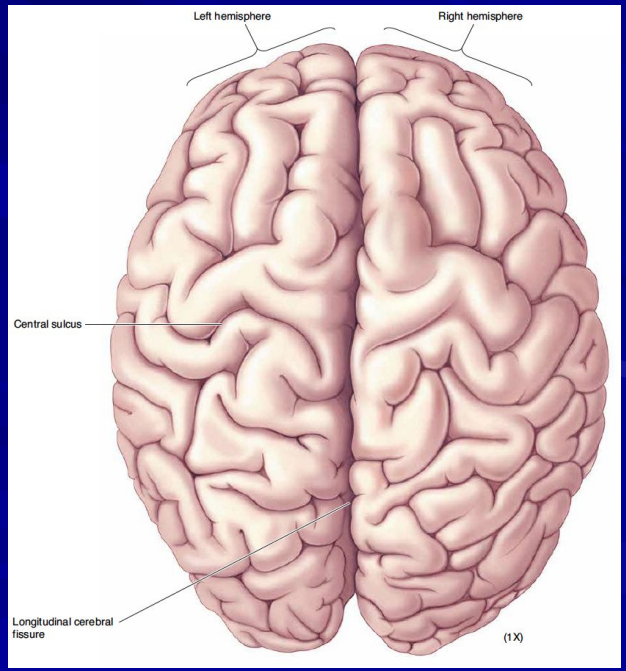
FIGURE 7.21
The rat brain and human brain compared. (a) Dorsal view. **(b)** Midsagittal view. **(c)** Lateral view. (Brains are not drawn to the same scale.)

The Structure of the Nervous System

The Cerebrum

- the largest part of the brain
- has two cerebral hemispheres, separated by the deep sagittal fissure.
- In general, the right cerebral hemisphere receives sensations from, and controls movements of the left side of the body.

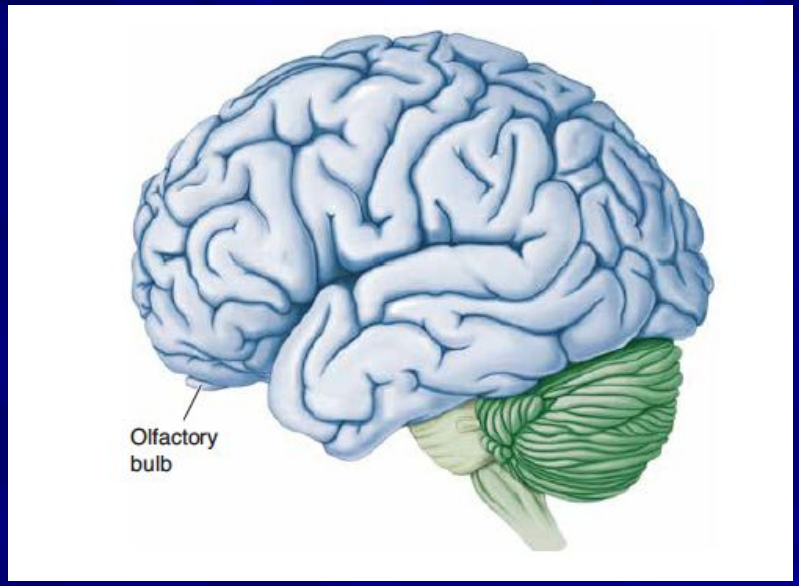


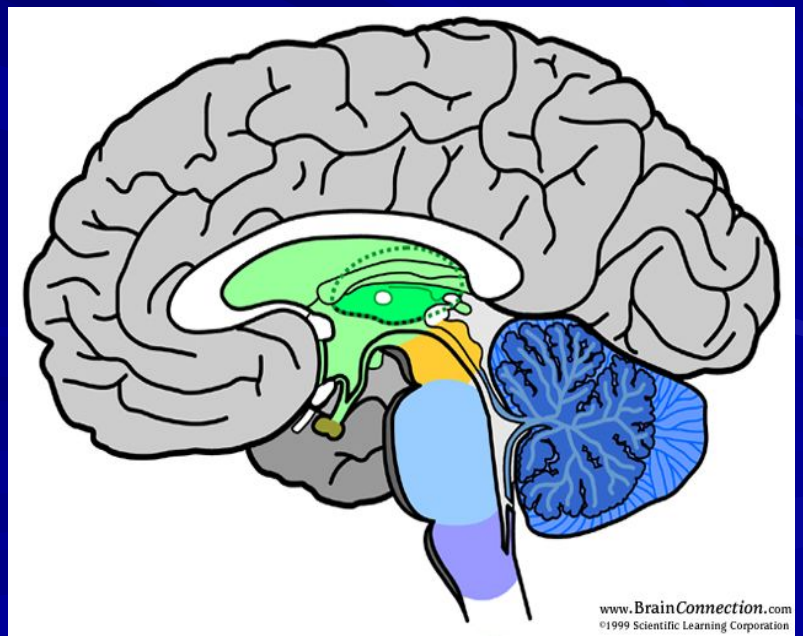


The Structure of the Nervous System

The Cerebellum

- is lying behind the cerebrum.
- contains as many neurons as both cerebral hemispheres combined.
- is primarily a movement control center that has extensive connections with the cerebrum and the spinal cord.
- the left side of the cerebellum is concerned with movements of the left side of the body, and the right side of the cerebellum is concerned with movements of the right side.

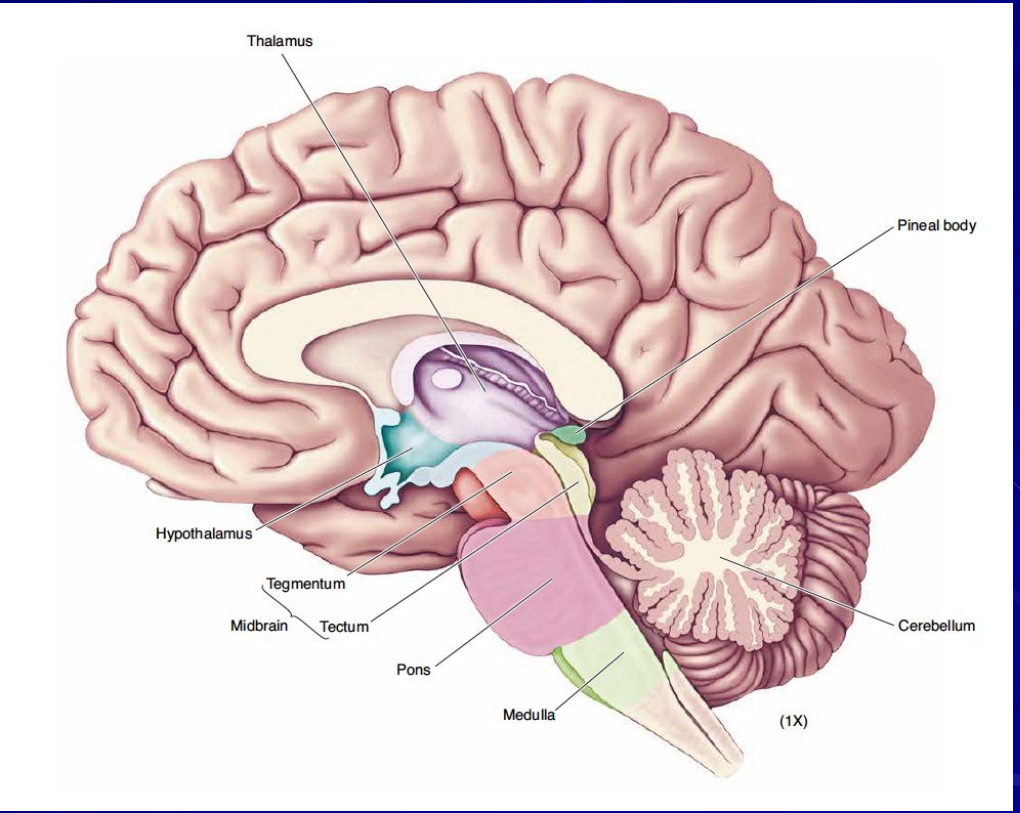




The Structure of the Nervous System

The Brain Stem

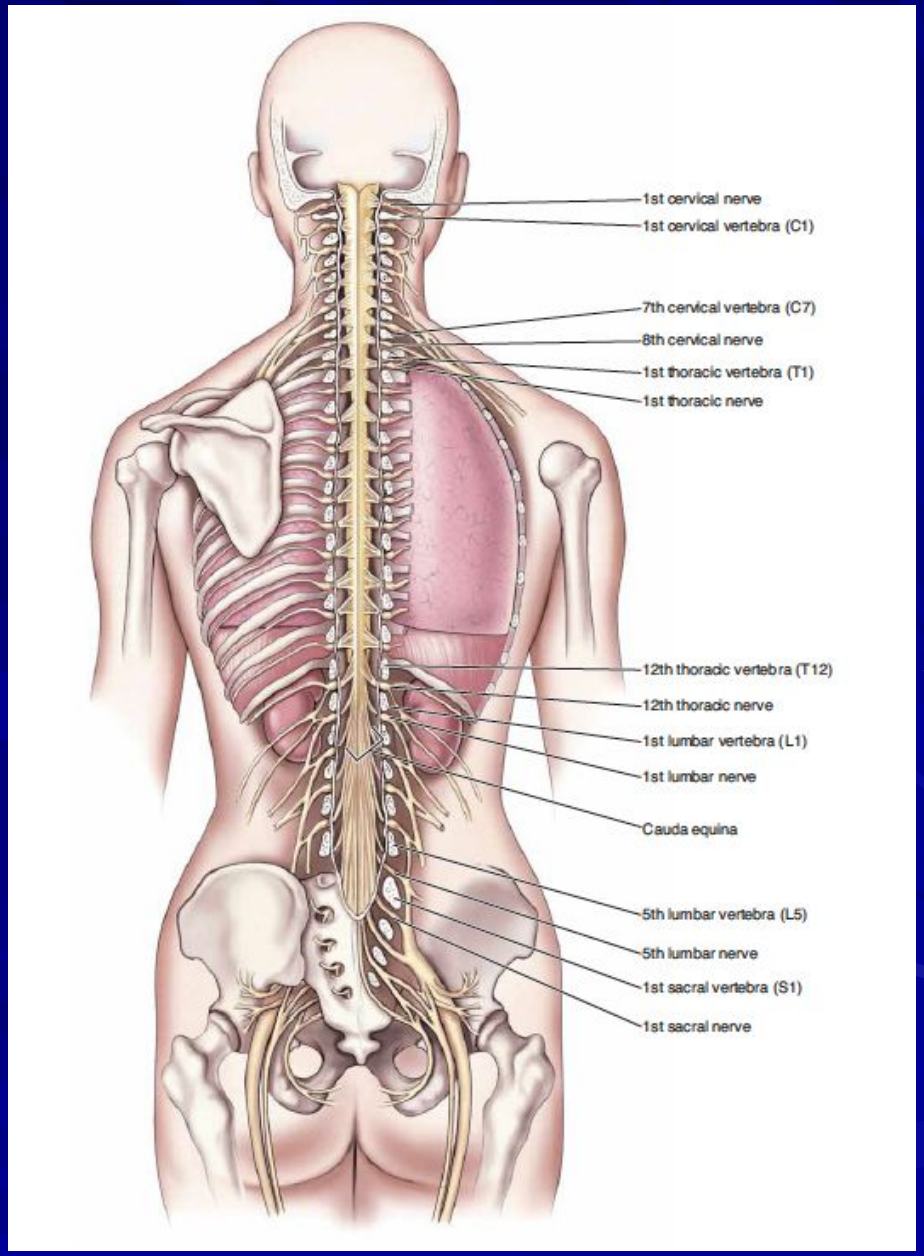
- forms the stalk from which the cerebral hemispheres and the cerebellum sprout.
- is a complex nexus of fibers and cells that in part serves to relay information from the cerebrum to the spinal cord and cerebellum, and vice versa.
- is part of brain where vital functions are regulated, such as breathing, consciousness, and the control of body temperature.
- damage to the brain stem is usually fatal.



The Structure of the Nervous System

The Spinal Cord

- is encased in the bony vertebral column
- is attached to the brain stem
- is the major conduit of information from the skin, joints, and muscles of the body to the brain, and vice versa
- A transection of the spinal cord results in anesthesia (lack of feeling) in the skin and paralysis of the muscles in parts of the body caudal to the cut.

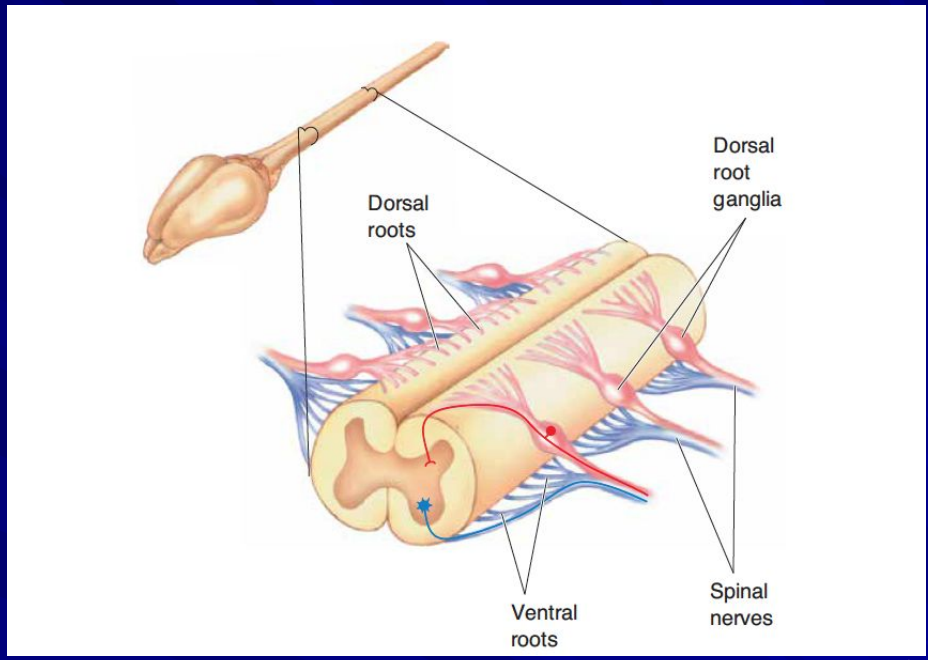


The Structure of the Nervous System

The Spinal Cord

- The spinal cord communicates with the body via the spinal nerves
- Each spinal nerve attaches to the spinal cord by means of two branches, the dorsal root and the ventral root

1. the dorsal root contains axons bringing information into the spinal cord
2. the ventral root contains axons carrying information away from the spinal cord

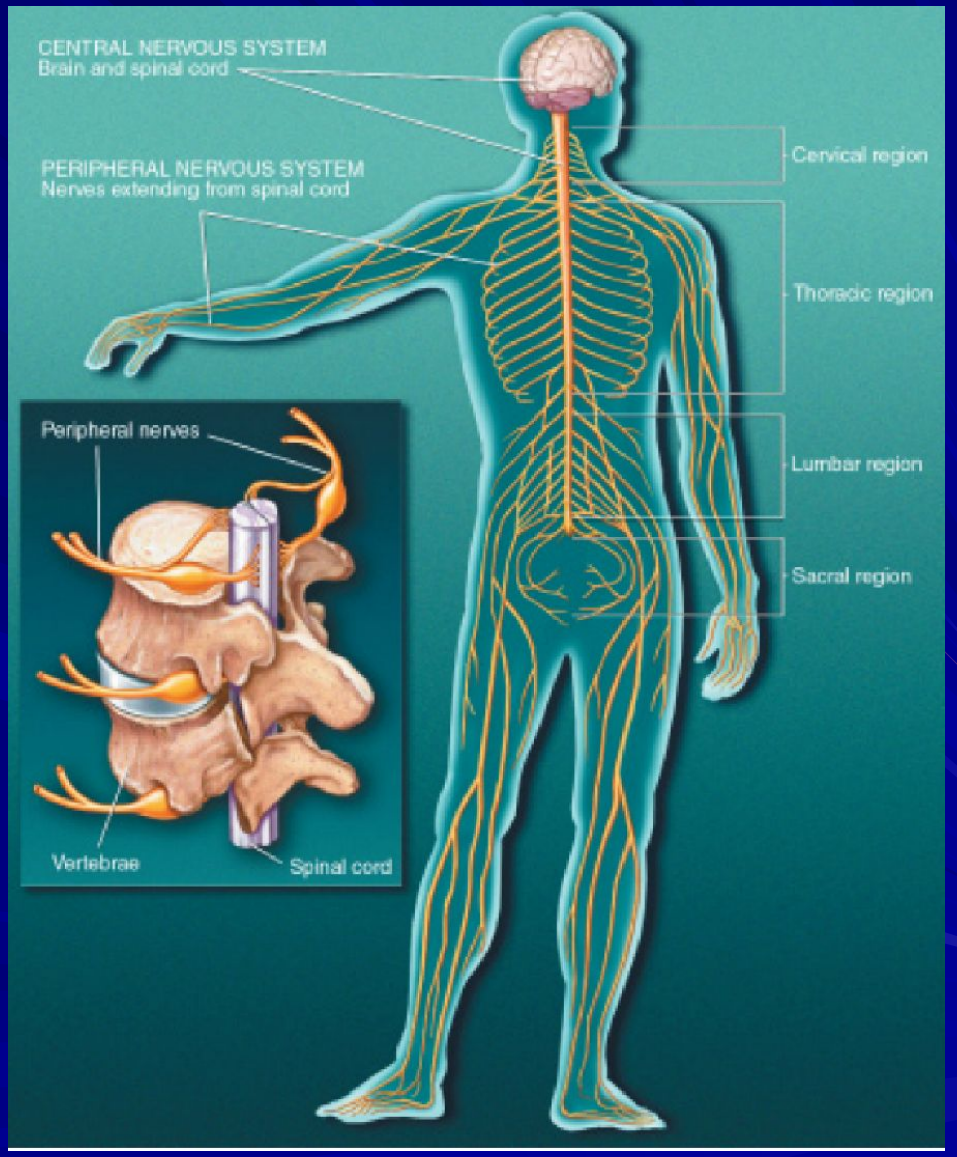


The Structure of the Nervous System

The Peripheral Nervous System (PNS)

The PNS has two parts:

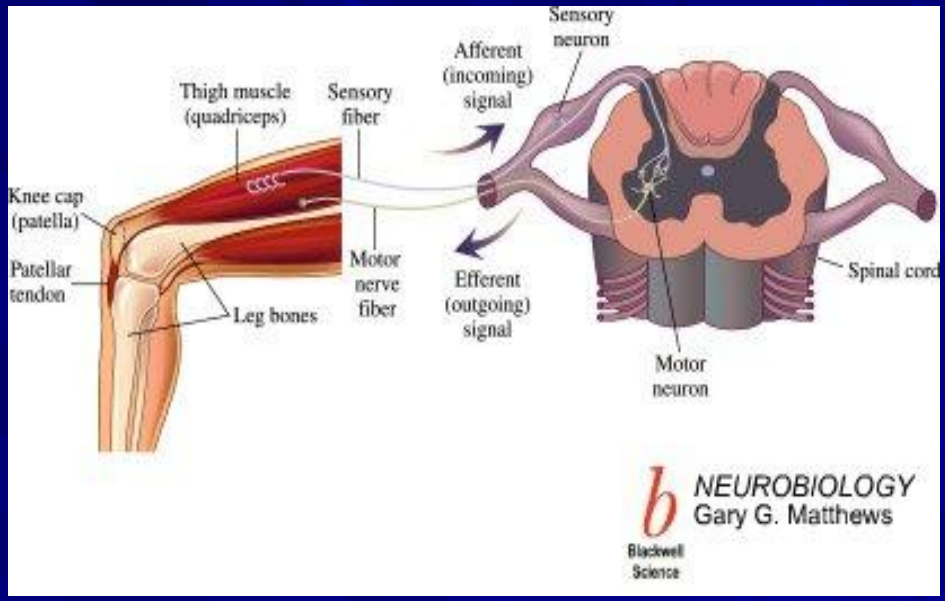
1. the somatic PNS
2. the visceral PNS.

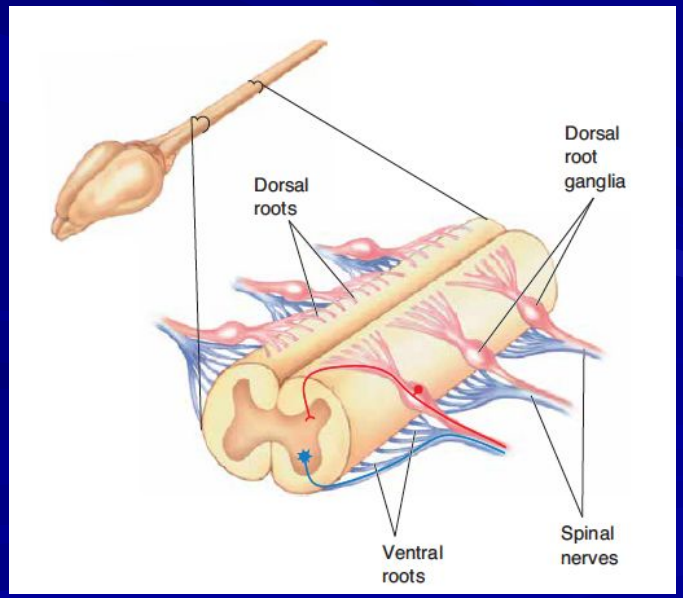


The Structure of the Nervous System

The Somatic PNS

- all the spinal nerves that innervate the skin, the joints, and the muscles that are under voluntary control
- The somatic motor axons derive from motor neurons in the ventral spinal cord.
- The cell bodies of the motor neurons lie within the CNS, but their axons are mostly in the PNS
- The somatic sensory axons enter the spinal cord via the dorsal roots
- The cell bodies of sensory neurons lie outside the spinal cord in dorsal root ganglia





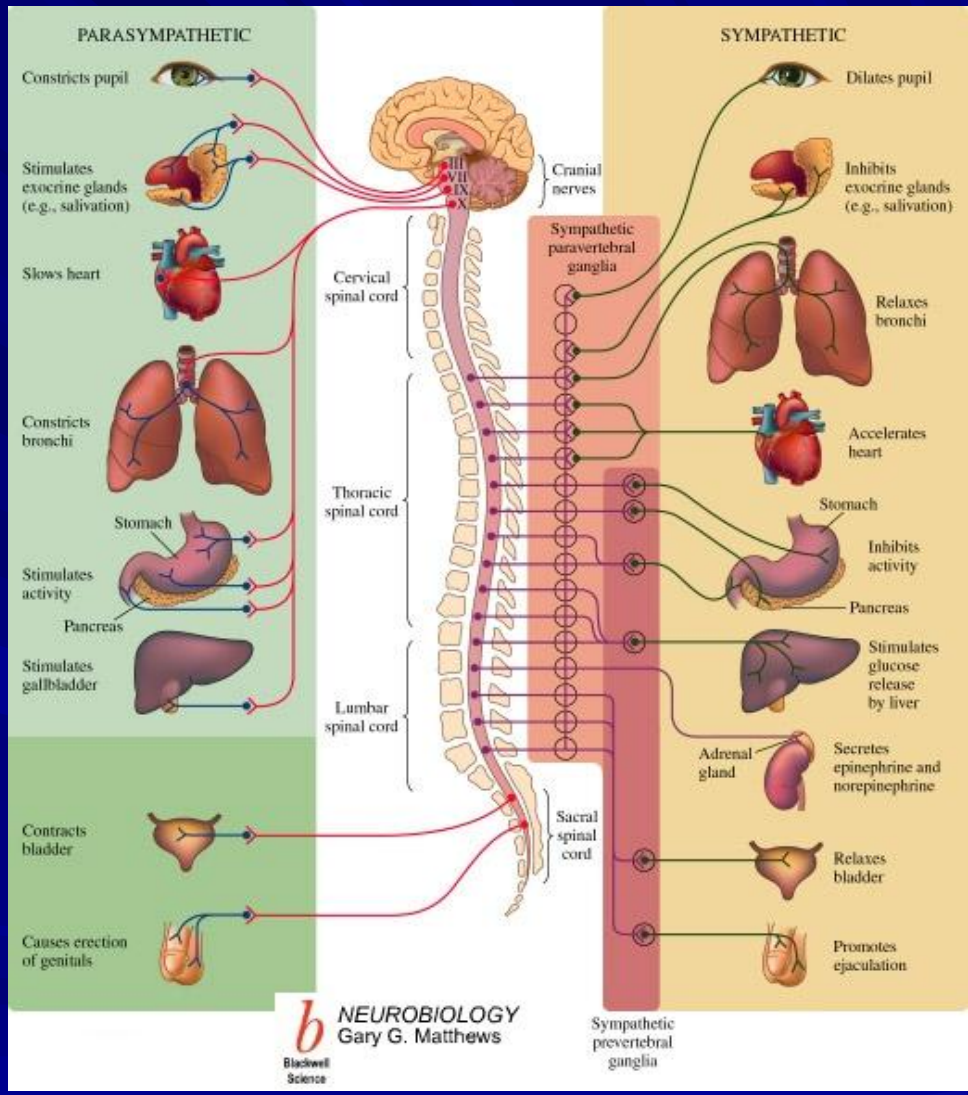
The Structure of the Nervous System

The Visceral PNS

(involuntary, vegetative, autonomic nervous system)

- consists of the neurons that innervate the internal organs, blood vessels, and glands
- visceral sensory axons (afferent) bring information about visceral function to the CNS
- visceral motor axons (efferent) command

1. the contraction and relaxation of smooth muscles
2. the rate of cardiac muscle contraction
3. the secretory function of various glands



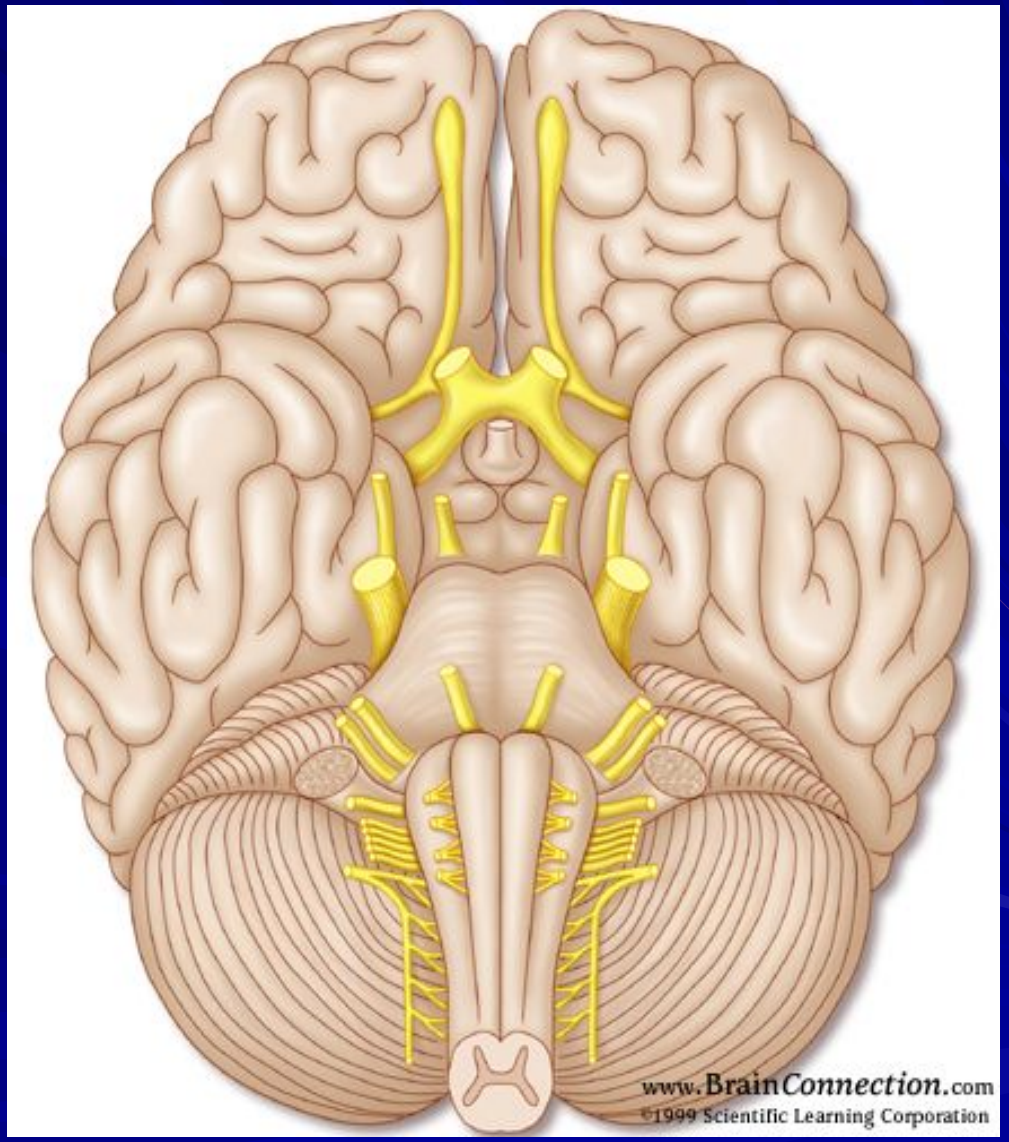
The Structure of the Nervous System

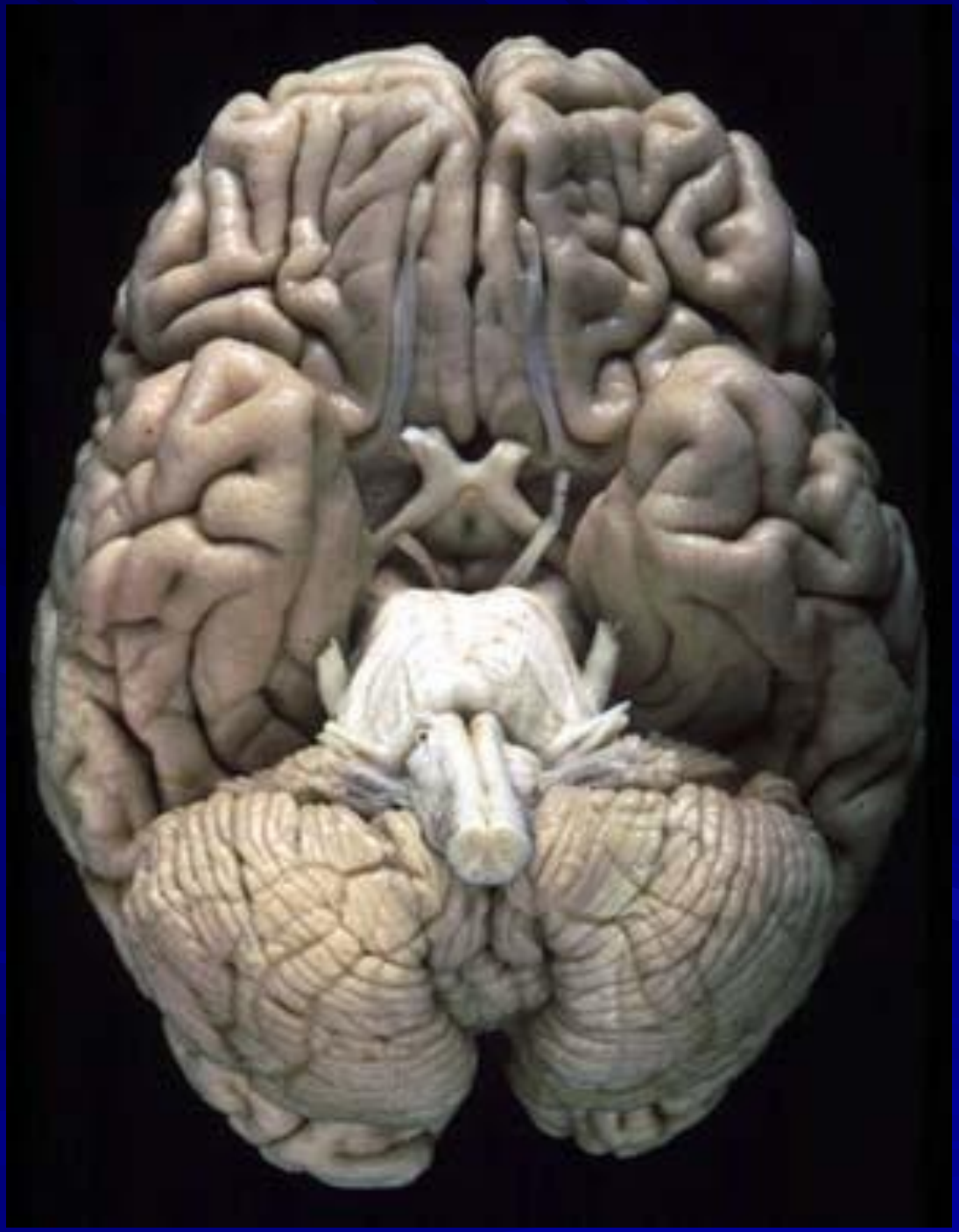
- There are 12 pairs of cranial nerves that arise from the brain stem and innervate (mostly) the head

- Each cranial nerve has a name and a number associated with it

- Some of the cranial nerves are part of the

1. CNS
2. somatic PNS
3. visceral PNS



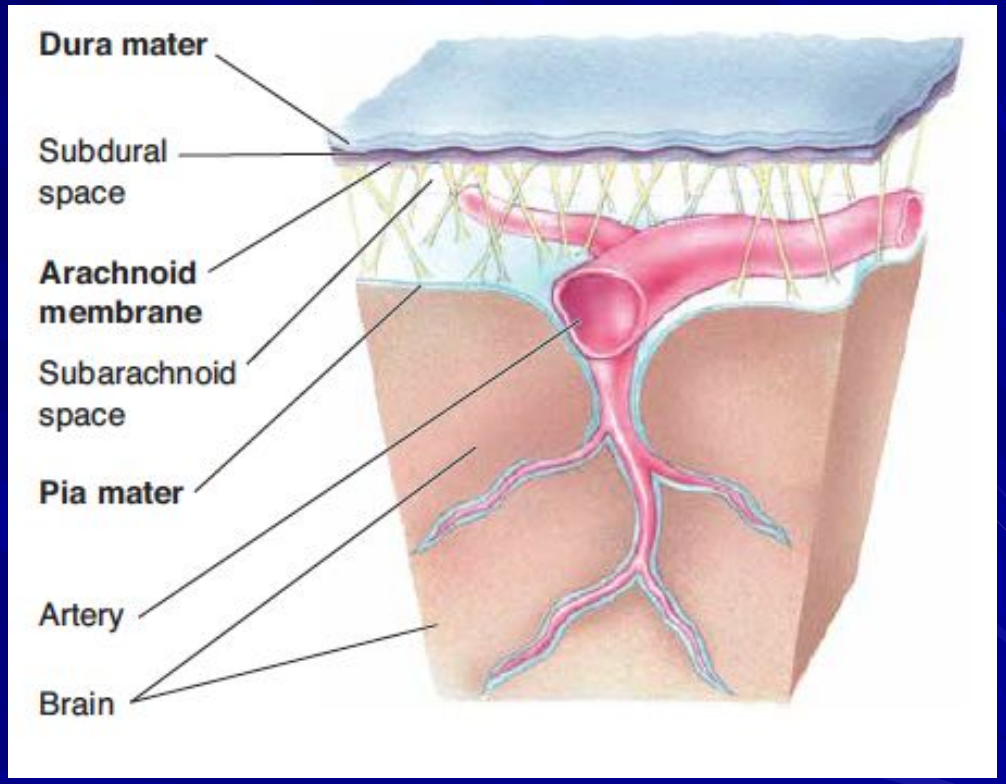


The Meninges

The CNS is protected by three membranes collectively called the meninges.

1. dura mater
2. arachnoid membrane
3. pia mater

The dura matter forms a tough, inelastic bag that surrounds the brain and spinal cord.



The Meninges

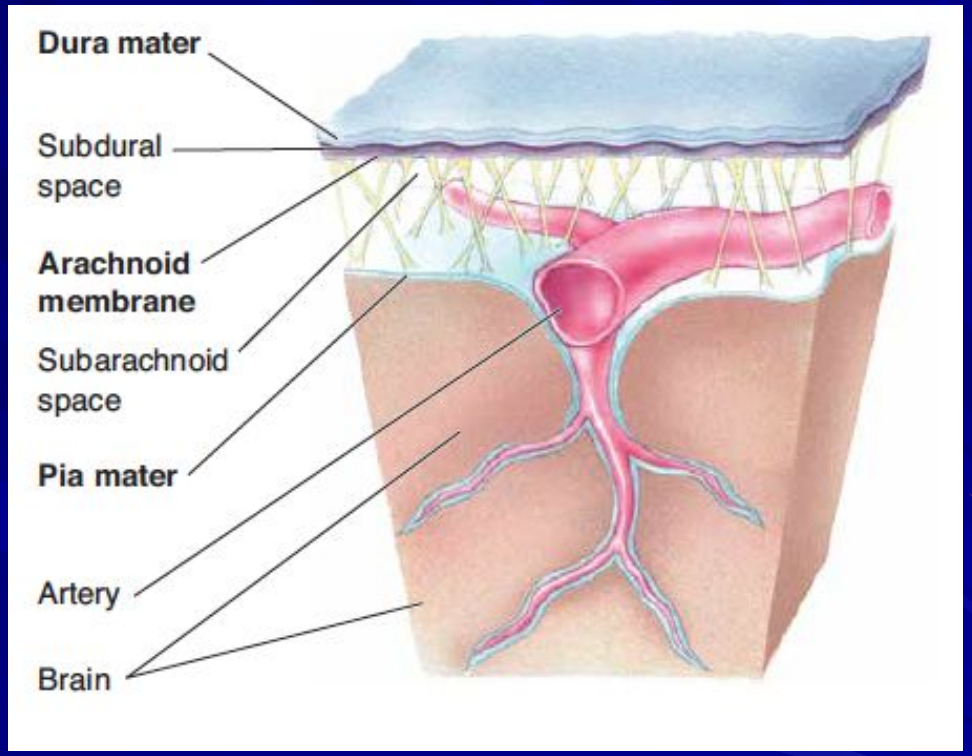
There is subdural space between dura matter and arachnoid membrane.

There is subarachnoid space between arachnoid membrane and pia matter.

Subarachnoid space is filled with cerebrospinal fluid (CSF) .

The pia mater is a thin membrane that adheres

closely to the surface of the brain.

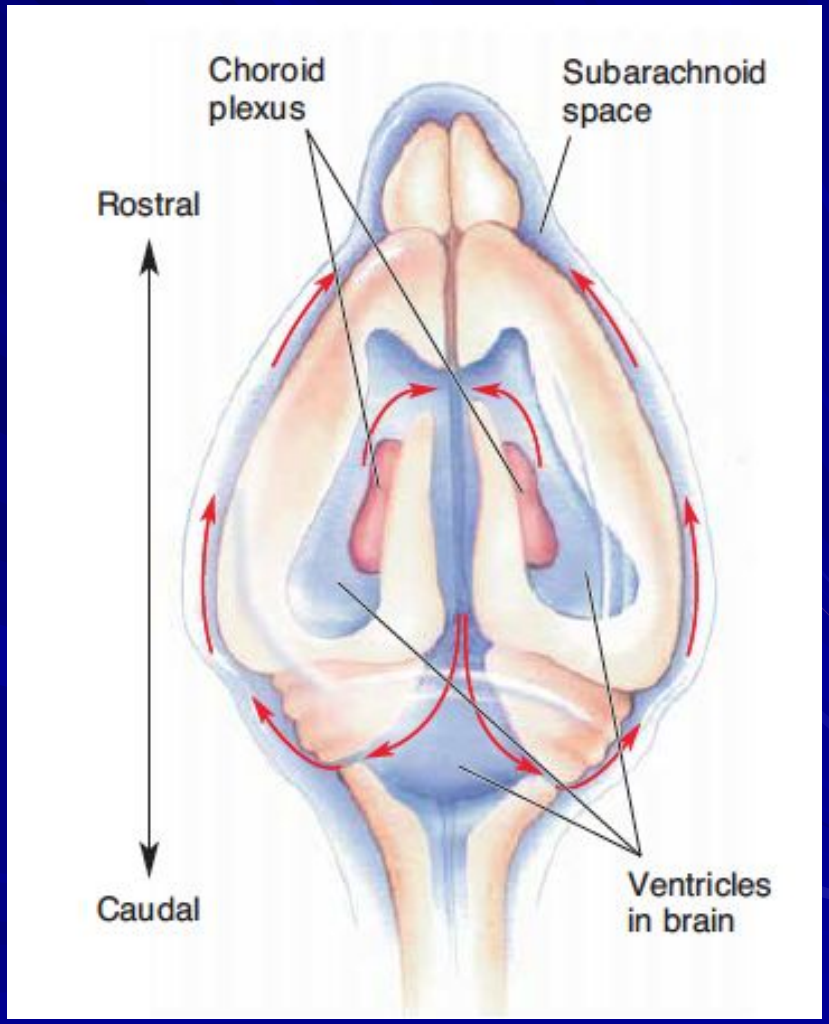


The Ventricular System

The ventricular system is the fluid filled caverns and canals inside the brain.

The fluid is cerebrospinal fluid (CSF).

- CSF is produced by choroid plexus in the ventricles of the cerebral hemispheres.
- CSF flows from the paired ventricles to a series of connected, central cavities at the core of the brain stem.



The Ventricular System

- CSF exits the ventricular system and enters the subarachnoid space by way of small openings located near where the cerebellum attaches to the brain stem.
- In the subarachnoid space, CSF is absorbed by the blood vessels at arachnoid villi.
- If the flow of CSF from the choroid plexus through the ventricular system to the subarachnoid space is impaired, the fluid will back up and cause a swelling of the ventricles. This condition is called hydrocephalus