

Lobes of the Brain

Objective

1. *What are the lobes of brain and its functions?*
2. *What is the cerebellum?*
3. *Nuclie of cerebellum,its location and functions?*

The human brain is the most complex organ in the body. The brain is divided into four sections, known as lobes .

1. Frontal lobe,
2. Occipital lobe,
3. Oarietal lobe,
4. Temporal lobe

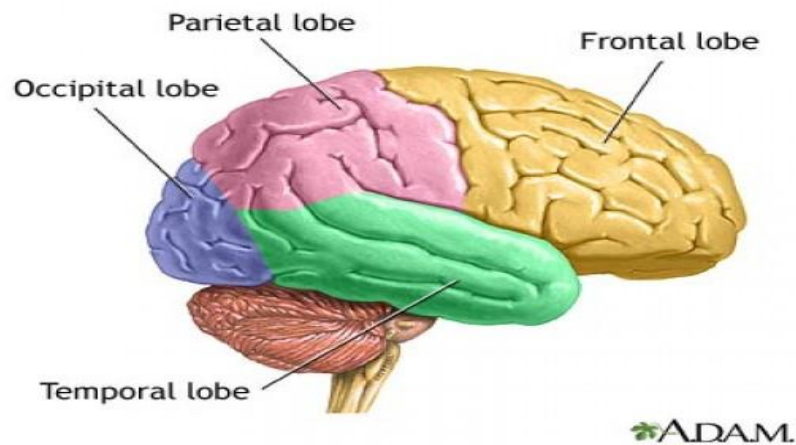


Figure: show lobes of brain

Frontal Lobe

The Frontal Lobe of the brain is located deep to the Frontal Bone of the skull.

It plays an integral role in the following functions/actions

- Memory Formation
- Emotions
- Decision Making/Reasoning
- Personality

Parietal Lobe

The Parietal Lobe of the brain is located deep to the Parietal Bone of the skull. It plays an integral role in the following functions/actions

- Senses and integrates sensation(s)
- Spatial awareness and perception
(Proprioception - Awareness of body/ body parts in space and in relation to each other).

Occipital lobe

The Occipital Lobe of the Brain is located deep to the Occipital Bone of the Skull .

Its primary function is the processing, integration, interpretation of VISION and visual stimuli .

Temporal lobe

The Temporal Lobes are located on the sides of the brain, deep to the Temporal Bones of the skull. They play an integral role in the following functions:

- Hearing
- Organization/Comprehension of language.
- Information Retrieval (Memory and Memory Formation)

Cerebellum

The **cerebellum** (“little brain”) is part of CNS that is located at the back of the brain, underlying the occipital and temporal lobes of the cerebral cortex in posterior cranial fossa . It is a relatively small portion of the brain -- about ten percent of the total weight, but it contains roughly half of the brain's neurons, specialized cells that transmit information via electrical signals.

The cerebellum has been considered a motor structure, because cerebellar damage leads to impairments in motor control and posture and because the majority of the cerebellum’s outputs are to parts of the motor system.

Cerebellar gross anatomy

Anatomically, the cerebellum is divided into three lobes by two deep fissures, : (1) the *anterior lobe*, (2) the *posterior lobe*, and (3) the *flocculonodular lobe* been rolled downward from its normally hidden position. Note, down the center of the cerebellum, a narrow band called the *vermis*, which is separated from the remainder of the cerebellum by shallow grooves. Most cerebellar control functions for muscle movements of the *axial body*, *neck*, *shoulders*, and *hips* are located in this area.

The cerebellar deep nuclei (or cerebellar nuclei) are the sole output structures of the cerebellum. These nuclei are encased by a highly convoluted sheet of tissue called the cerebellar cortex, which contains almost all of the neurons in the cerebellum..

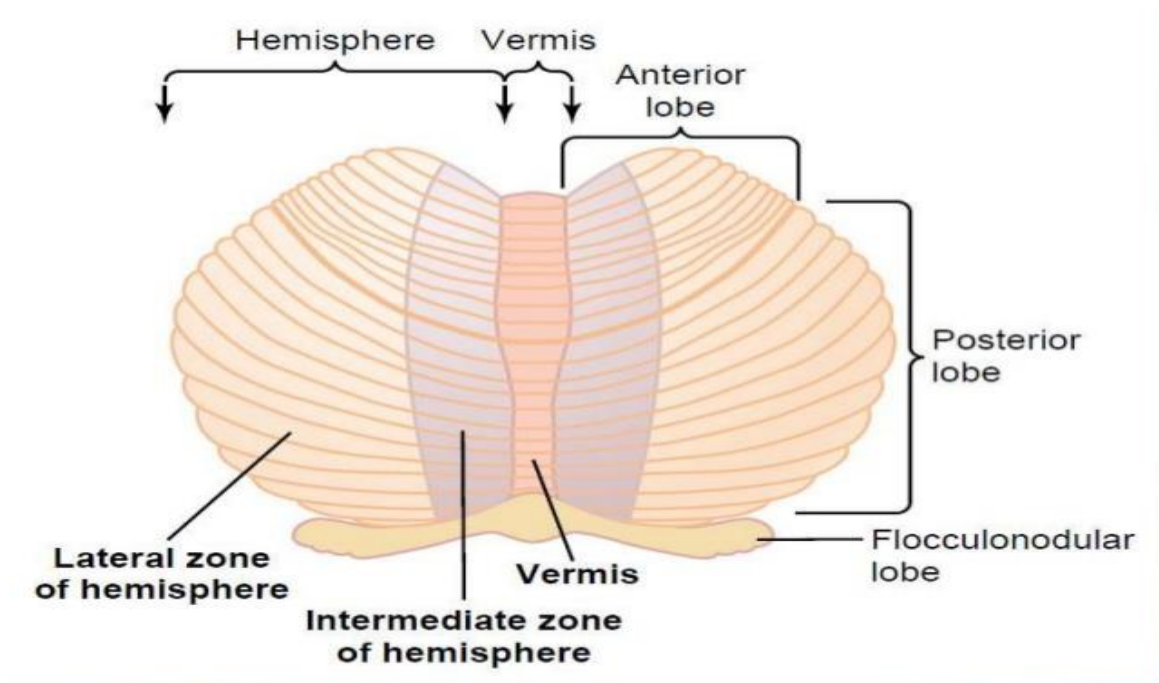


Figure show divisions of cerebellum

Function

The cerebellum is involved in the following functions:

1. ***Maintenance of balance and posture.***
2. ***Coordination of voluntary movements.***
3. ***Motor learning.*** The cerebellum is important for motor learning. The cerebellum plays a major role in adapting and fine-tuning motor programs to make accurate movements through a trial-and-error process (e.g., learning to hit a baseball).

4. **Cognitive functions.** Although the cerebellum is most understood in terms of its contributions to motor control, it is also involved in certain cognitive functions, such as language.

Cerebellar nuclei

1. The **fastigial nucleus** is the most medially located of the cerebellar nuclei. It receives input from the vermis and from cerebellar afferents that carry vestibular, proximal somatosensory, auditory, and visual information. It projects to the vestibular nuclei and the reticular formation.
2. The **interposed nuclei**: They are situated lateral to the fastigial nucleus. They receive input from the intermediate zone and from cerebellar afferents that carry spinal, proximal somatosensory, auditory, and visual information.
3. The **dentate nucleus** is the largest of the cerebellar nuclei, located lateral to the interposed nuclei. It receives input from the lateral hemisphere and from cerebellar afferents that carry information from the cerebral cortex (via the pontine nuclei).

4. The **vestibular nuclei** are located outside the cerebellum, in the medulla. The vestibular nuclei receive input from the flocculonodular lobe and from the vestibular labyrinth. They project to various motor nuclei and originate the vestibulospinal tracts.

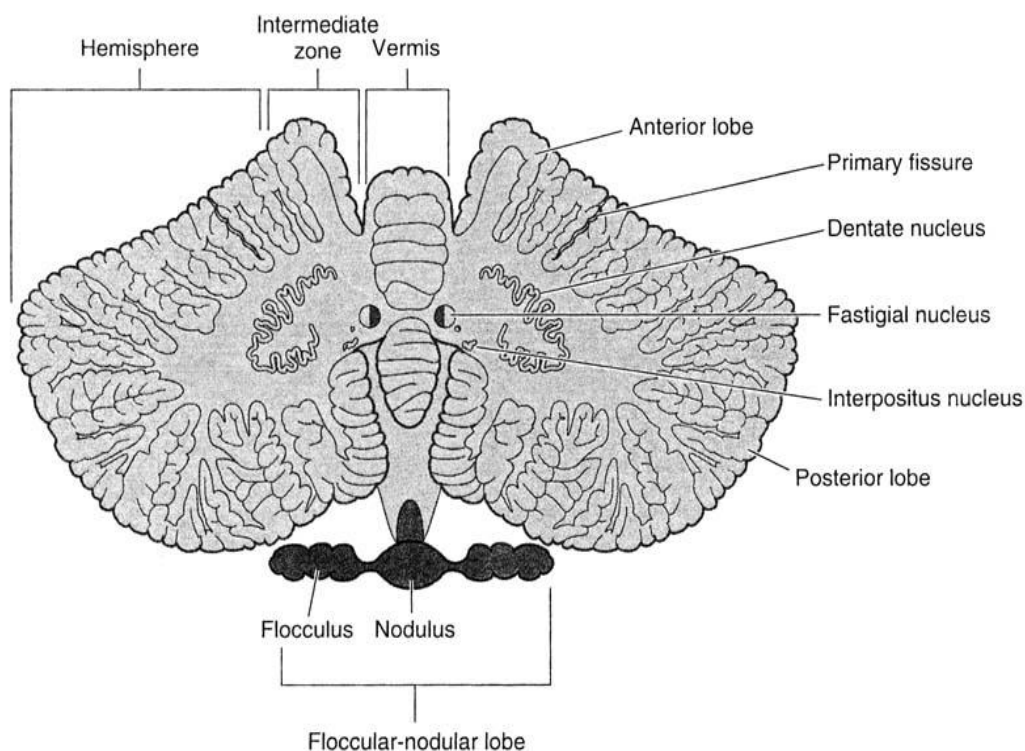


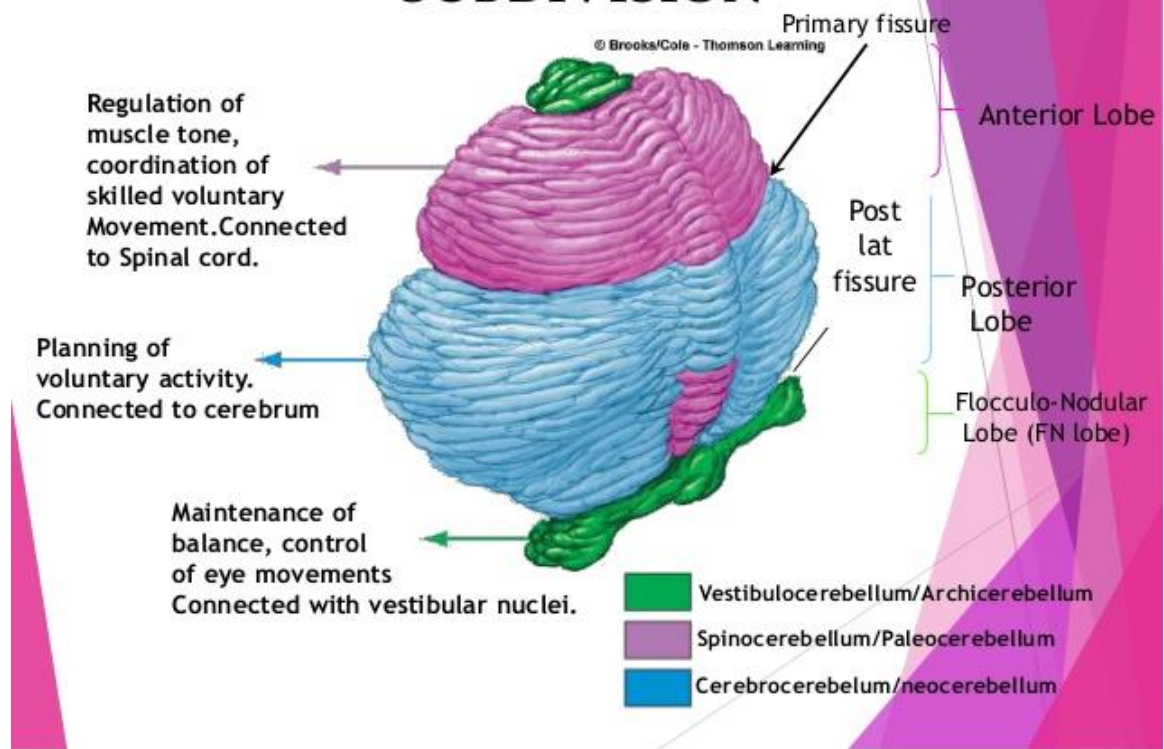
figure show Cerebellar nuclei

Functional Subdivisions of the Cerebellum

The anatomical subdivisions correspond to three major functional subdivisions of the cerebellum.

1. **Vestibulocerebellum.** The vestibulocerebellum comprises the **flocculonodular lobe** and its connections with the **lateral vestibular nuclei**. As its name implies, it is involved in vestibular reflexes (such as the vestibuloocular reflex) and in postural maintenance.
2. **Spinocerebellum.** The spinocerebellum comprises the **vermis** and the **intermediate zones** of the cerebellar cortex, as well as the **fastigial** and **interposed nuclei**. As its name implies, it receives major inputs from the spinocerebellar tract. It is involved in the integration of sensory input with motor commands to produce adaptive motor coordination.
3. **Cerebrocerebellum.** The cerebrocerebellum is the largest functional subdivision of the human cerebellum, comprising the **lateral hemispheres** and the **dentate nuclei**. In addition, the cerebrocerebellum is involved in the cognitive functions of the cerebellum.

FUNCTIONAL AND PHYLOGENETIC SUBDIVISION



Thank you

References : Guyton and Hall textbook of medical physiology, thirteen edition