

The 8th lecture

In

Anatomy and Physiology

For the

1st Class

Nervous System (Part II)

The Central Nervous System (CNS)

Central Nervous System (CNS)

- It is a soft organ and it consists of the brain and the spinal cord.
- In sectioning, shows region of gray (**gray matter**) and region of white (**white matter**).
- **Gray matter** contains **neuronal cell bodies, dendrites, and glial cells**. While **white matter** contains mainly **myelinated axons**.
- In cross section of the brain, **gray matter** forms the brain cortex and **White matter** forms the more central region.
- In cross section of spinal cord, **white matter** is peripheral and **gray matter** is central.

Cross Section of the Brain

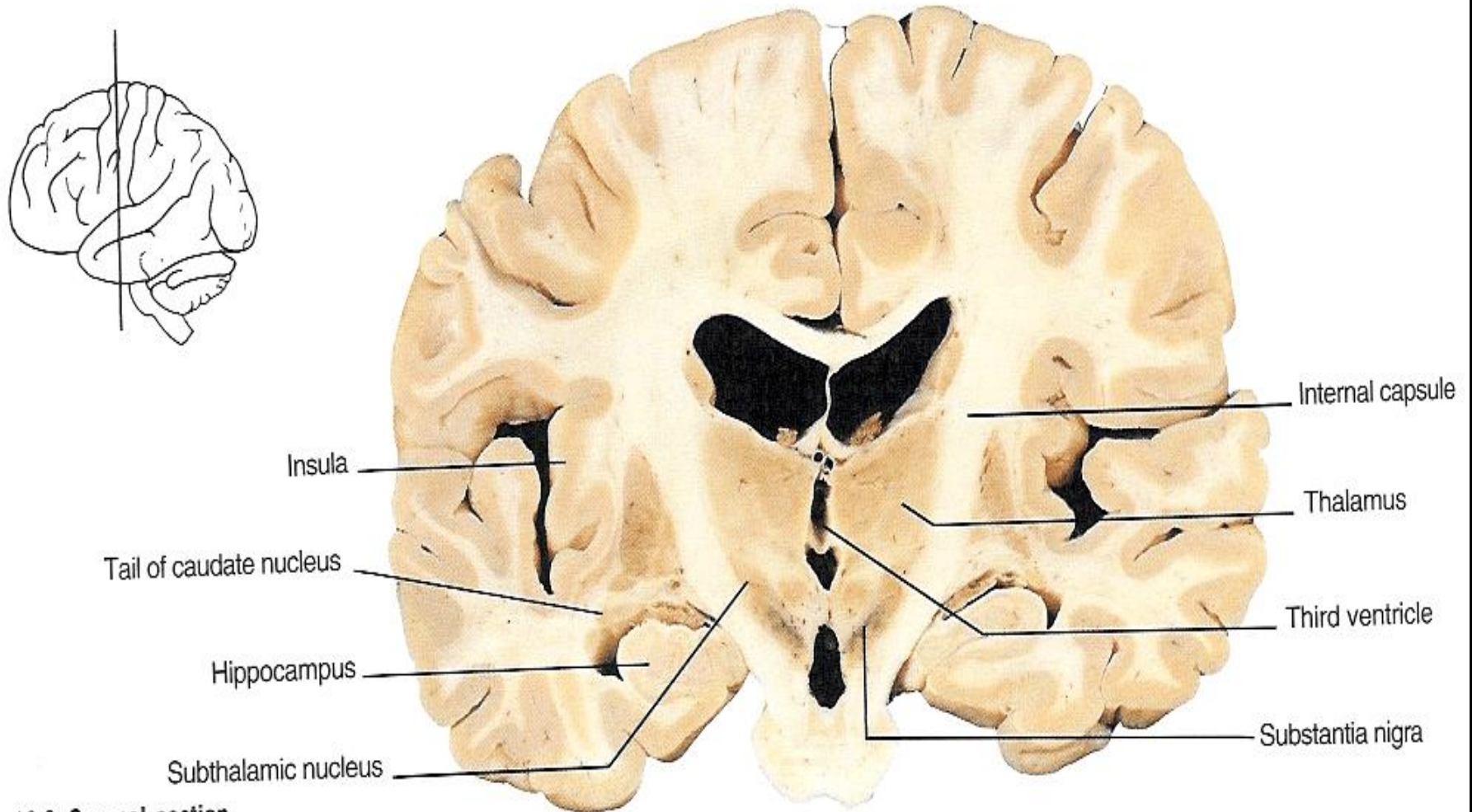
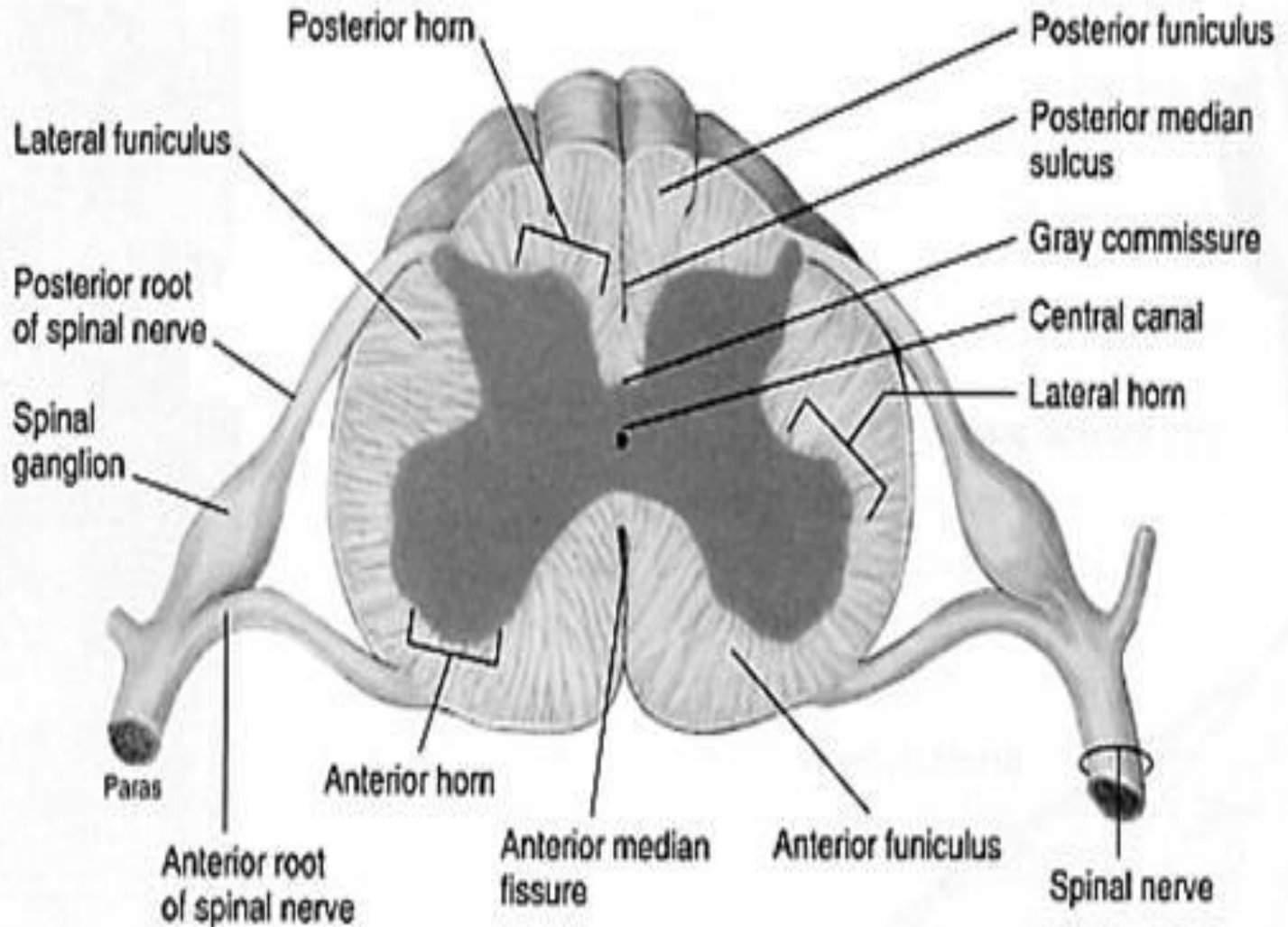


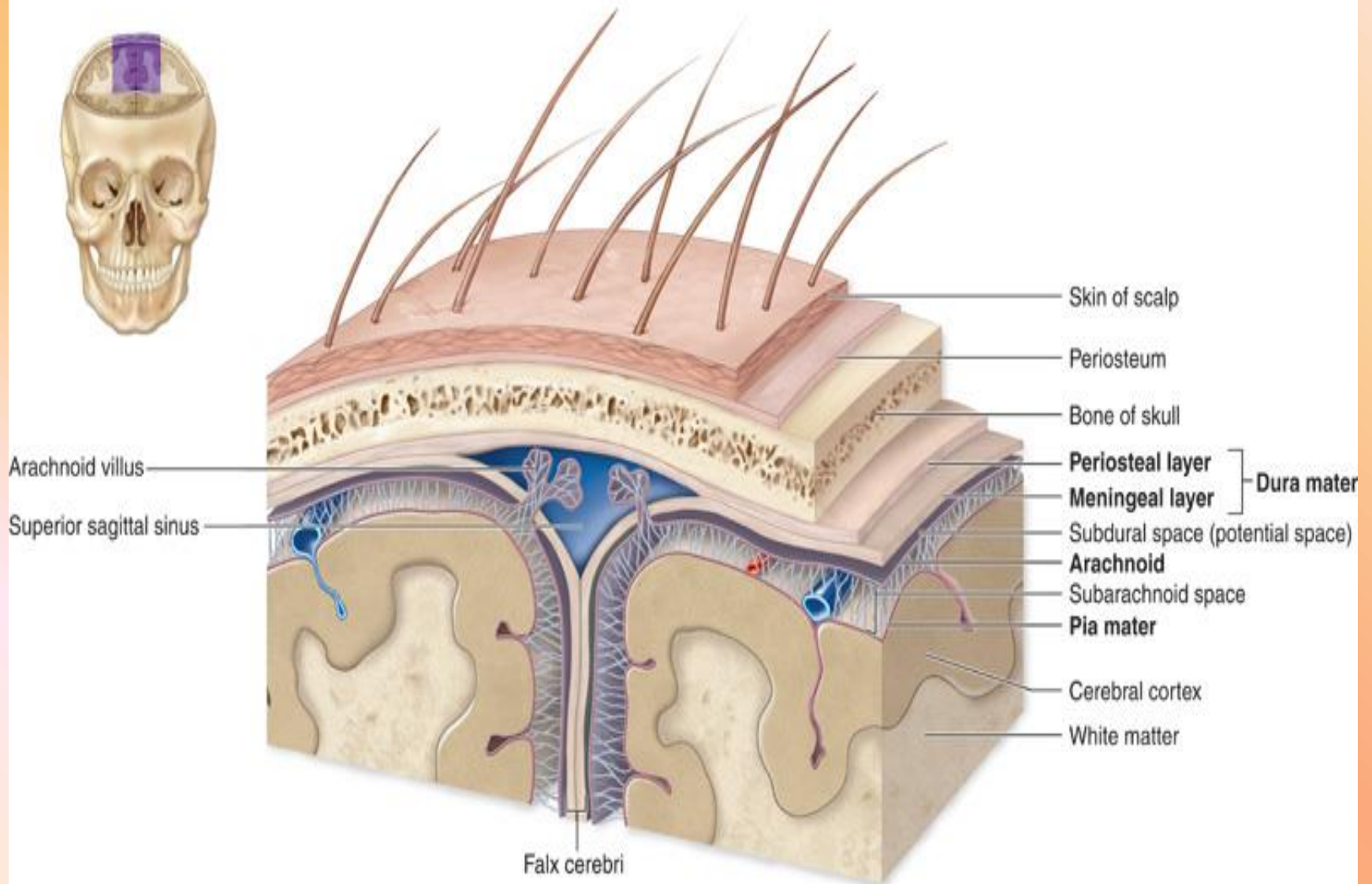
Fig. 10.9 Coronal section.

Cross Section of the Spinal Cord

White matter is peripheral and **gray matter** is central.



- CNS is covered with membranes which is called **meninges** [three membranous layers these are (dura mater, arachnoid and pia mater)].
- Dura mater is the external layer, and the arachnoid is the middle while the pia mater is the inner layer which contains a large number of blood vessels.
- The **cerebral spinal fluid** (CSF) is founded in the space between arachnoid and pia mater.
- The CSF **protects the brain from injury**. And also helps to **carry nutrition and remove waste products**.



Brain ventricles

- These are cavities within brain.
- The ventricles are continuous with one another as well as with the central canal of the spinal cord.
- There are 4 ventricles in the brain.

Blood brain barrier

- The blood brain barrier is the functional barrier that prevents the passage of some substances, such as antibiotics and chemicals and bacterial toxic matter, **from blood to nerve tissue.**

The Brain

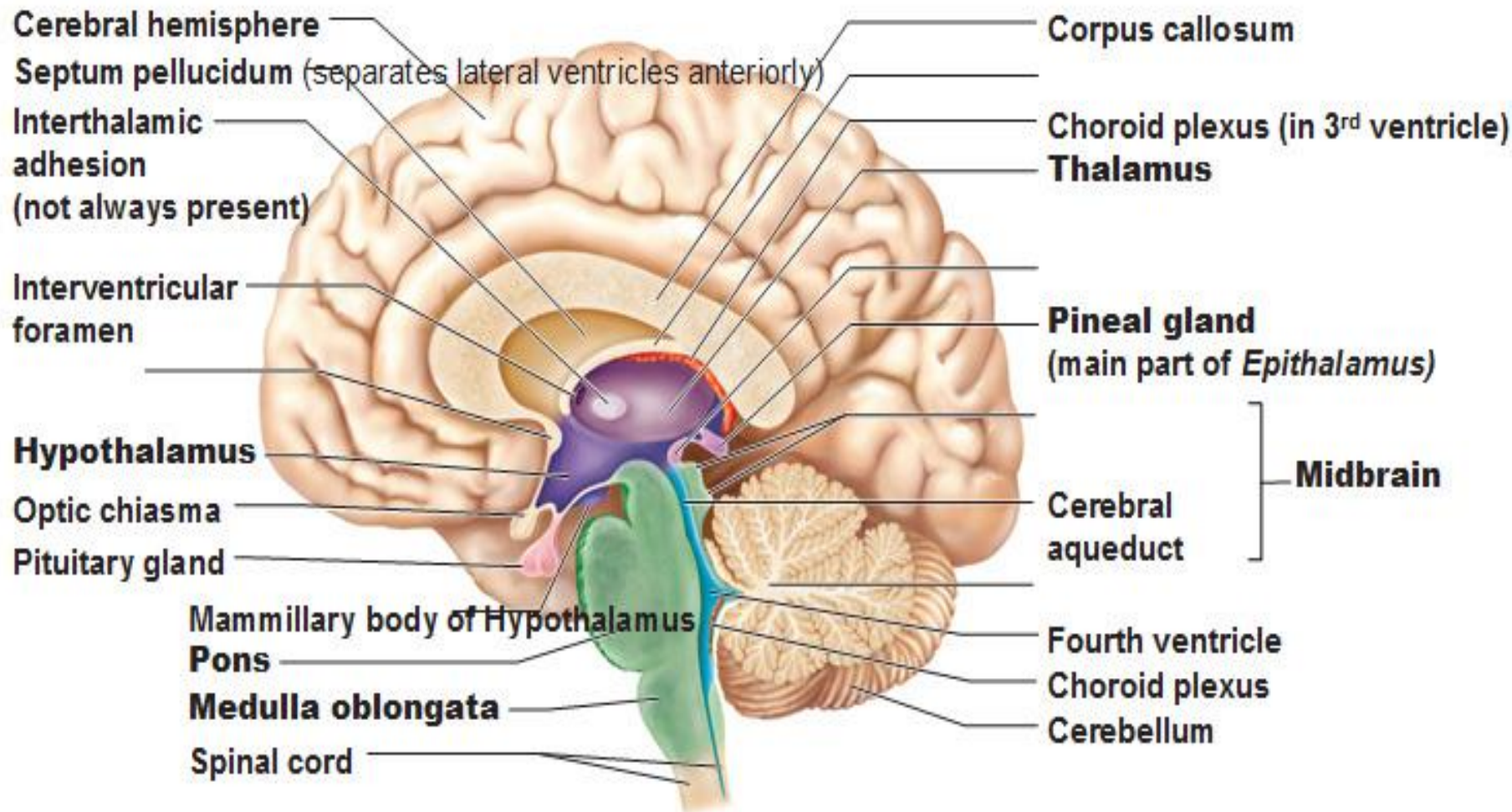
- **Parts of the brain are:**

1. Cerebrum
2. Cerebellum
3. Brainstem

Cerebrum

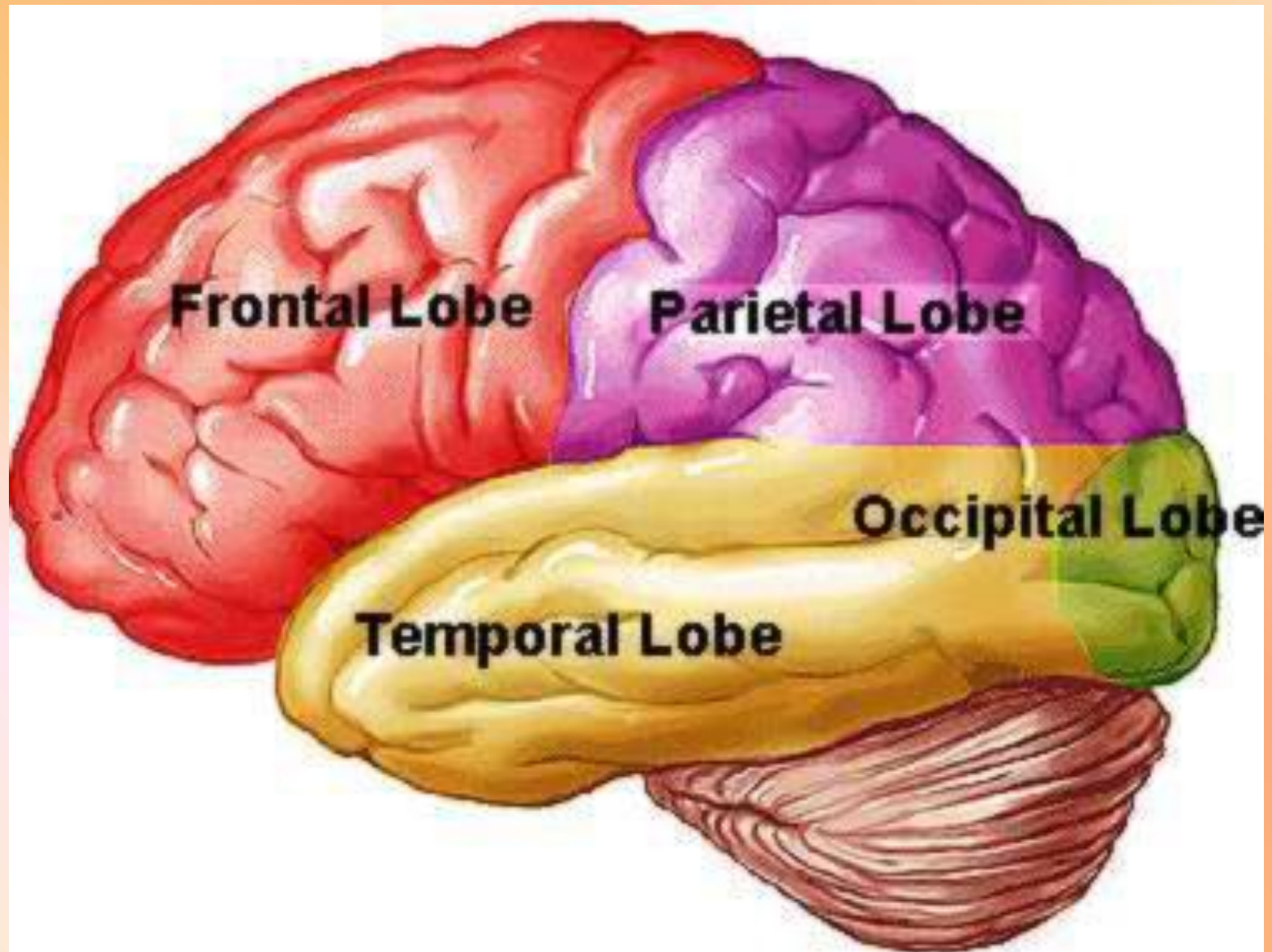
- The cerebrum is the largest and most developing portion of the brain.
- The cerebrum is divided into:
 - Telencephalon**
 - Diencephalon (consists thalamus, hypothalamus, and pineal body)**
- The **telencephalon** is divided into two hemisphere. The left hemisphere control the majority of functions on the right side of the body, while the right hemisphere controls most of functions on the left side of the body.
- The cerebrum contains grooves and folds.
- The grooves are called sulci while the folds are called gyri. The large grooves divide the cerebrum into lobes, so there are six lobes in the cerebrum.
- The lobes of cerebrum are: **frontal, parietal, temporal, occipital, insular, and limbic lobes.**

The Diencephalon (and Brainstem)



(a)

Lobes of cerebellum



- **The frontal** is involved in planning organizing, problem solving, and selective attention. The portion known as the pre frontal cortex control personality and various higher cognitive functions such as behavior and emotions. The back of the frontal lobe consists of the premotor and motor areas which produce and modify movements.
- **The Parietal lobe** process the sensory informations (touch, pressure) and integrate somato-sensory informations. Damage to the right parietal lobe can cause special visuo-spatial defect. Damage to the left parietal lobe may disrupt a patient ability to understand spoken and/or writing language.
- **The Temporal lobe:** are center of memory in learning, audition and required for recognize different things like faces, signs, environment).
- **The Occipital lobe:** is important for vision and visual processing.
- **The Insular lobe** is important for pain, bladder control and Gustation (taste).
- **limbic lobe** is important for emotion.

The thalamus

- : refers to paired oval masses of gray matter that lie on the either side of the third ventricle.
- **Thalamus** consists of many thalamic nuclei (synapses among neurons inside the CNS).
Thalamus is usually considered as a functional gateway of cerebral cortex.

Hypothalamus

- **Functions of the hypothalamus:**
- master control of the autonomic nervous system
- regulation of body temperature
- control emotional behavior
- control food intake
- control water intake
- regulation of sleep-wake (circadian) rhythm

Cerebellum

The cerebellum is also called little brain. And it lies behind the pons and the medulla.

Functions of the cerebellum

It responsible for motion, balance, learning new things.

Brainstem

- The brainstem consists of
 1. **Midbrain:** is continuous above with cerebral hemispheres.
 2. **Pons**
 3. **Medulla oblongata:** it is continuous below with the spinal cord.

Functions of the brainstem

- Autonomic activities in the body, like breathing, digestion, heart beat,-----ect

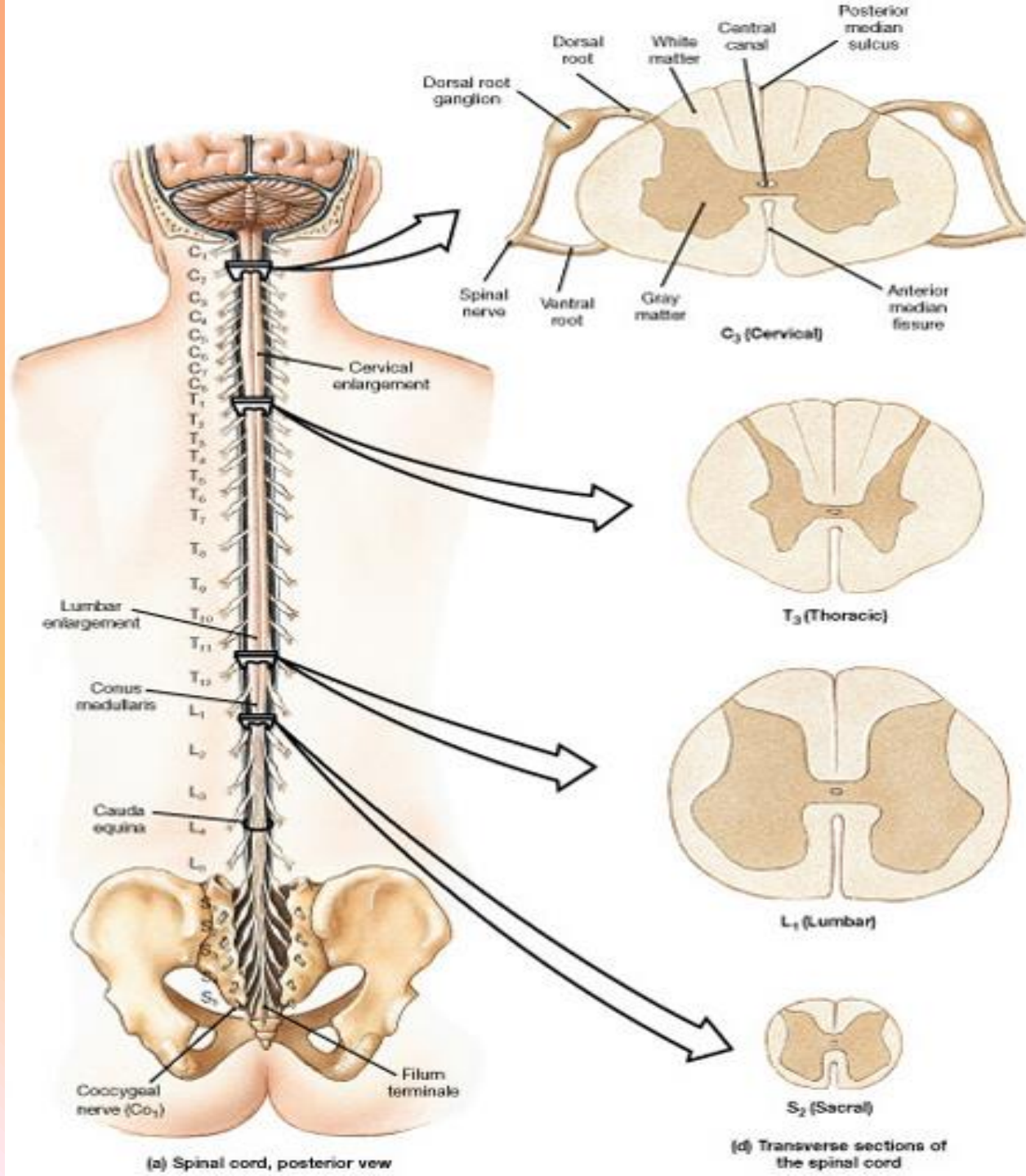
Spinal Cord

- The spinal cord is encased (located) in the bony vertebral column.
- It attached to the brainstem.
- It carry information from joint, muscle, skin, and other organs to the brain and vas versa.
- The nerve exit the spinal cord through the spinal notches between vertebrae.

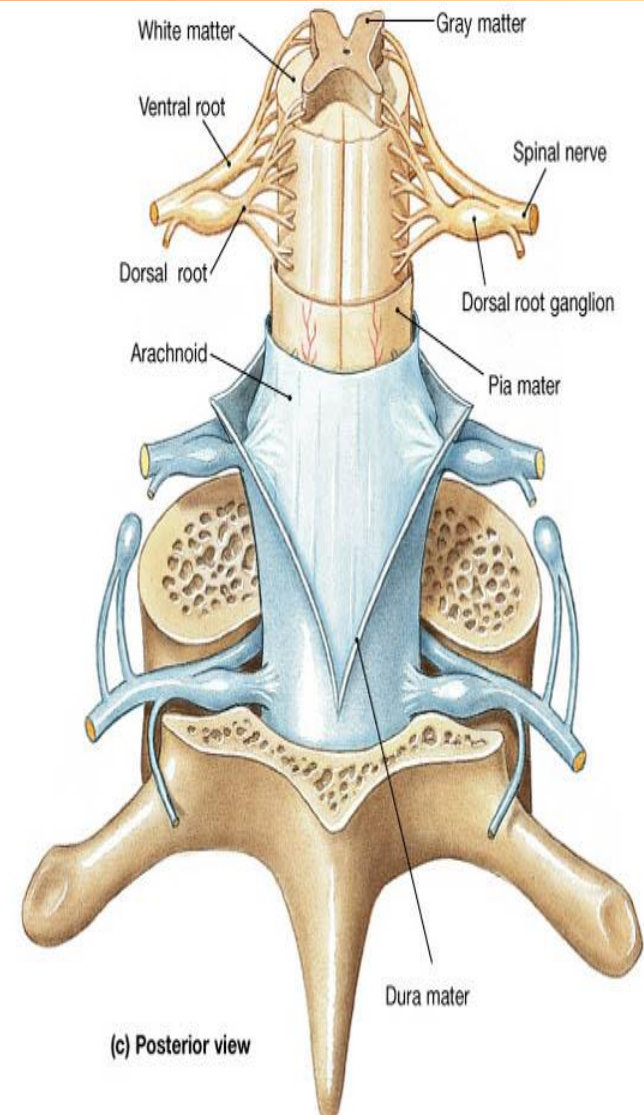
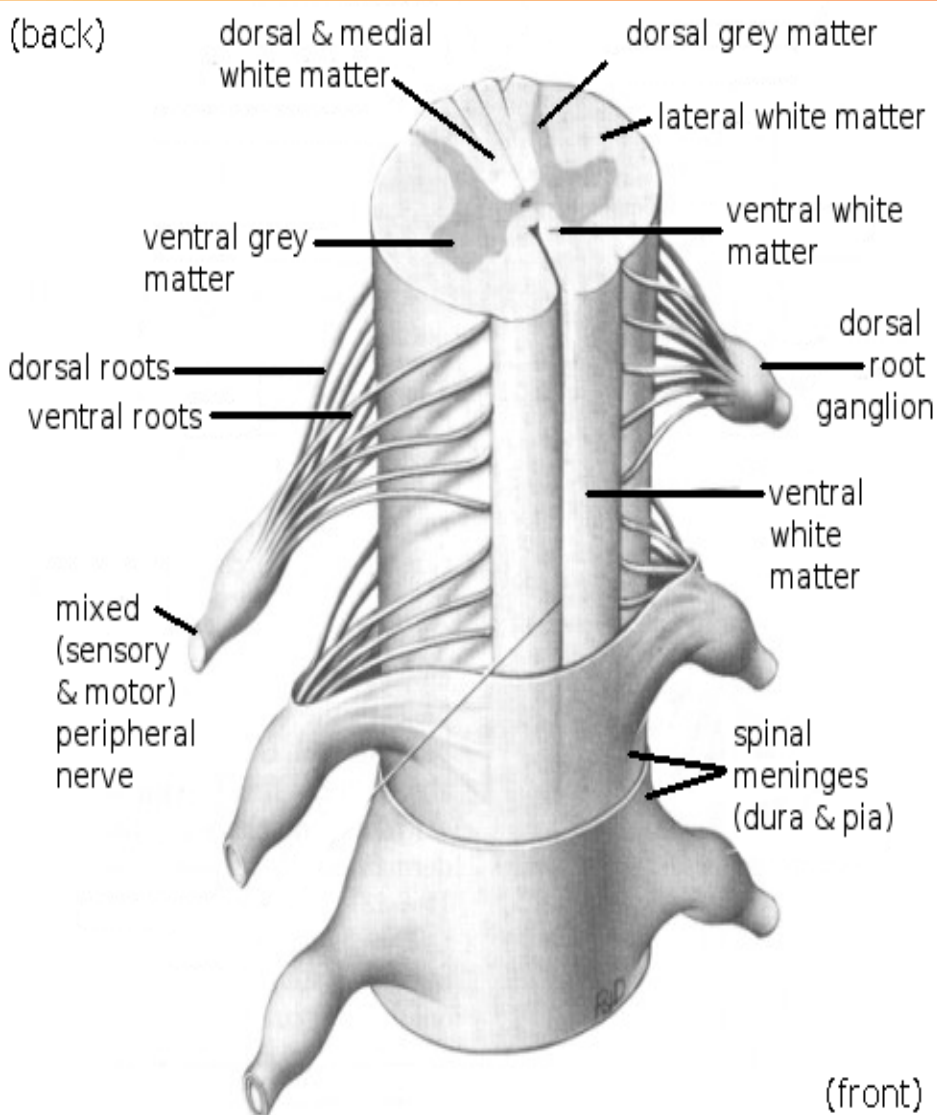
Spinal Cord Segments

- The spinal cord is a long, thin collection of nerves from the brain that extends to approximately the 2nd lumbar vertebra.
- It is divided into 4 main regions:
 1. Cervical spinal cord
 2. Thoracic spinal cord
 3. Lumbar spinal cord
 4. Sacral spinal cord
- There are 30 segments in the spinal cord. Each segment has one pair of nerve on each side.

Spinal cord segments

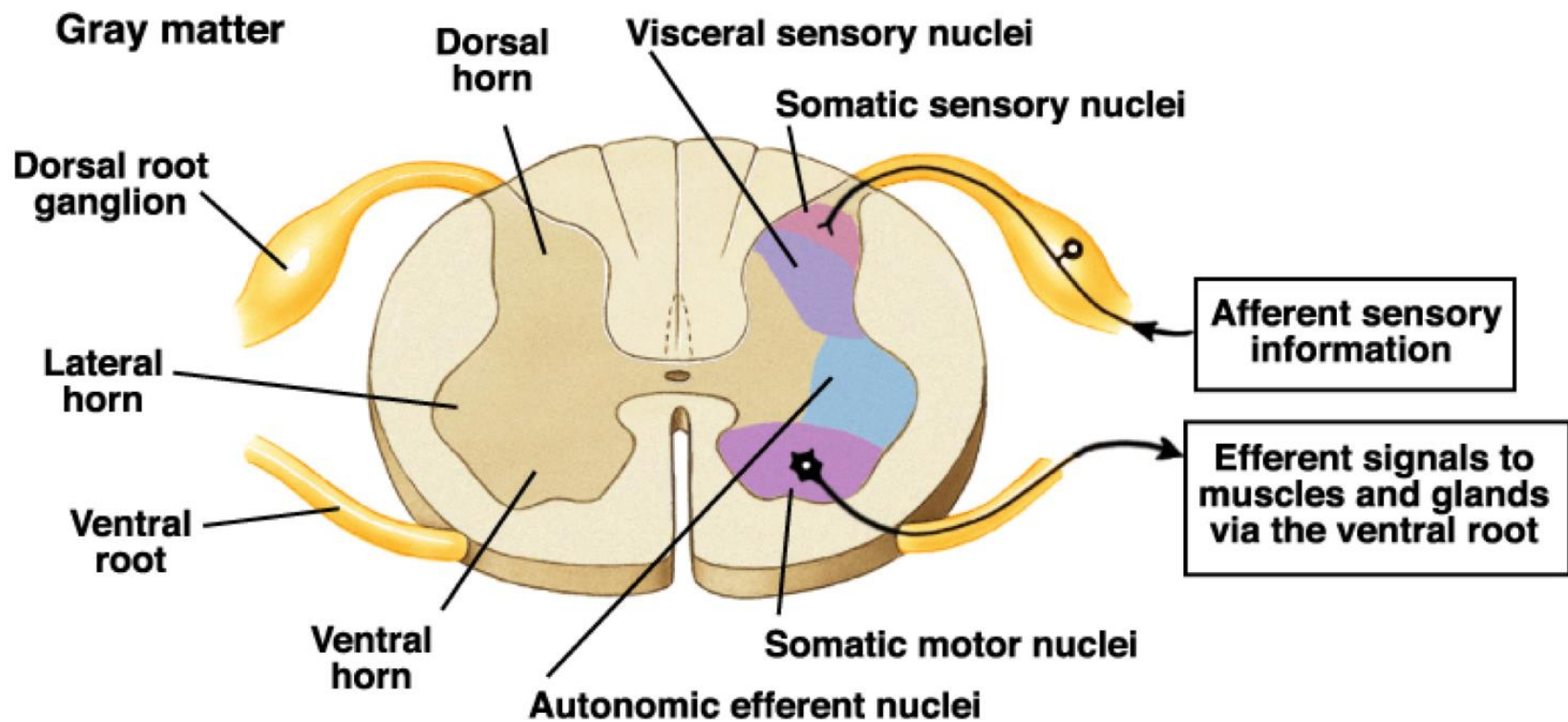


The spinal cord communicates via the spinal nerves



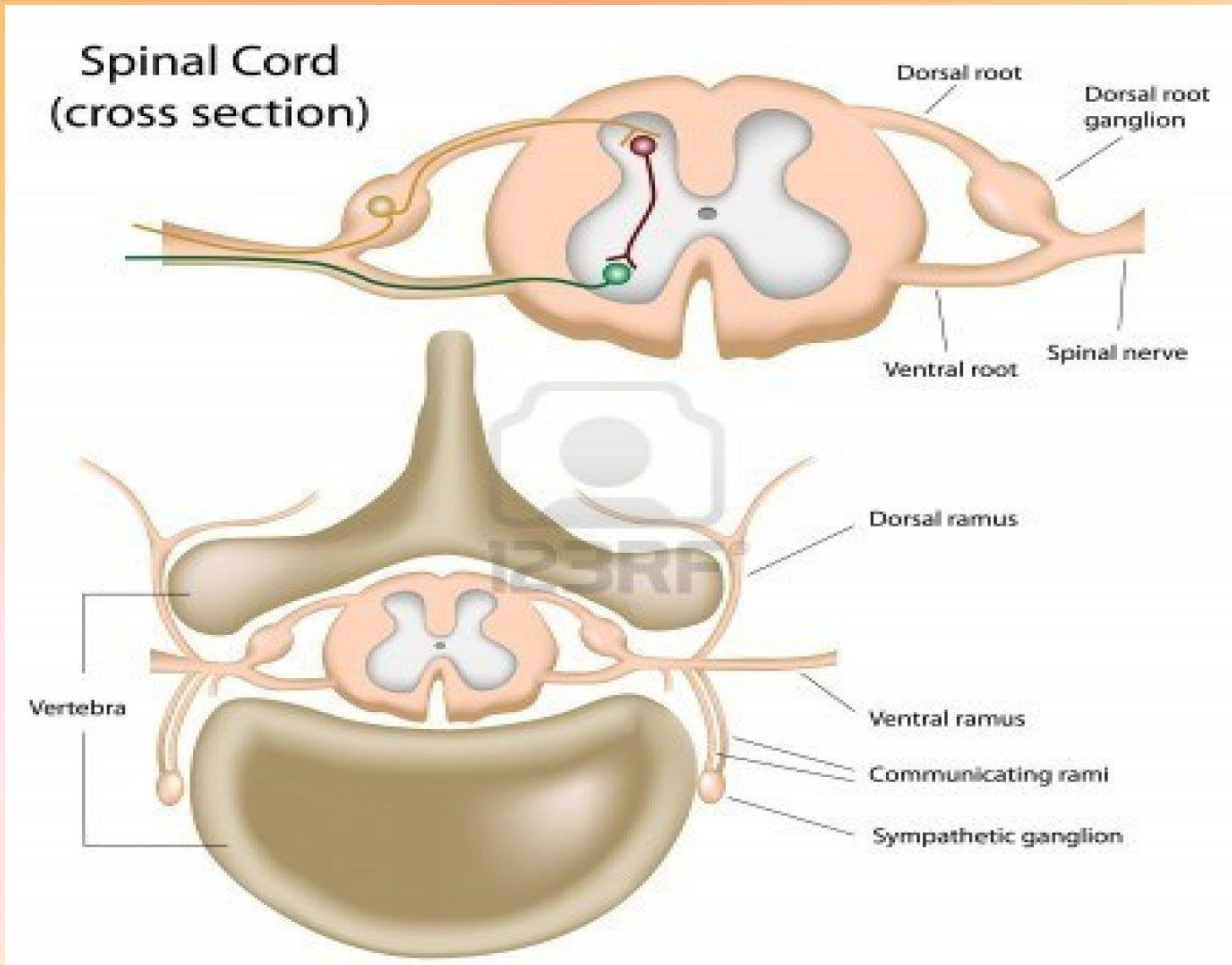
Cross Section of the Spinal Cord

- The gray matter of the spinal cord forms an **H- shaped mass**.
- **Central canal** is an opening located in the horizontal bar of the this H and the central canal contains CSF.
- the gray matter of the legs of the H forms the **anterior horns**.
- the gray matter of the arms of the H forms the **posterior horns**.
- The **anterior horns** contain **motor neurons** whose axons make up the **ventral roots** of the spinal nerves.
- The **posterior horns** receive sensory fibers from neurons in the **dorsal roots**

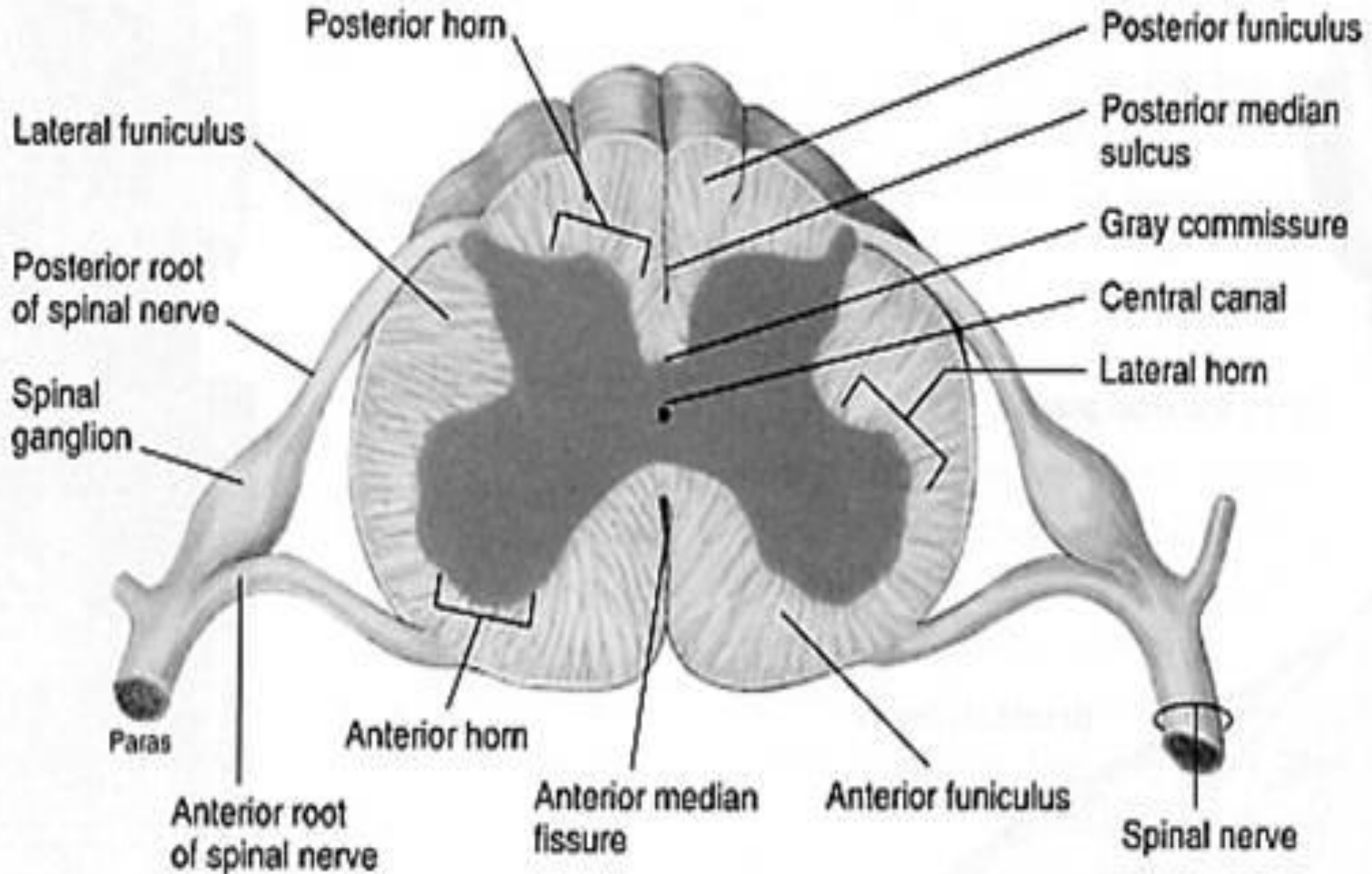


- **Dorsal root ganglia** are present at each spinal segment.
- Each pair of **dorsal root ganglia** contains sensory neuron cell bodies.
- Adjacent to the dorsal root there is a ventral root.
- **Ventral root** contains the axons of motor neurons, also exit the spinal cord.
- **Together the dorsal root and the ventral root form the spinal nerve.**
- So the spinal nerve are the mixed nerve because they contain both sensory and motor nerve fibers.

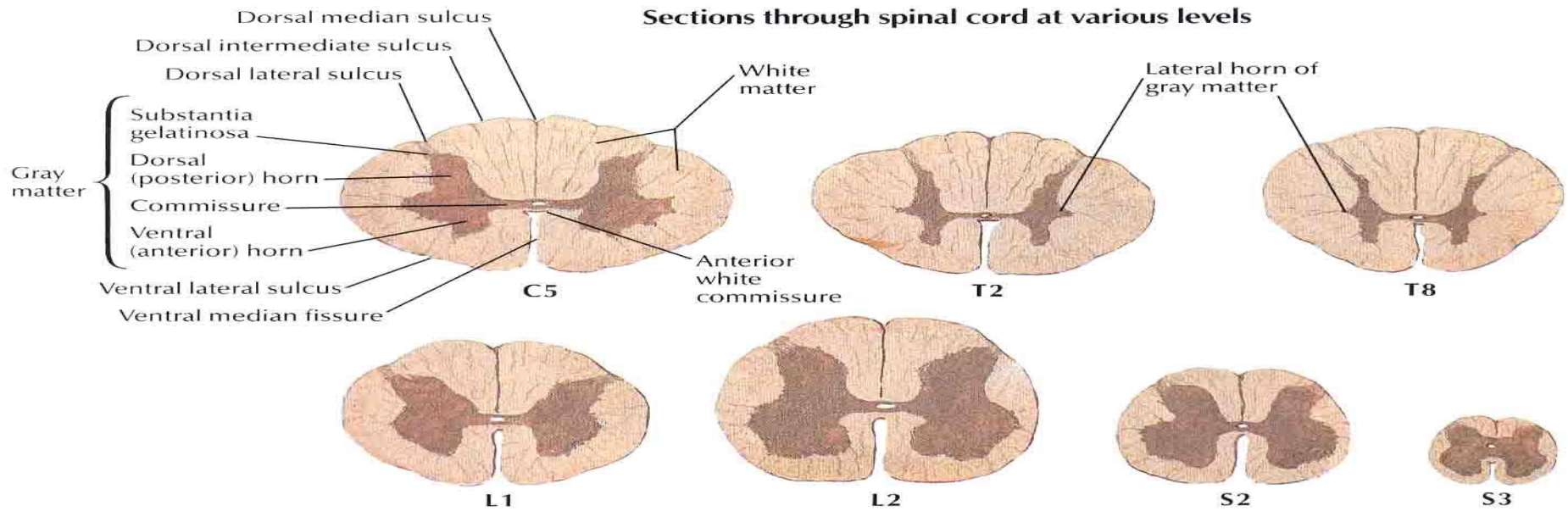
Cross Section of the Spinal Cord



Cross Section of the Spinal Cord



Sections through spinal cord at various levels



Principal fiber tracts of spinal cord

- Ascending pathways
- Descending pathways
- Fibers passing in both directions

