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NERVOUS SYSTEM

By

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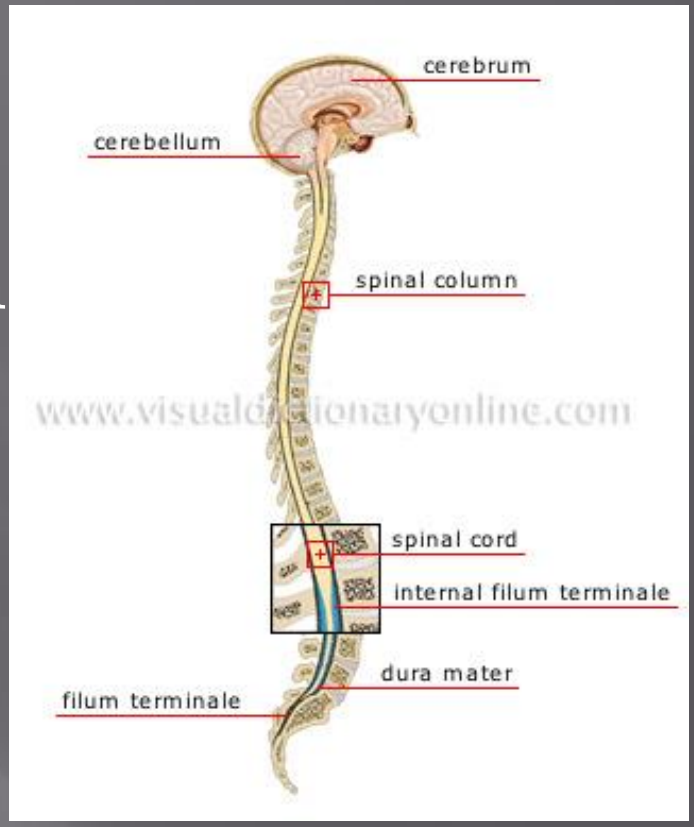
The nervous system :

1. the **central nervous system**
   - brain
   - spinal cord



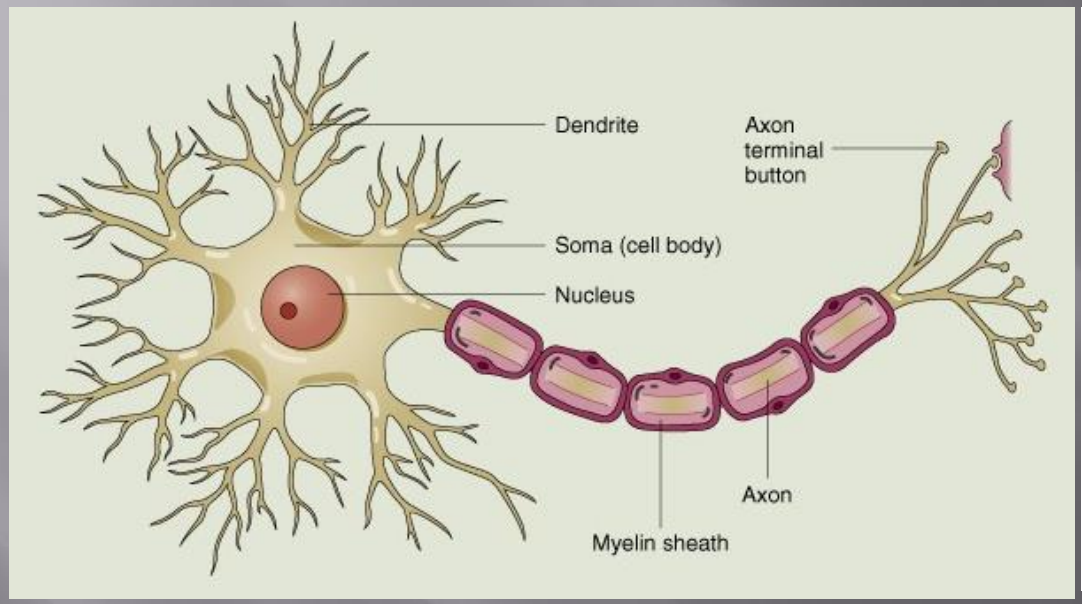
2. the **peripheral nervous system**
   - 12 pairs of cranial nerves
   - 31 pairs of spinal nerves.

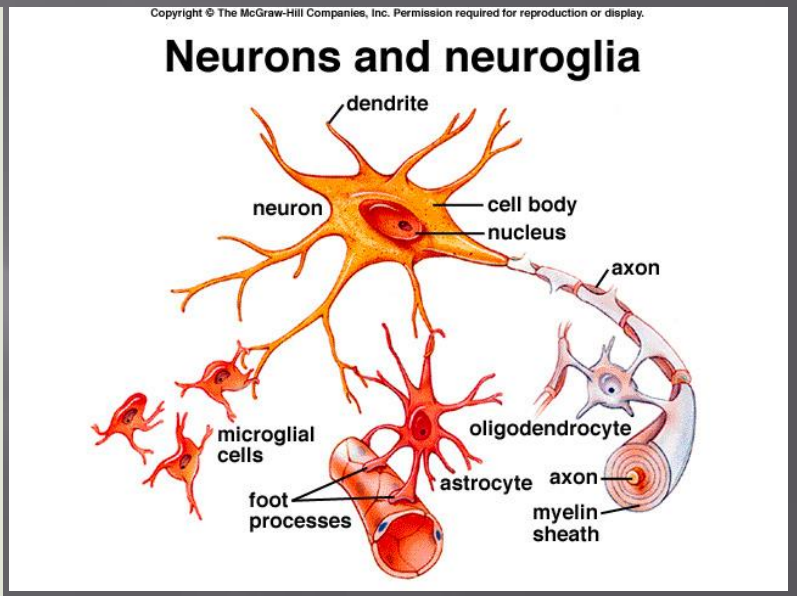
Functionally:

1. the **somatic nervous system**
   controls voluntary activities
2. the **autonomic nervous system**
   controls involuntary activities

Central Nervous System

- nerve cells(**Neurons)** and their processes
- supported by specialized tissue called **neuroglia**..





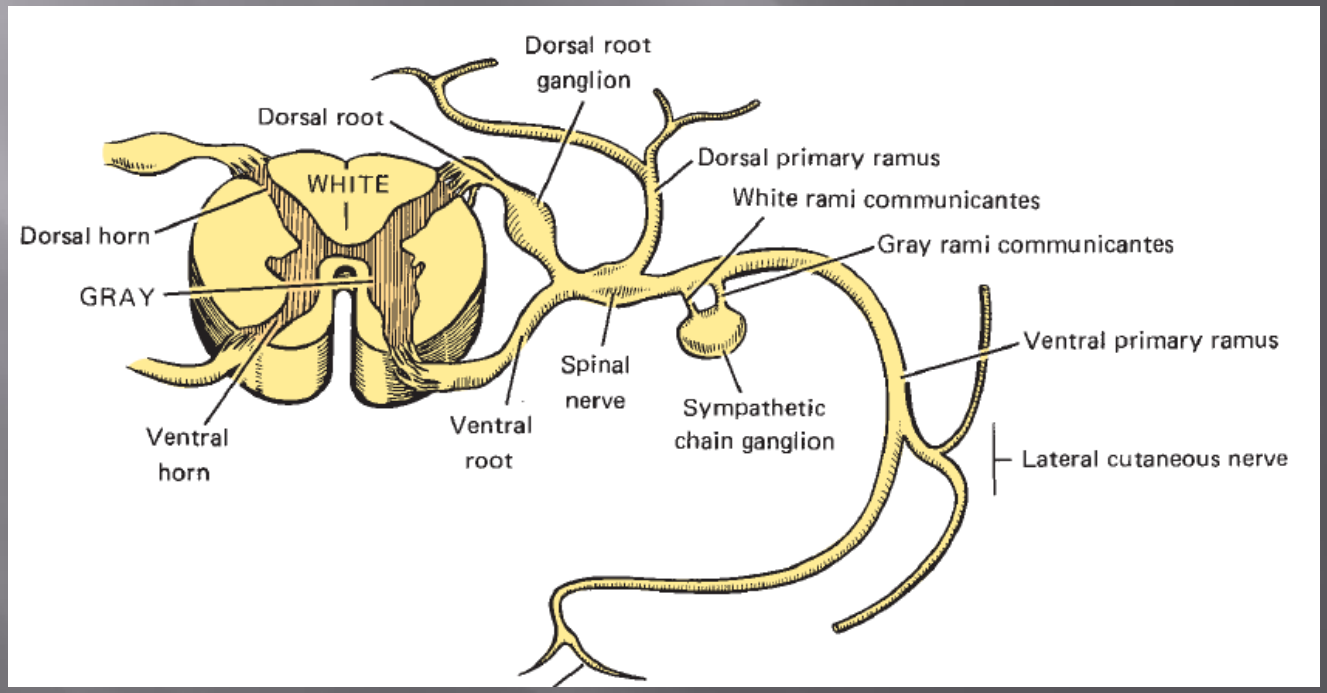
types of processes:

dendrites: short processes

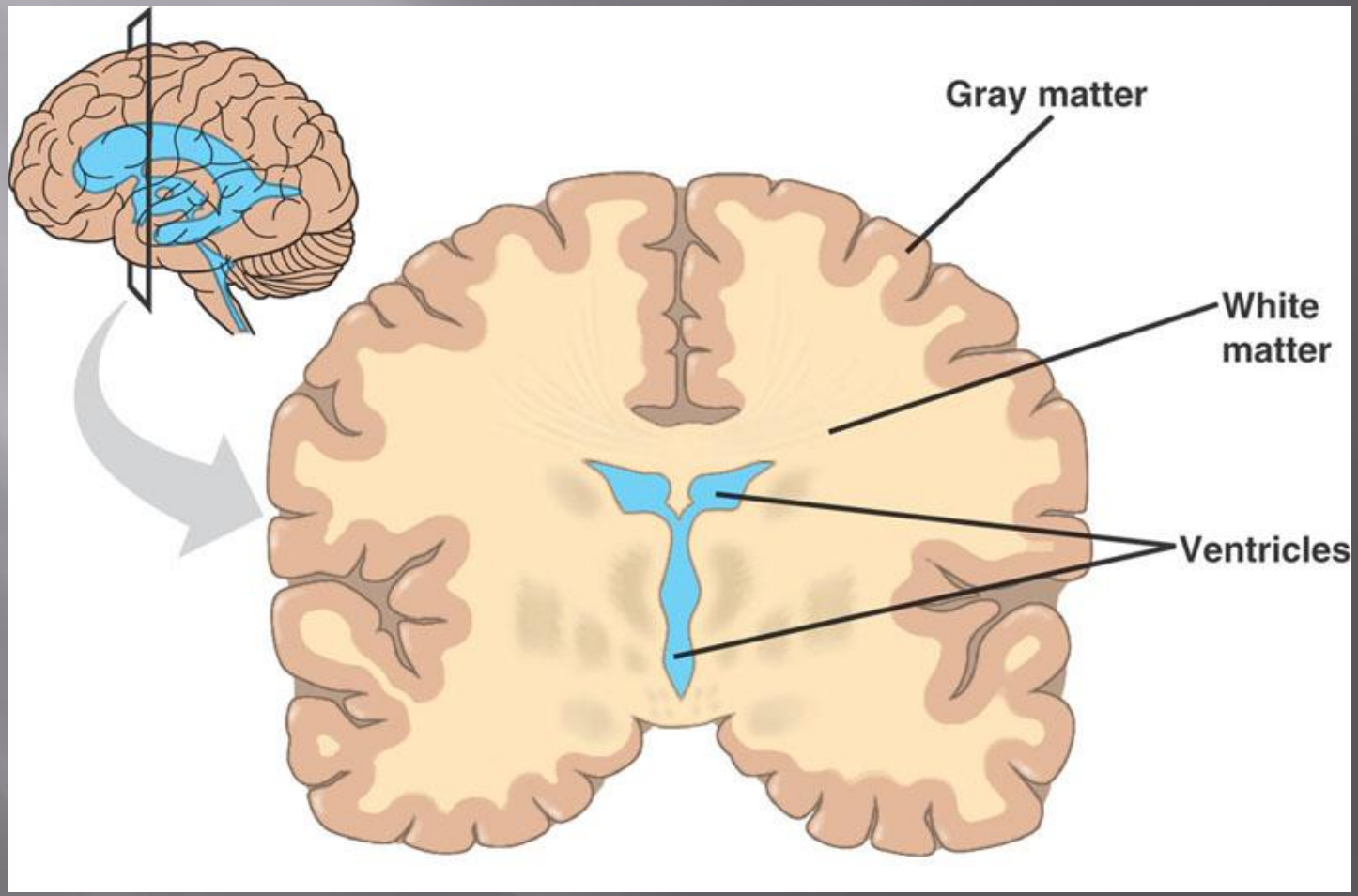
an **axon:** the longest process

The interior of the central nervous system is organized into gray and white matter.

- **Gray matter**
  consists of nerve cells embedded in neuroglia.
- **White matter**
  consists of nerve fibers (axons) embedded in neuroglia

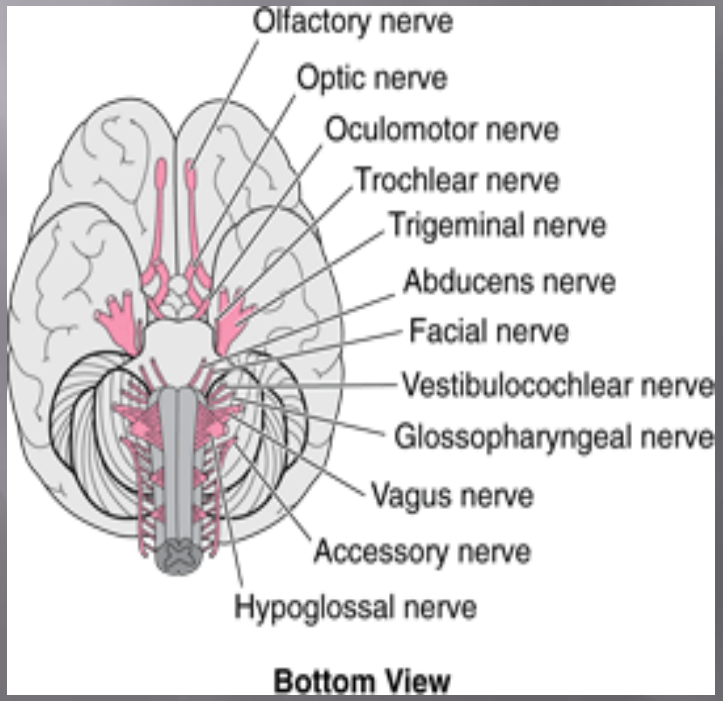


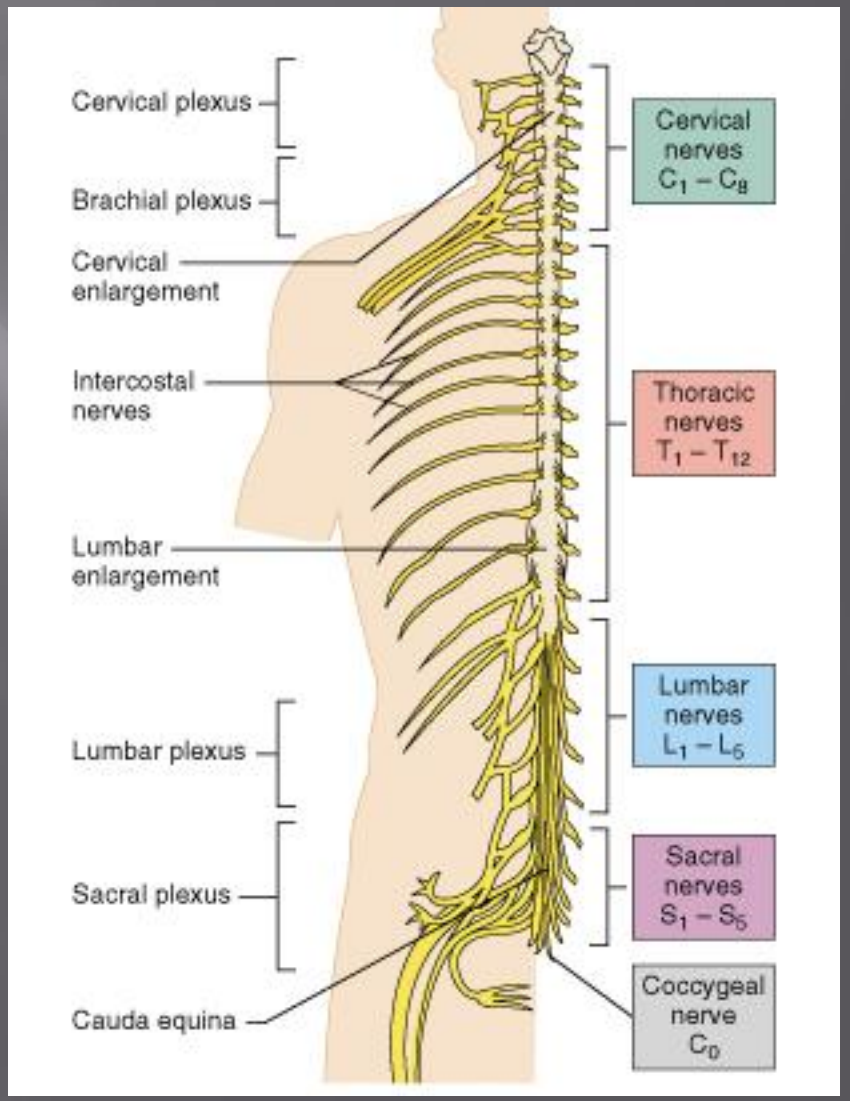
Brain

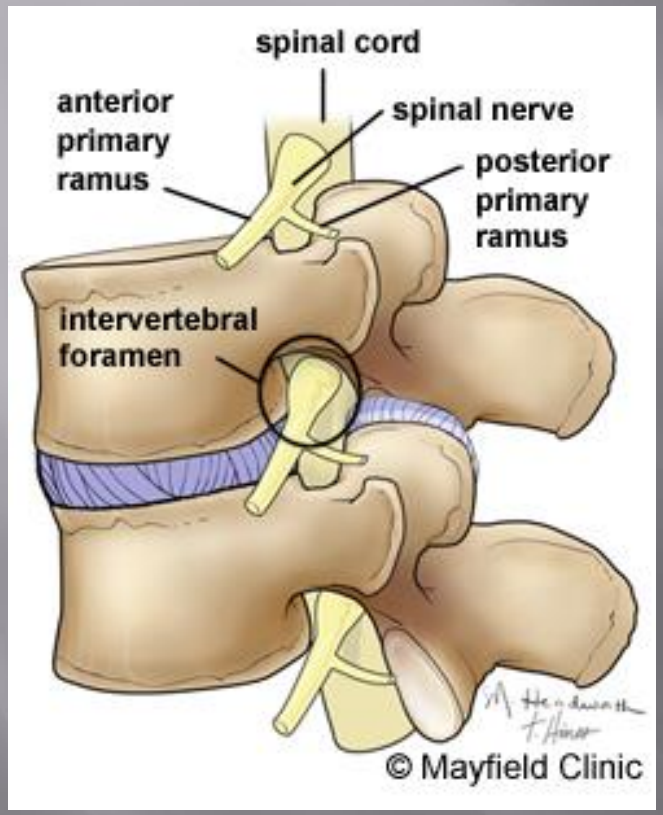


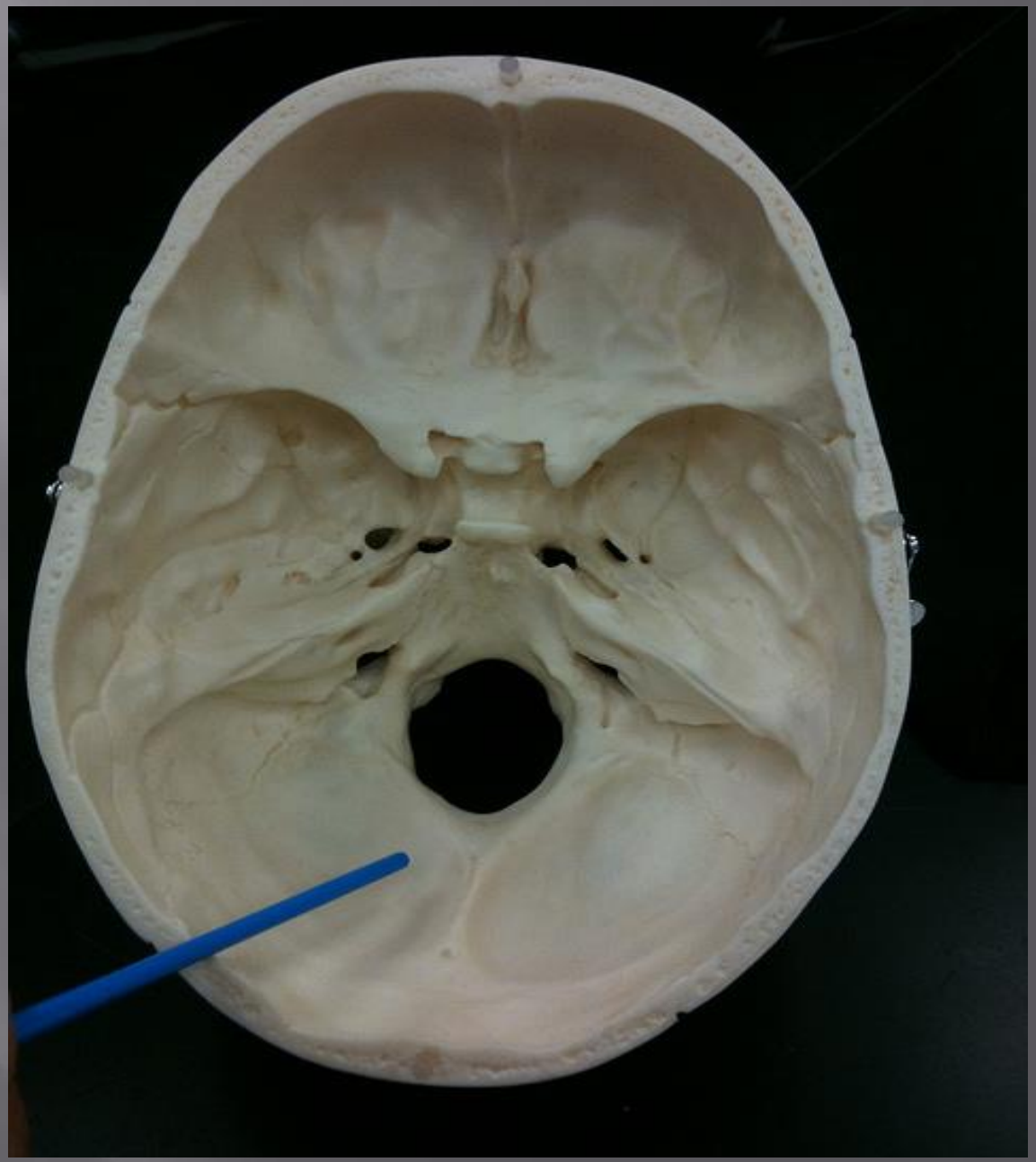
Peripheral Nervous System

Cranial nerves: 12 pairs
Spinal nerves: 31 pairs



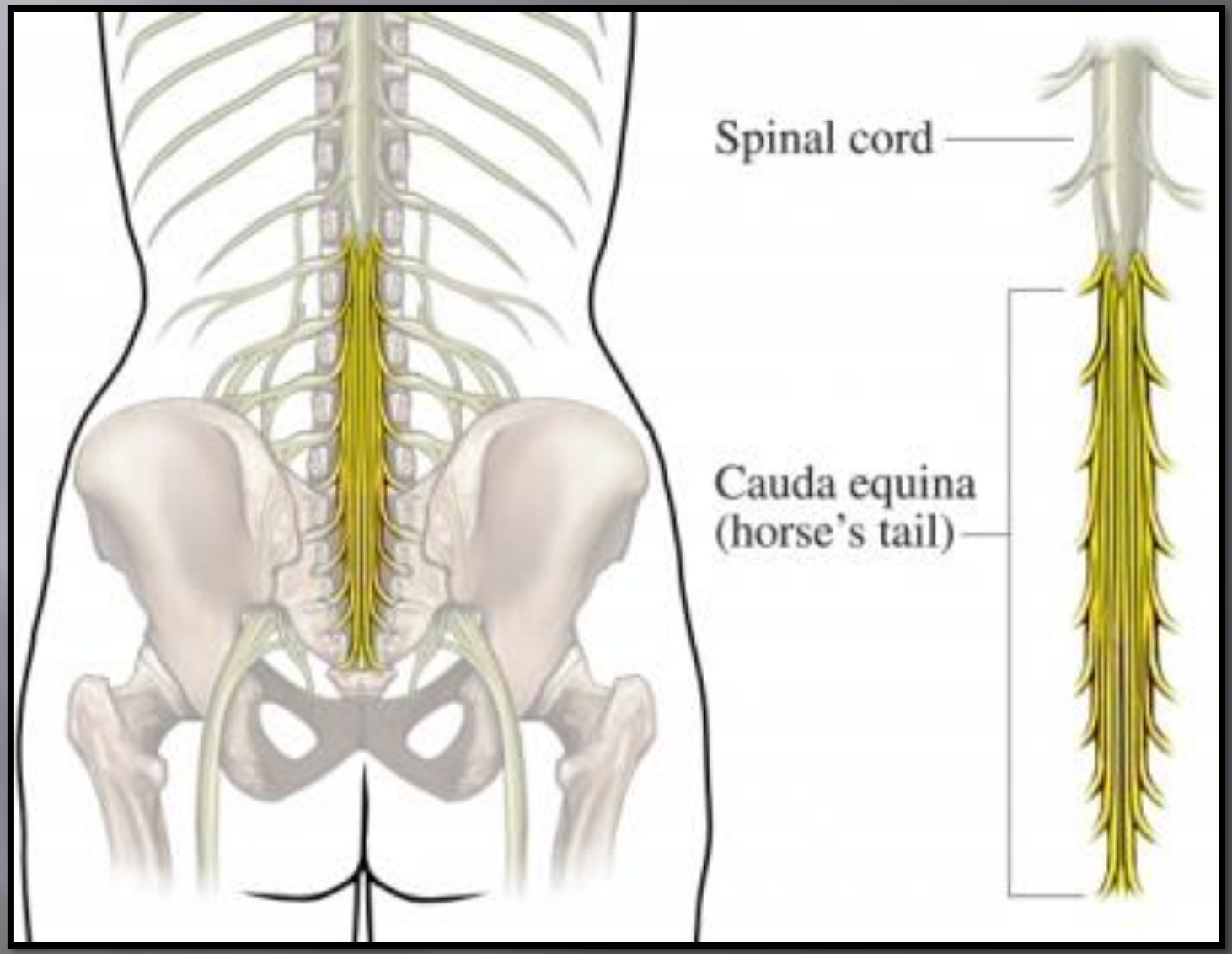


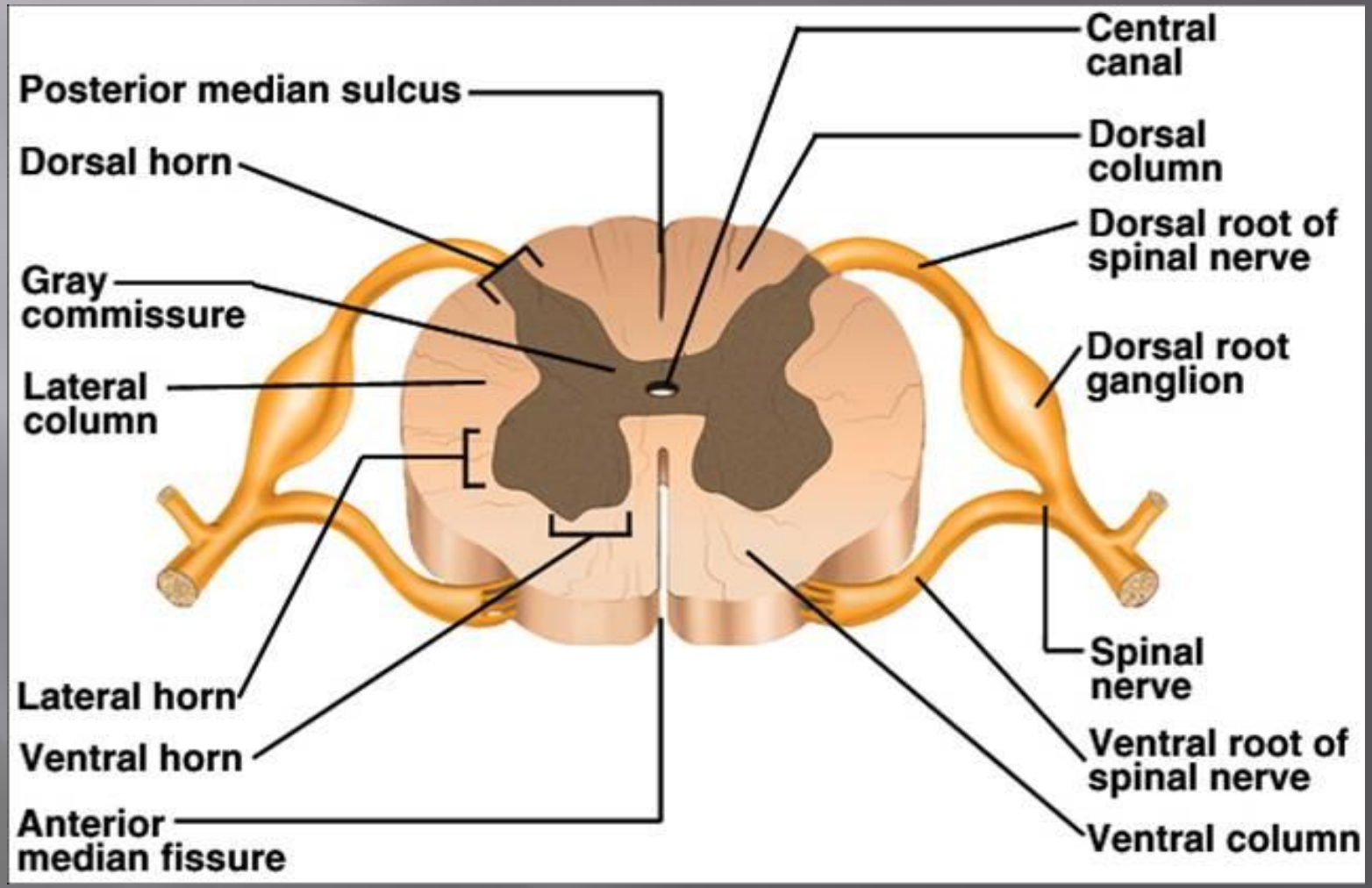

spinal cord
anterior primary ramus
spinal nerve
posterior primary ramus
intervertebral foramen
© Mayfield Clinic



During development, the spinal cord grows in length more slowly than the vertebral column. In the adult, when growth ceases, the lower end of the spinal cord reaches inferiorly only as far as the lower border of the 1st lumbar vertebra.

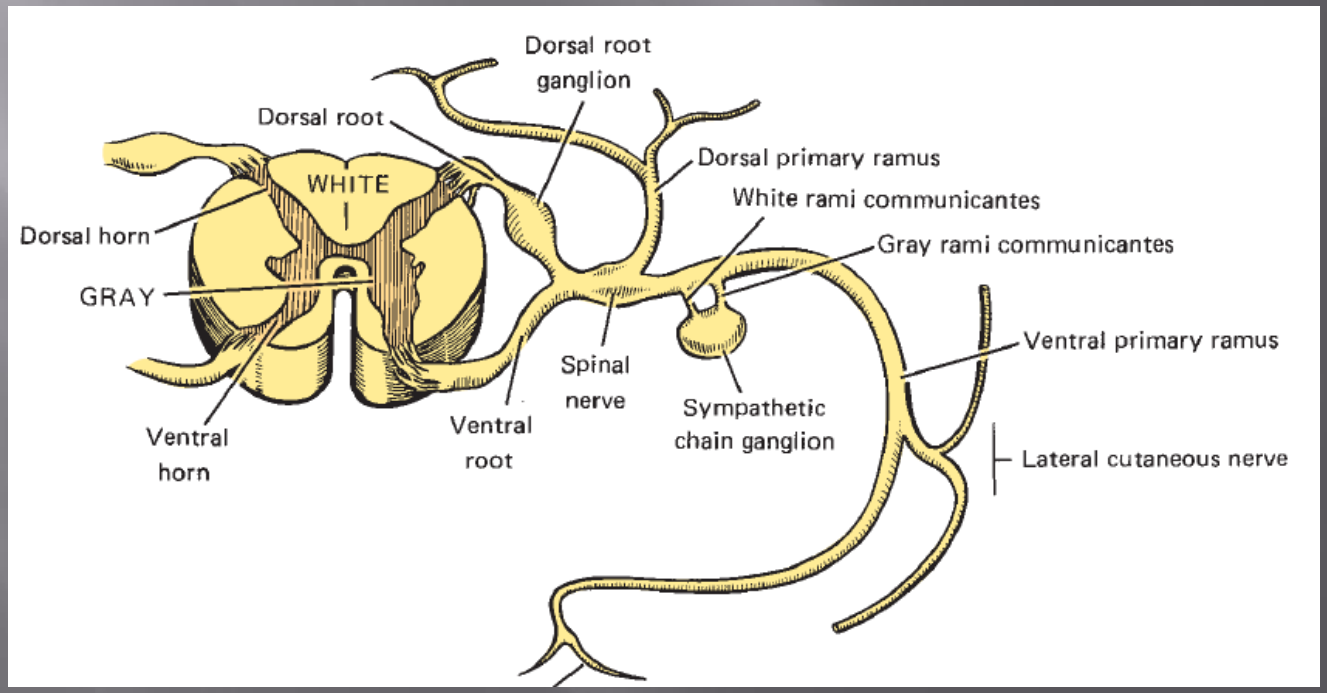
To accommodate for this disproportionate growth in length, the length of the roots increases progressively from above downward. In the upper cervical region, the spinal nerve roots are short and run almost horizontally, but the roots of the lumbar and sacral nerves below the level of the termination of the cord form a vertical bundle of nerves that resembles a horse's tail and is called the **cauda equina**.


Spinal cord
Cauda equina
(horse's tail)


Central canal
Posterior median sulcus
Dorsal column
Dorsal horn
Dorsal root of spinal nerve
Gray commissure
Dorsal root ganglion
Lateral column
Spinal nerve
Lateral horn
Ventral root of spinal nerve
Ventral horn
Anterior median fissure
Ventral column

In addition to the anterior and posterior rami, spinal nerves give a small **meningeal branch** that supplies the vertebrae and the coverings of the spinal cord (the meninges).

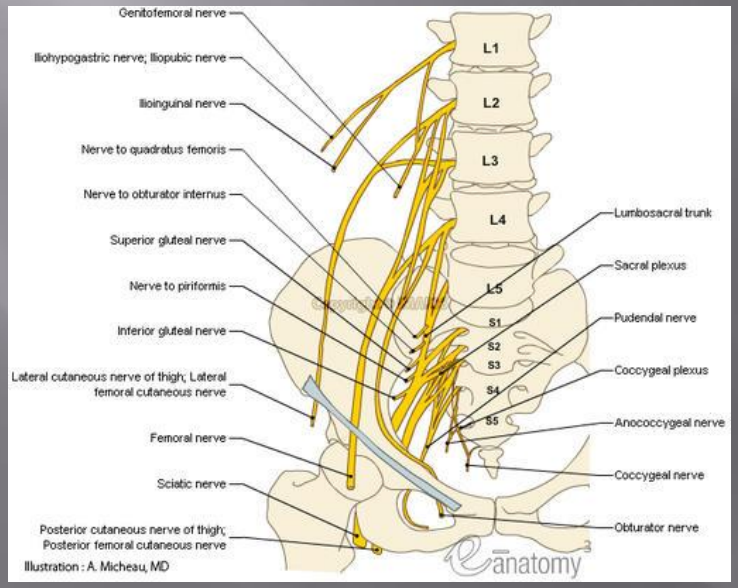
Thoracic spinal nerves also have branches, called **rami communicantes**, which are associated with the sympathetic part of the autonomic nervous system.

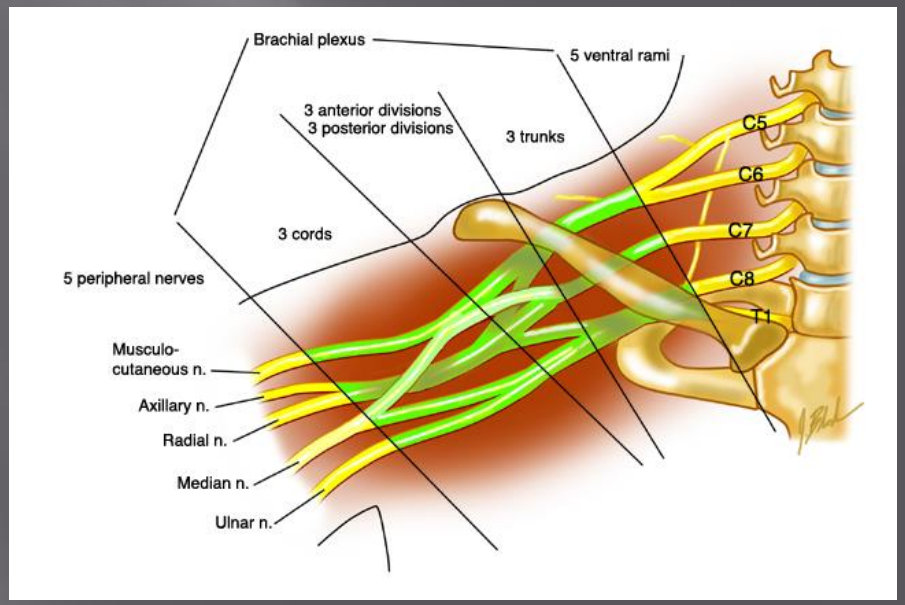


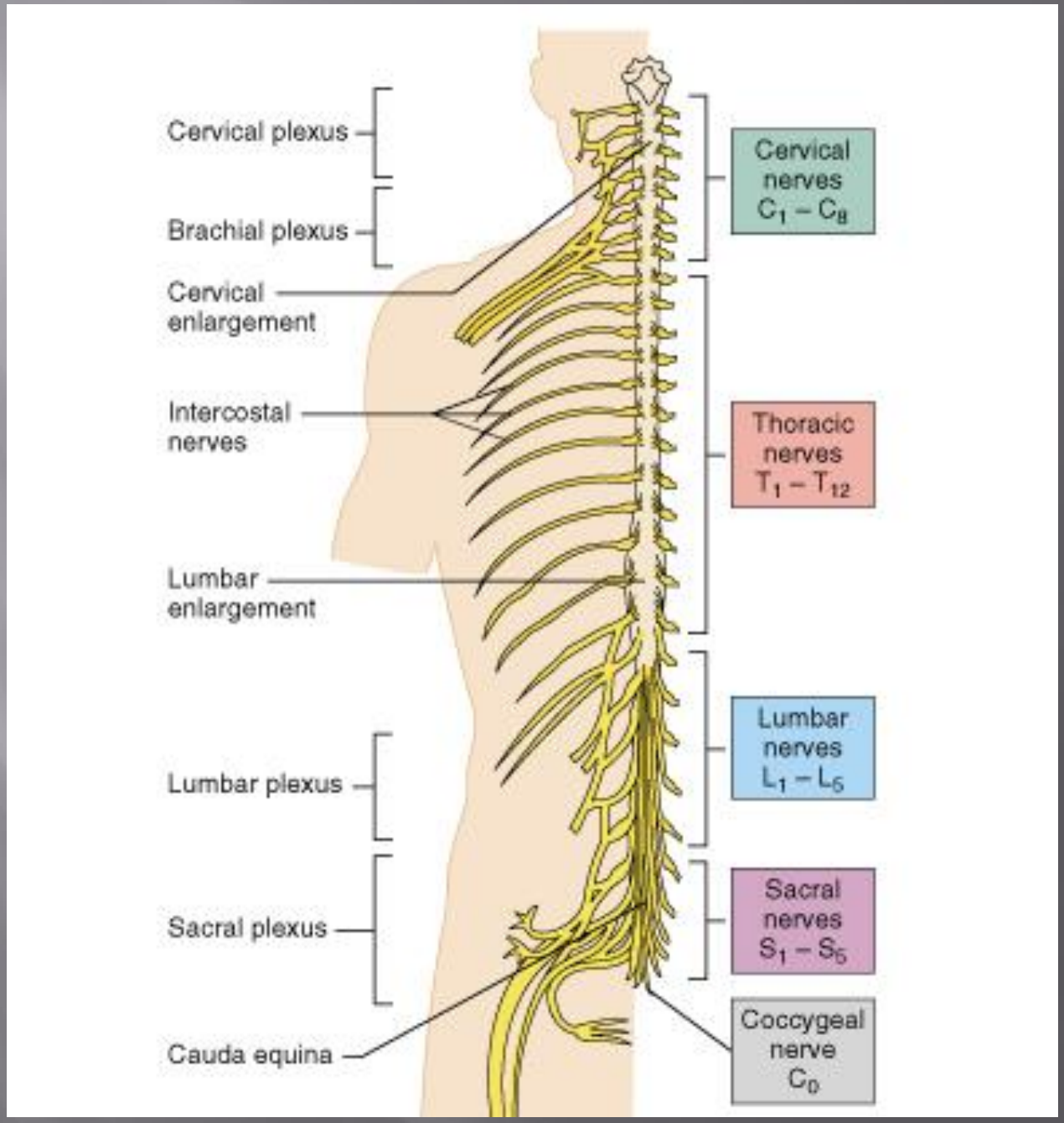
Plexuses

At the root of the limbs, the anterior rami join one another to form complicated nerve plexuses. The **cervical** and **brachial plexuses** are found at the root of the upper limbs,

the **lumbar** and **sacral plexuses** are found at the root of the lower limbs.






Cervical plexus
Brachial plexus
Cervical enlargement
Intercostal nerves
Lumbar enlargement
Lumbar plexus
Sacral plexus
Cauda equina
Cervical nerves $C_1 - C_8$
Thoracic nerves $T_1 - T_{12}$
Lumbar nerves $L_1 - L_5$
Sacral nerves $S_1 - S_5$
Coccygeal nerve C_0

Autonomic Nervous System

- concerned with innervation of involuntary structures the heart, smooth muscle, and glands
- distributed throughout CNS and PNS
- Divided into the **sympathetic** and the **parasympathetic**

Action of sympathetic nervous system

1. It accelerates the heart rate
2. Causes constriction of the peripheral blood vessels
3. Raises the blood pressure.
4. Brings about a redistribution of the blood.
5. It inhibits peristalsis of the intestinal tract
6. Closes the sphincters
7. Dilating the pupils

Fight and flight

Energy expending

Thoracolumber outflow

Action of parasympathetic nervous system

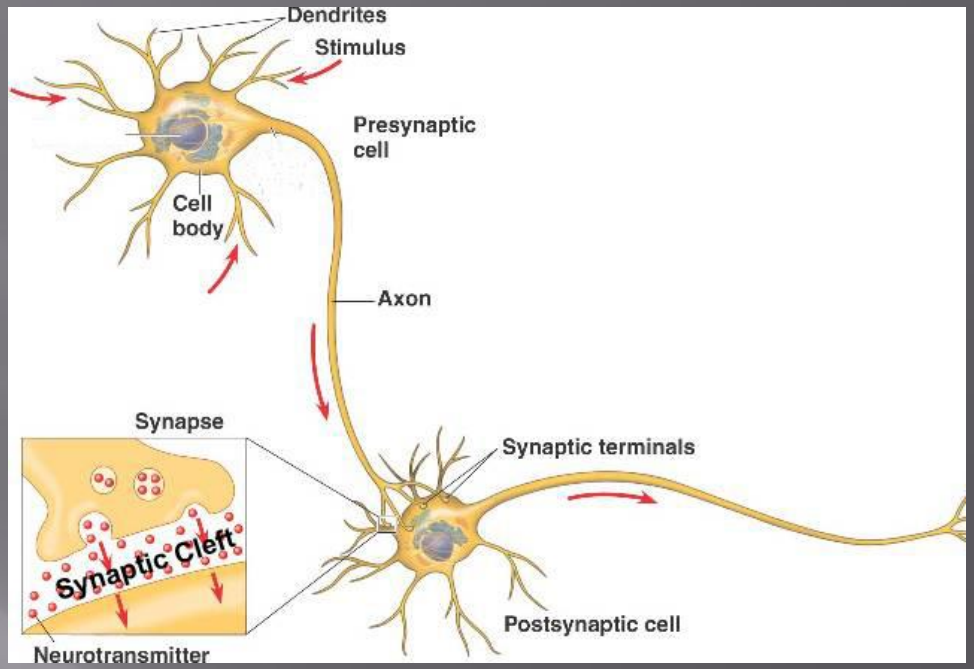
1. Slow the heart rate
2. Increase peristalsis of the intestine
3. Increase the glandular activity
4. Open the sphincters.
5. Constricting the pupils

Calm the body

Energy conseving

Craniosacral outflow

The cell body of the first neuron within the two neuron chain of the autonomic system is located within the visceral efferent column of the CNS. The axon of this neuron will synapse on the cell body of the second neuron in the chain, located in one of the autonomic ganglia; thus, this axon is preganglionic.



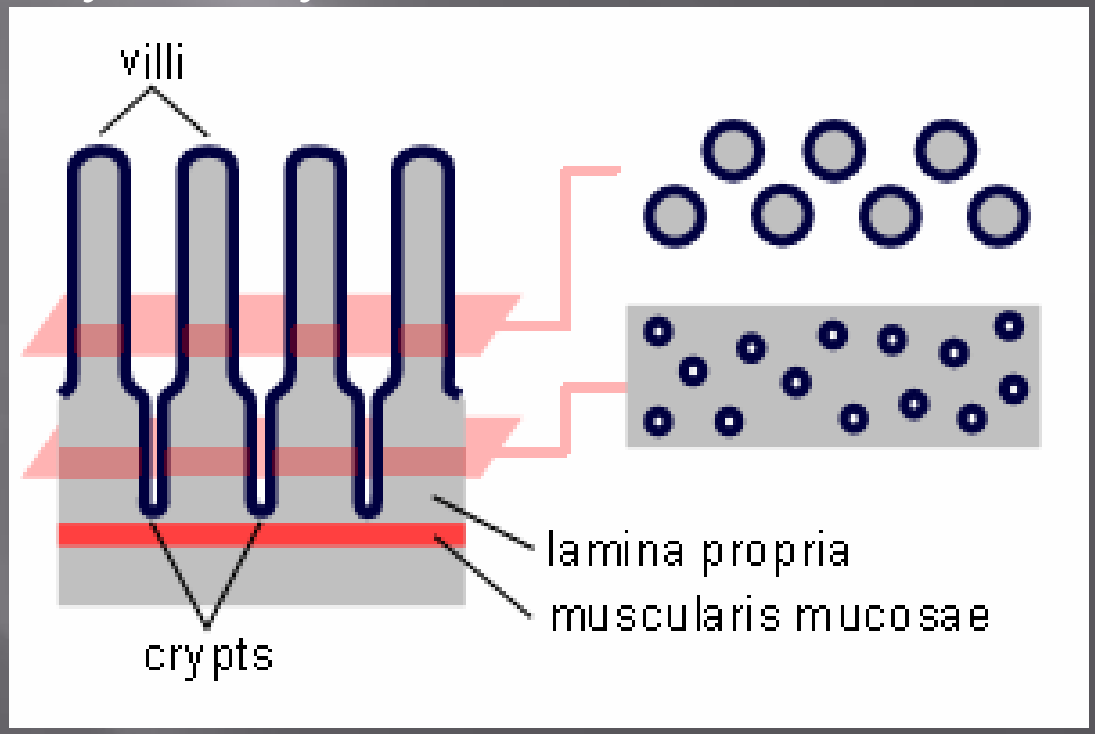
The axon of the second neuron is postganglionic and extends to the effector organ

- Acetylcholine is the neurotransmitter of both preganglionic sympathetic and parasympathetic neurons and postganglionic parasympathetic neurons.

- noradrenaline is the primary neurotransmitter of postganglionic sympathetic neurons except those serving sweat glands. In this case, the neurotransmitter is acetylcholine

Mucous Membrane

- the lining of organs or passages that communicate with the surface of the body.
- consists of a layer of epithelium supported by a layer of connective tissue, the **lamina propria.**
- Smooth muscle, called the **muscularis mucosa,** is sometimes present in the connective tissue.
- A mucous membrane may or may not secrete mucus on its surface.



Serous Membranes

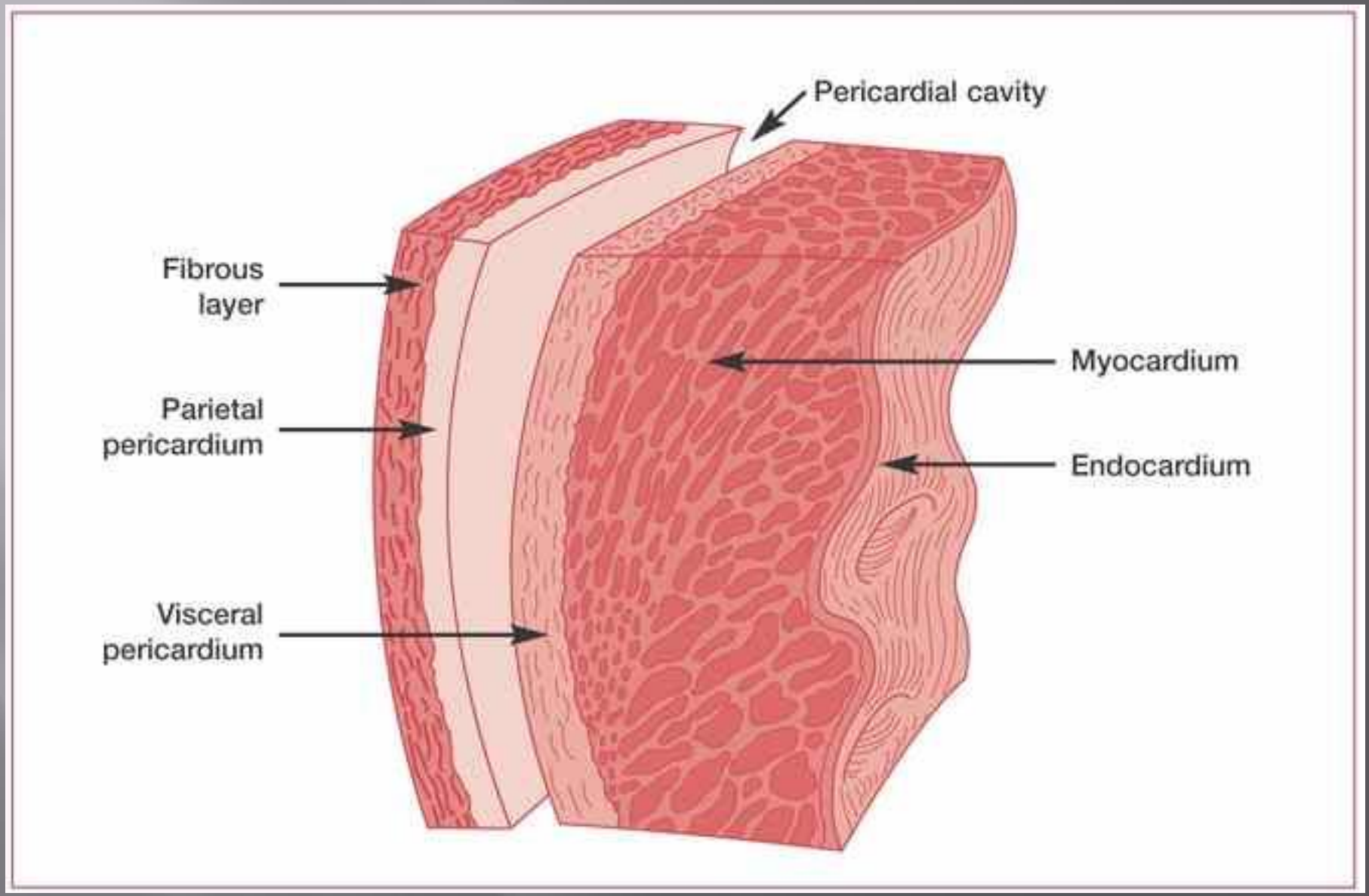
•line the cavities of the trunk and are reflected onto the mobile viscera.

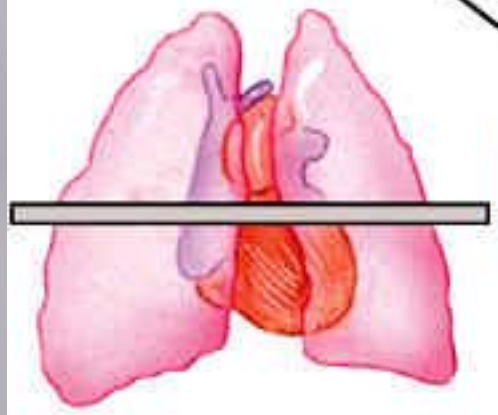
•They consist of a smooth layer of mesothelium supported by a thin layer of connective tissue.

•The membrane lining the wall of the cavity is the **parietal layer**

• The membrane covering the viscera is called the **visceral layer**

•Slitlike interval that separates these layers forms the **pleural, pericardial,** and **peritoneal cavities** and contains a small amount of serous liquid, the **serous exudate**.


Pericardial cavity
Fibrous layer
Parietal pericardium
Visceral pericardium
Myocardium
Endocardium



Pericardium

Pleura

Right lung

Left lung

Right pleural cavity

Pericardial cavity

Heart

Left pleural cavity

Parietal pleura

Visceral pleura

Pleural Cavities

- The serous exudate lubricates the surfaces of the membranes and allows the two layers to slide readily on each other. The parietal layer of a serous membrane is richly supplied by spinal nerves. It is therefore sensitive to all common sensations such as touch and pain. The visceral layer is supplied by autonomic nerves. It is insensitive to touch and temperature but very sensitive to stretch


Thank you ...