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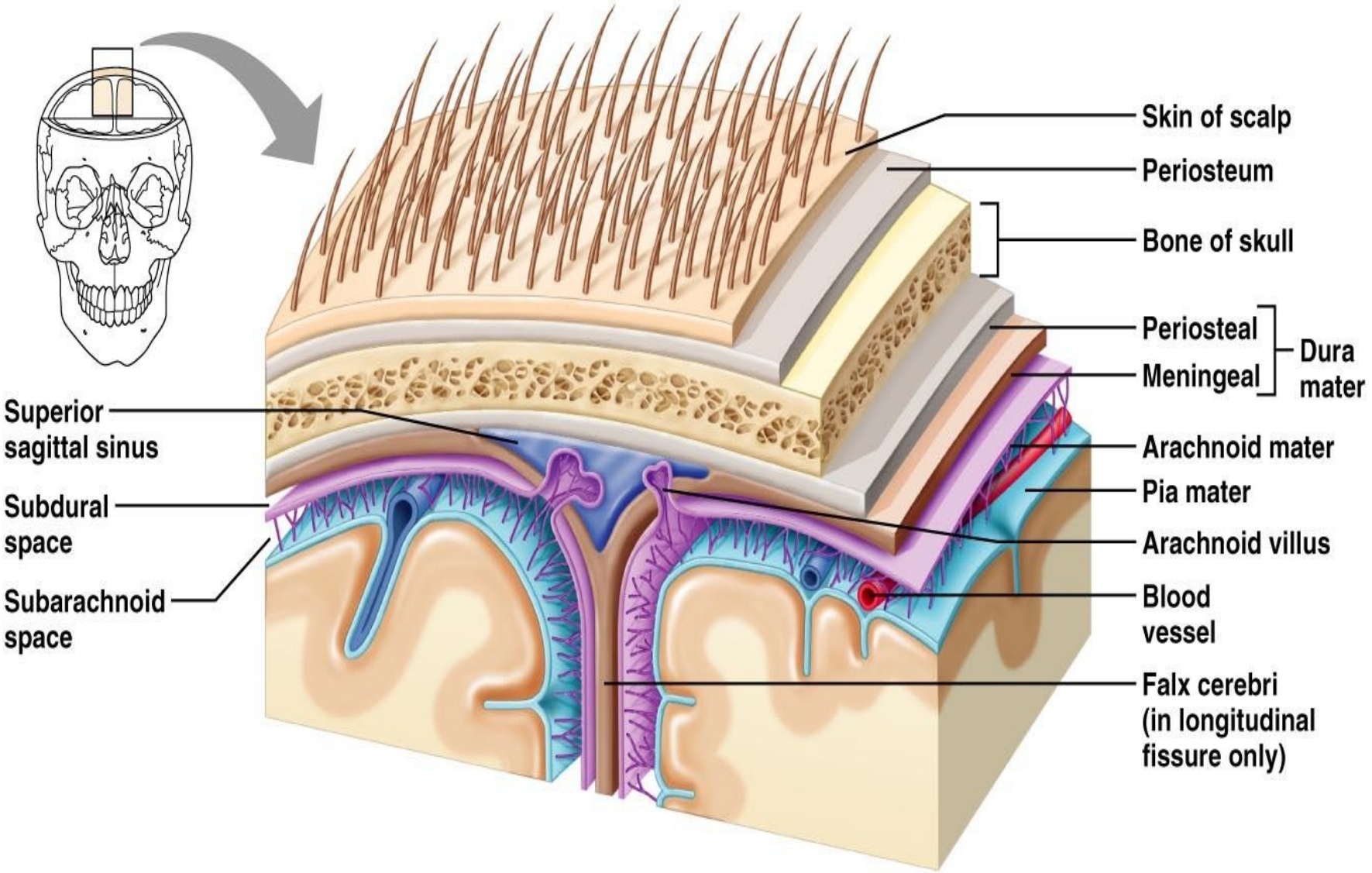
- **The Central Nervous System**

- For post basic nursing & midwifery

BY: Dr. Genale, MD

- Protection of The Brain
  - Meninges:

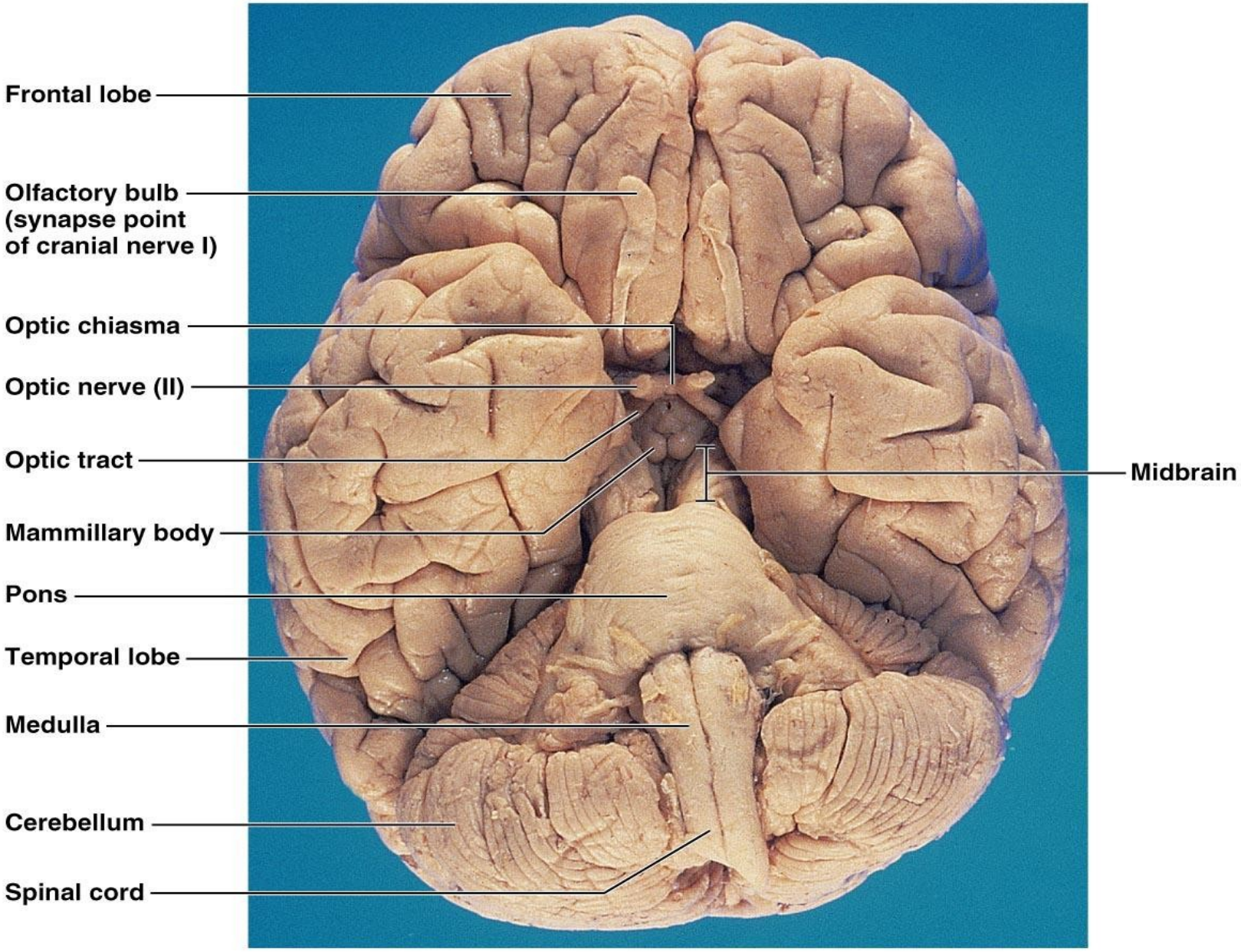
  1. Body membranes that cover the brain and spinal cord for protection and nourishing purposes.
  2. Consists of 3 layers: (each layer is a "menix")
  a) **Dura mater** ("tough mother"): outermost layer that attaches the brain to cranial bones, and the spinal cord to vertebrae. Made up of fibrous connective tissue that protects the CNS.
  b) **Arachnoid mater** ("web like mother"): middle layer made up of thin membranes that lack blood vessels. It reabsorbs cerebrospinal fluid (CSF).
  c) **Pia mater** ("gentle mother") innermost layer made of thin membranes that contain capillaries for providing nourishment to the brain and spinal cord. Forms capillary networks called plexuses which produce CSF



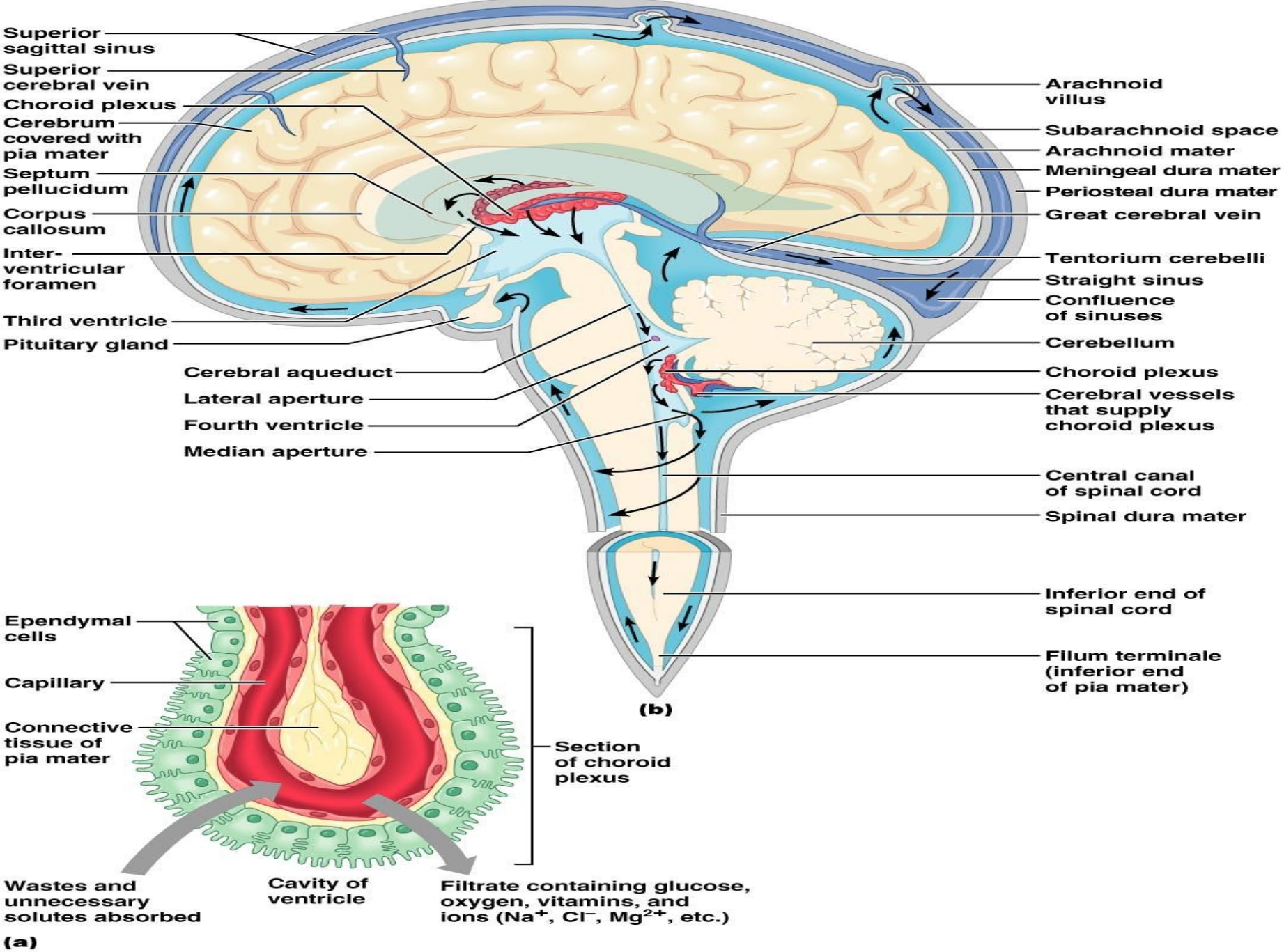
(a)

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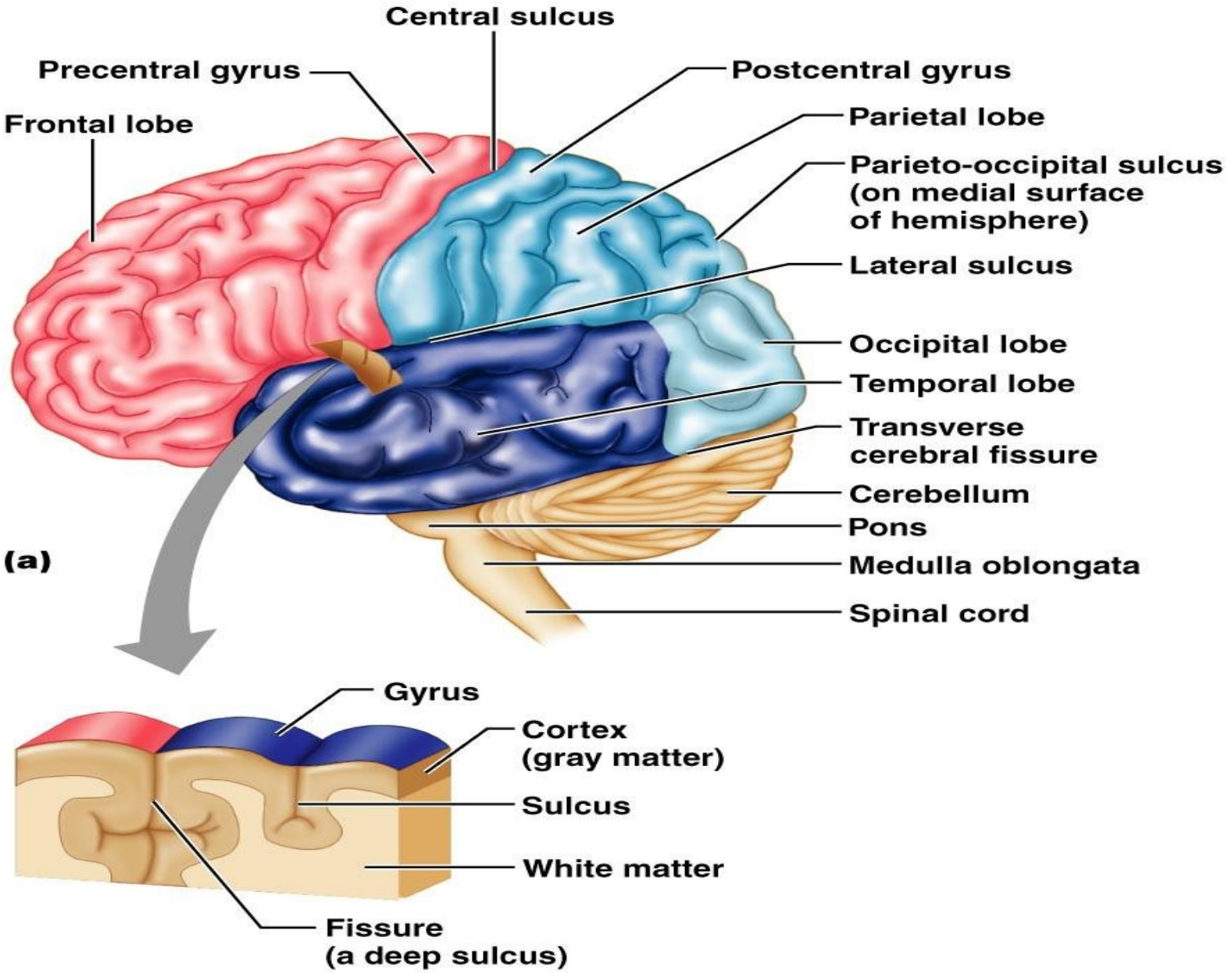
- **The Brain**
  1. The largest organ in the nervous system; composed of about 100 billion neurons (interestingly, although the neurons contain **DNA**, there is no DNA replication or mitosis in the brain, as a result the number of neurons decreases as a person ages).
  2. Divided into 3 main regions: **Cerebrum**, **Cerebellum**, and the **Brain Stem**.
  3. Contains spaces called **ventricles** where choroid plexuses of Pia mater produce cerebrospinal fluid (CSF), and these ventricles allow CSF to circulate around the brain and into the spinal cord (through the central canal).



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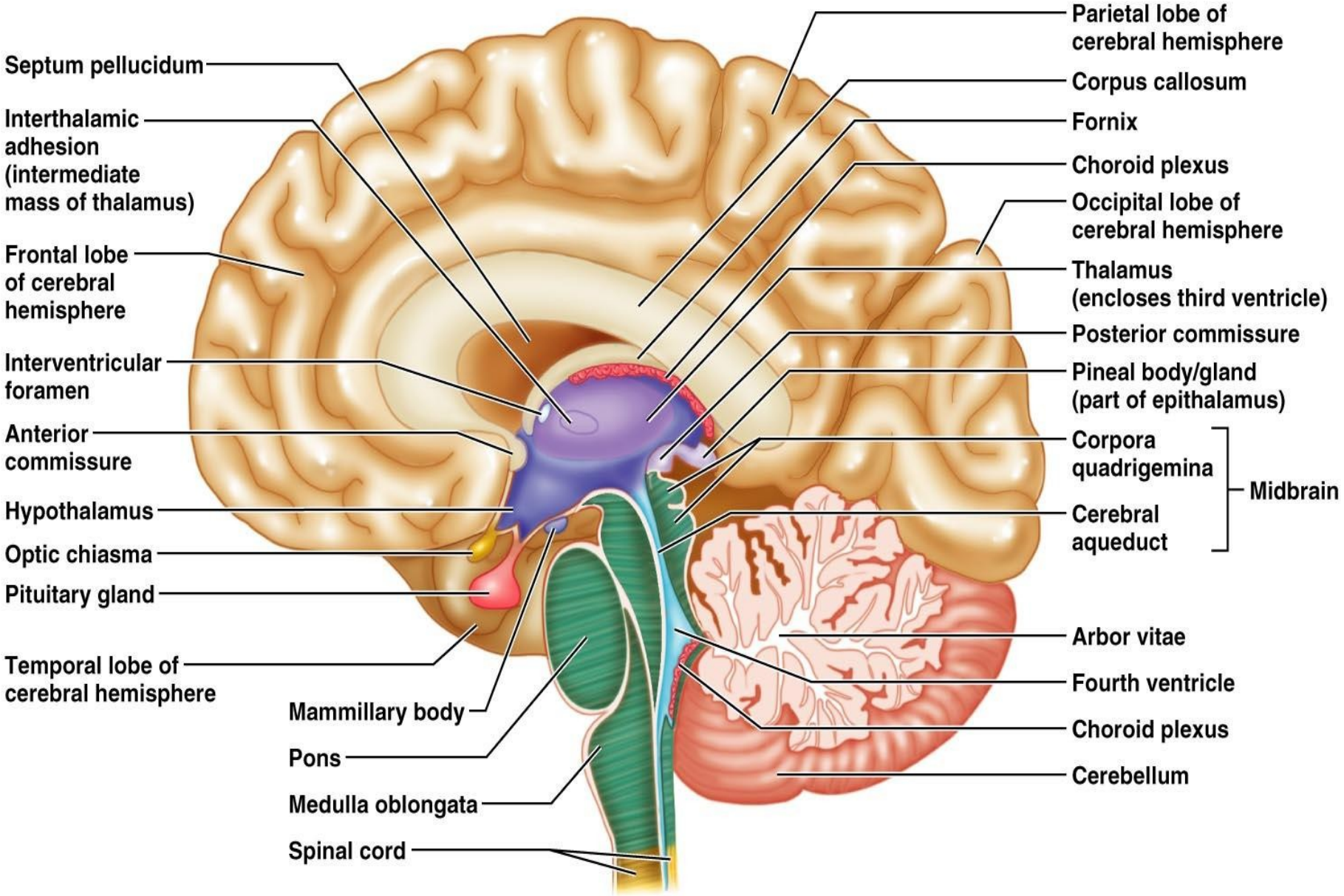


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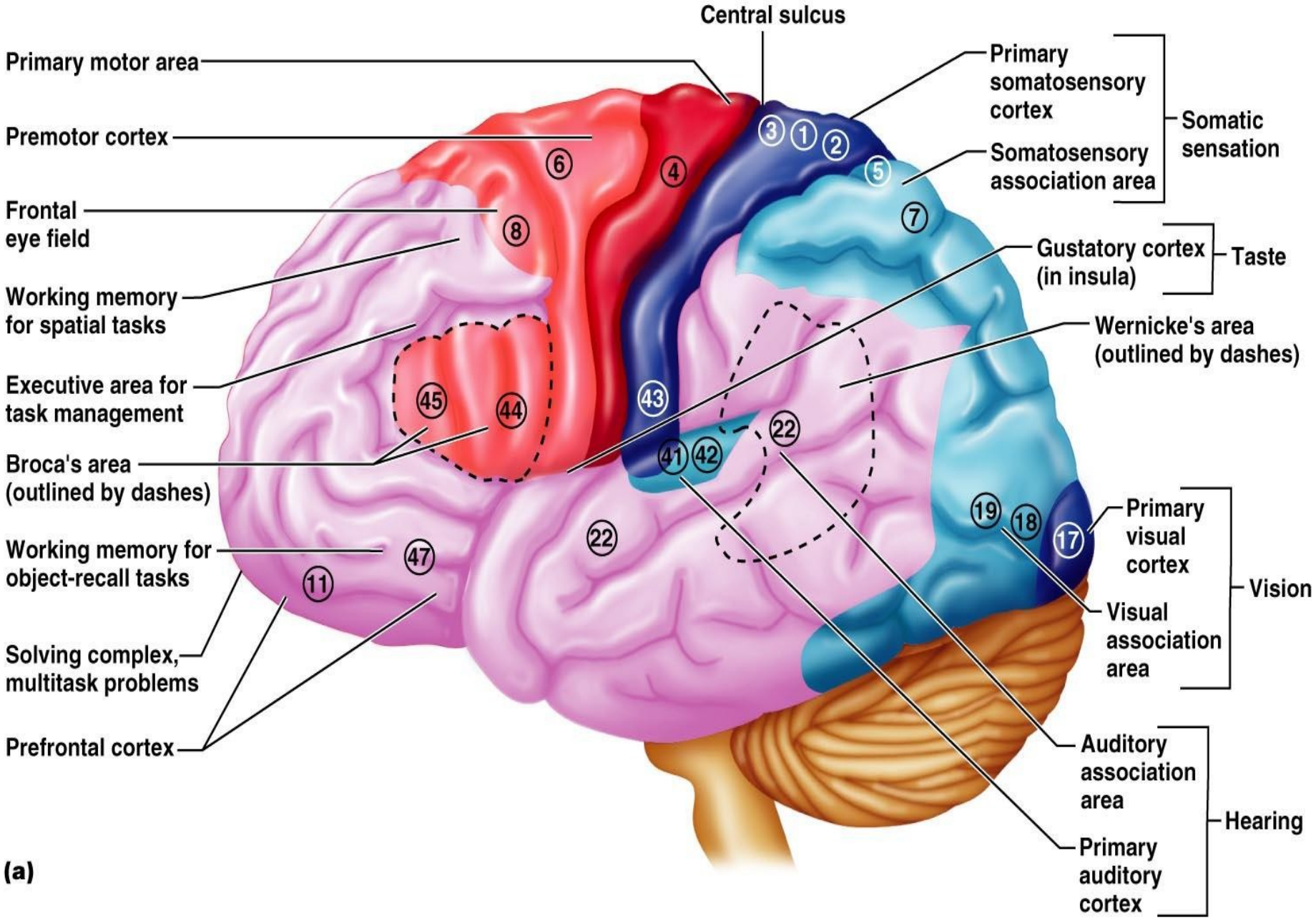
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- 4. **Cerebrum:**
  a) **Cerebral Cortex (**outer region) is made of **gray** matter (unmyelimated neurons) which contains up 75% of all neurons in the nervous system, while **Cerebral Medulla** (inner region) is made of **white** matter (myelinated neurons).
  b) Consists of left and right hemispheres, created by the longitudinal fissure at the center of cerebrum, and are connected by the **corpus callosum**.
  c) Its surface is marked by ridges called **convolutions** (**gyri**) which are separated by grooves called **sulcus** (or **fissure**, if the grooves are deeper).



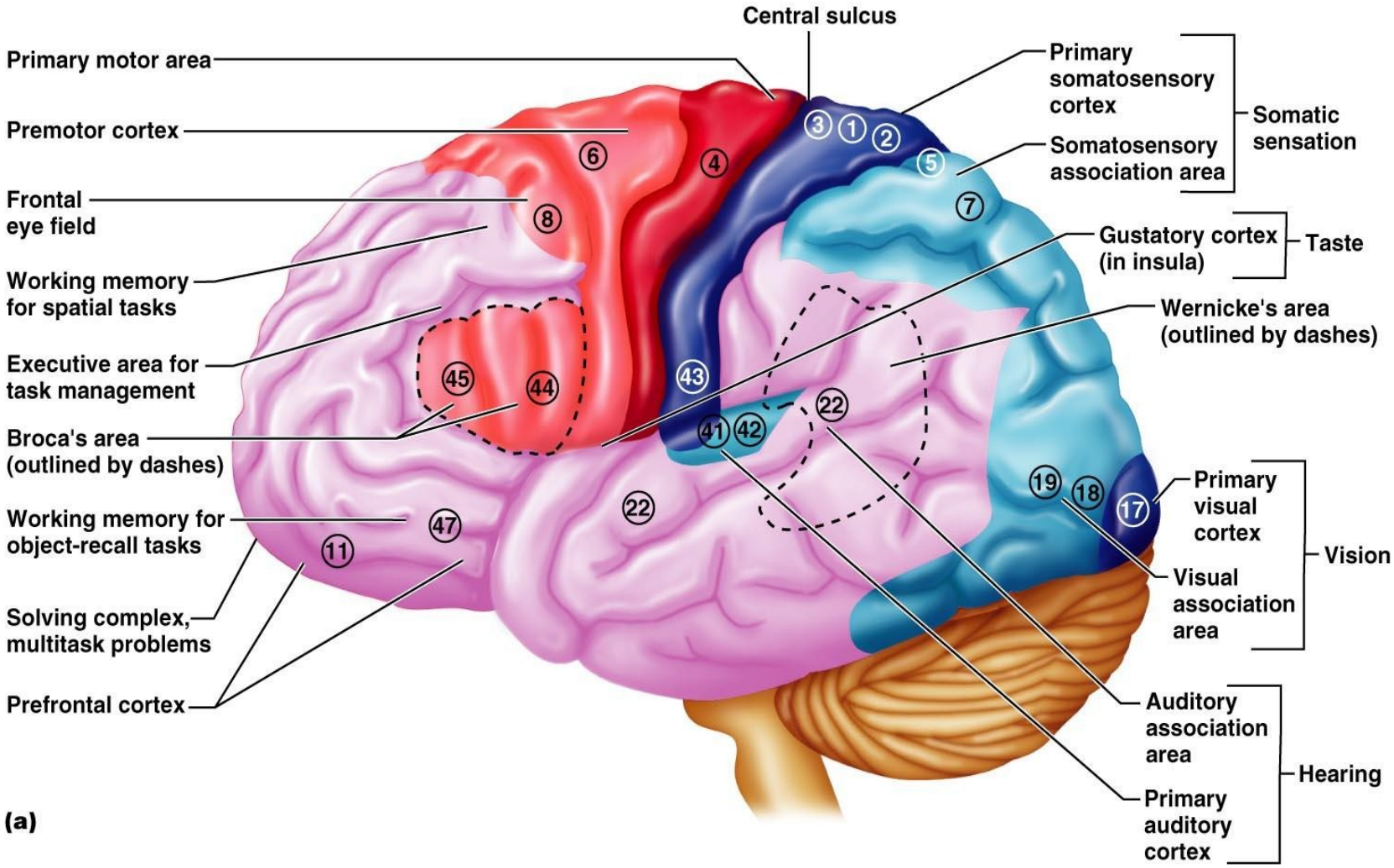
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- d) **Frontal lobe** controls skeletal muscle movement and intellectual processes.
  e) **Parietal lobe** controls sensations and speech.
  f) **Temporal lobe** controls hearing and memory.
  g) **Occipital lobe** controls vision



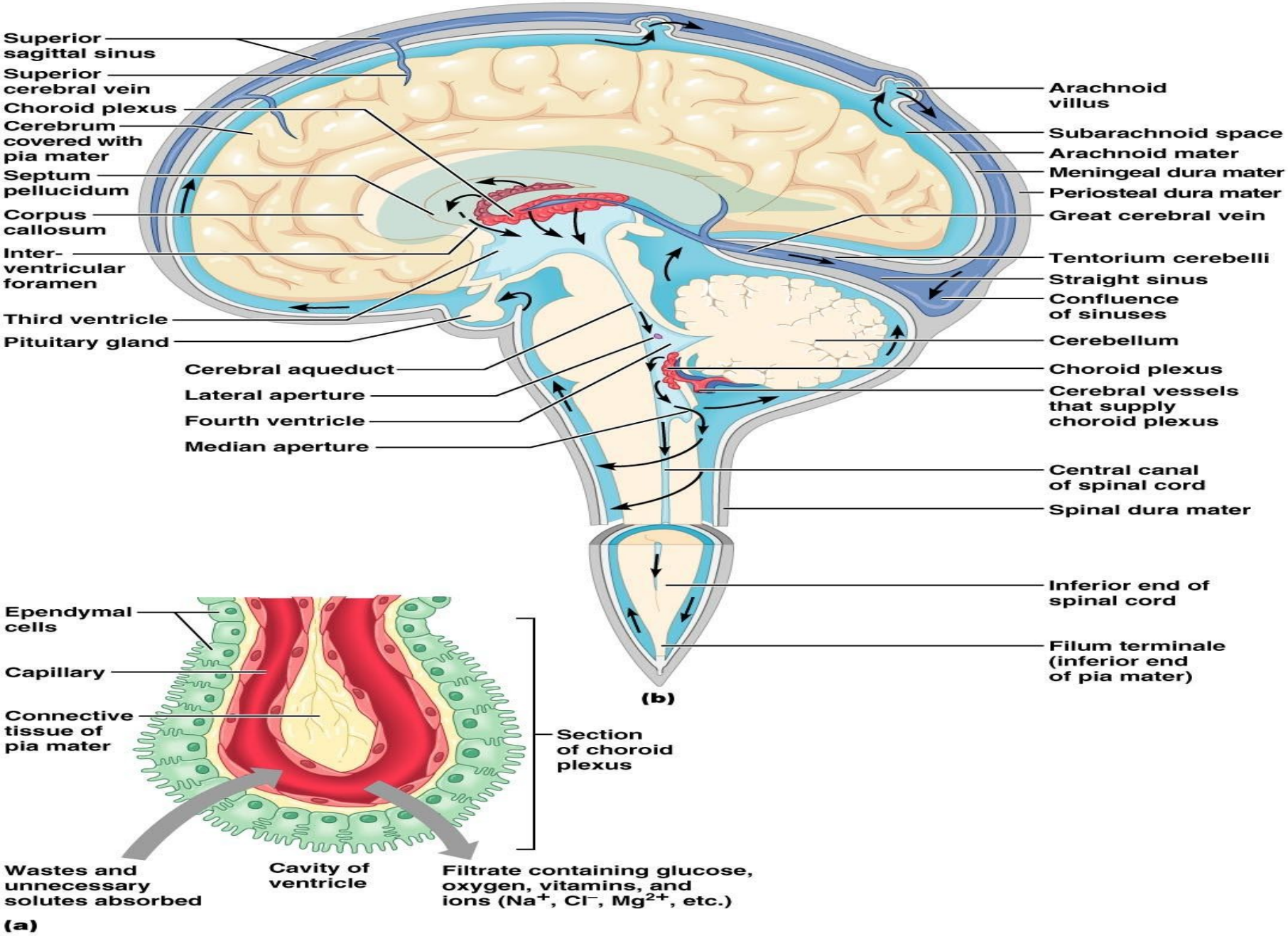
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- h) Functional regions of cerebral cortex:
  Motor areas: located in frontal lobe, to control voluntary muscles.
  Motor speech area ("Broca's area"): located in frontal lobe, to control muscles of mouth, tongue, and larynx for speech.
  Frontal eye field: located in frontal lobs just above the broca's area, to control muscles of the eye and eyelid.
  Auditory area: located in temporal lobe, to control hearing.
  Visual area: located in occipital lobe, to control visual recognition of objects and combine visual images.
  Sensory areas: located in parietal lobe, to be involved in cutaneous sensations of temperature, touch, pressure and pain.
  Association areas: located in all of cerebral cortex, to interconnect sensory and motor functions of all lobes of the cerebrum.



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- 5. **Cerebellum**
  . Coordinates and controls muscular movement and muscle tone.
  . Maintains body posture, by working with the equilibrium receptors in the inner ear.
  . New data suggest that it also functions as the "thesaurus" for speech , finding the right words to use.

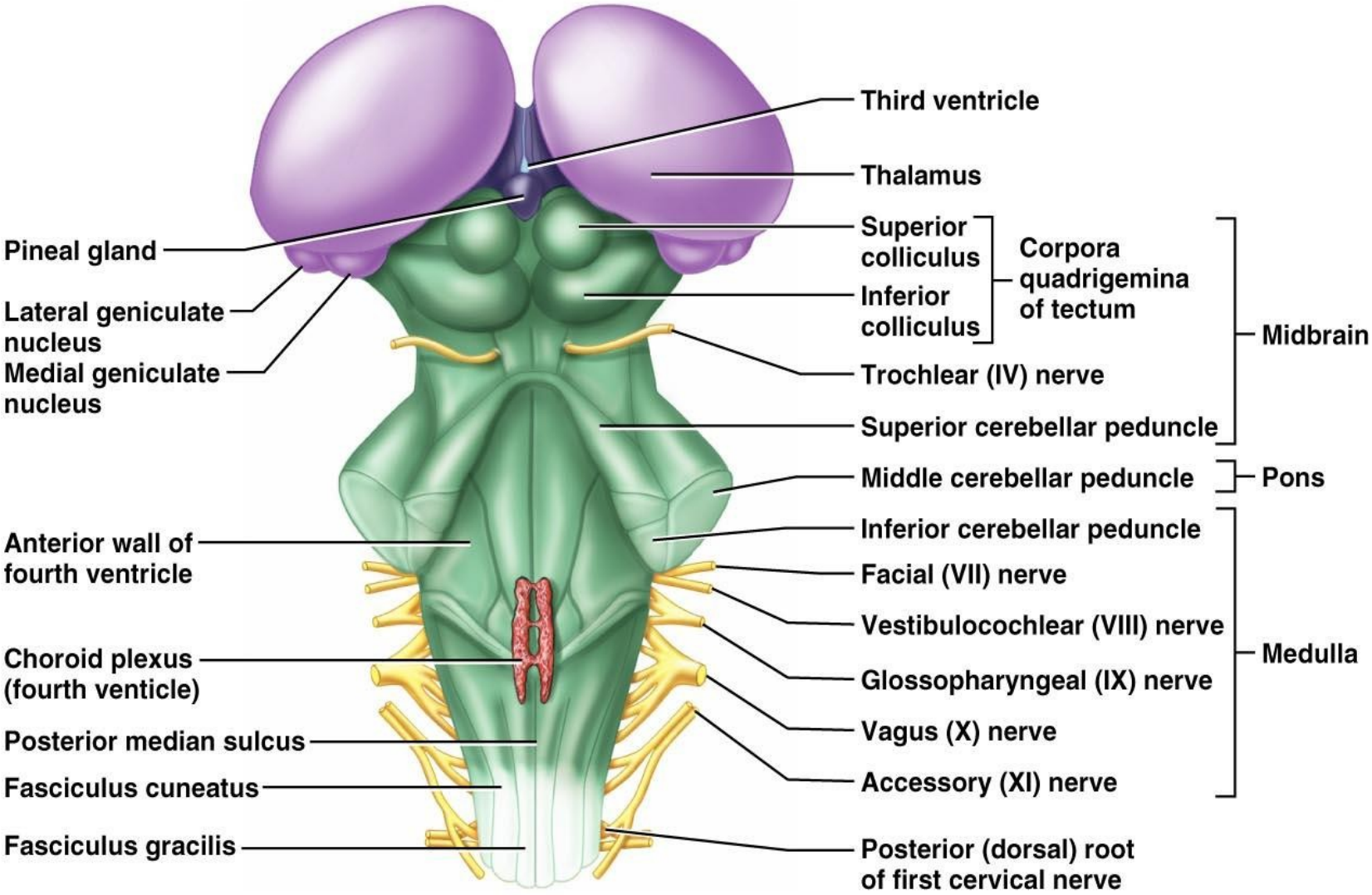


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Brain Stem

- 6. Made of brain tissue at the base of cerebrum, connecting the cerebrum to the spinal cord.
  * Functions largely for autonomous activities.
  Subdivided into
  diencephalon,
  midbrain, pons and
  medulla oblongata.

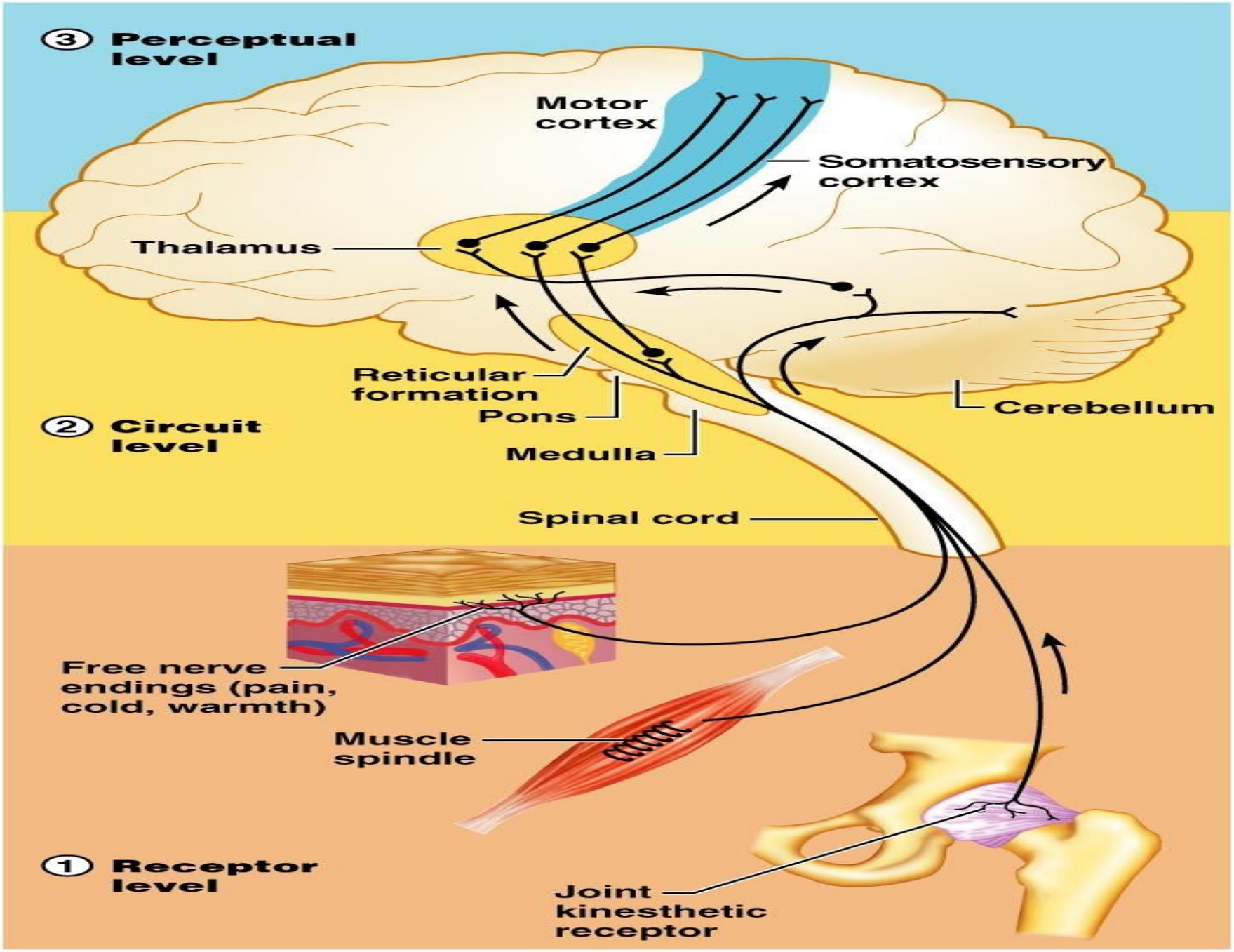
Brain Stem



(c) Dorsal view

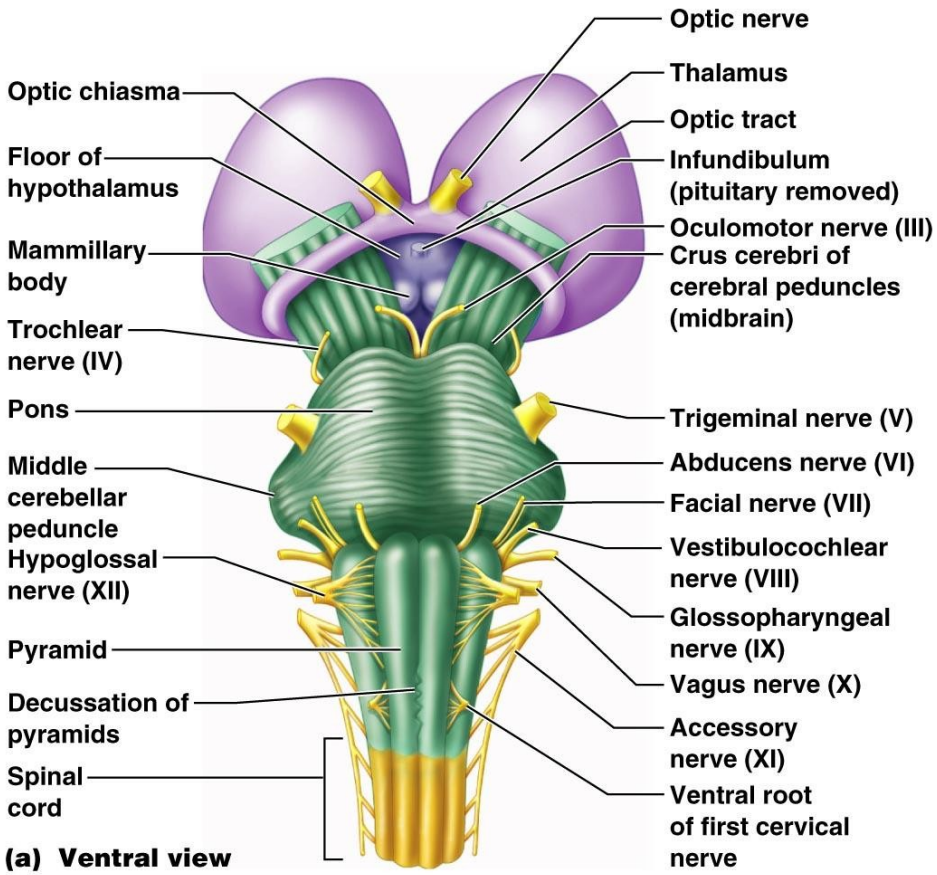
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- **I. Diencephalon:**
  consists of Thalamus and
  Hypothalamus.
  a) Thalamus- It is a major relay center to direct nerve impulses from various sources to the proper destinations.
  b) hypothalamus (an important area for regulating homeostatic activities, such as hunger, thirst, sex drive, and even addictions).

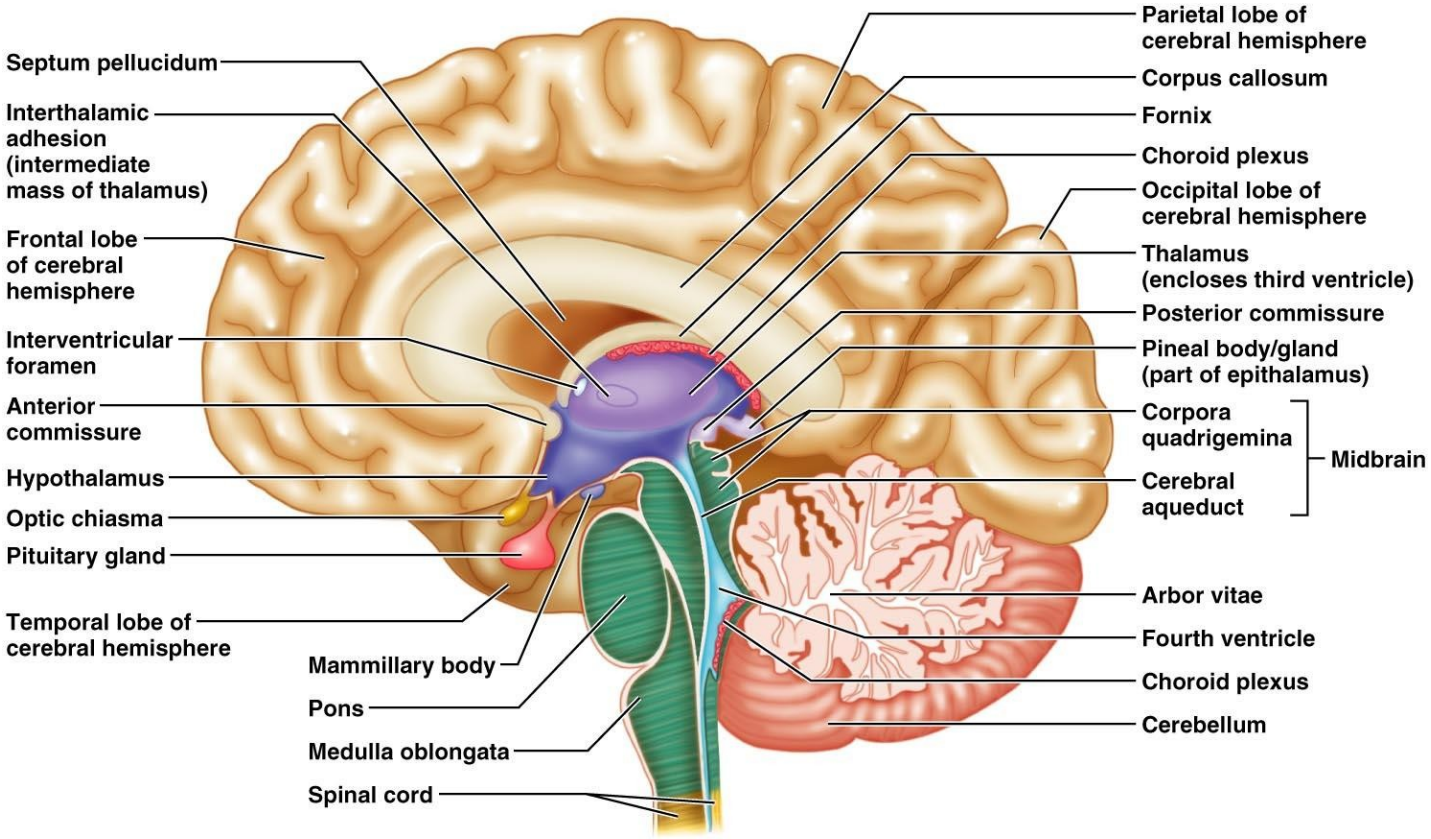


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- Hypothalamus regulates:
  1) Heart rate and arterial blood pressure.
  2) body temp.
  3) water & electrolyte balance.
  4) control of hanger & body weight.
  5) control of movements and glandular secretion of the stomach & intestines.
  6) production of neurosecretory substances that stimulate the pituitary gland to release hormones
  that help regulate growth and influence reproduction
  7) sleep and wakefulness.

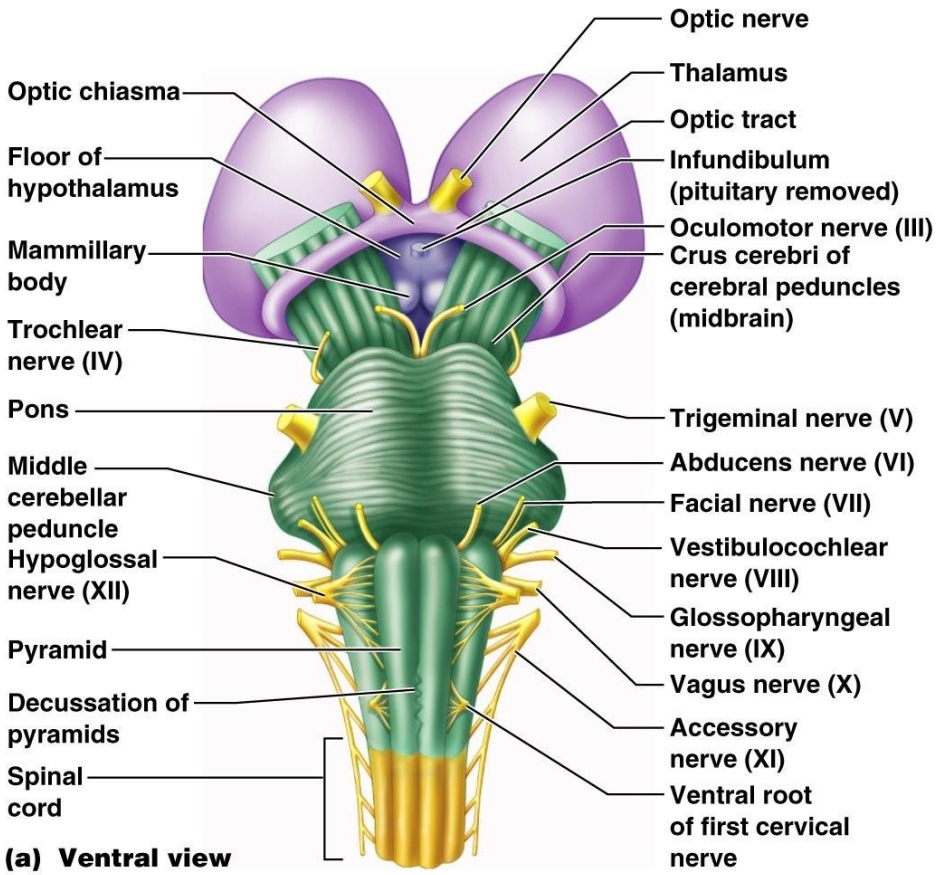


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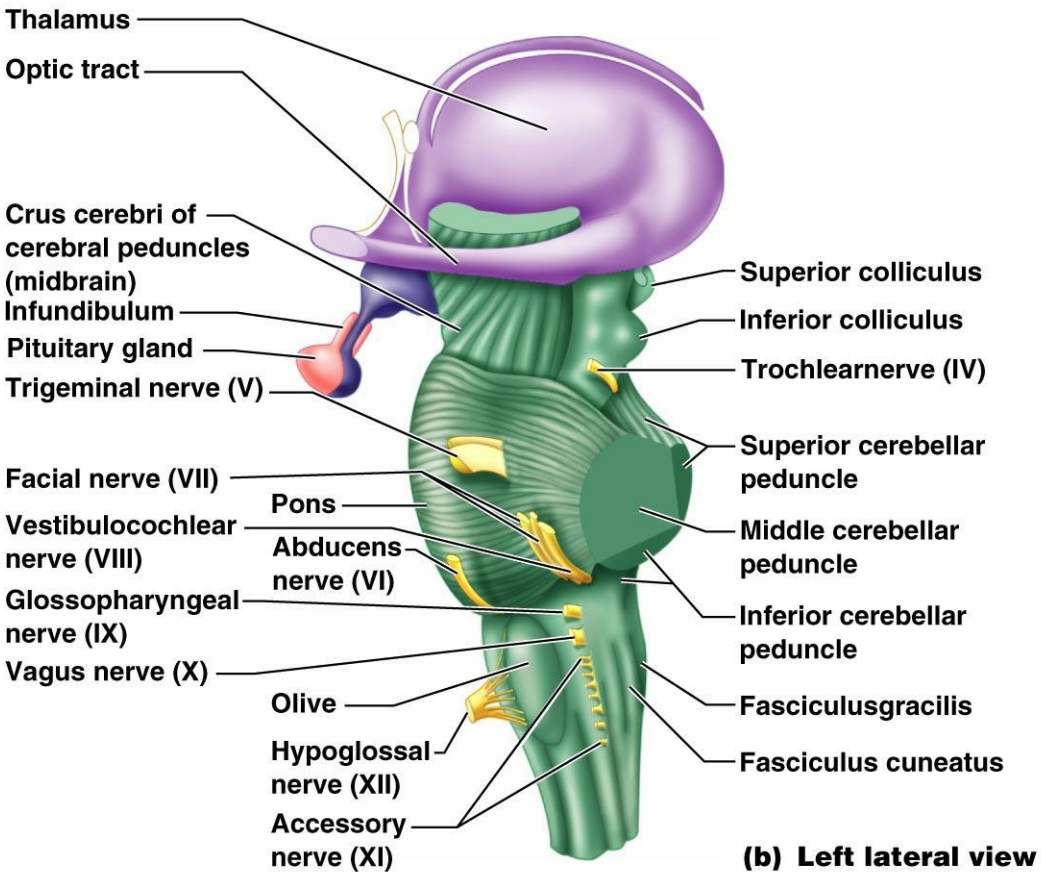


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- Other parts of diencephalons:
  1) optic tracts and optic chiasma that is formed by optic nerves crossing over.
  2) infundibulum - site of attachment of pituitary gland
  3) post. Pituitary glandhangs from the floor of hypothalamus
  4) mammillary bodiesRelay station in olfactory pathway.
  5) pineal gland- produce melatonin that controls sleep - awake cycle.

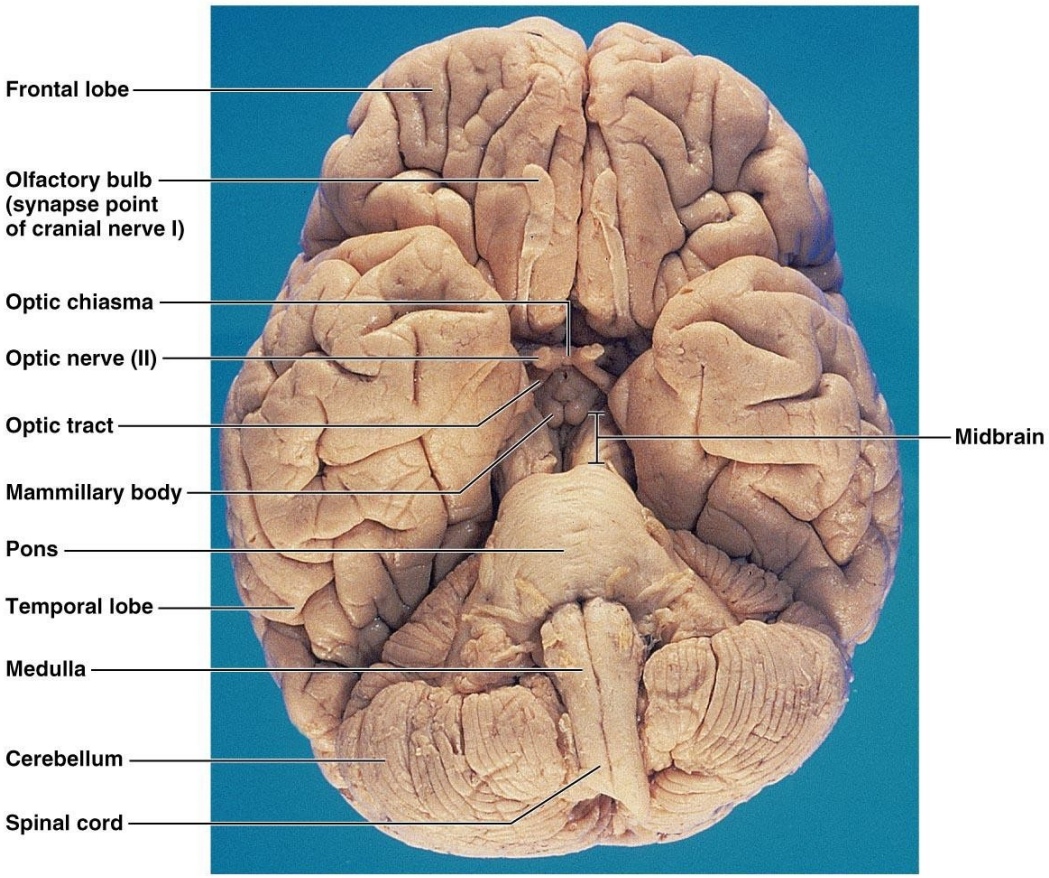


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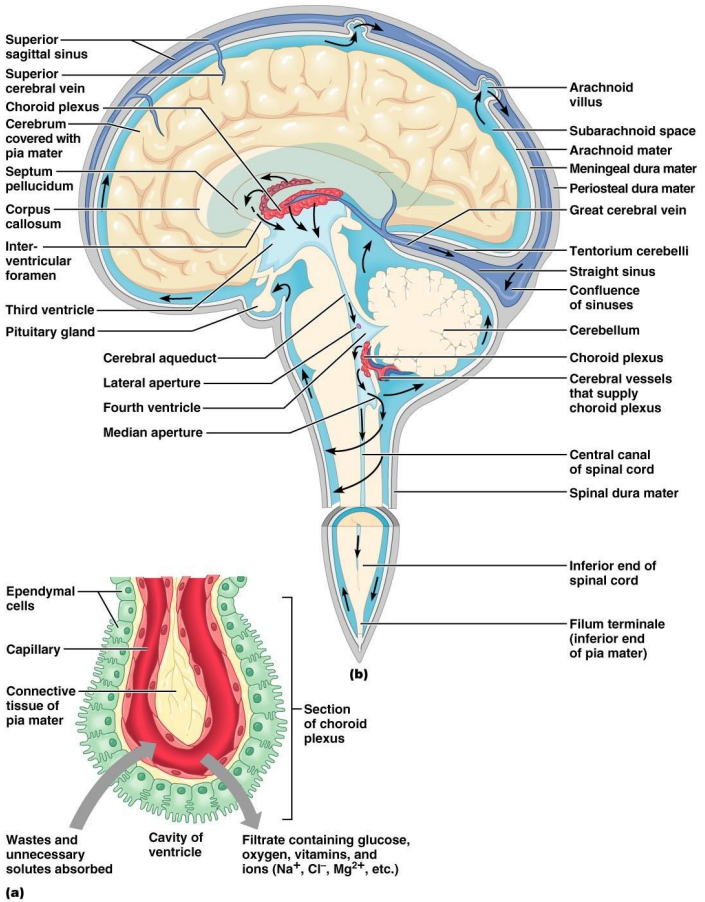
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- **II. Midbrain:** serves as a major cerebral reflex center, and also helps direct **CSF** from the third ventricle to fourth ventricle.
  III. Pons: contains at least 2 "respiratory centers" (groups of specialized neurons) which regulate the duration and depth of breathing.
  IV. Medulla oblongata: at the base of base of brain stem and continuous to become spinal cord. It contains specialized neurons that form"cardiac centers" (to control heart rate), "vasomotor centers" (to control blood flow and blood pressure), and "respiratory centers" (to control respiratory rhythms).



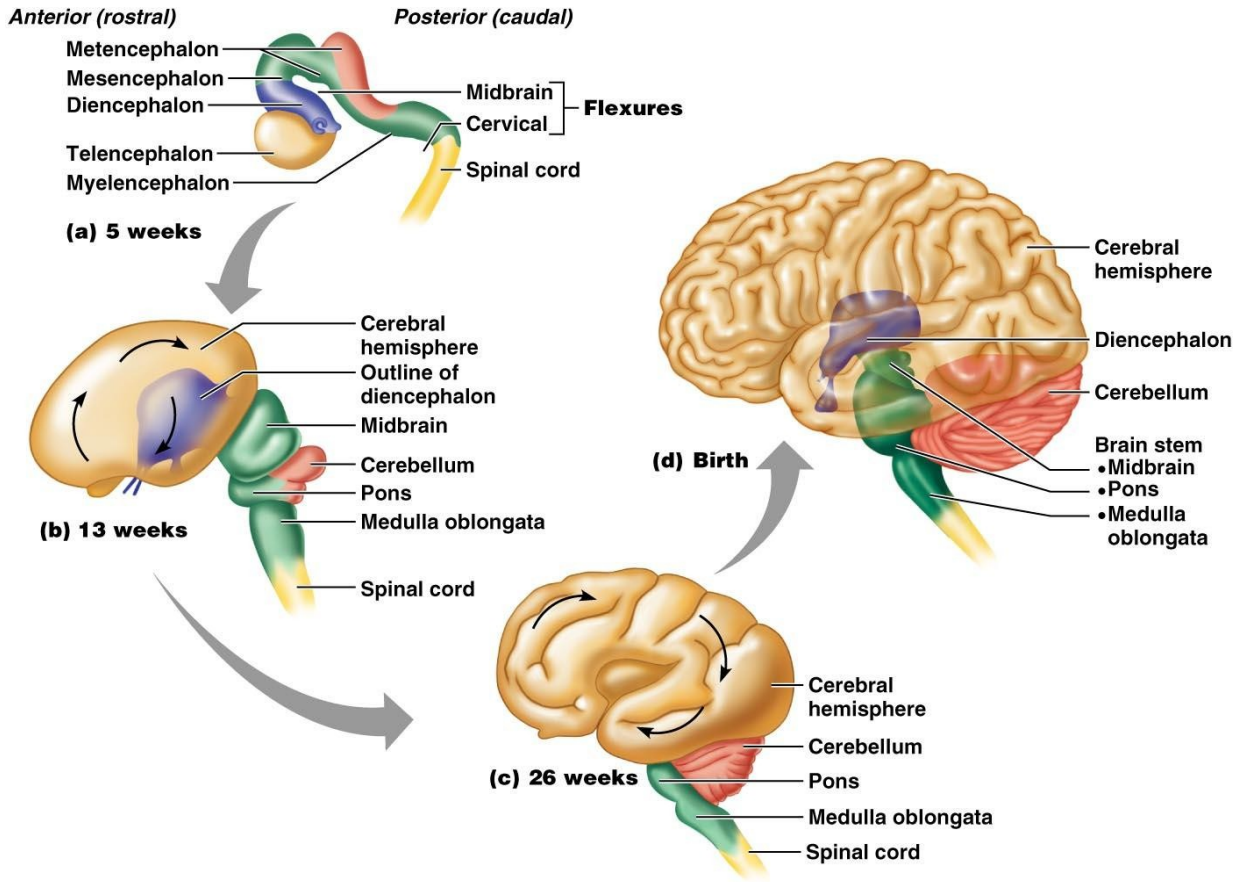
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- 7. **Cerebrospinal fluid (CSF):**
  Its chemical composition is similar to **blood plasma,** since it is derived from brood plasma.
  Made by **choroids plexuses** (clusters of capillaries in pia mater) in cerebral ventricles.
  Circulates in the brain (through the ventricles), spinal cord (through central canal), and between arachnoid and pia mater layers of meanings around the central nervous system.
  Reabsorbed constantly by arachnoid mater and drained into veins.
  Mainly designed to protect **CNS** by serving as a cushion , and as a relatively stable solution in maintaining ionic concentrations and waste removal.
  When too much CSF accumulates in the skull, it can result in **hydrocephalus** where the excess volume creates dangerously high pressure exerting onto brain tissue.



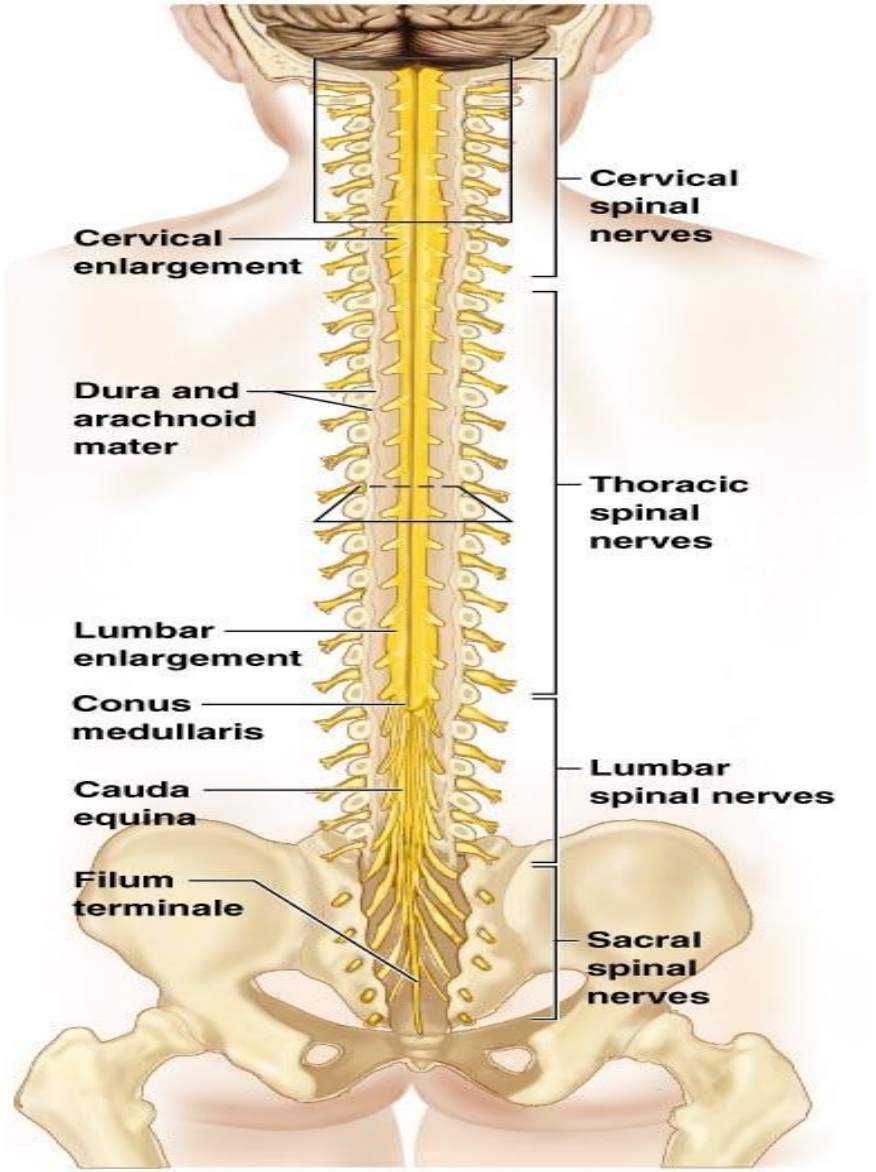
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- Structural Development of The Brain
  Embryonic vesicle: Forebrain (Prosencephalon)
  a. Anterior portion (Telencephalon) produces Lateral Ventricles, cerebrum and basal ganglia.
  b. Posterior portion (Diencephalon) produces Third Ventricle, Thalamus, Hypothalamus, post. Pituitary gland, and pineal gland.
  Embryonic vesicle: Midbrain (Mesencephalon) produces cerebral aqueduct, and midbrain.
  Embryonic vesicle: Hindbrain (Rhombencephalon)
  a. Anterior portion (Metencephalon) produces fourth ventricle, cerebellum, and pons.
  b. Posterior portion (Myelencephalon) produces fourth ventricle, and medulla oblongata.



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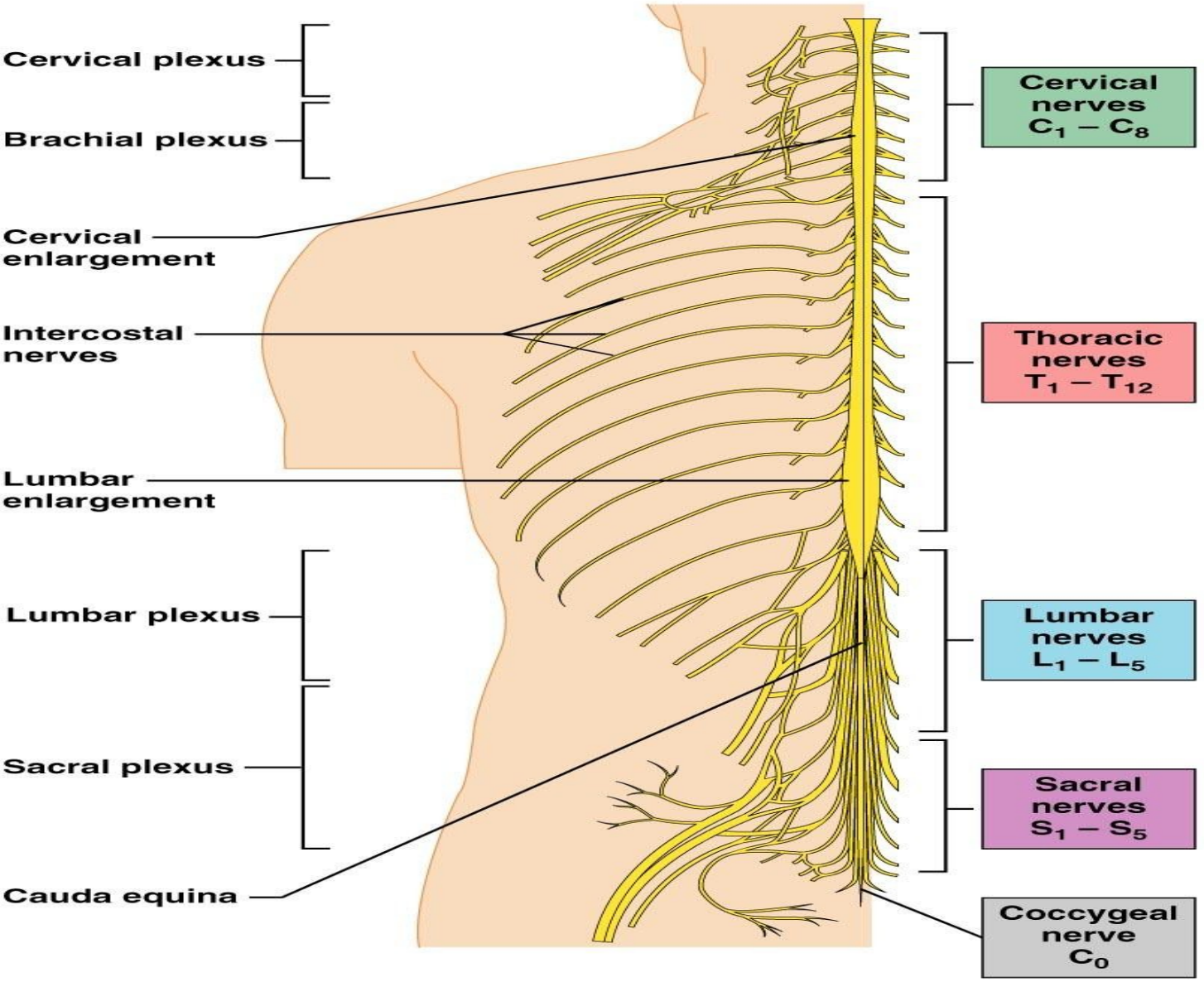
- Spinal cord
  A long nerve cord that begins at the foramen magnum and ends at the first or second lumbar vertebra.
  Divided into 31 segments (named after the vertebral regions), each segment gives rise to a pair of spinal nerves (part of the PNS).
  In general, the location of the spinal nerve corresponds with the location of the effector organ (e.g. cervical nerves connect to muscles and glands on the head, face, and neck).



(a)

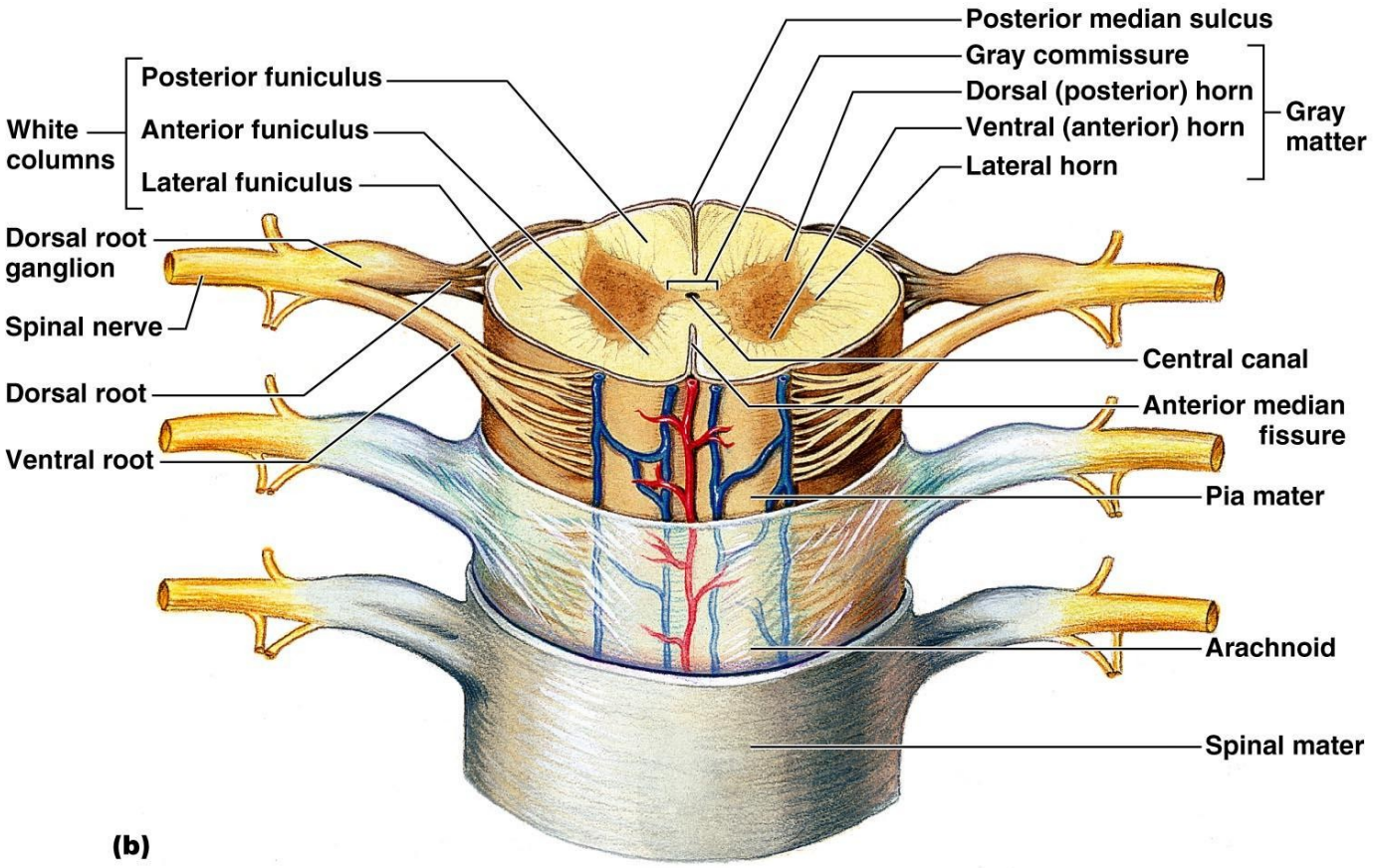
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- Most spinal nerves form net - works called plexuses.
  - **C1 to C4** from cervical plexus which serves the head, face, and neck.
  - **C5 to T1** from brachial plexus which serves the shoulder, arm, and hands.
  - **T2 to T11** do not from any plexus.
  - **T12 to S5** form lumbosacral plexus which serves the lower body and lower limbs.
  - **Coccygeal** nerves do not form any plexus.



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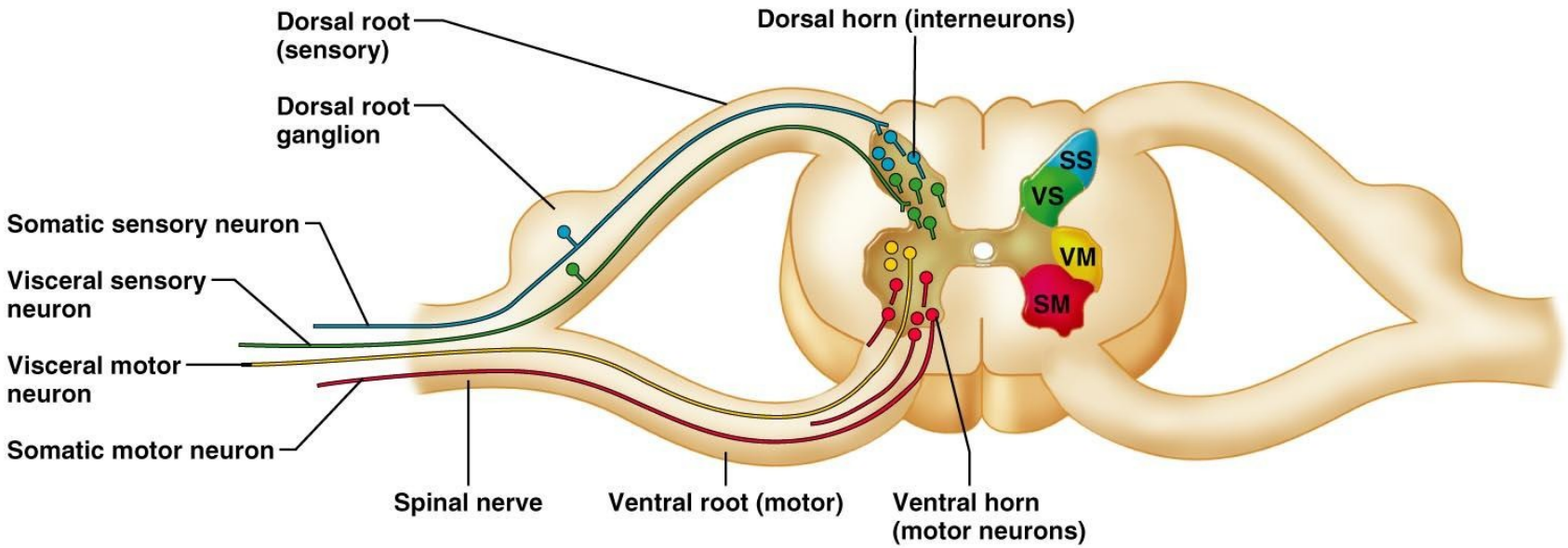
- **Cross sectional anatomy of the spinal cord:** two grooves divide
  spinal cord into night left halves.
  1. Ant. median fissure or groove (deep).
  2. post median sulcus (shallow groove).
  • The spinal cord consist of white matter surrounded by gray matter.
  Gray matter resembles a butterfly. The upper and lower wings of gray
  matter are called posterior horn and anterior horn respectively



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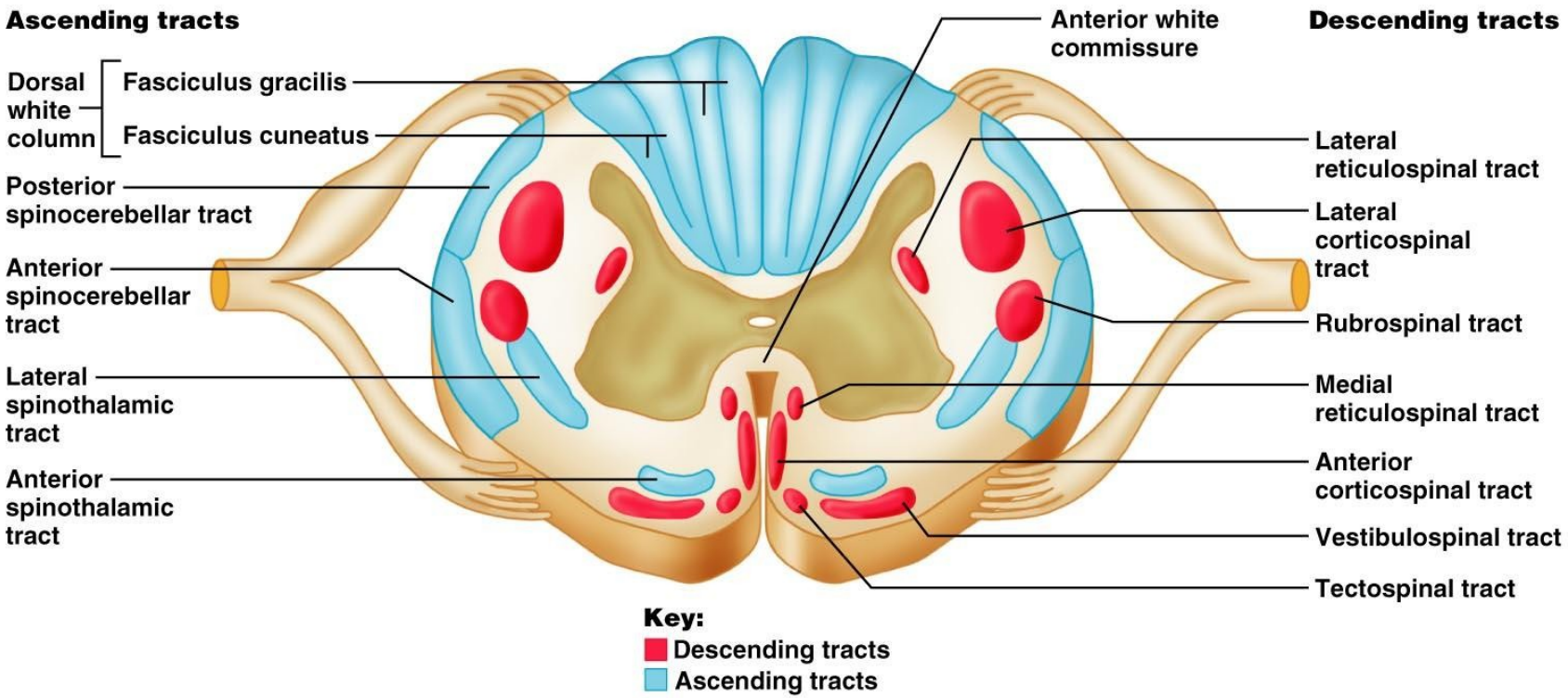
- Lat. horn is located between post. and ant. horns on either side.
  • Central canal contains **CSF**.
  • The gray matter further divides the white matter into 3 regains on
  each side.
  a) The anterior column (or Funiculi)
  b) The lateral column (or Funiculi)
  c) The posterior column (or Funiculi)

- Ant. horn mostly house nerve cells bodies of somatic motor neurons.
  These send their axons out via the ventral root of the spinal cord to
  skeletal muscles.
  Afferent fibers carrying impulses from peripheral sensory receptors
  form the dorsal root. Their nerve cell bodies are found in an enlarged
  area called **dorsal root ganglion.**



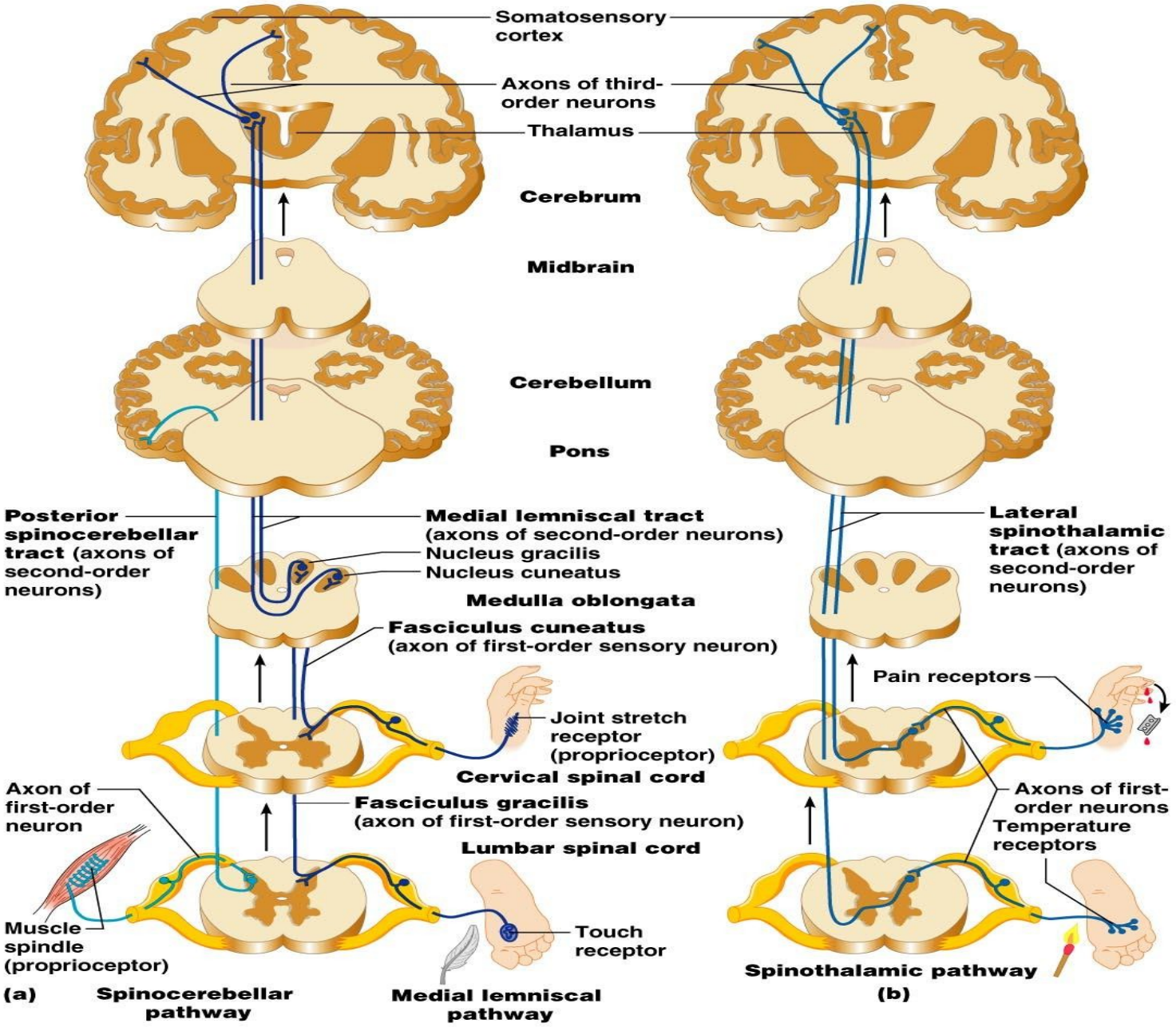
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- Tracts of The Spinal Cord
  Tracts: The nerve tracts of the spinal cord provide a two-way
  communication system between the brain and the body.
  a) **Ascending tract**: conduct sensory impulses to the brain.
  b) Descending tract: conduct motor impulses from the brain to motor
  neurons reaching muscles, glands, etc



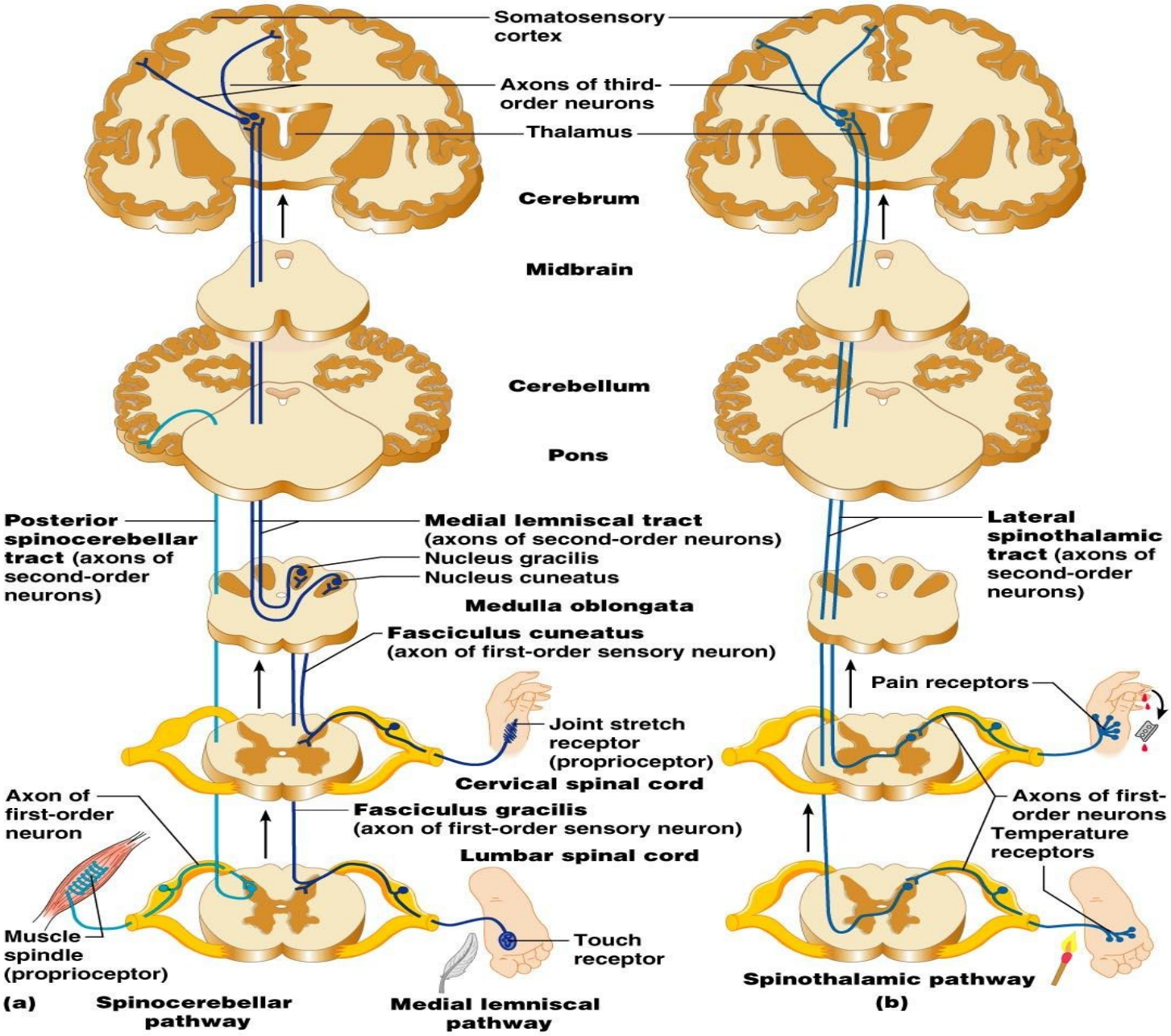
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- **A) Ascending Tracts**
  1. **Fasciculus gracilis** (transmits sensory impulses from lower limbs) and **Fasciculus Cuneatus** (transmits sensory impulses from upper limbs): Located in posterior funiculi and conduct sensory impulses associated with senses of touch, pressure and body movement from skin, muscles, tendons, and joints to the brain.



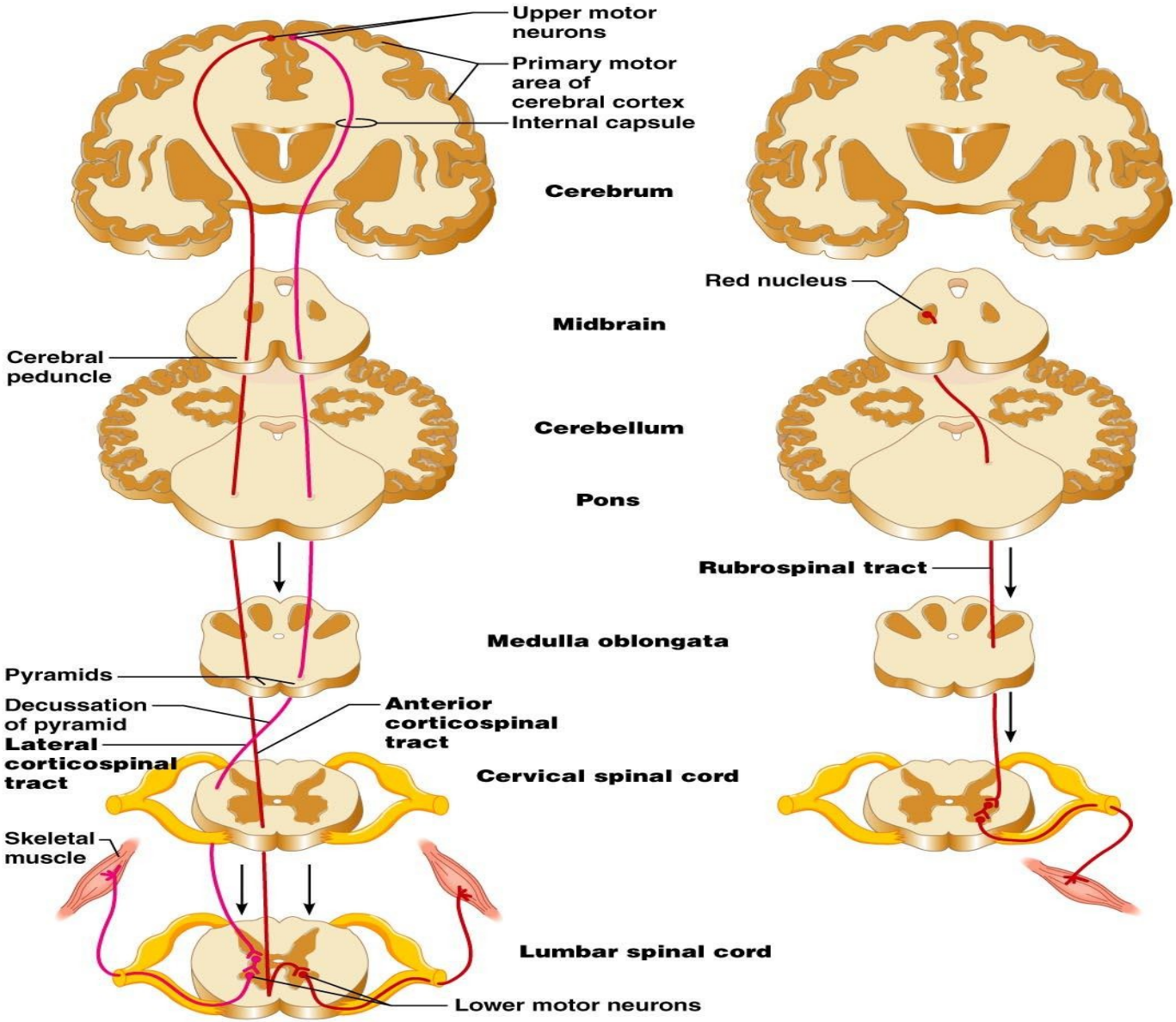
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- 2. **Spinocerebellar tract:** conduct impulses (sensory) required for coordination of muscle movements from lower limb and trunk muscles to cerebellum.
  3. **Spinothalamic tract:** conduct sensory impulses for pain and temperature to brain



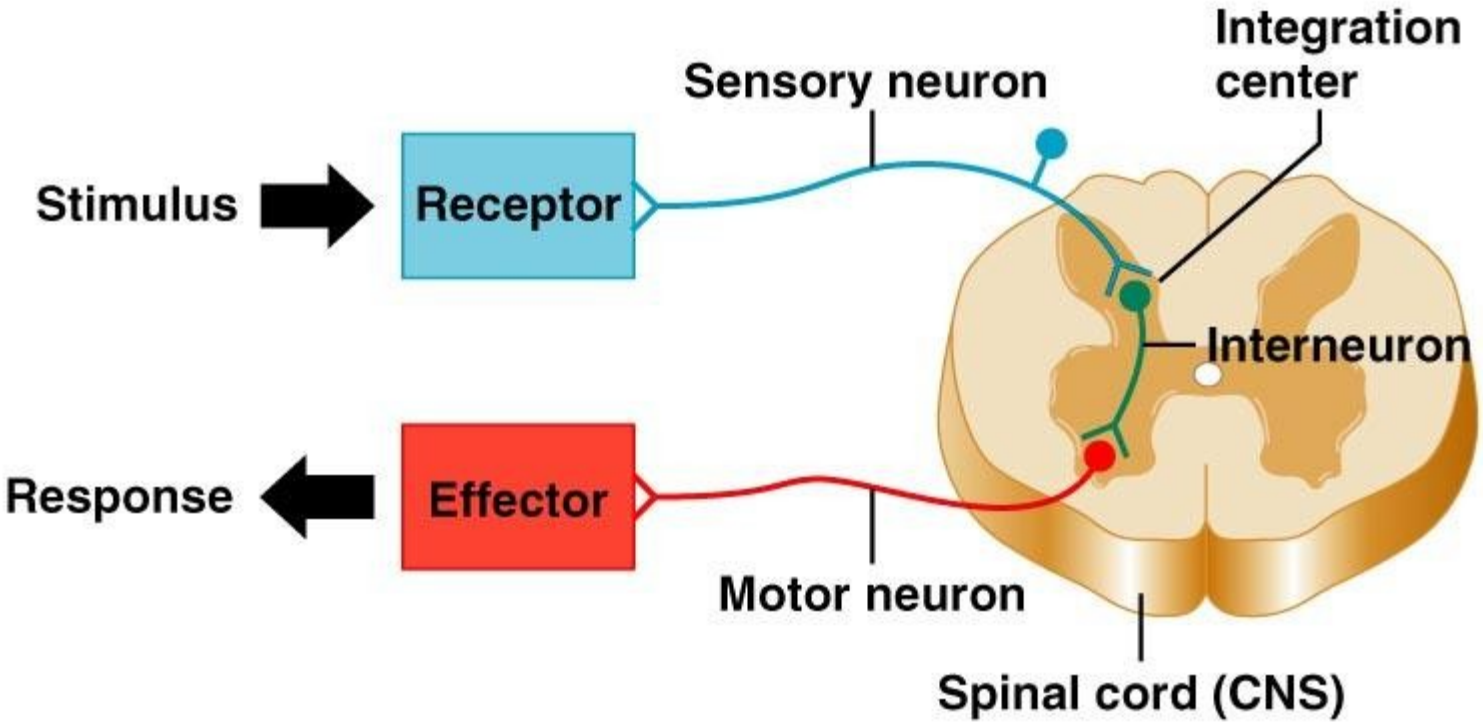
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- **B. Descending Tracts**
  1. **Corticospinal tract:** conducts motor impulses associated with voluntary movement from the brain to skeletal muscles.
  2. **Reticulospinal tract:** conducts motor impulses associated with maintenance of muscle tone and the activity of sweat glands from the brain.
  3. **Rubrospinal tract:** conducts motor impulses associated with muscular coordination and the maintenance of posture from the brain.



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- Reflex Arc
  In a **spinal reflex arc,** a stimulus (i.e. heat, sharp objects) has to be detected by a **receptor** which sends a nerve impulse to the **sensory neuron,** which relays the impulse through the dorsal root of the spinal
  cord, to the **interneuron** in the gray matter of spinal cord. The impulse is now relayed to the **motor neuron** through the ventral root
  of the spinal cord, and finally causes a quick action at the **effector organ** (muscle or gland) to react to the stimulus.



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- Clinical Terms
  Neurologist: doctor who specializes in nervous system disorders.
  Concussion: slight brain injury causing dizzines & loss of consciousness.
  Cerebrovascular accident: commonly known as stroke occurs when blood flow to brain is blocked.
  Alzheimer's disease: progressive disease causing degeneration of brain, loss of memory, language and disorientation.
  Epilepsy: disorder of the CNS That is caused by temporary disturbances in normal brain function (impulses) and is accompanied by seizures and loss of consciousness.
  Parkinson's disease : disorder of brain causing pill-rolling movement of fingers tremor, head nodding, and lack of facial expression.
  Encephalopathy: any disorder of the brain.
  Neuralgia: sharp recurring pain associated with a nerve, usually caused by inflammation or injury.

Thank You