Systemic Module

CNS

"Anatomy"

Introduction to Neuroanatomy

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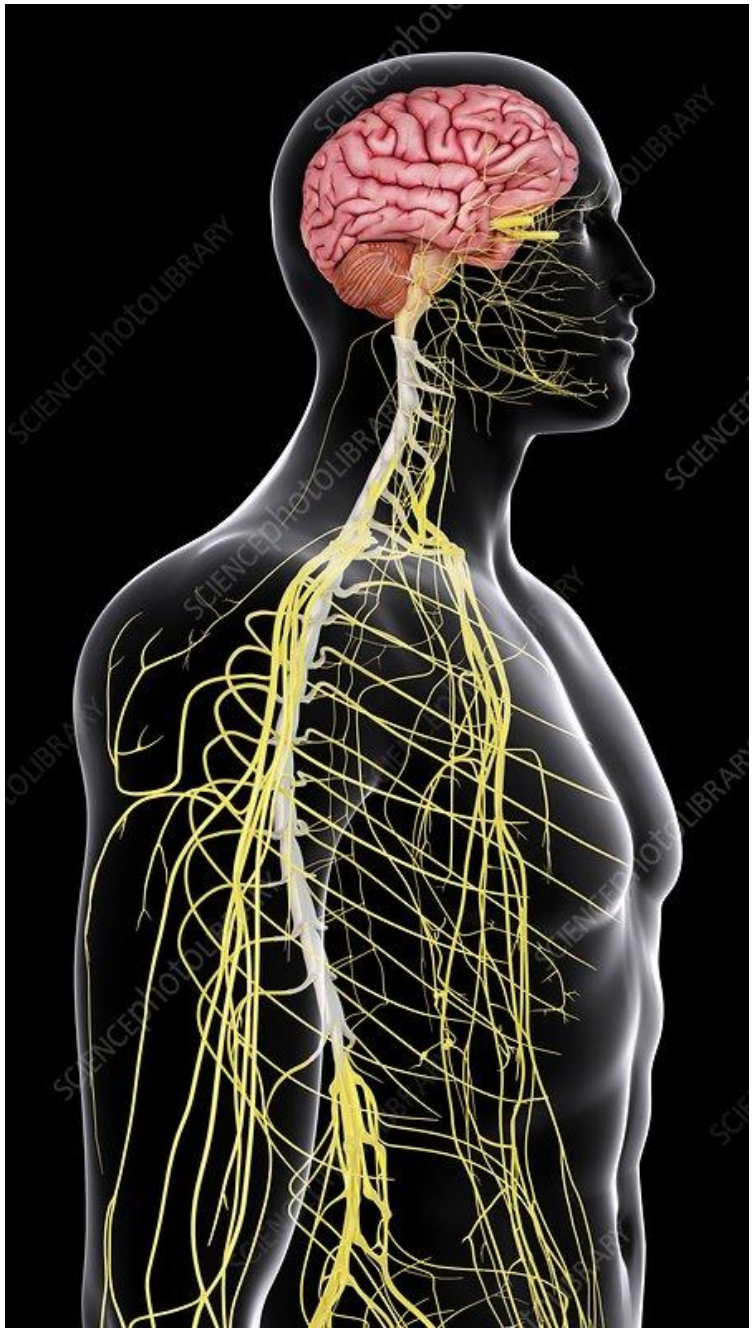
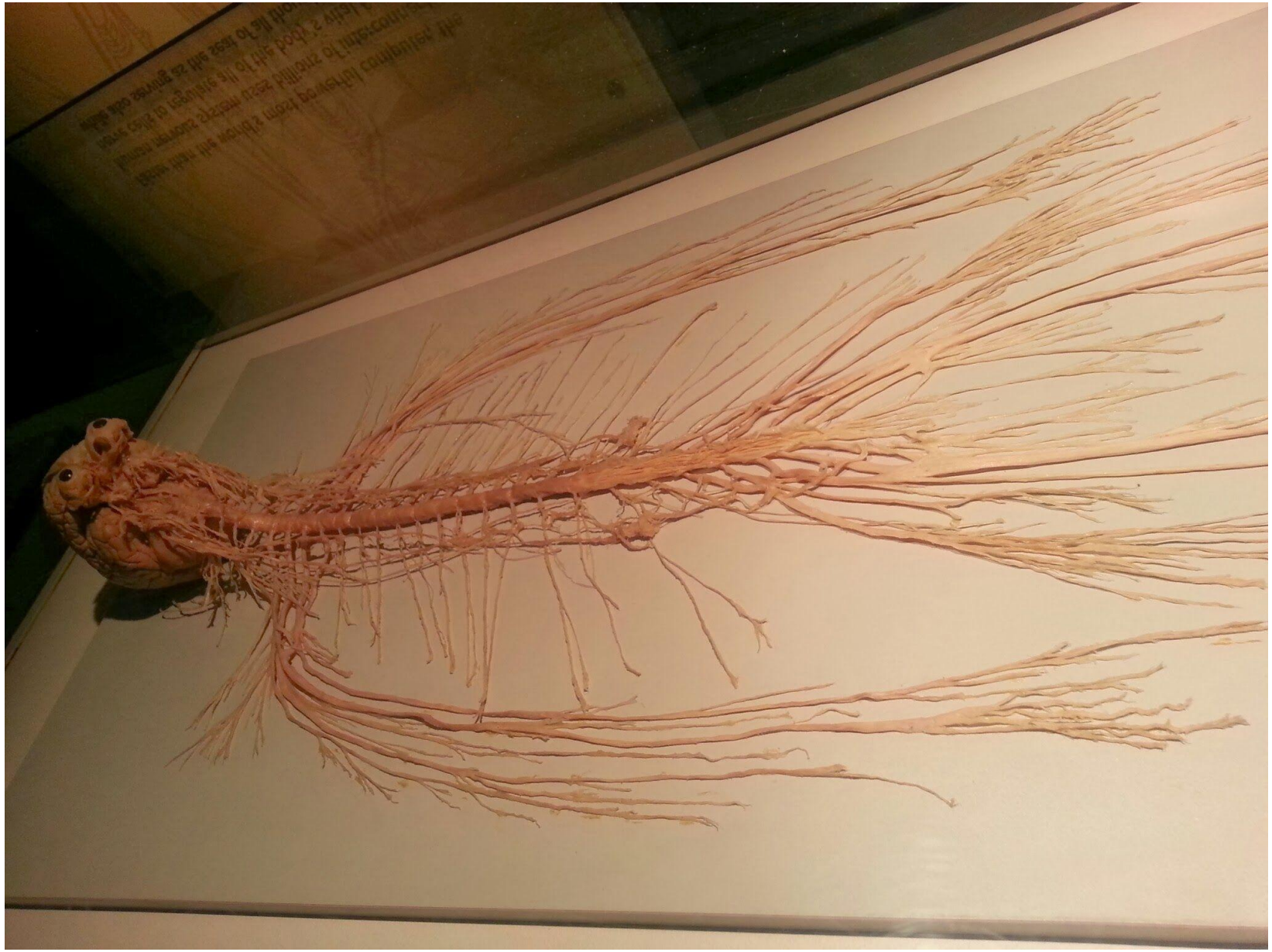
Nervous System

- Two main divisions of Nervous system:
  - **Central Nervous System (CNS).**
  - **Peripheral Nervous System (PNS).**
- **CNS:** Composed of the **brain** and **spinal cord.**
- **PNS:** Composed of the **cranial nerves** (12 pairs) and **spinal nerves** (31 pairs).





Nervous System

- PNS consists of :
  - **Sensory (afferent) nerves.**
  - **Motor (efferent) nerves.**
- The sensory nerves send nerve impulse from the body to the CNS
- Impulse reaches brain and is integrated (control center).
- The motor nerves send the reaction commands from the CNS to the effector organs.

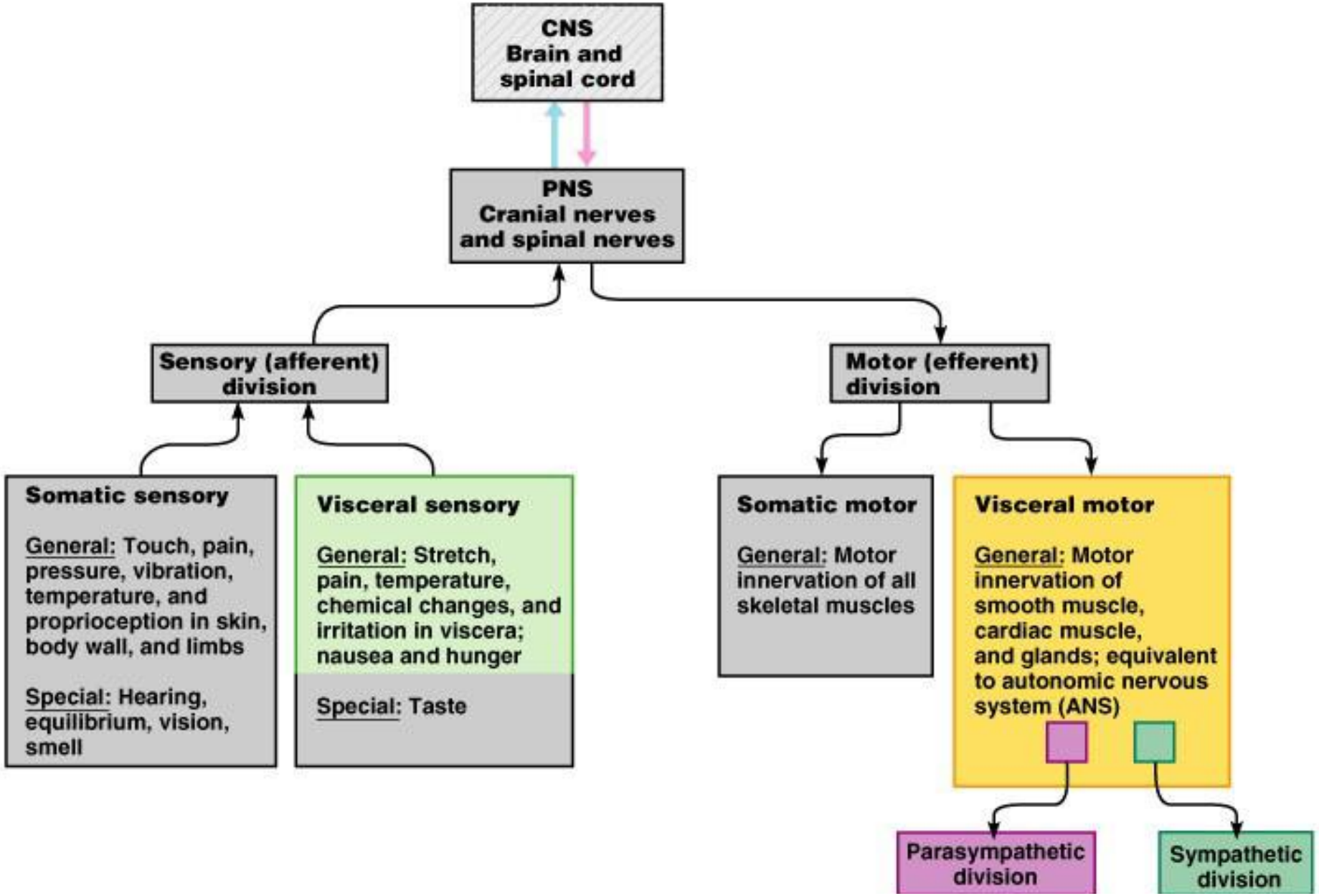
Nervous System

- Motor nerves (or motor output) are functionally divided into:

1. **The somatic nervous system** which regulates the voluntary contraction of the skeletal muscles.

2. **The autonomic nervous system** which regulates the involuntary control of smooth, cardiac muscles and glands.

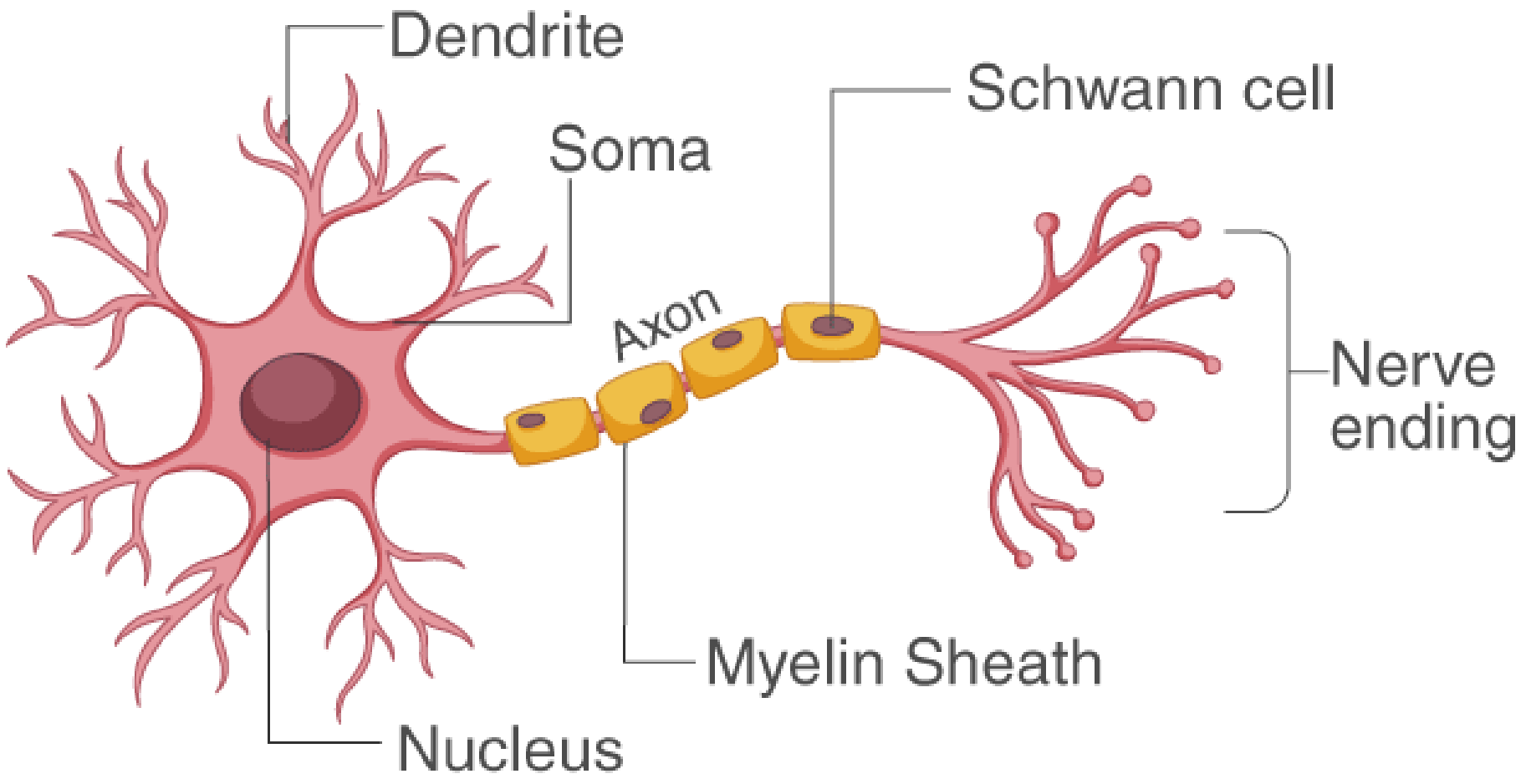
Organization of Nervous System

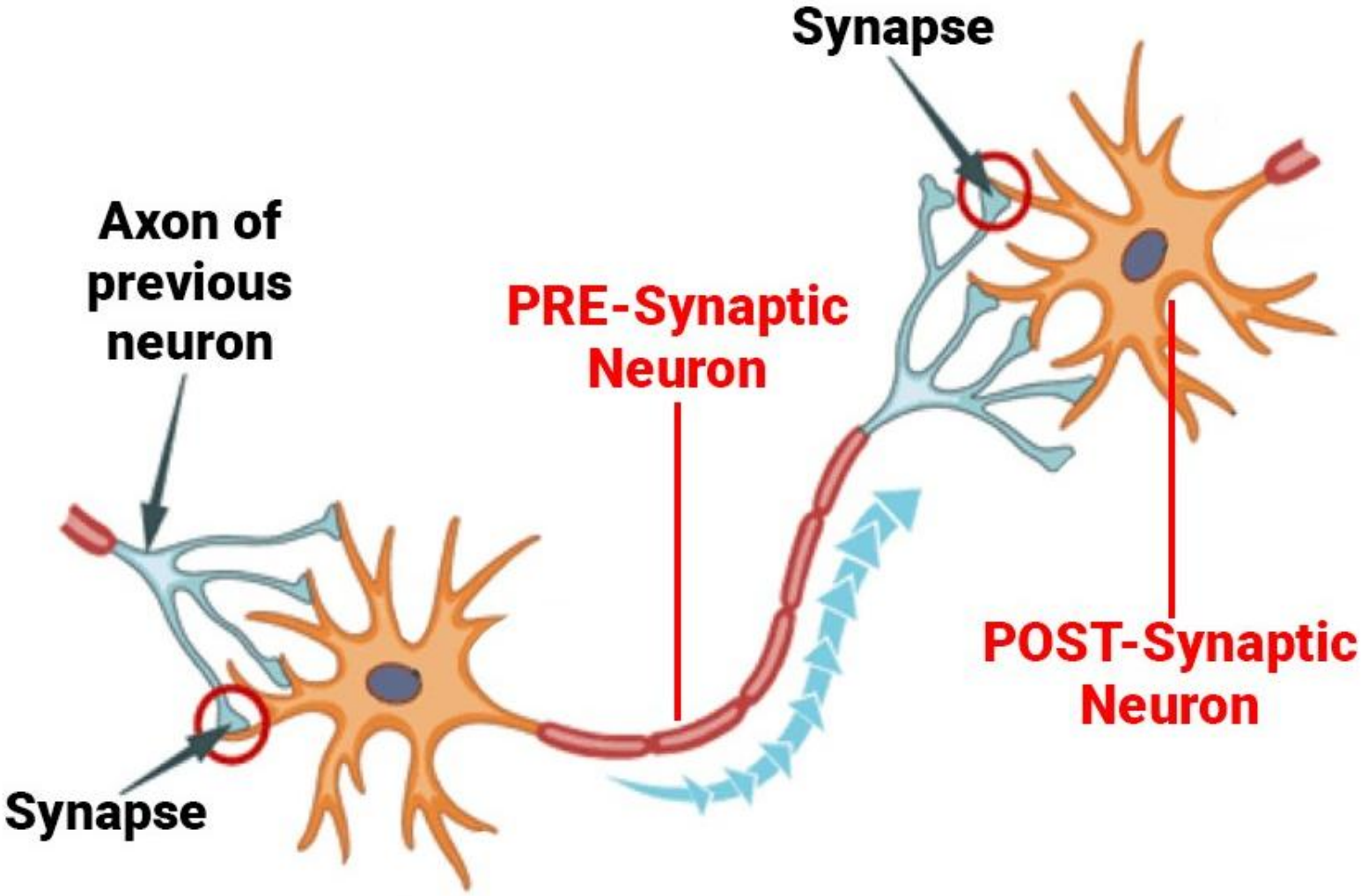


Neurons

- The basic **structural and functional unit** of the nervous system.
- Consist of a **cell body** (contains the nucleus & cell organelles) and **processes** arising from it.
- The processes arising from the cell body of a neuron are**:**
  - **Axon:** single long process which carries nerve impulse away from cell body (conducting outputs).
  - **Dendrites:** short multiple processes which carry nerve impulses towards cell body (receive inputs).

STRUCTURE OF NEURON





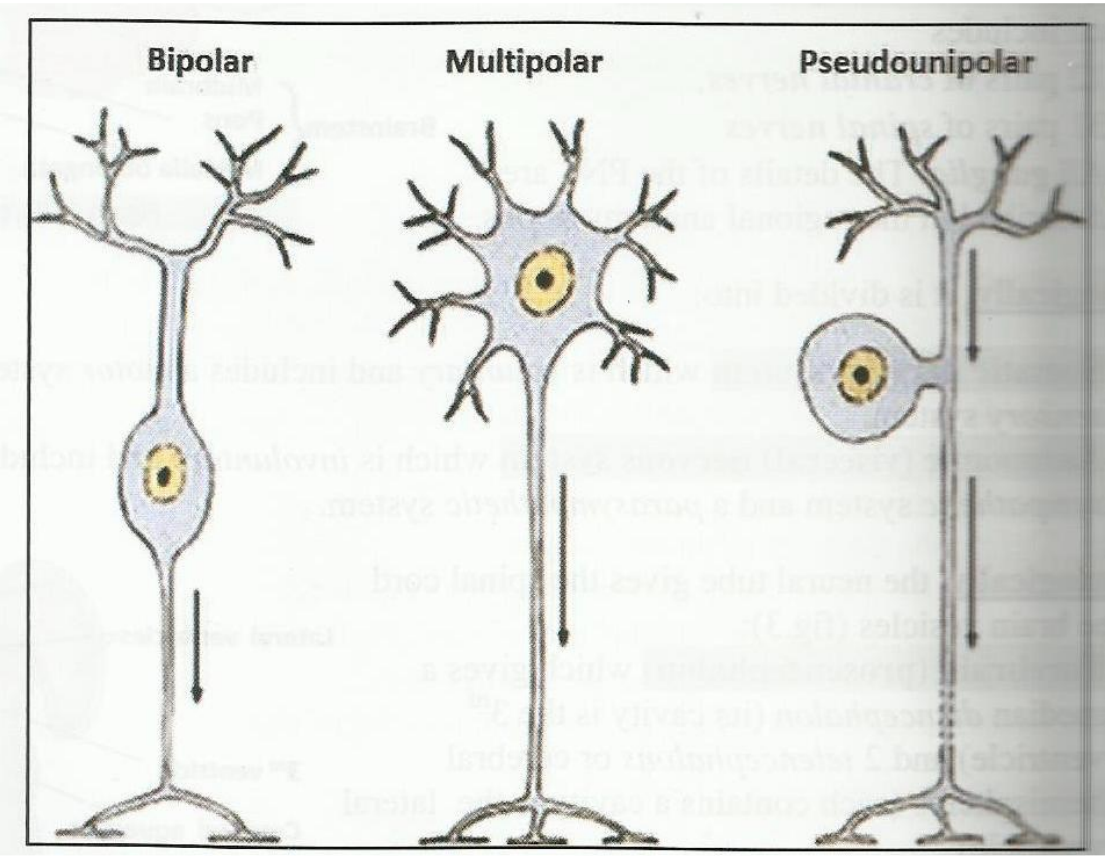
Synapse: it is the site of contact between the axon of one neuron & the dendrites of another neuron. It is also the where a nerve impulse passes from one neuron to another neuron.

Types of Neurons

1. **Unipolar** (pseudounipolar): as in posterior root ganglion of spinal nerves.

2. **Bipolar:** as in the retina, cochlear and vestibular ganglia.

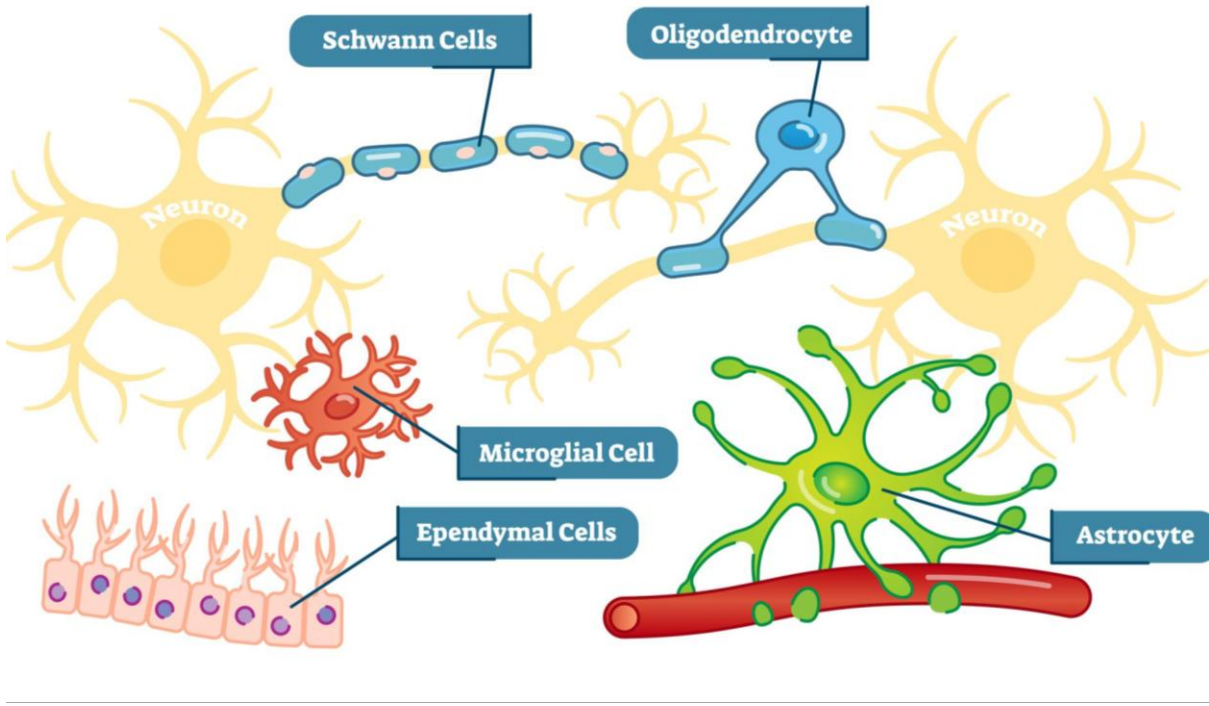
3. **Multipolar:** as in most parts of the brain & spinal cord.



Supporting Cells of Nervous System

- Non conducting cells of the nervous systems.
- Provide support and protection for neurons
- Collectively known as **glia cells** or **neuroglia:**

1. **Oligodendrocytes**
2. **Schwann cells**
3. **Astrocytes**
4. **Ependymal cells**
5. **Microglia**



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- **Astrocytes:** most abundant glia cells, star- shaped with many process. Provide the main support for nerve cells, and contribute to the formation of blood–brain barrier.

- **Oligodendrocytes:** Small cells with few processes –responsible for the formation of the myelin sheath of the nerve fibers of the CNS.

- **Schwann cells:** responsible for the formation of the myelin sheath of the nerve fibers of the CNS.

- **Microglia**: The smallest glial cells - the only glial cells of mesodermal origin (while other glial cells are of ectodermal origin) - act as phagocytes in degenerative and inflammatory conditions.

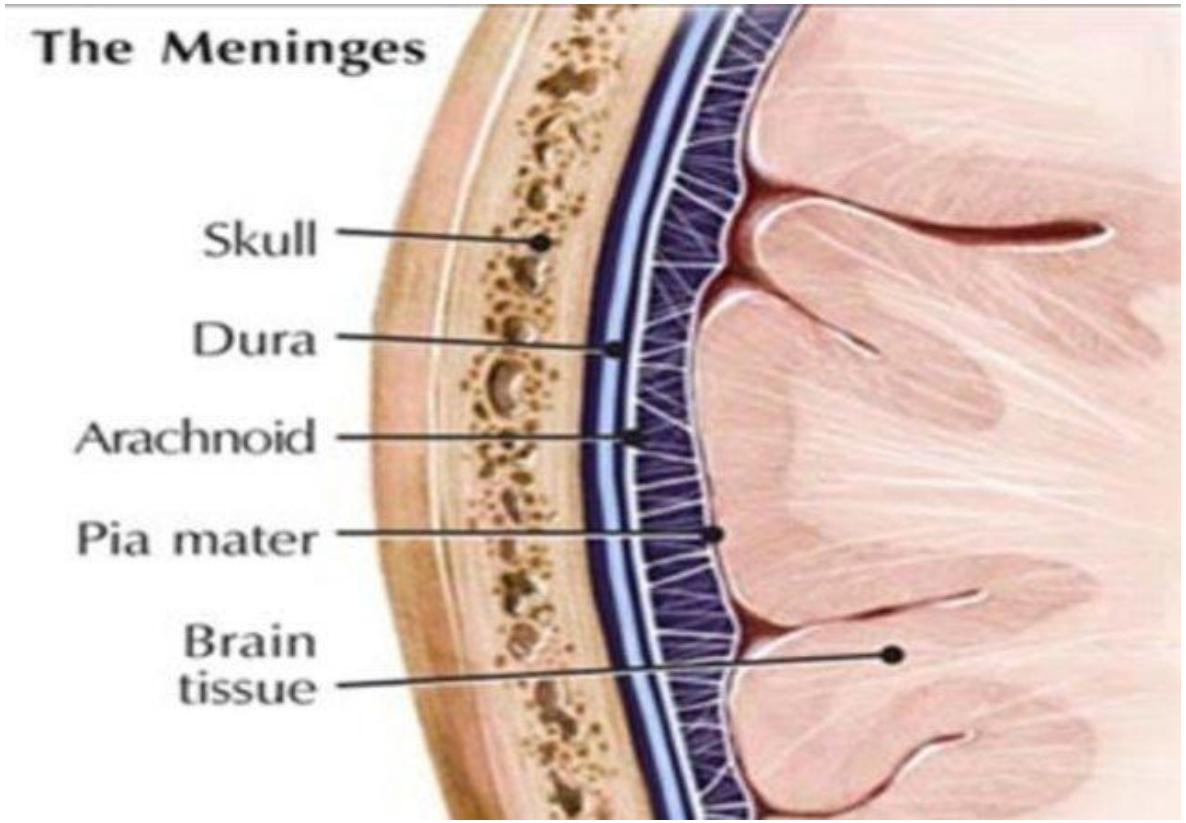
- **Ependymal cells:** Cuboidal ciliated cells that line the cavities of the brain & spinal cord. They also form the cells of choroid plexus and assist in the formation of CSF.

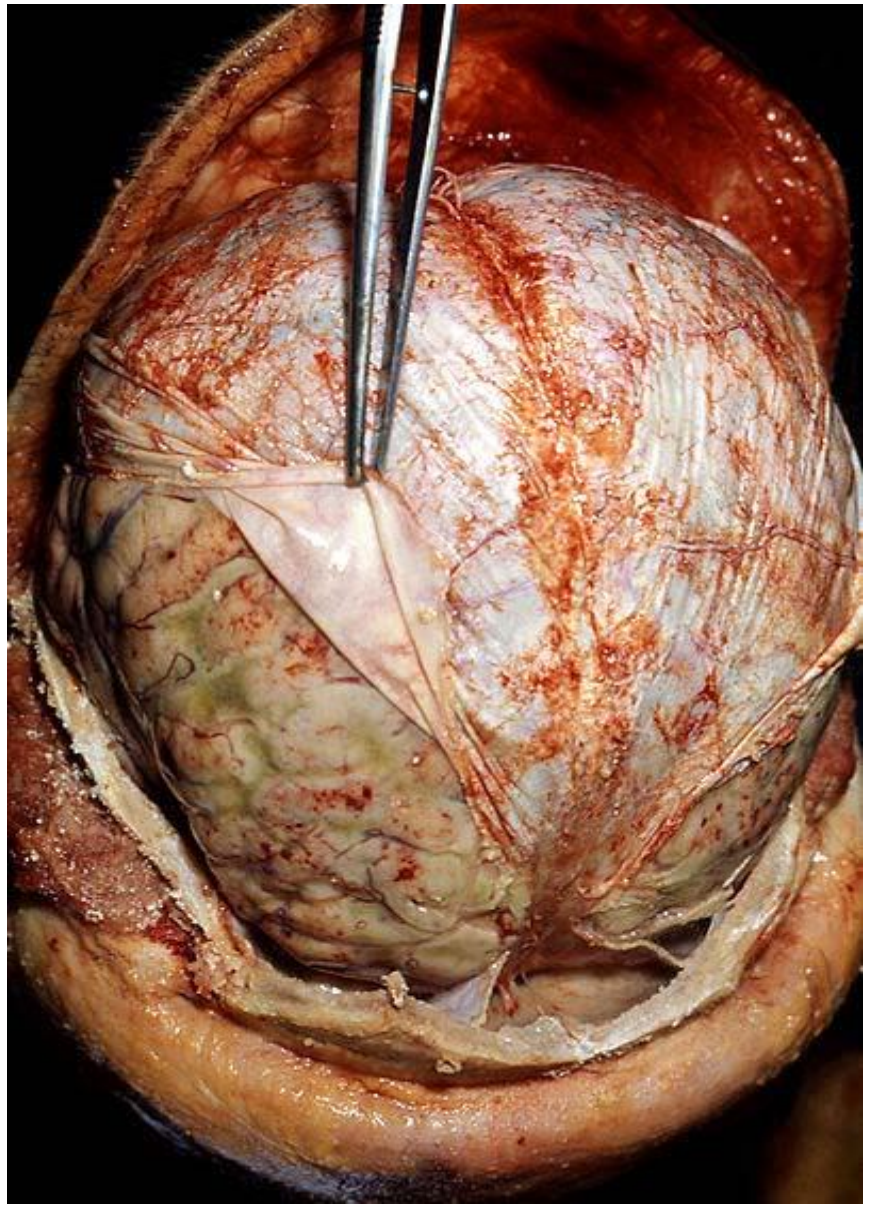
Protection of the CNS

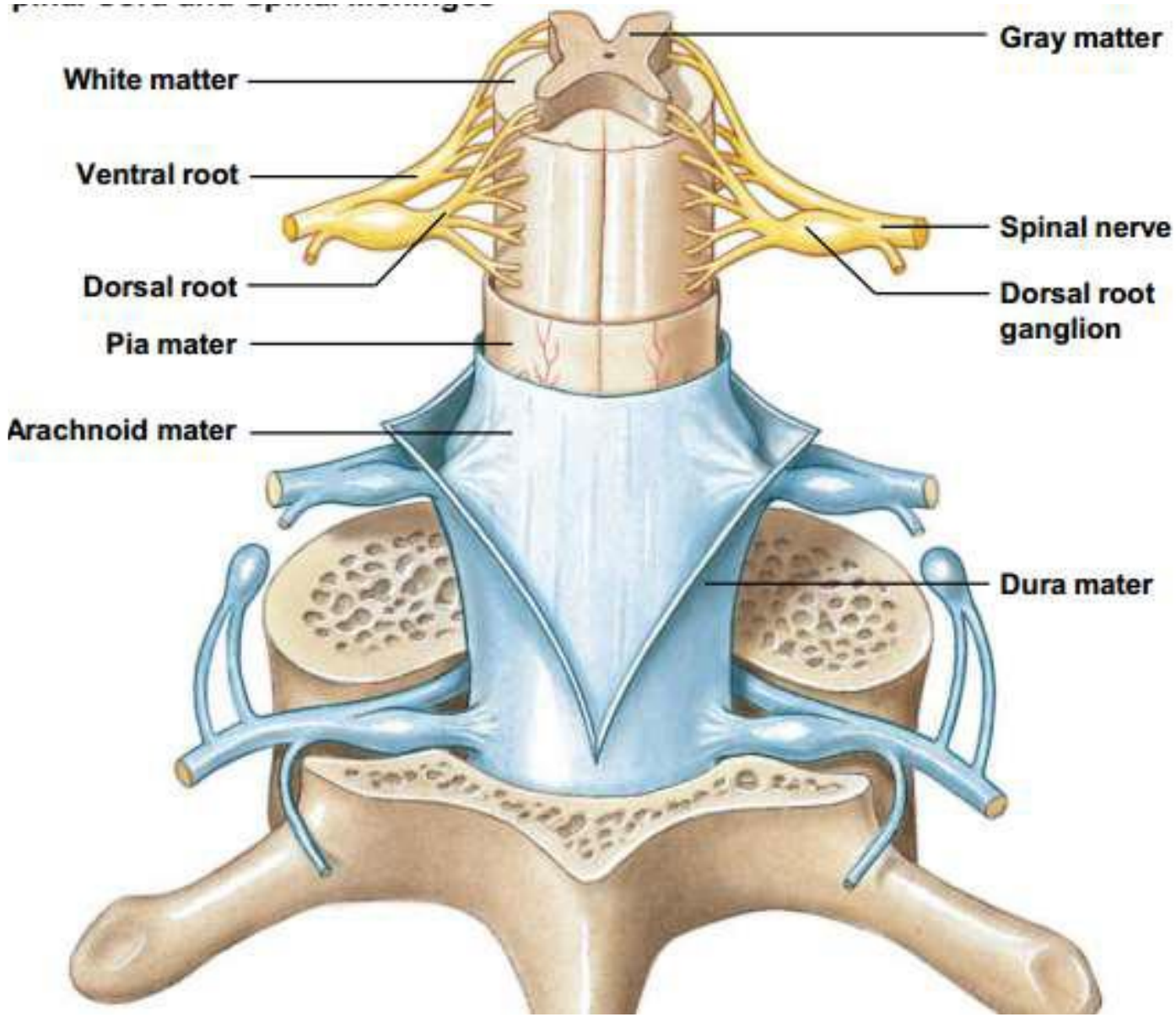
- The skull and vertebral column
- Meninges
  - 3 layers of tissue coverings and protecting brain and spinal cord.

    1. **Dura mater** (outer tough layer)
    2. **Arachnoid mater** (middle layer)
    3. **Pia mater** (inner layer)

  - Between pia & arachnoid matter lies *subarachnoid space* which contains the **cerebro-spinal fluid (CSF).**






Gray matter
White matter
Ventral root
Spinal nerve
Dorsal root
Dorsal root ganglion
Pia mater
Arachnoid mater
Dura mater

Brain

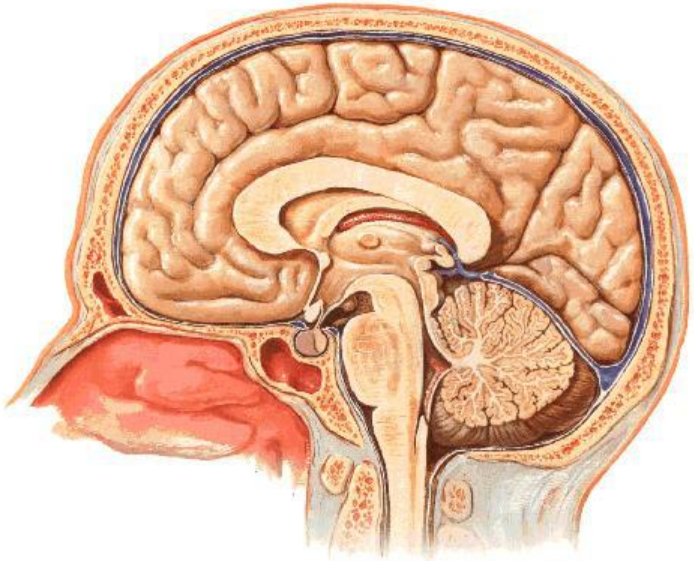
- The brain is formed of:

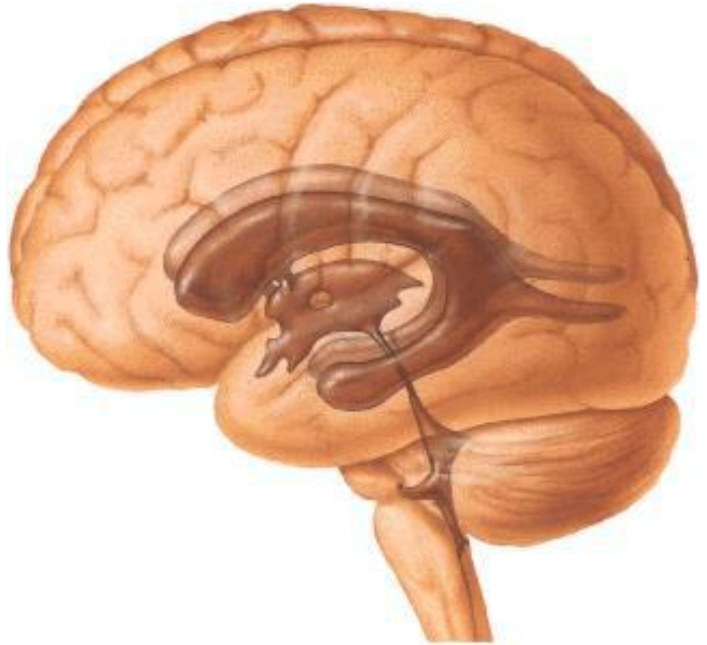
1. **Cerebrum:** formed of two cerebral hemispheres.

2. **Diencephalon:** formed of *thalamus* and *hypothalamus*. Lies in between the two cerebral hemispheres.

3. **Brain stem:** which is formed of:
   - Midbrain
   - Pons
   - Medulla oblongata

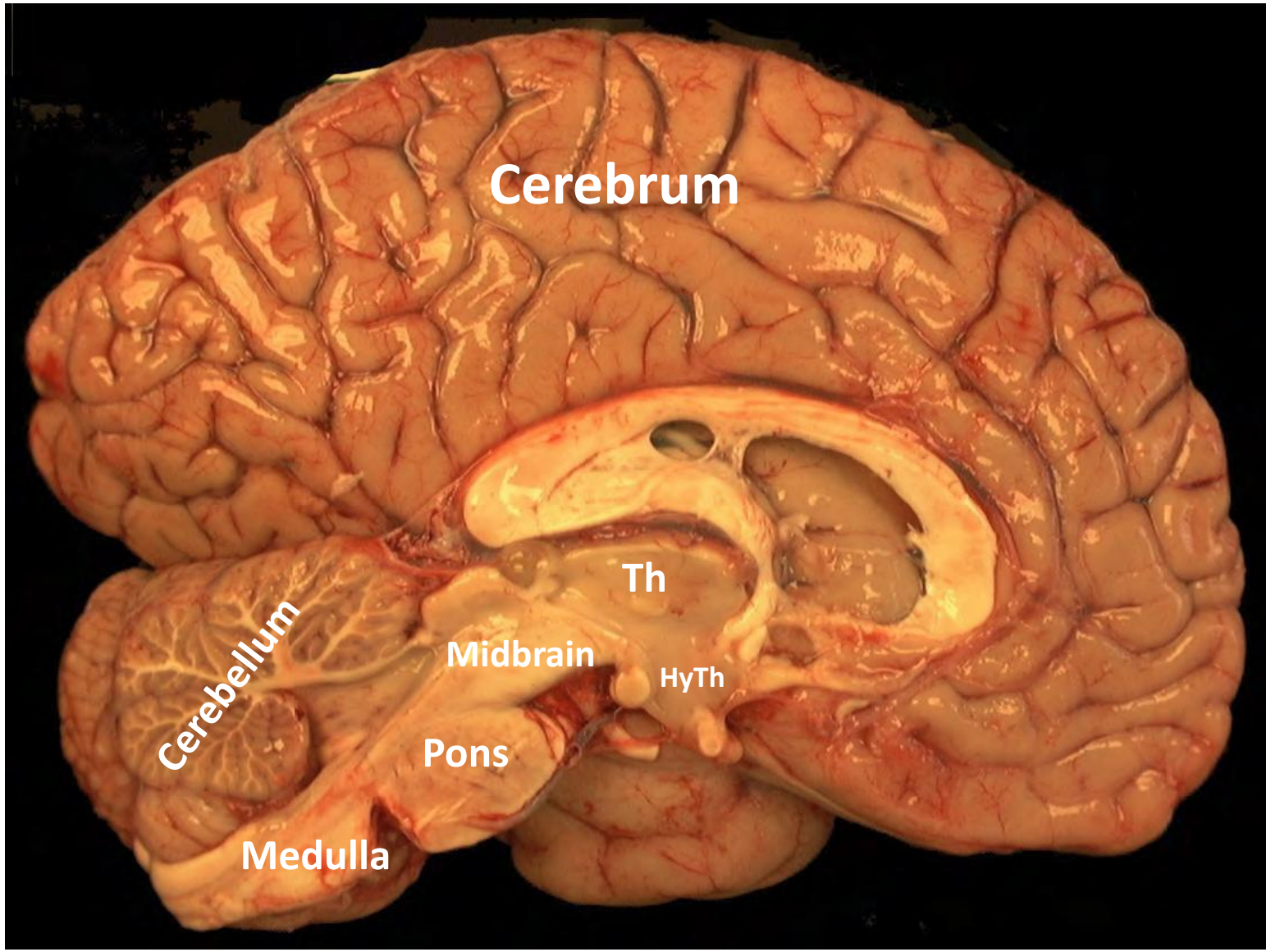
4. **Cerebellum:** formed of two cerebellar hemispheres.





Medial view of a left half brain

Dorsal



Posterior

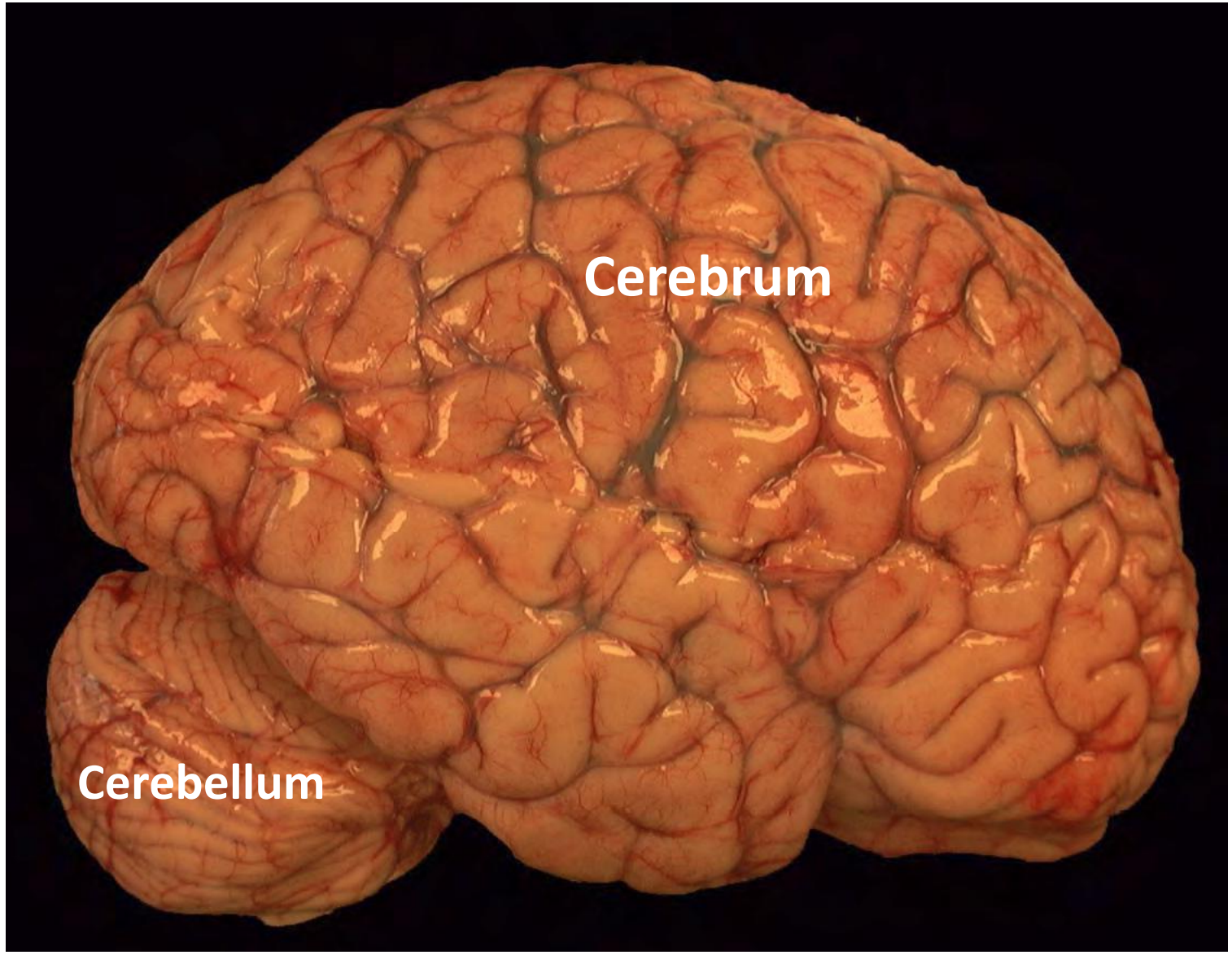
Anterior

Ventral

Lateral view of a left half brain

Dorsal

Posterior



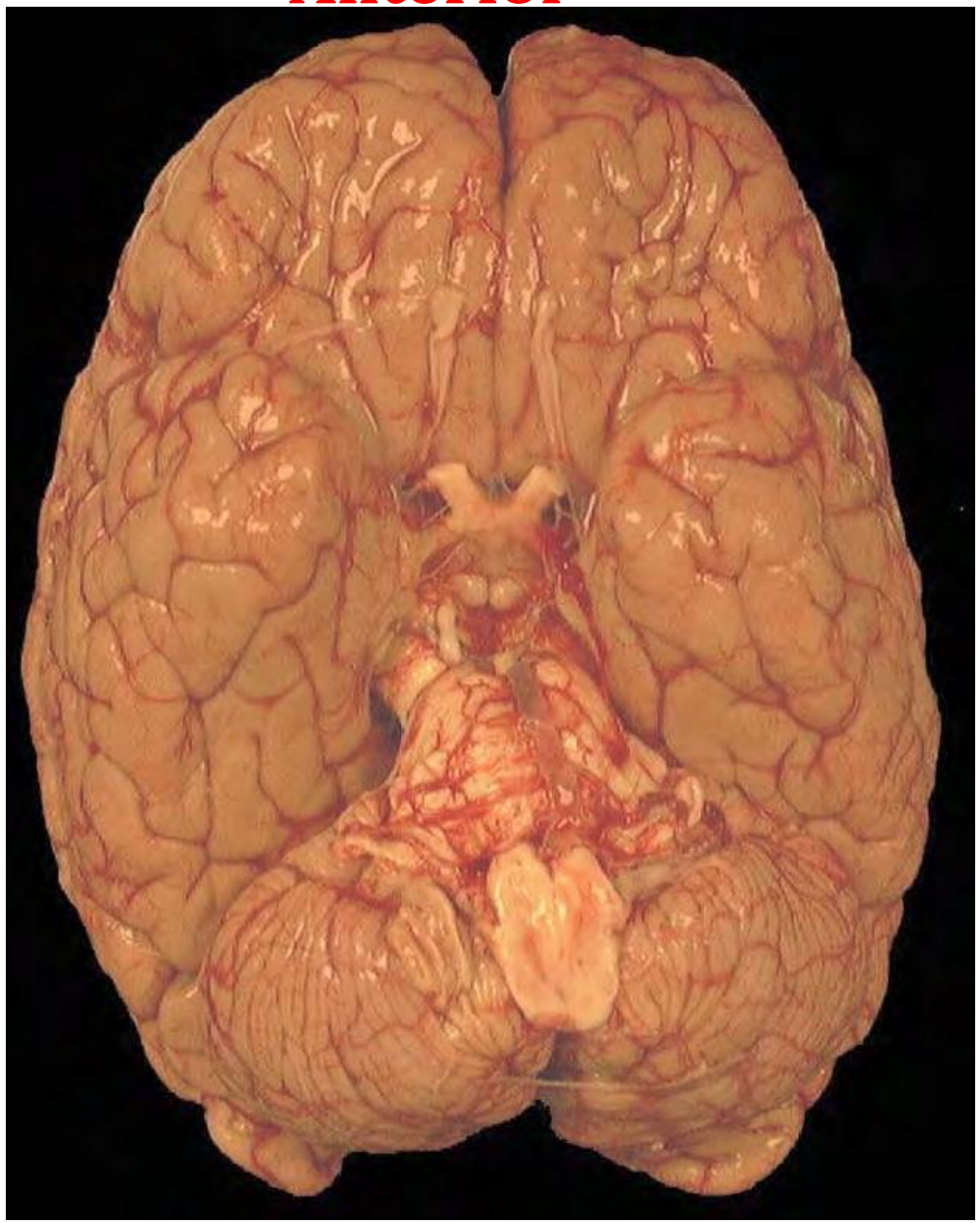
Anterior

Ventral

Ventral view of a human brain

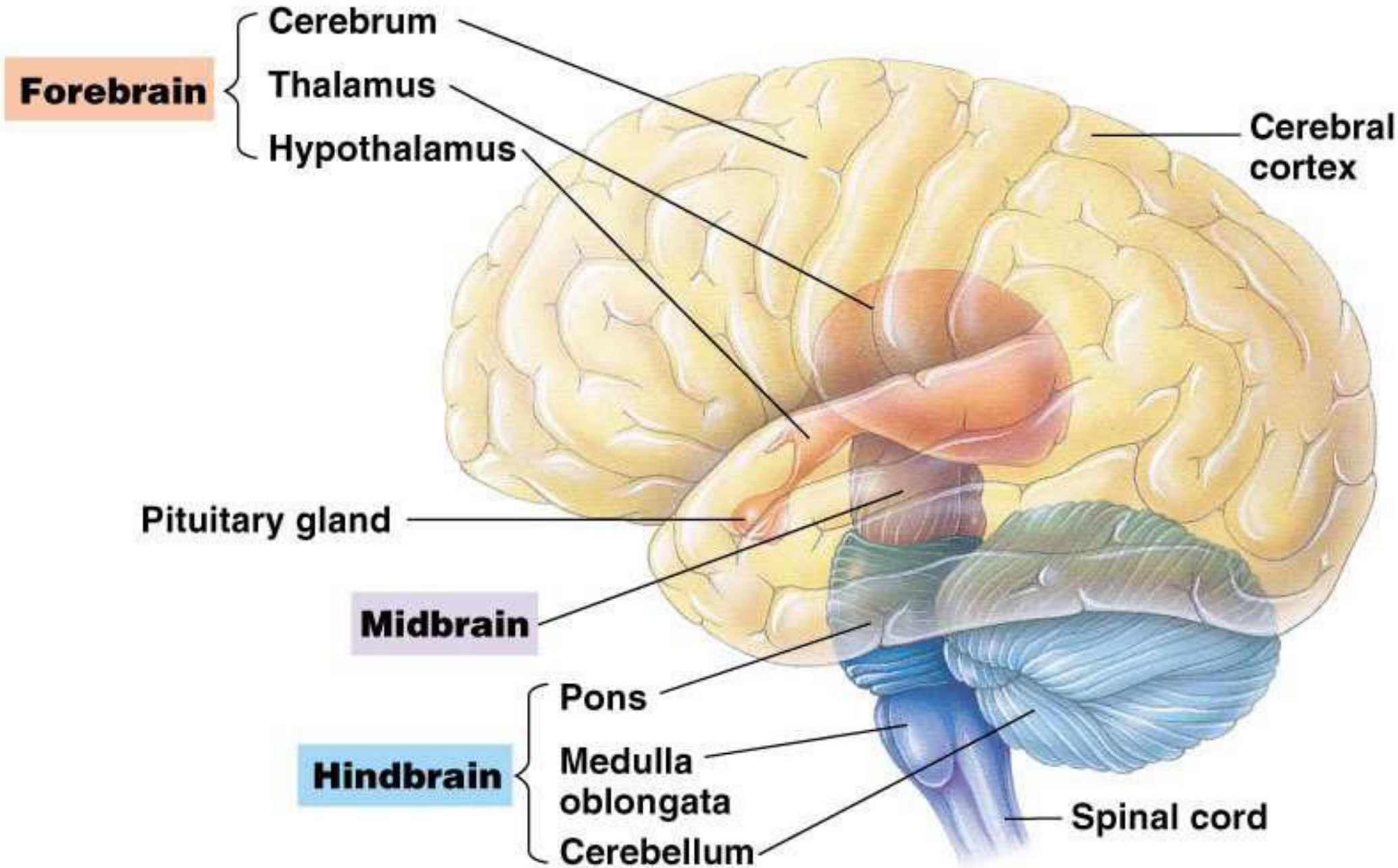
Anterior

Lateral



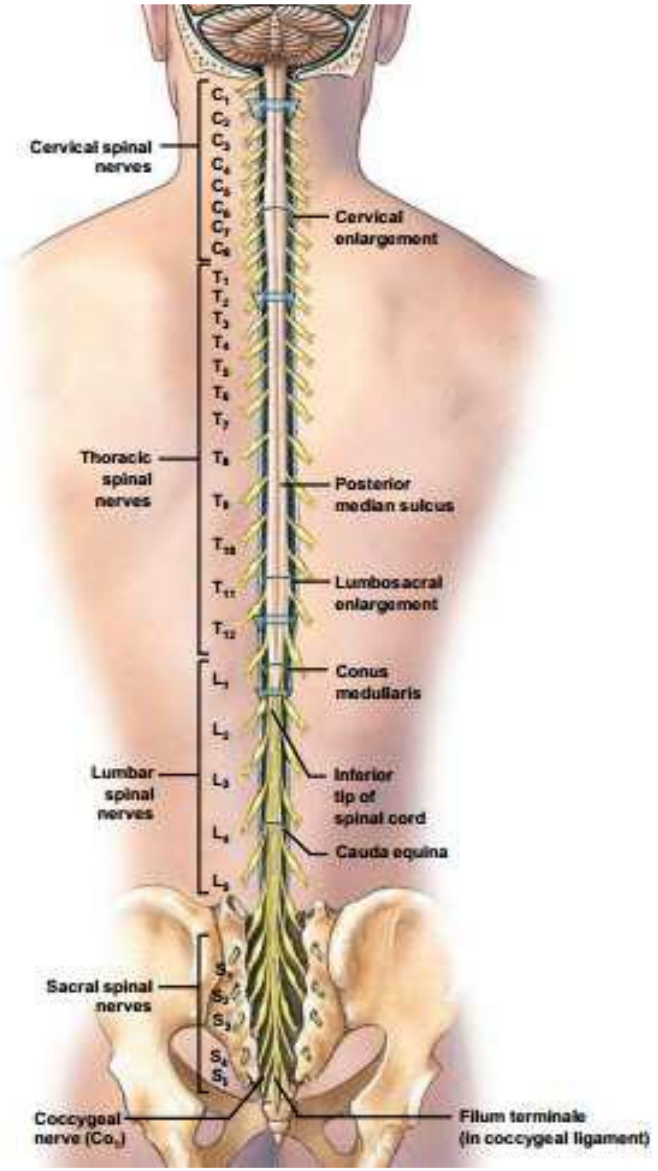
Lateral

Posterior


Forebrain
Cerebrum
Thalamus
Hypothalamus
Cerebral cortex
Pituitary gland
Midbrain
Pons
Hindbrain
Medulla oblongata
Cerebellum
Spinal cord

Spinal Cord

- It is the downward continuation of the medulla oblongata.
- It terminates inferiorly in the adult at the level of the lower border of the L1.
- It has a narrow cavity called the central canal.
- It is covered with the 3 meninges like the brain.



Thank you

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