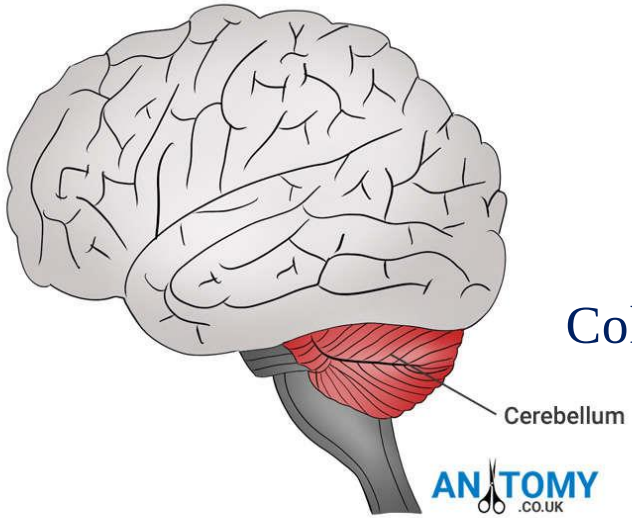
Cerebellum



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objectives

1. What is **cerebellum**
2. The Functions of **cerebellum**
3. Anatomical areas of cerebellum
4. Input (afferent) Pathways to the Cerebellum
5. Output (Efferent) Signals from the Cerebellum
6. Functional divisions of Cerebellum

- The **cerebellum** receives information from the sensory systems, the spinal cord, and other parts of the brain and then regulates motor movements. The **cerebellum** coordinates voluntary movements such as posture, balance, coordination, and speech.

- Has long been called a silent area of the brain, principally because electrical excitation of the cerebellum does not cause any conscious sensation and rarely causes any motor movement.

How is it that the cerebellum can be so important when it has no direct ability to cause muscle contraction?

- The answer is that it helps sequence the motor activities and also monitors and makes corrective adjustments in the body's motor activities while they are being executed.

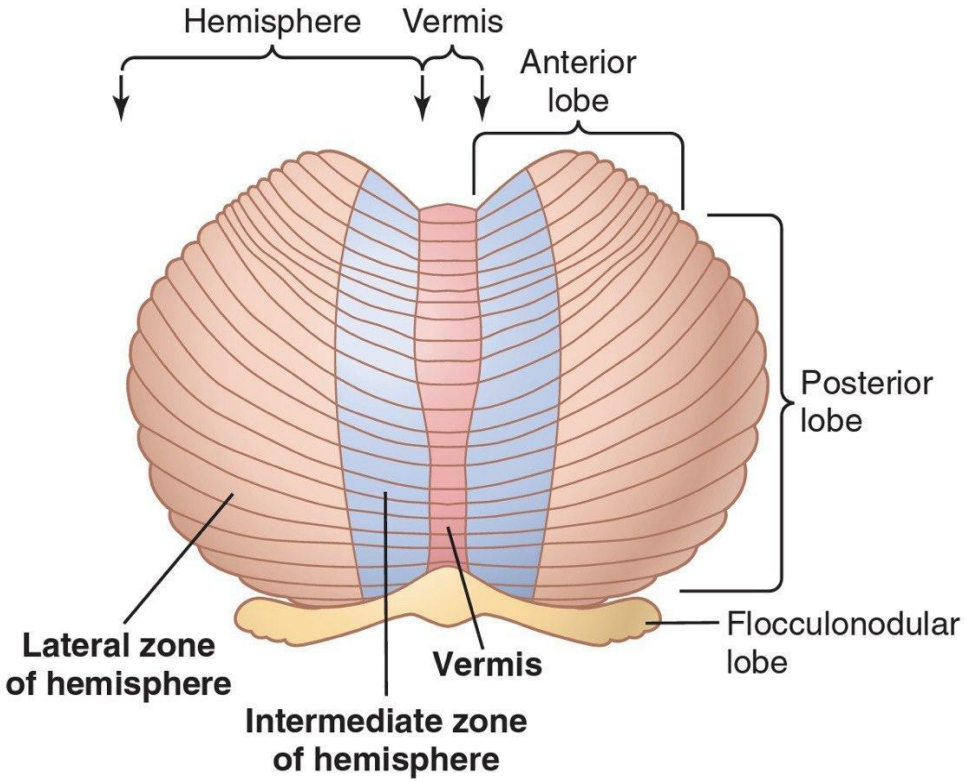
Anatomical and Functional areas of cerebellum

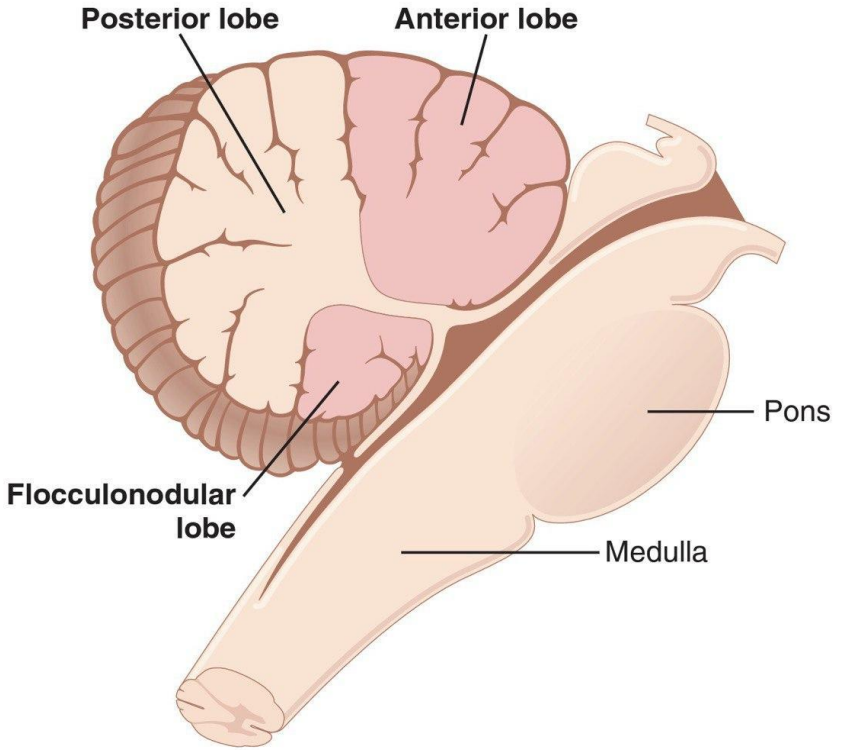
- Anatomically, the cerebellum is divided into three lobes by two deep fissures

(1) the anterior lobe

(2) the posterior lobe

(3) the flocculonodular lobe


Hemisphere
Vermis
Anterior lobe
Posterior lobe
Flocculonodular lobe
Lateral zone of hemisphere
Vermis
Intermediate zone of hemisphere


Posterior lobe
Anterior lobe
Pons
Flocculonodular lobe
Medulla

- In the center of cerebellum, narrow band separated from remainder by smaller grooves called "vermis".
- In the vermis, most cerebellar control functions of muscle movements of axial body, neck, shoulders, and hips are located.
- On each side of vermis, there is large protruding "cerebellar hemisphere
- Each hemisphere is divided into an "intermediate zone" and "lateral zone“.

The intermediate Zone

Concerned with controlling muscle contractions in distal portions of upper and lower limbs (hands, fingers, feet, and toes).

The Lateral Zone

This area joins with cerebral cortex in overall planning of sequential motor movements.

Without this zone, most discrete motor activities of body lose their appropriate timing and sequencing → become incoordinate.

Input (afferent) Pathways to the Cerebellum

A. From other parts of brain

1. Motor and somatosensory cortices through corticopontocerebellar pathway to lateral divisions of cerebellar hemisphere on opposite side.
2. Brainstem through:
   - Olivocerebellar tract
   - Vestibulocerebellar tract
   - Reticulocerebellar tract

B. From the periphery

I. Dorsal Spinocerebellar tract

- Transmit input signals from:
  i. Muscle spindles
  ii. Golgi tendon organs, large tactile receptors of skin, and joint receptors.

- These signals apprises cerebellum of momentary status about:

1) Muscle contraction
2) Degree of tension on muscle tendon
3) Positions and rates of movements of the body parts
4) Forces acting on the body surface

2. Ventral Spinocerebellar tract

- Enter same areas of cerebellum through superior cerebellar peduncle and terminate in both sides of cerebellum.

- These fibers tell the cerebellum what motor signals are arrived at the anterior horns.

Functional units of cerebellar coretx

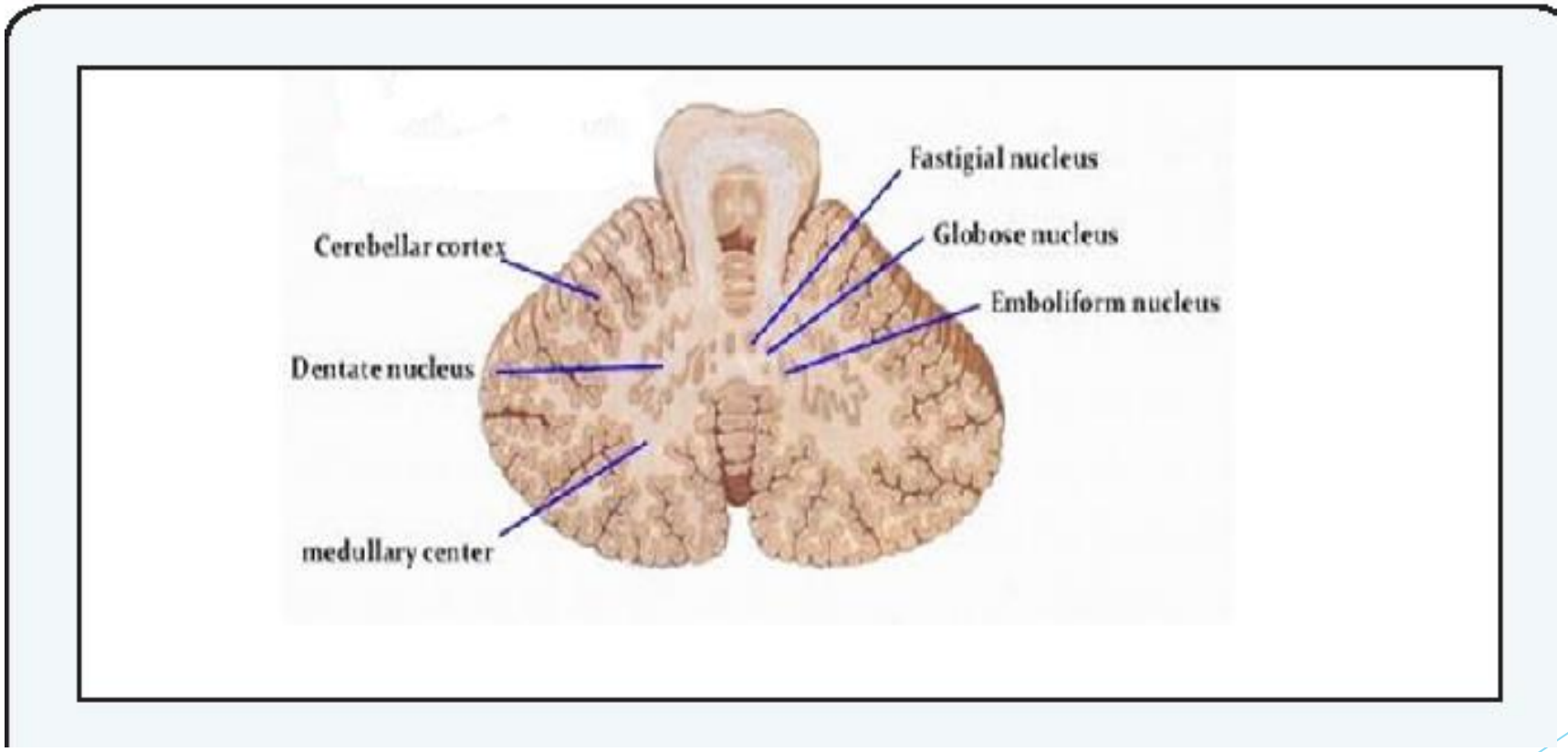
- 3 layers form the functional units of cerebellum

A. External molecular layer

B. Purkinje cell layer (One-cell thickness) (inhibitory)

C. Internal granular layer (excitatory)

Output (Efferent) Signals from the Cerebellum



Output Signals from the Cerebellum

- 3 cerebellar nuclei "dentate, interposed composed of the (globose nucleus and the emboliform nucleus,) and fastigial".

- Output signals leave deep nuclei of cerebellum and distributed to other parts of brain through:

1) Pathway originate in the vermis

- Through fastigial nuclei into pons and medulla oblongata of brainstem.
- Function to:

i. Control equilibrium in association with vestibular apparatus

ii. Control postural attitudes of body in association with reticular formation.

2) Pathway originate in intermediate zone pass

- through interposal nuclei to Ventrolateral and ventroanterior nuclei of thalamus ➔ to cerebral cortex ➔ Several midline structures of thalamus ➔ to basal ganglia ➔ to Red nucleus and reticular formation of brainstem.

- Functions to coordinate reciprocal contractions of agonist and antagonist muscles in hands, fingers, and thumb.

Cerebellum Functionally divided overall in to

1. The vestibulocerebellum

It provides neural circuits for most of the body's equilibrium movements.

Balance

2. The spinocerebellum

It provides the circuitry for coordinating mainly movements of the distal portions of the limbs, especially the hands and fingers

Manage Stance and gaite

3. The cerebrocerebellum.

plan sequential voluntary body and limb movements.

Smoothing the movements

Recap

1. Cerebellum receives information from the sensory systems, the spinal cord, and other parts of the brain

2. its and then regulates, coordinates voluntary movements , posture, balance, coordination, and speech.

3. helps sequence, and monitor the motor activities

4. Anatomically, divided into :the anterior, posterior and flocculonodular lobes

5. Receives

_ input from brain (Motor and somatosensory , Brainstem).

_From the periphery.

6. Functional units.

7. Output Signals from the Cerebellum

8. functional divisions

Thank You