THE CEREBELLUM

Dr. Aiman Qais Afar
Surgical Anatomist

College of Medicine / University of Mutah

2024-2025

Tuesday 17 December 2024

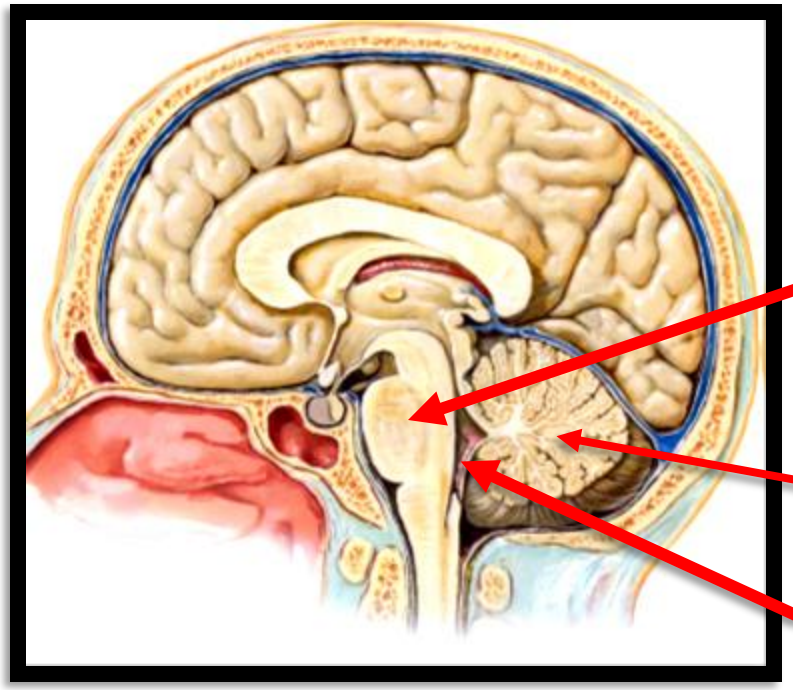
The cerebellum

- The cerebellum is the largest subdivision of the hindbrain.

* Position; It lies posterior to the pons and medulla oblongata separated from them by the 4th ventricle.

- It occupies the greater part of the posterior cranial fossa.

- It is covered by the tentorium cerebelli separating it from the cerebral hemisphere.



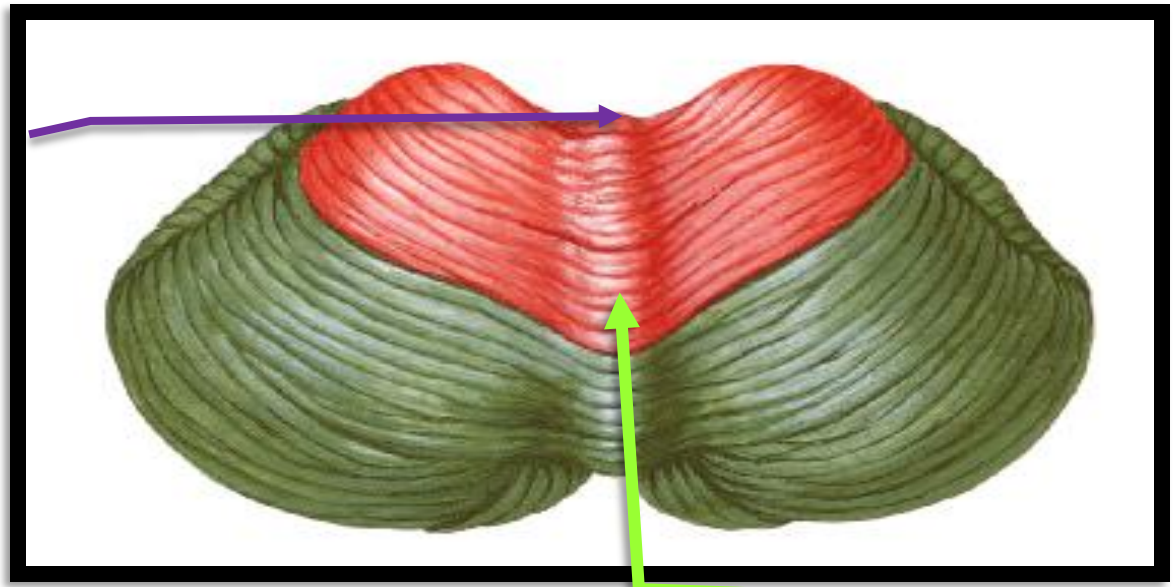
• EXTERNAL FEATURES

-It is formed of a median part called the vermis and 2 cerebellar hemisphere.

1- It has 2 surfaces (superior and inferior)

A- Superior surface,

- The middle part is raised and called the superior vermis.
- The lingula is the most anterior part of the superior vemis.
- The superior surface of each cerebellar hemisphere is nearly flat and slopes downwards and laterally.

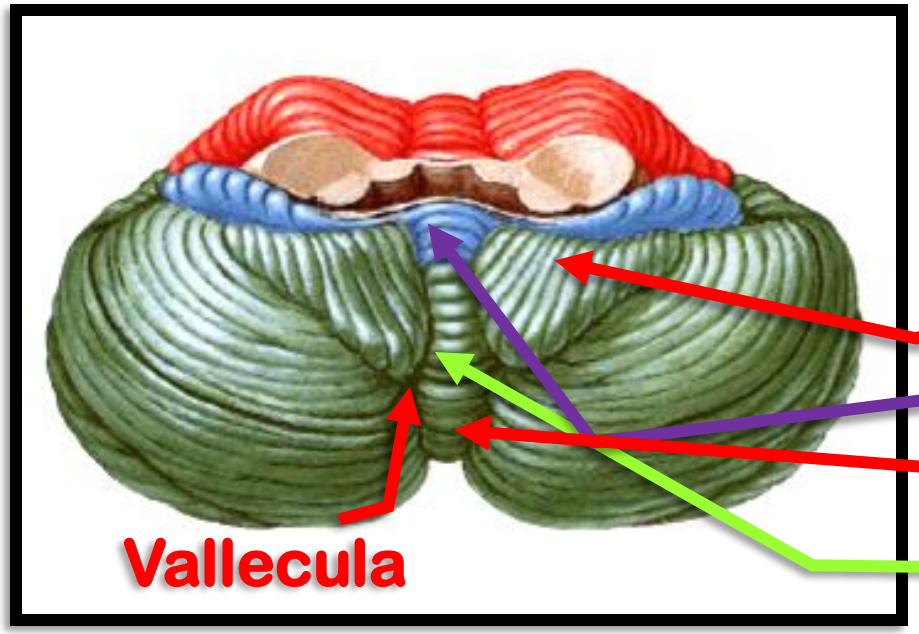


• EXTERNAL FEATURES

Dr. Aiman Al Maathidy
Tuesday 17 December 2024

B- Inferior surface,

- The inferior part of the vermis is called the inferior vermis and lies in the bottom of a depression between the two hemispheres called Vallecula.
- The inferior vermis consists of nodule, uvula and pyramid.
- The inferior surface of each hemisphere is nearly convex and rests on the floor of the posterior cranial fossa.
- Tonsil is a small part of the cerebellar hemisphere that lies lateral to the inferior vermis.



Inferior surface

Tonsil

Nodule

Pyramid

inferior vermis

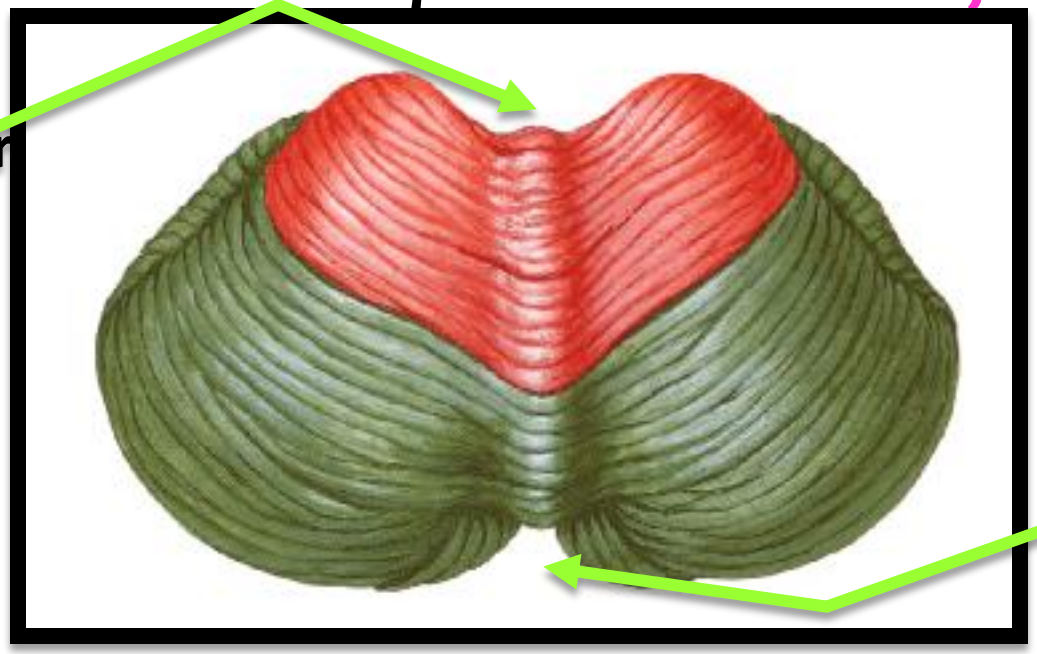
• EXTERNAL FEATURES

2- It has 2 notches (anterior and posterior)

A- Anterior notch;

- It is a large median depression, separated from the back of the pons and open medulla by the 4th ventricle.
- It contains 3 cerebellar peduncles that connecting the cerebellum with the brain steam.

B- Posterior notch is a smaller median depression contains falx cerebelli.

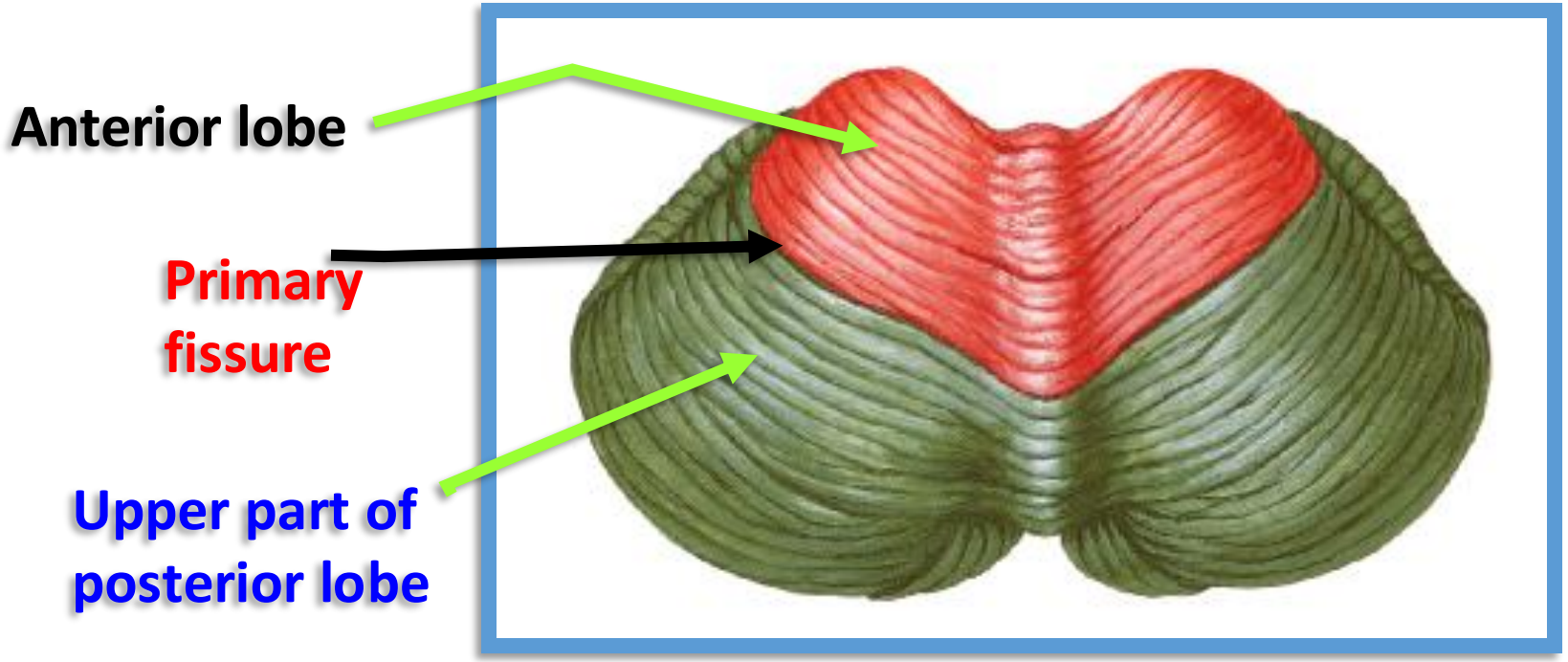


• EXTERNAL FEATURES

3- Fissures;

a- Primary fissure, is a V-shaped fissure on the superior surface.

- *It separates the anterior lobe from the posterior lobe.*



Dr. Aiman Al Maathidy

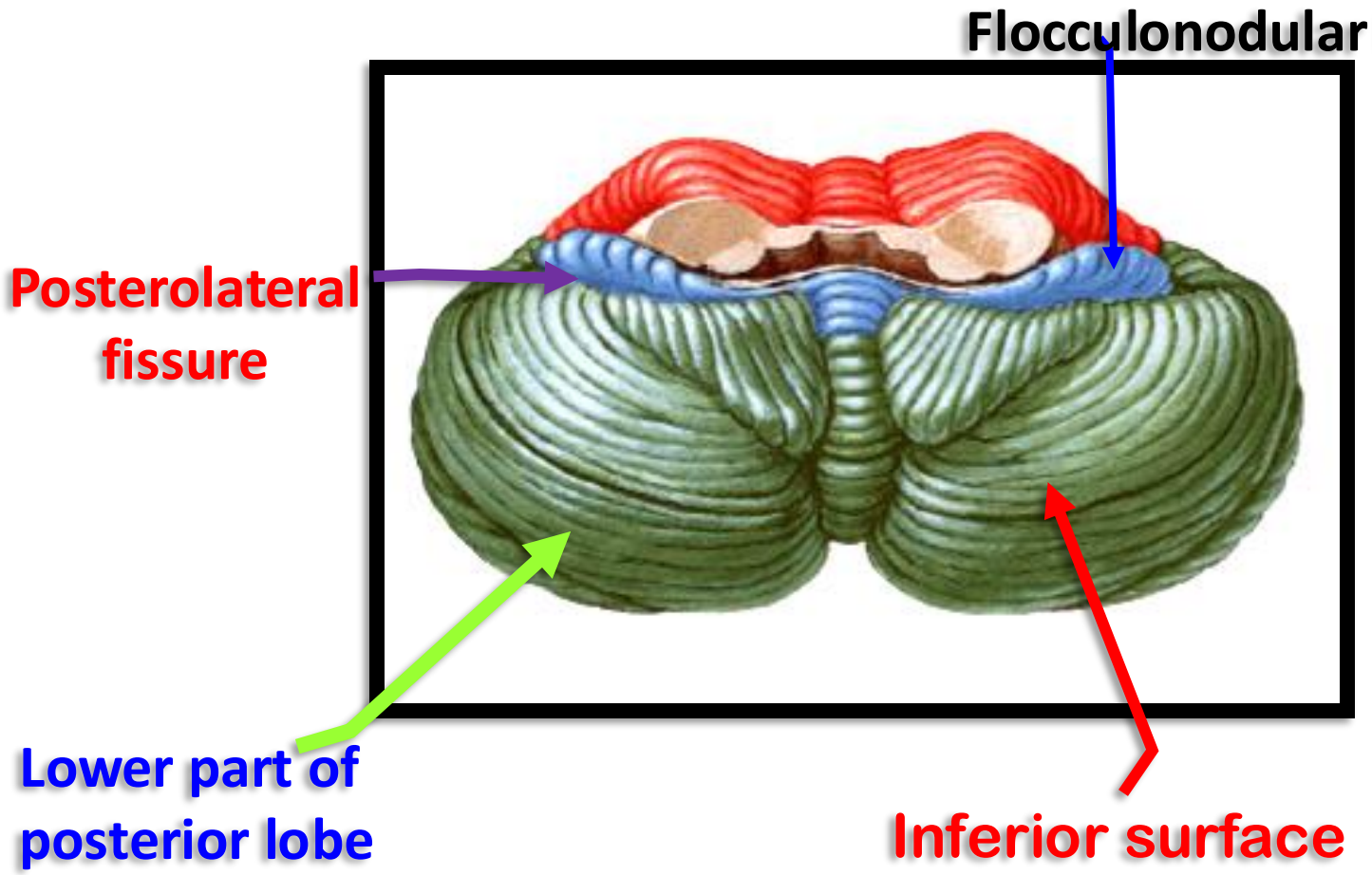
Tuesday 17 December 2024

It is a wide V-shaped fissure which separates the anterior lobe from the posterior lobe behind it

• EXTERNAL FEATURES

***b- Secondary (postero-lateral) fissure** on the inferior surface.*

- *It separates the folicculo-nodular lobe (infront) from the posterior lobe of the cerebellum*



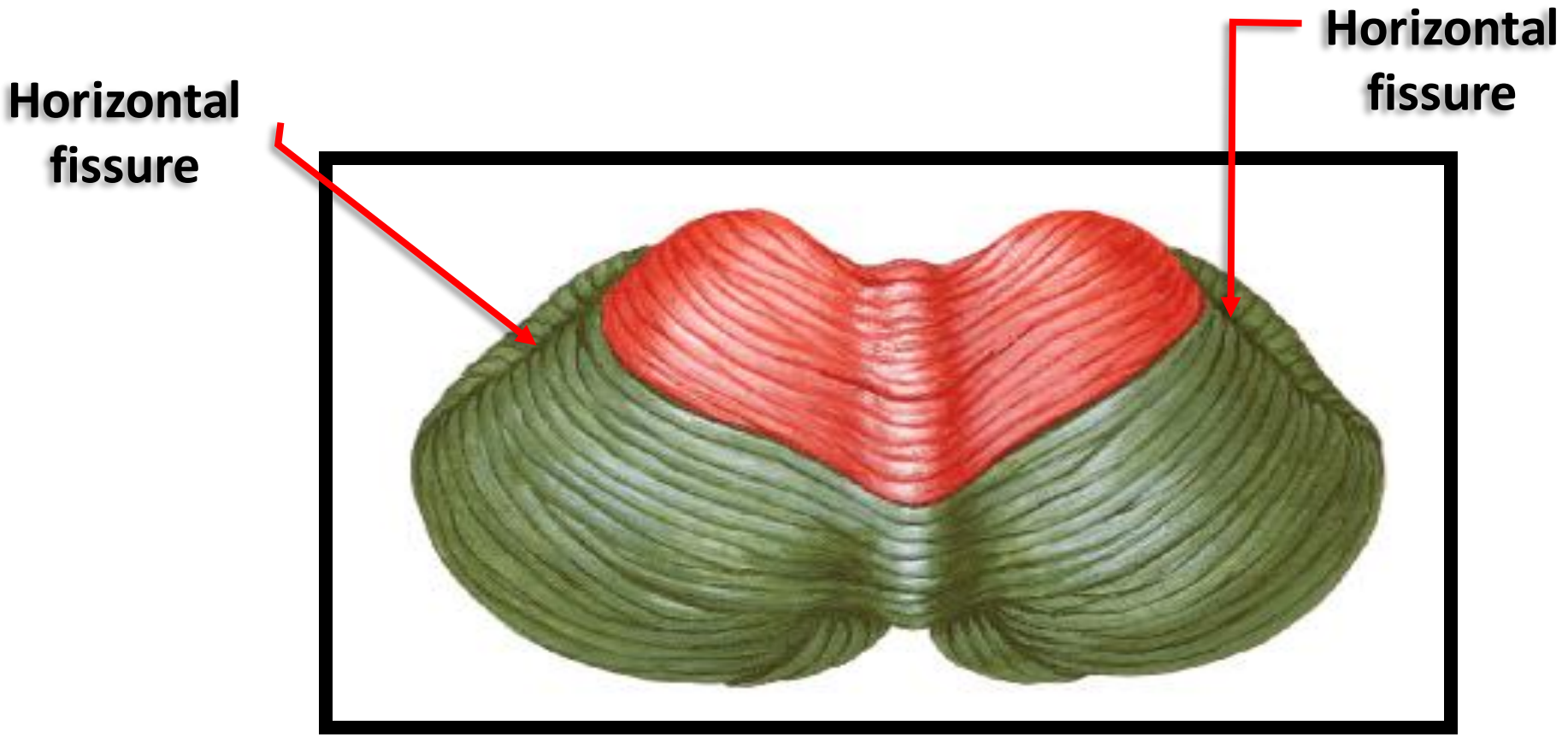
Dr. Aiman Al Maathidy

7

Tuesday 17 December 2024

• EXTERNAL FEATURES

***c- Horizontal fissure** extends from the anterior notch to the posterior notch around the side of the cerebellum between the inferior and superior surfaces.*

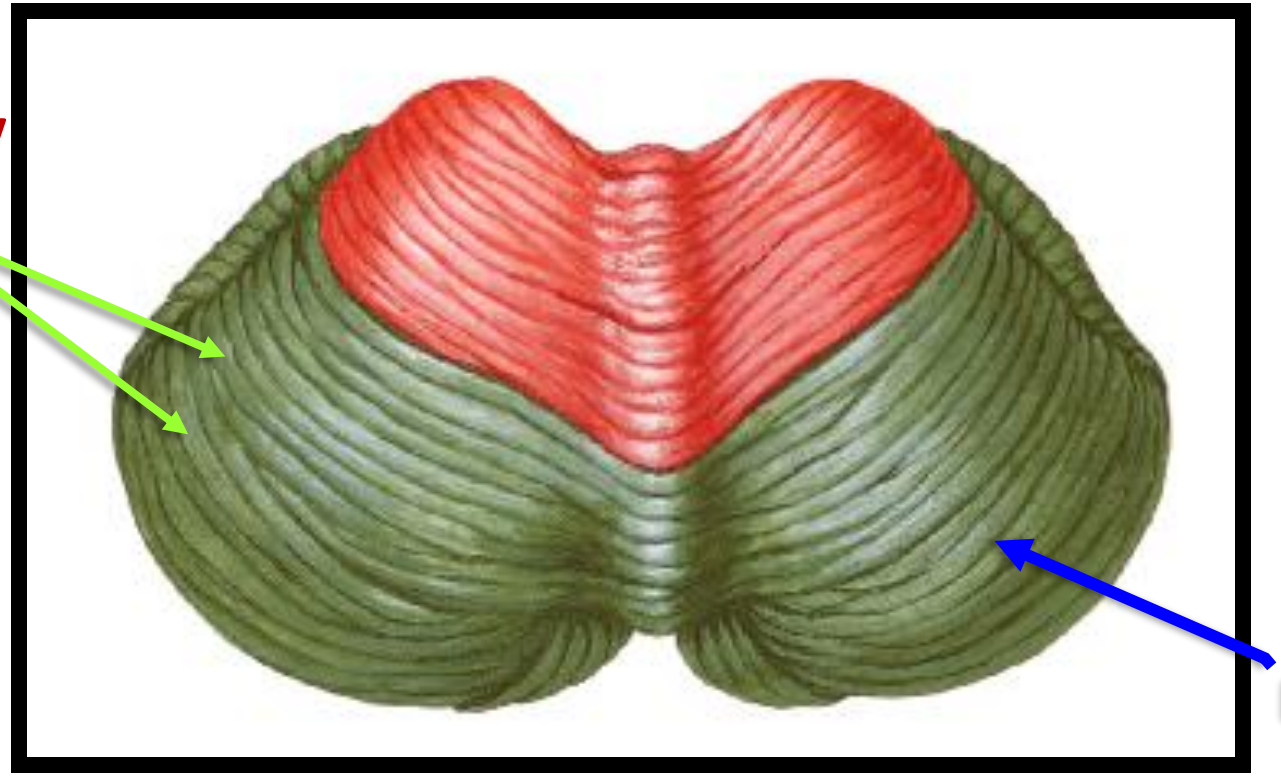


• EXTERNAL FEATURES

d- Great number of transverse fissures on the inferior and superior surfaces.

- The part of the cerebellum between the transverse fissures called folia.

- They increase the surface area of the cerebellar cortex in a limited space

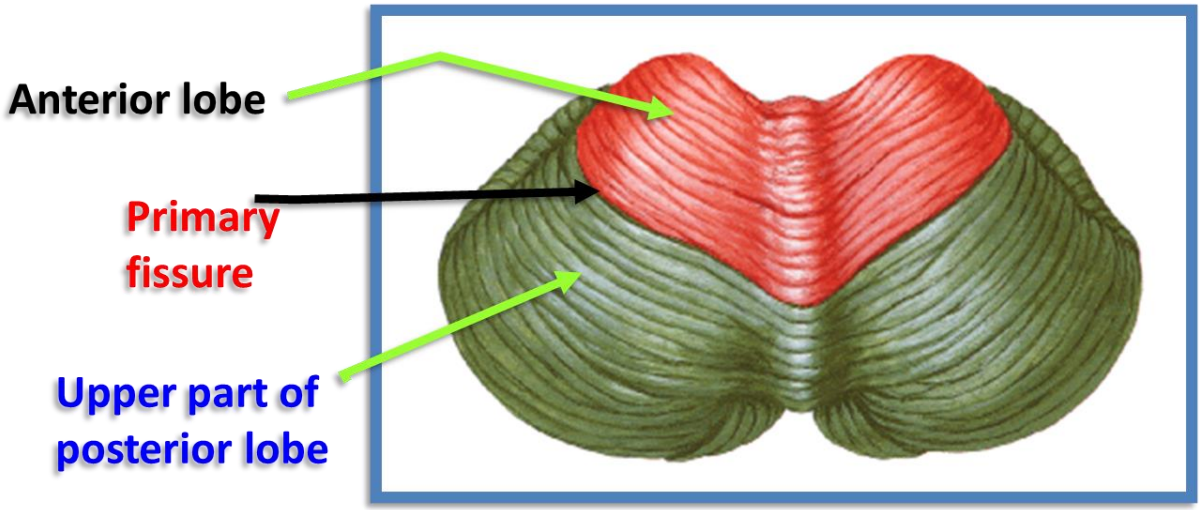


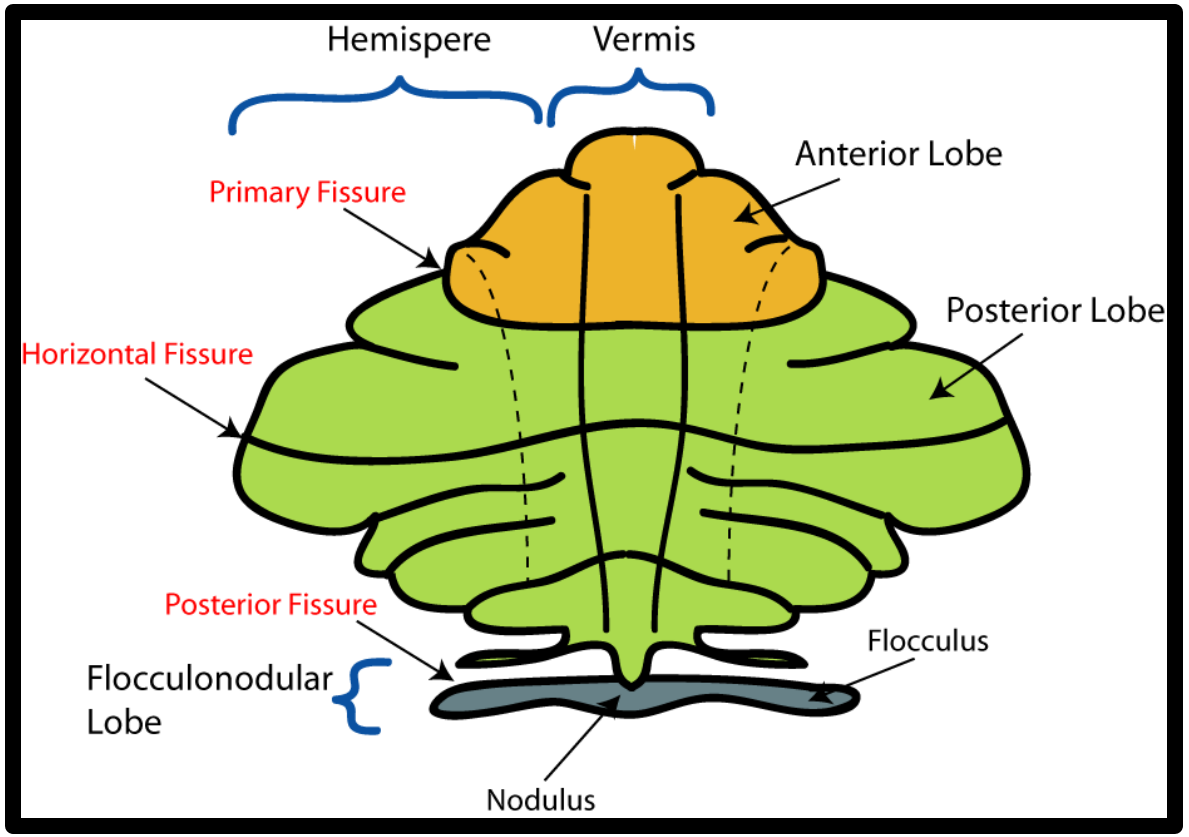
• EXTERNAL FEATURES

4- Subdivisions (lobes) of the Cerebellum

1- Anterior lobe (Paleo-cerebellar) *in front of the primary fissure on the superior surface.*

- *It receives afferent proprioceptive impulses from the spinal cord (clark's nucleus) via spino-cerebellar tract.*
- *It is concerned with the muscle tone.*





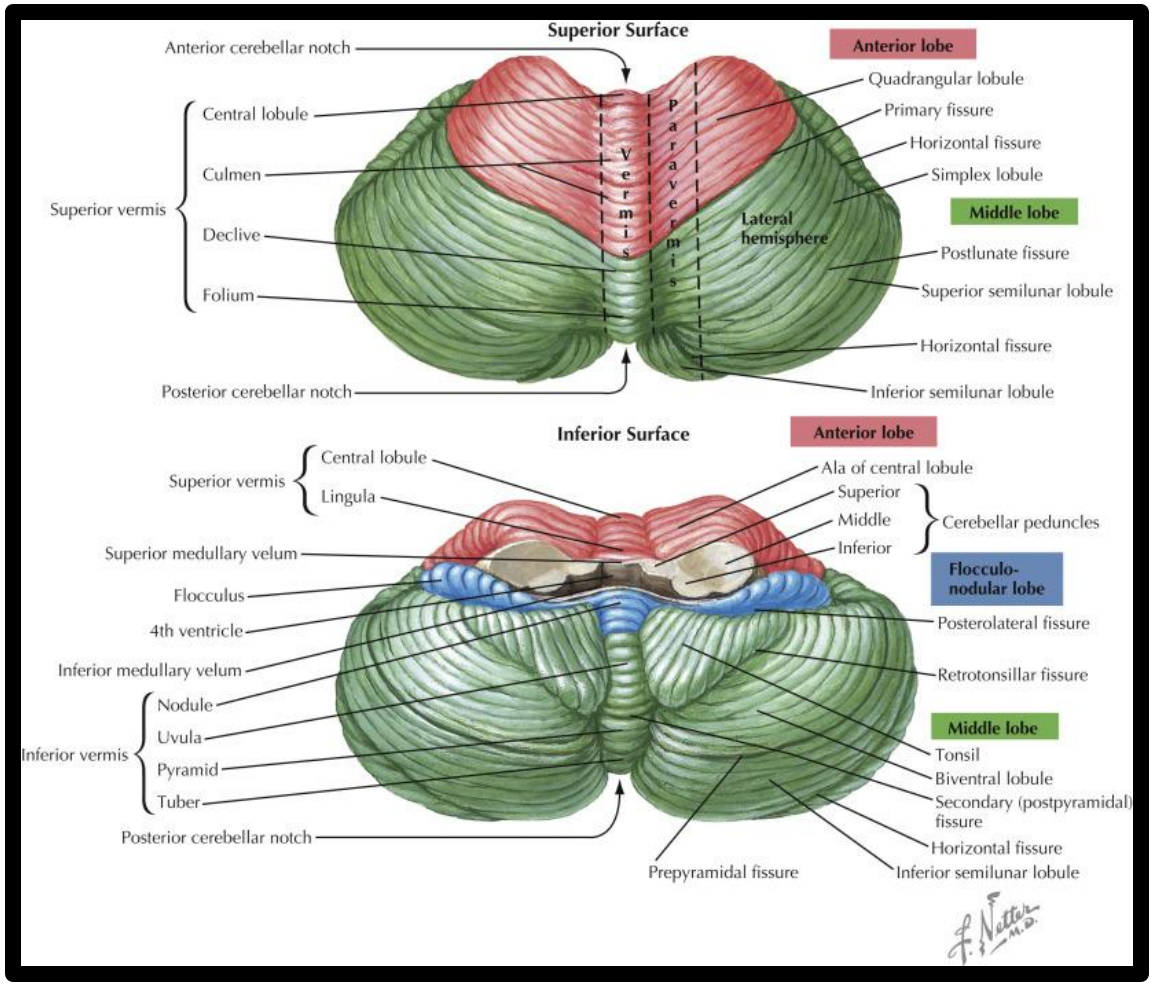
• EXTERNAL FEATURES

2- Posterior lobe (Neo-cerebellar) the major part of the cerebellum.

- It extends from the primary fissure to the secondry fissure.

- It receives afferent impulses from the cerebral cortex via ponto-cerebellar tracts (cortico-ponto-cerebellar pathway).

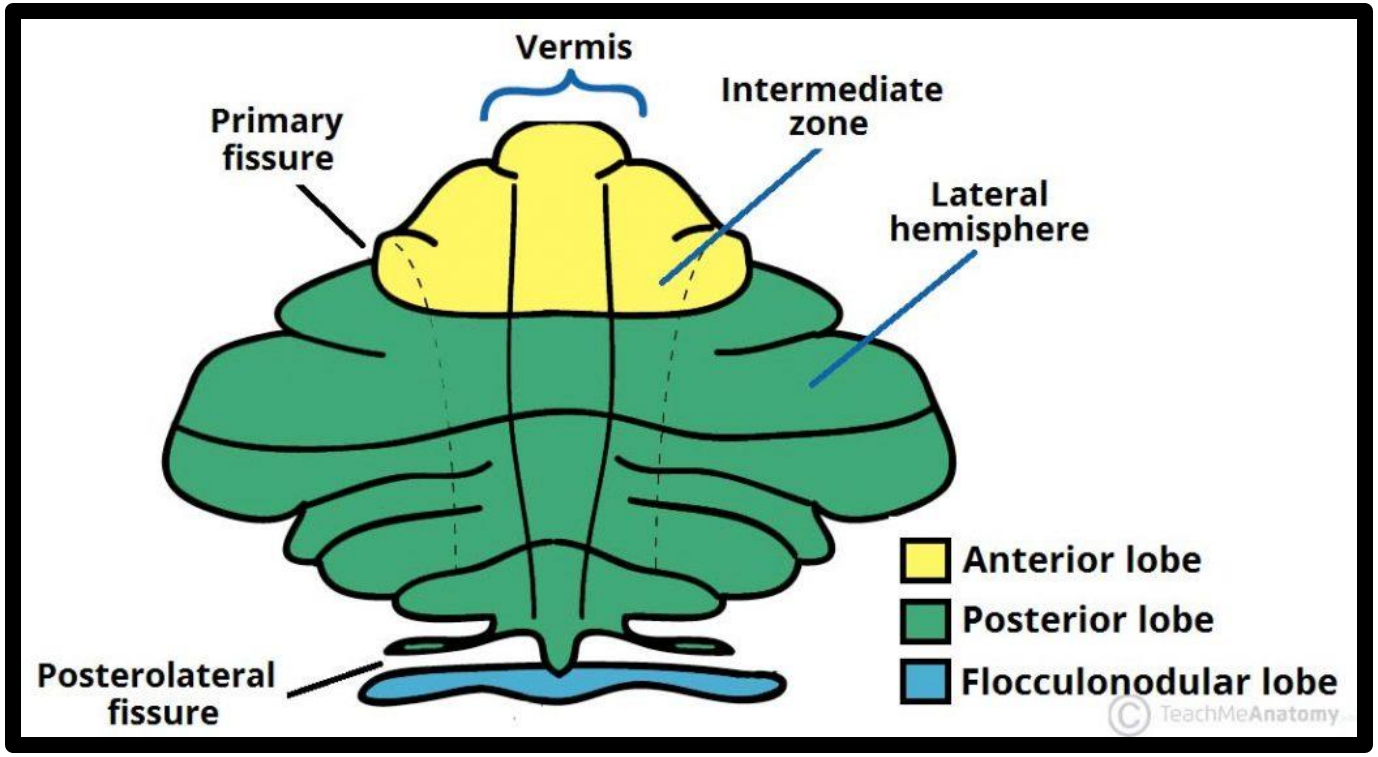
- It is concerned with the coordination of the action of different groups of muscles



• EXTERNAL FEATURES

3- (Flocculonodular lobe or Archi-cerebellum)

- It is formed of a nodule in the middle and 2 flocculi (one on each side).
- It receives afferent impulse from the vestibular apparatus via vestibulo-cerebellar tracts.
- It is concerned with equilibrium



Functional Areas of the Cerebellar Cortex

❖ ***The cortex of the vermis*** ***influences the movements of the long axis of the body, namely, the neck, the shoulders, the thorax, the abdomen, and the hips.***

❖ ***Immediately lateral to the vermis is a so-called intermediate zone of the cerebellar hemisphere***

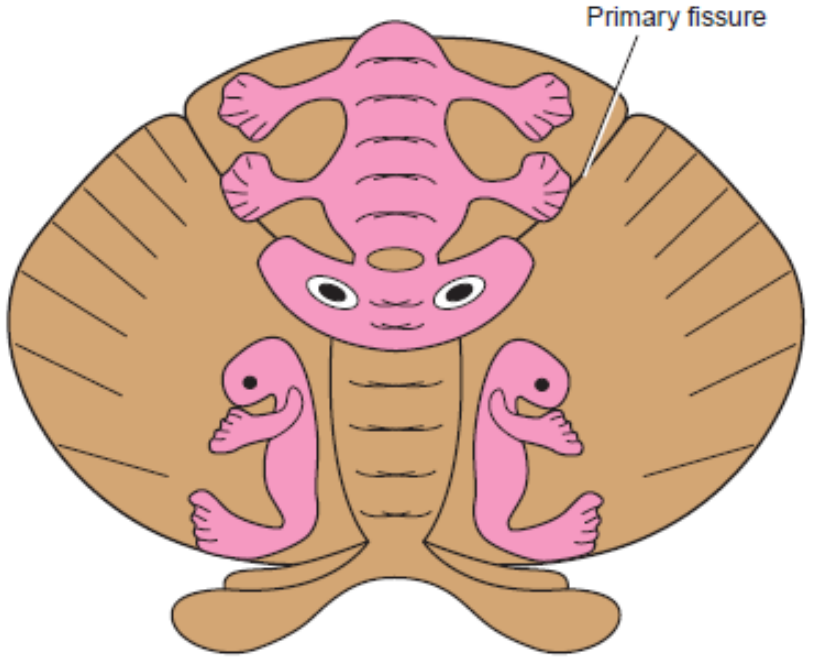


Figure 6-6 Somatosensory projection areas in the cerebellar cortex.

Dr. Aiman Al Maathidy

Tuesday 17 December 2024

This area has been shown to control the muscles of the distal parts of the limbs, especially the hands and feet.

Functional Areas of the Cerebellar Cortex

- ***The lateral zone of each cerebellar hemisphere*** ***appears to be concerned with the planning of sequential movements*** ***of the entire body and is involved with the conscious assessment of movement errors***

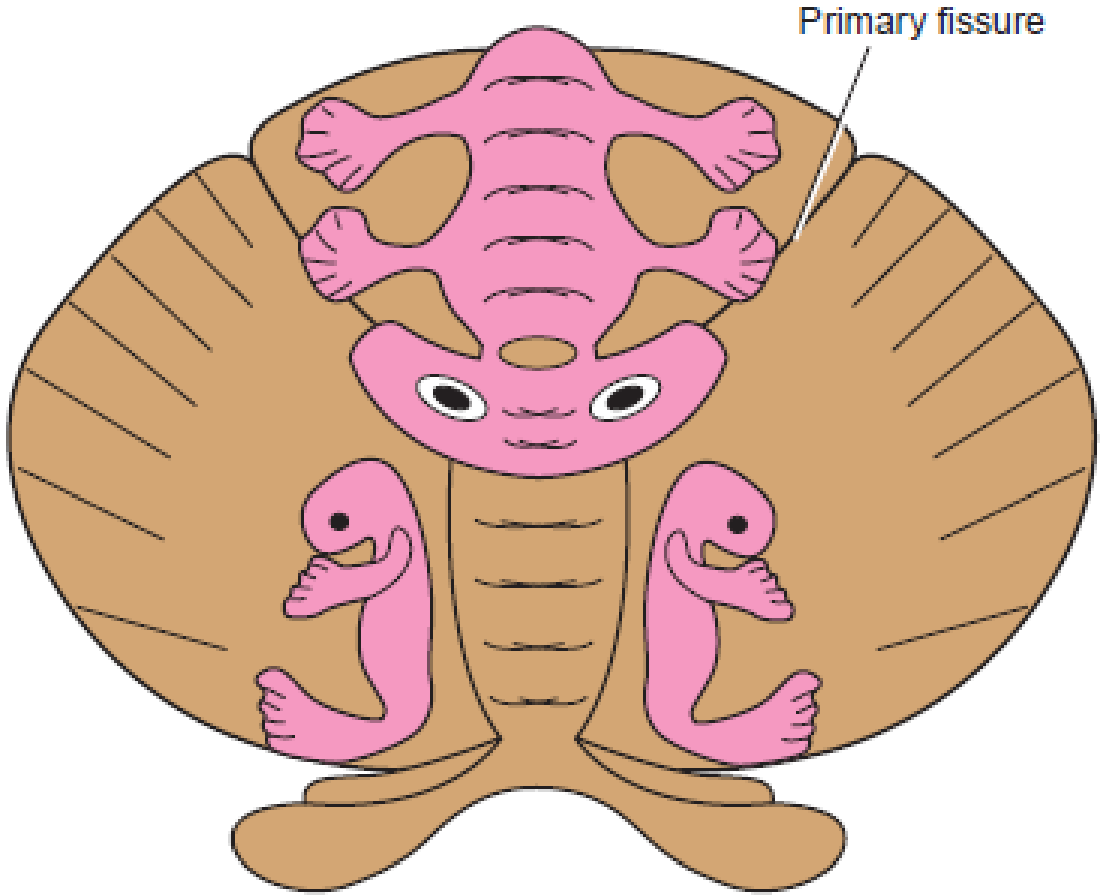


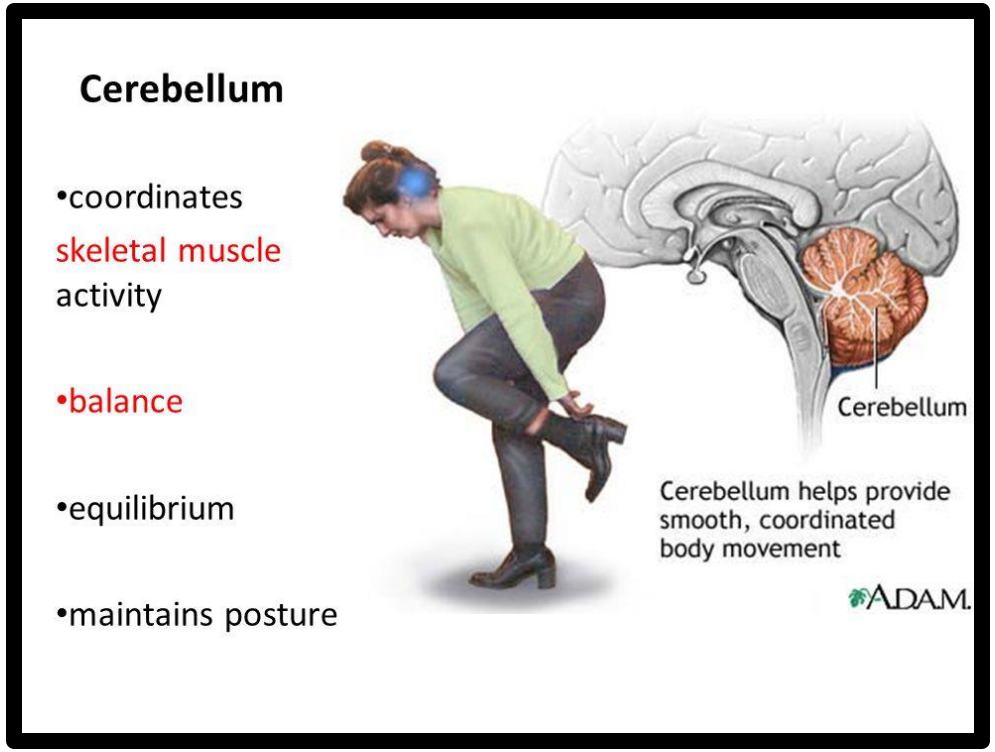
Figure 6-6 Somatosensory projection areas in the cerebellar cortex.

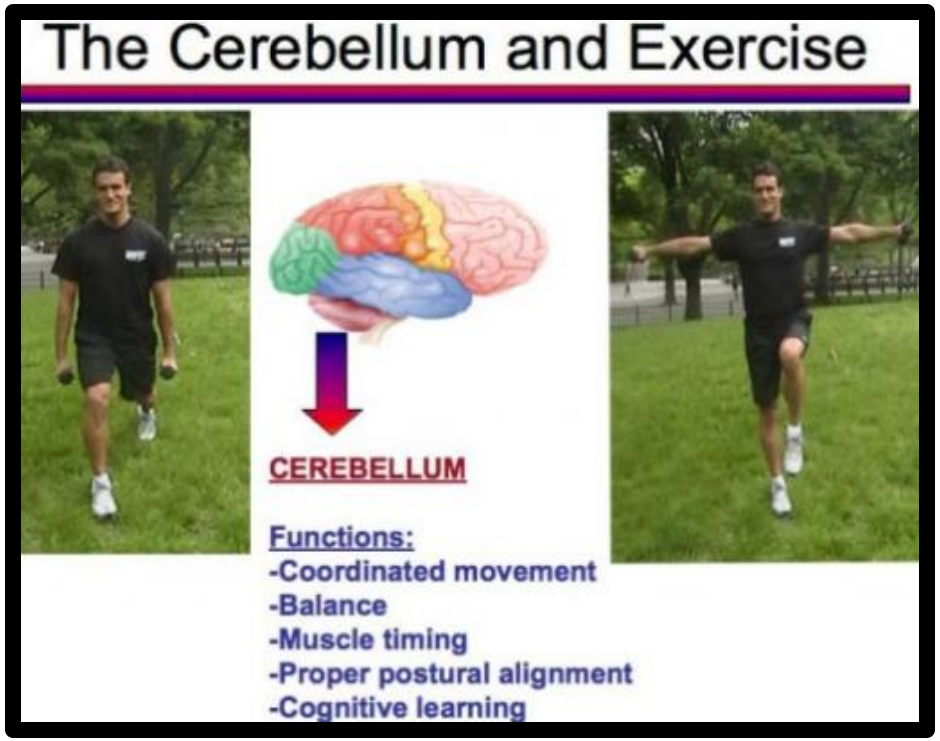
Functions of the cerebellum

1- Paleocerebellum (spinal part); controls the muscle tone of the body.

2- Neocerebellum (cortical part); it coordinate the action of different groups of muscles, So that the movements are done smoothly and accurately (Computer like organ).

3- Archicerebellum (vestibular part); controls the equilibrium of the body.





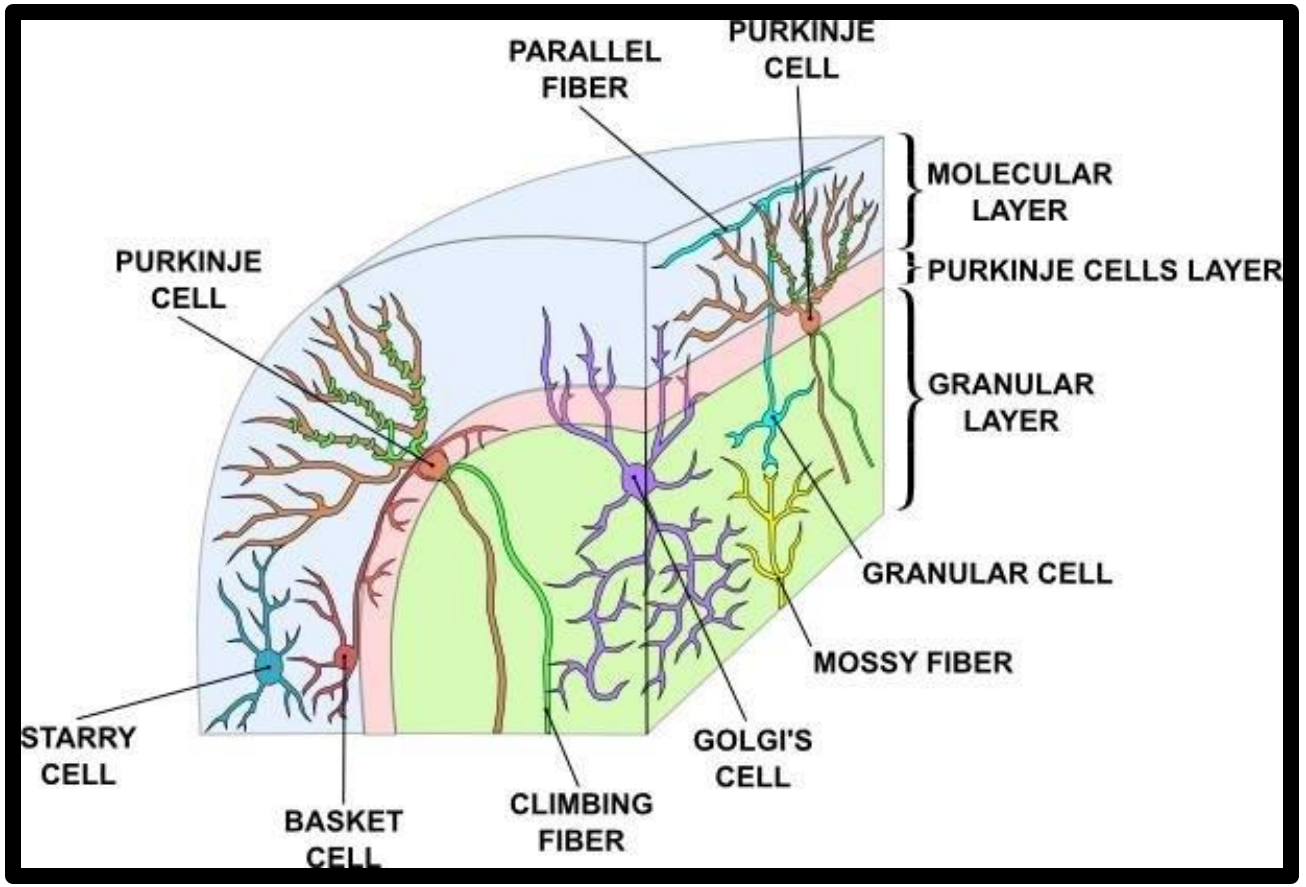
• Internal Structures

- The cerebellum consists of:

A- Gray matter; forms 2 main parts of the cerebellum

1- Cerebellar cortex; forming the outer surface of the cerebellum.

- It contains nerve cells that arranged into 3 layers as follows;

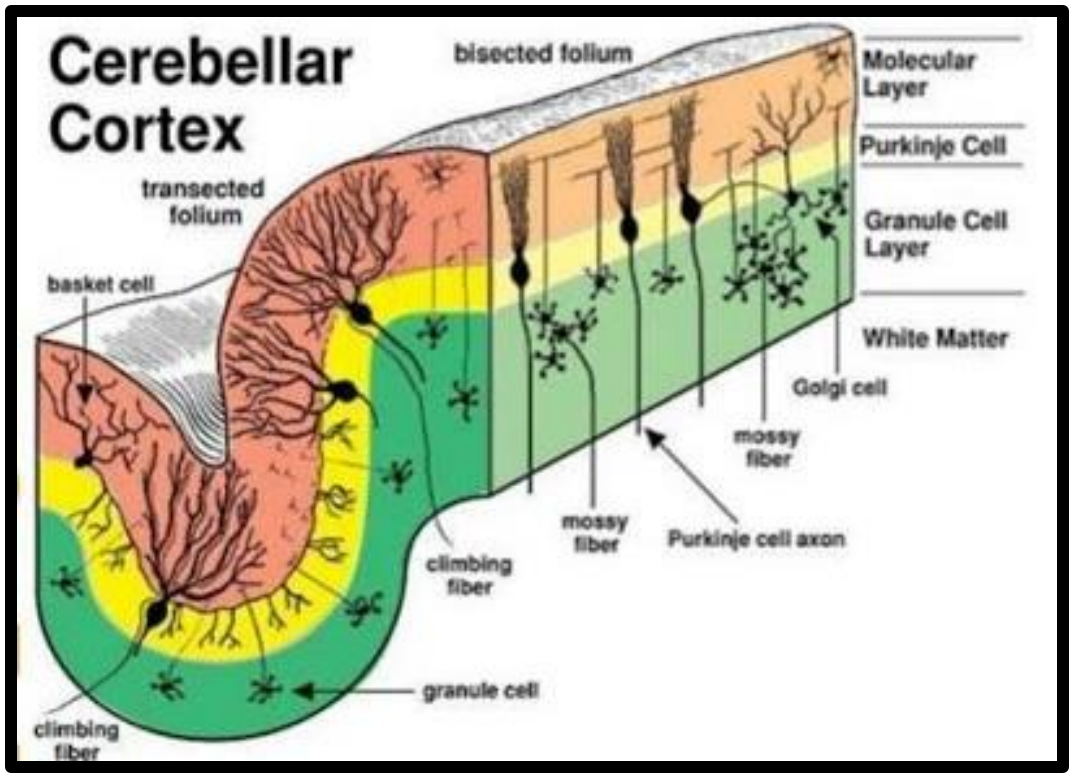


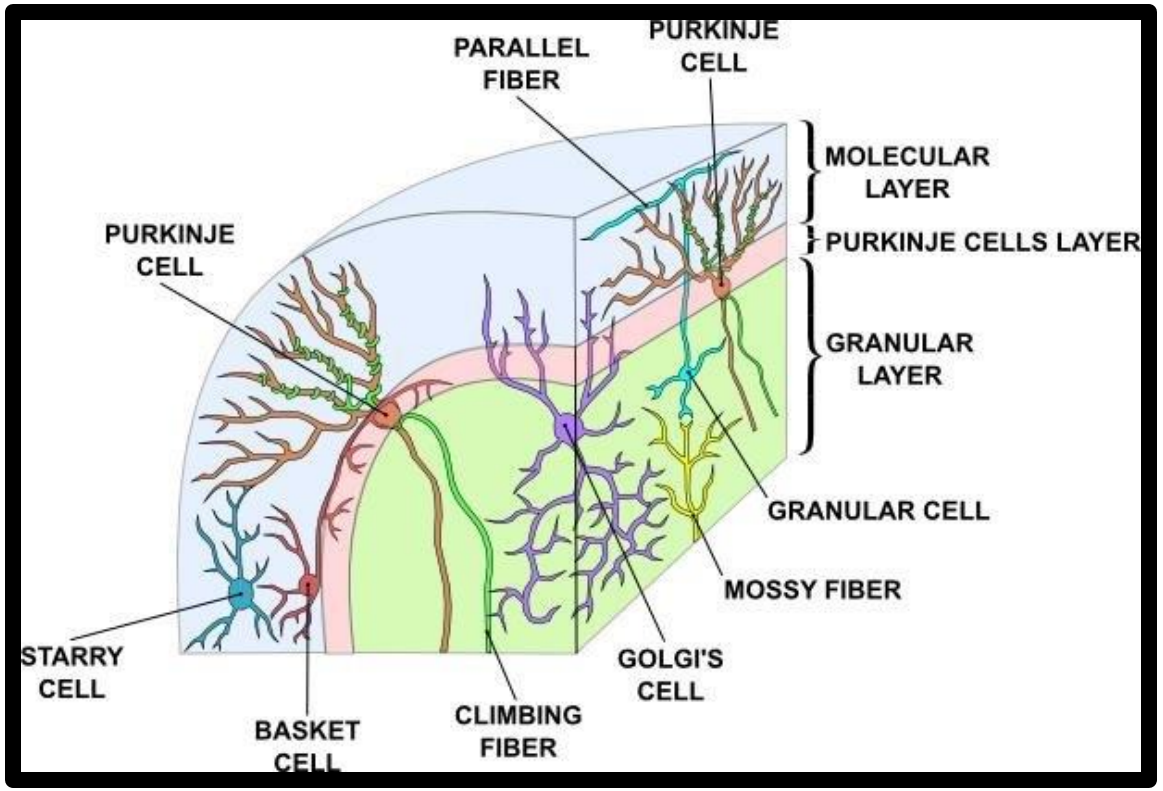
• Internal Structures

1- Outer molecular layer contains molecular and basket cells, dendrites of Purkinje cells, axons of granular cells and ends of climbing fibres (afferent fibres).

2- Intermediate layer formed of large flask shaped Purkinje cells.

3- Inner granular layer contains the granular cells and mossy fibres (afferent fibres)





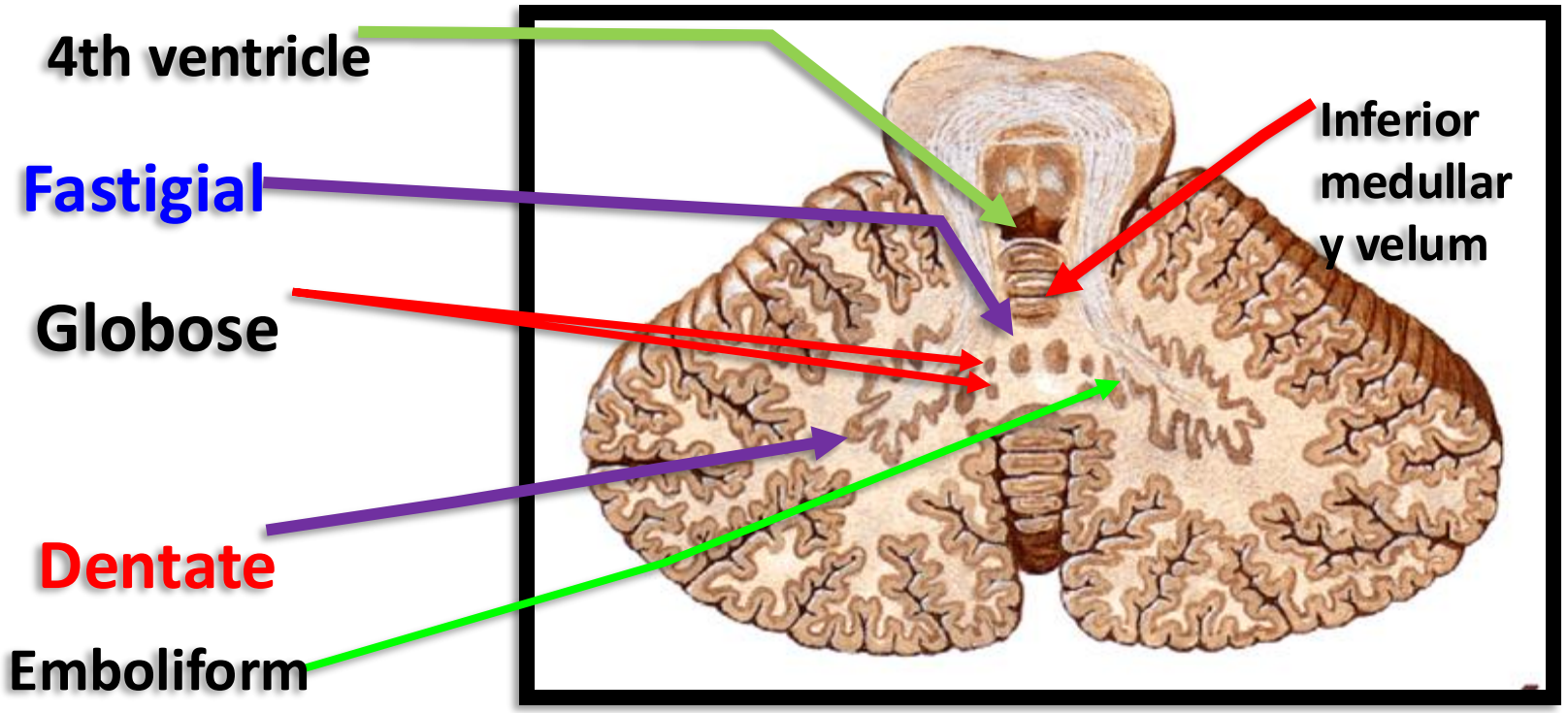
• Internal Structures

2- Central nuclei (DEGF),

- These are 4 nuclei arranged from lateral to medial:

1) **Dentate nucleus:** It is a corrugated bag of gray matter with a hilum directed medially. It is the largest and most lateral of the cerebellar nuclei.

-It is related to the neo-cerebellum.



2) **Emboliform nucleus**: It lies **medial to the dentate nucleus.**

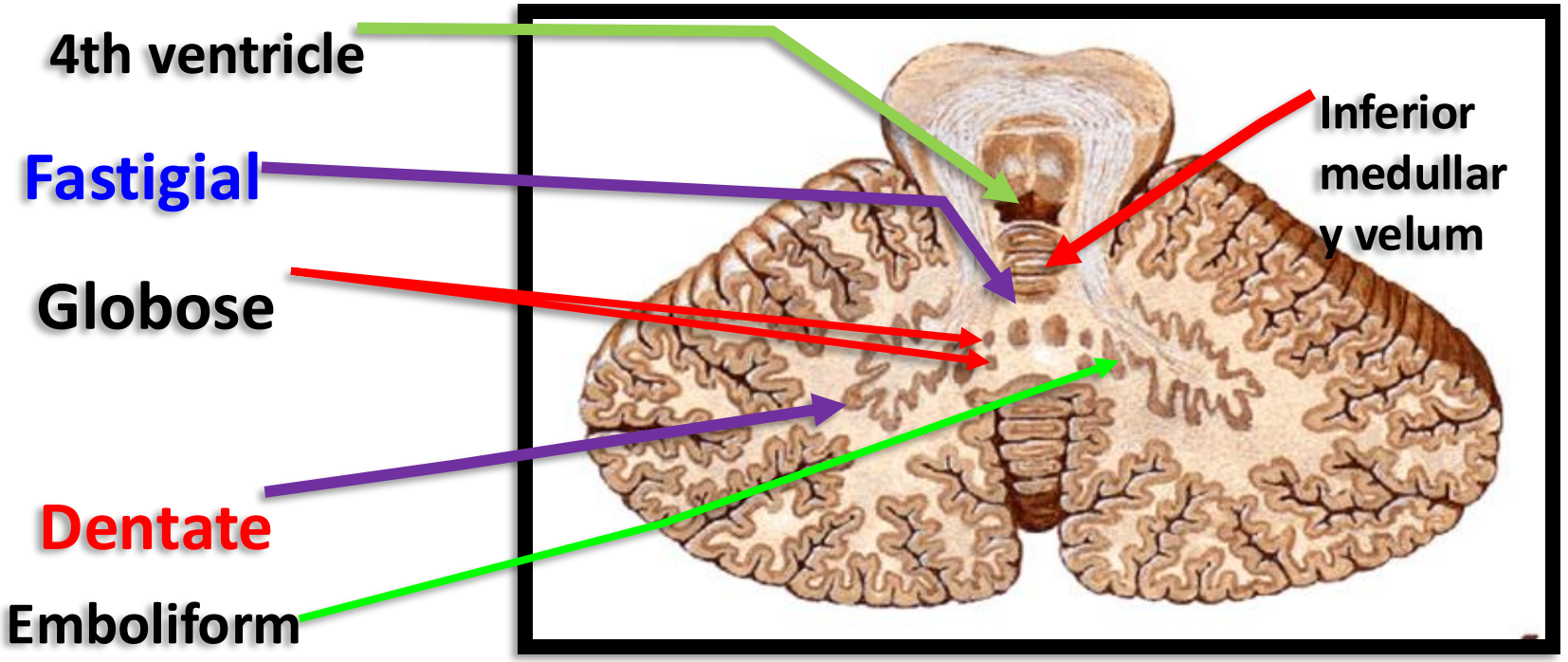
- It belongs to the paleo-cerebellum.

3) **Globosus nucleus**; It lies medial to **the emboliform nucleus.**

- It belongs to the paleo-cerebellum.

4) **Fastigial nucleus**: It is the **most medial nucleus.**

- It belongs to the archi-cerebellum.



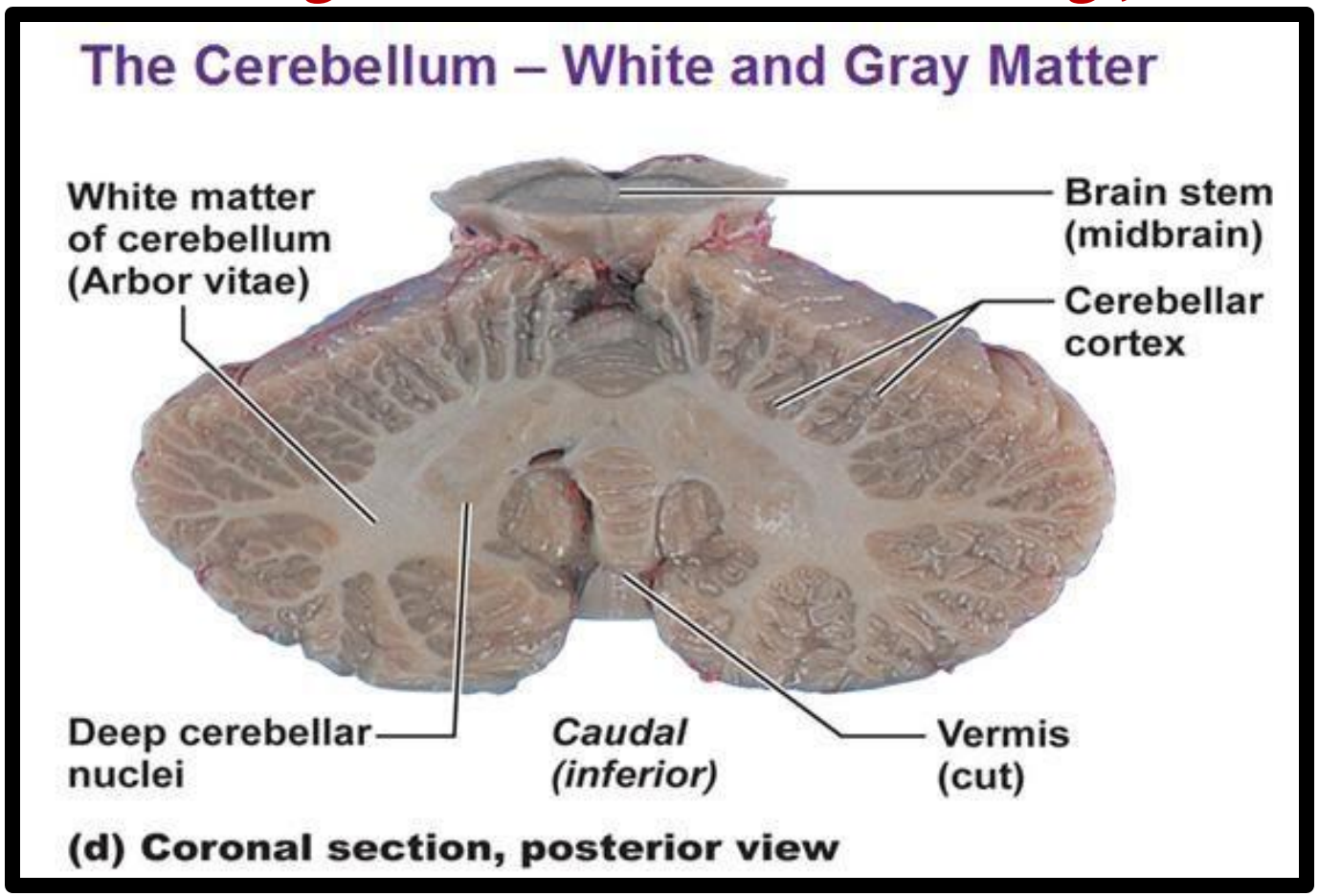
• Internal Structures

B- White matter, which forms the white center of each hemisphere.

-It is formed of:

-a- afferent and efferent cerebellar fibres (cerebellar peduncles).

- b- Axons of Purkinje cells, mossy fibres to the granular cells and climbing fibres to the molecular cells



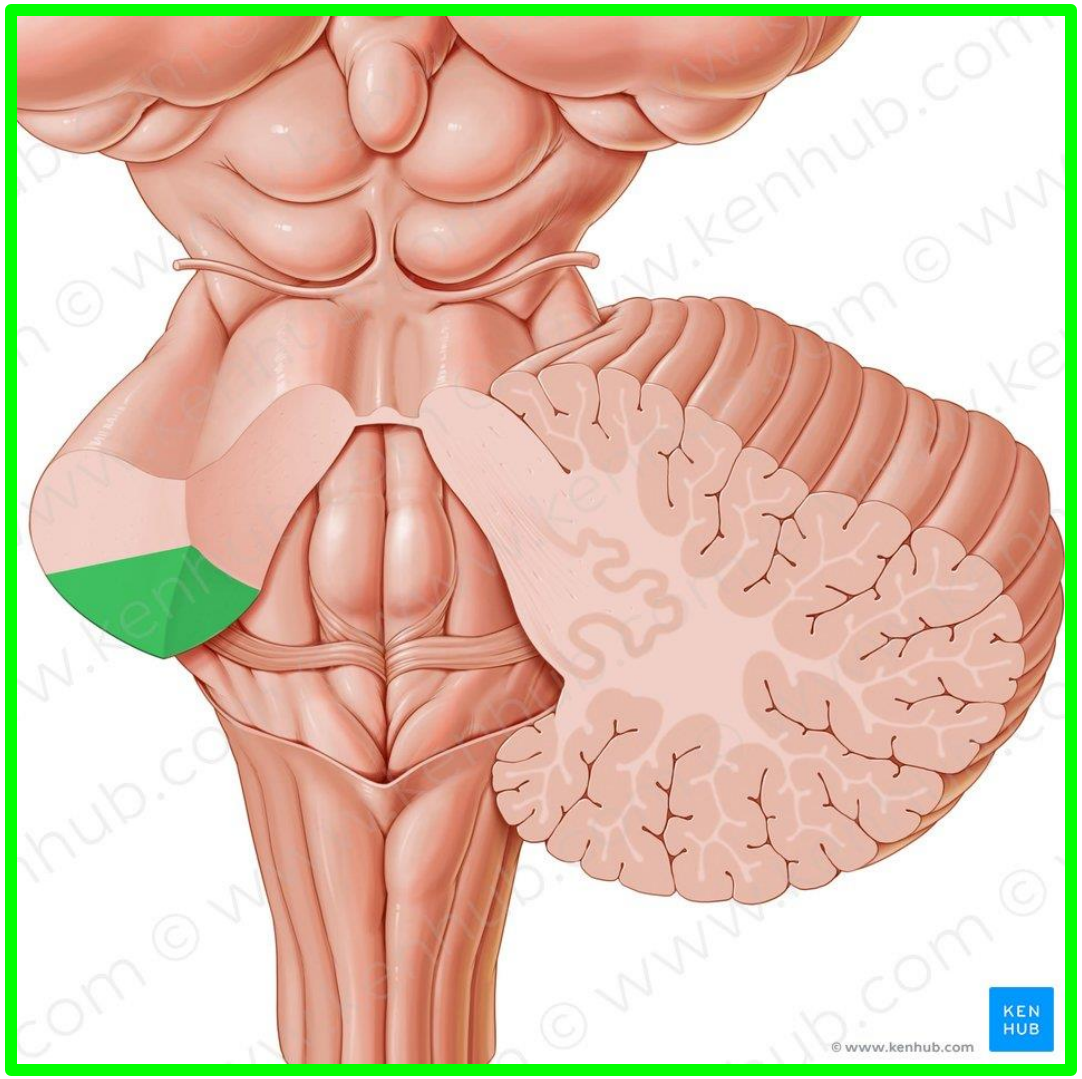
Cerebellar peduncles

- These are 3 bundles (superior, middle and inferior) of white matter on each side, connecting the cerebellum to the brain stem.

1- Inferior cerebellar peduncle:

- It connects the medulla oblongata with the cerebellum.

- It ascends upwards and laterally towards the anterior cerebellar notch.



Cerebellar peduncles

Dr. Aiman Al Maathidy
Tuesday 17 December 2024

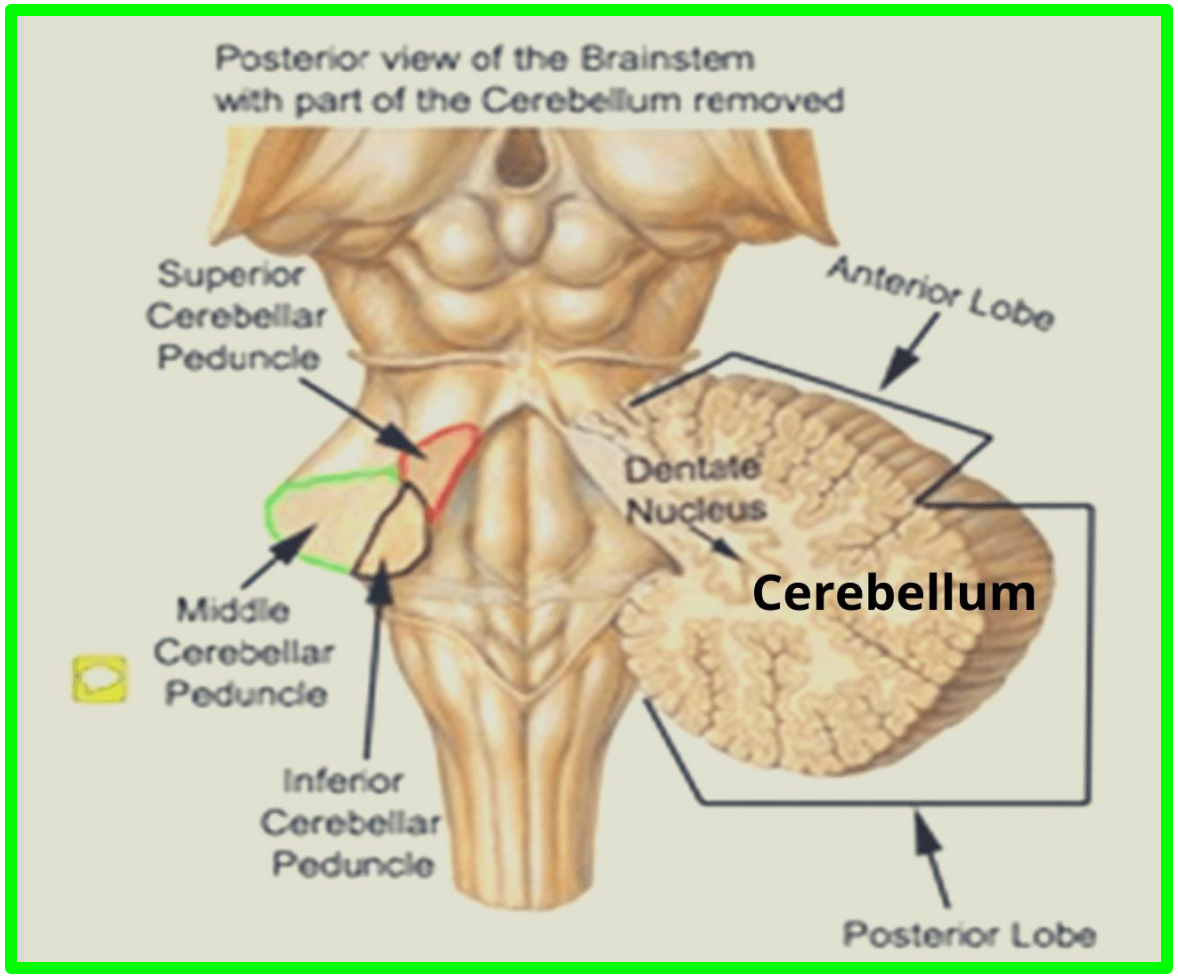
2- Middle cerebellar peduncle:

- It is the thickest of the three cerebellar peduncles.
- It emerges from the lateral aspect of the pons.

3- Superior cerebellar peduncle

- It emerges from the back of the midbrain.

- It runs downward and laterally on the side of the upper part of the 4th ventricle to enter the cerebellar hemisphere.



Blood supply of Cerebellum

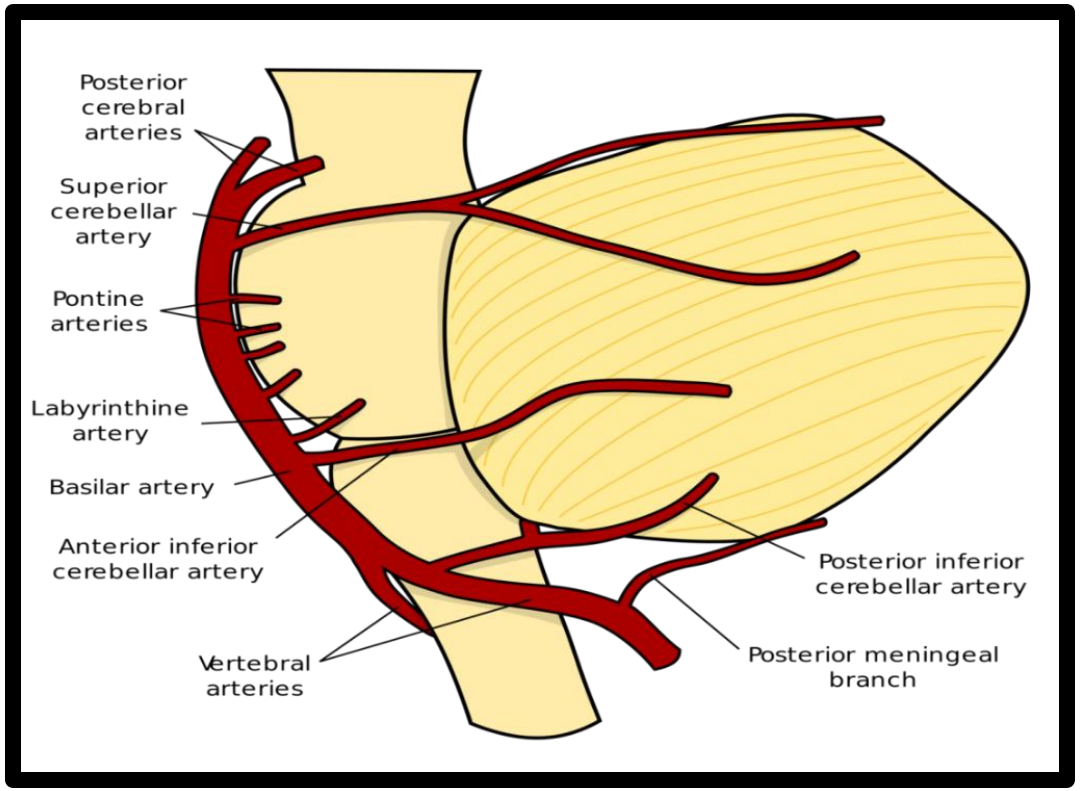
Dr. Aiman Al Maathidy

3 arteries on each side:

1-Superior cerebellar artery from the basilar artery and supplies the superior surface.

2-Anterior inferior cerebellar artery from the basilar artery and supplies the anterior part of the inferior surface.

3-Posterior inferior cerebellar artery; from the 4th part of vertebral artery and supply the posterior part of the inferior surface.



* Venous drainage, into the dural venous sinuses

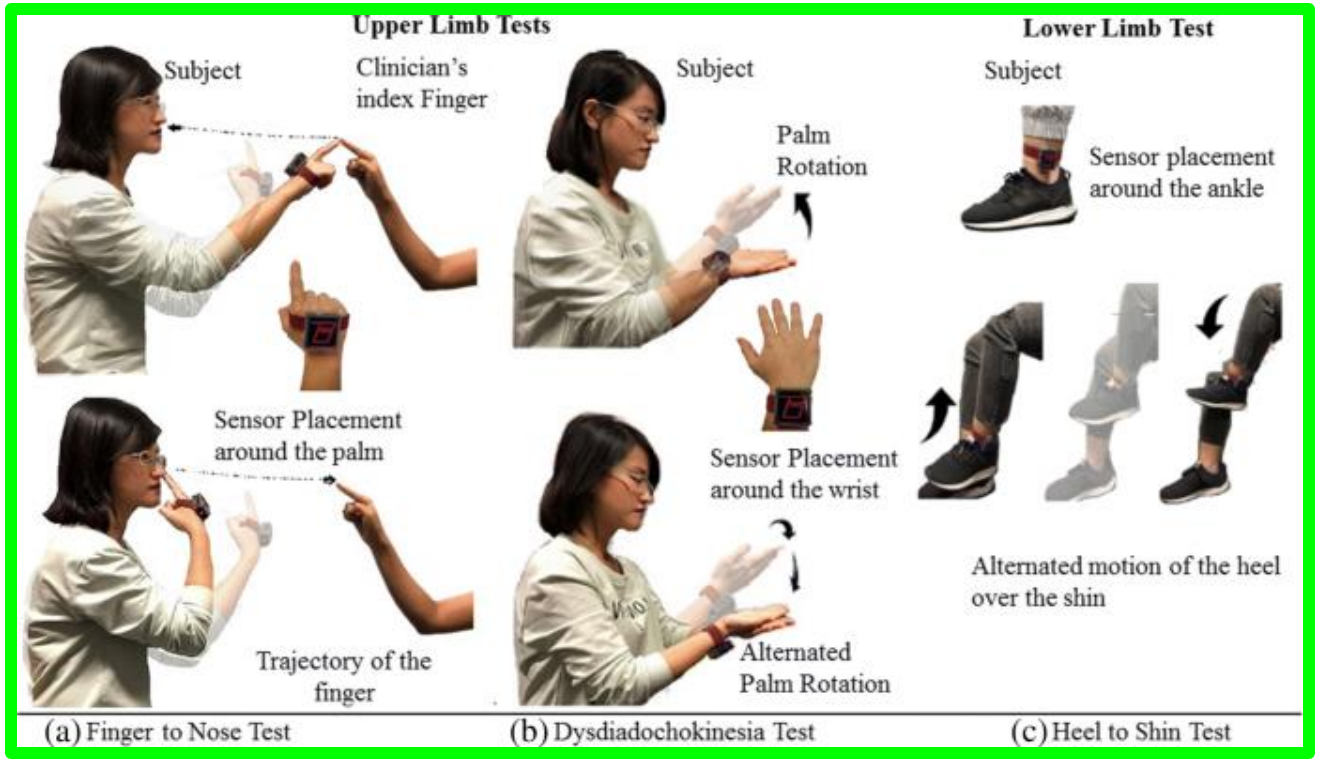
** Applied Anatomy:

Cerebellar lesions are usually vascular. It is manifested by;

1- Disturbance of equilibrium.

2- Hypotonia of the muscle.

3- Cerebellar ataxia, in the form of intermittent jerky movements.



** Applied Anatomy:

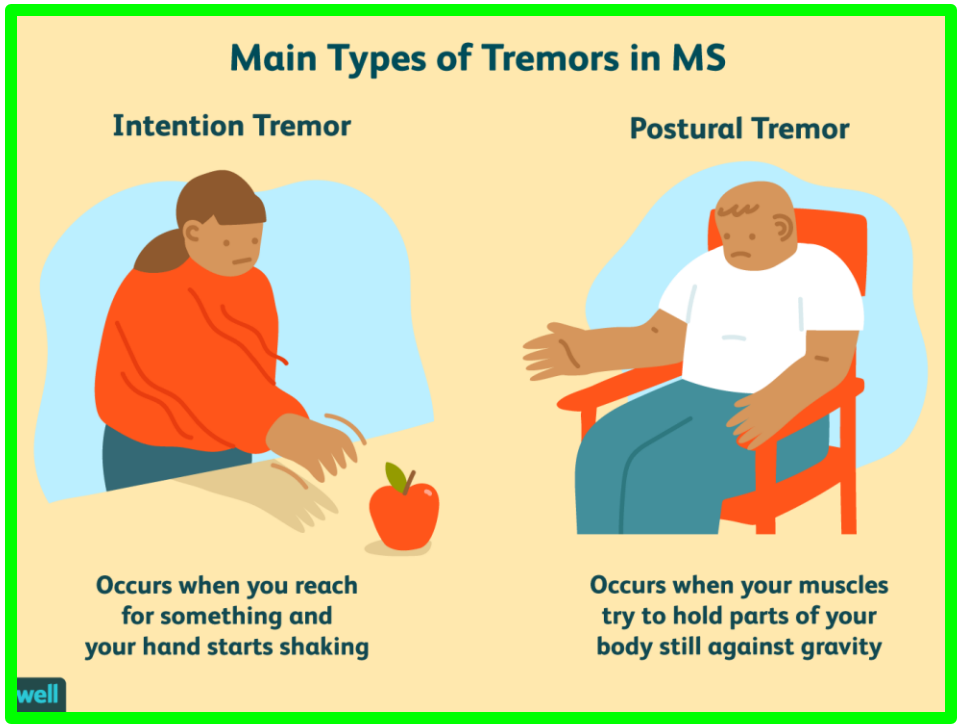
Dr. Aiman Al Maathidy
Tuesday 17 December 2024

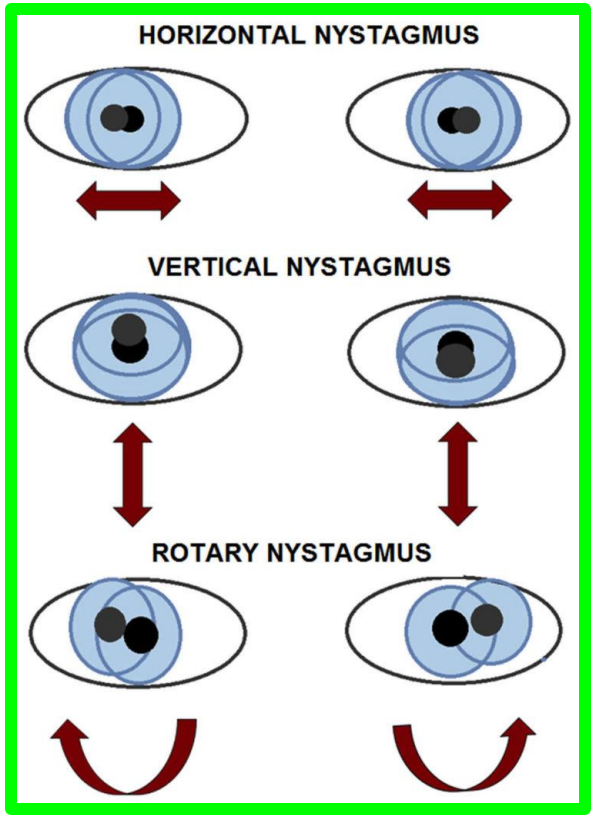
4- Intention tremor, absent at rest, best seen at the end of the finger-nose test.

5- Nystagus, in the form of jerky movements of the eyes.

6- Dysdiadokokinasis, which is evident by asking the patient to do rapidly alternating movements as supination and pronation of the forearm.

- The movement appears jerky, slow and incomplete.





اوراق الخريف

ودعت اغصانها وانتثرت لهبوب الريح اوراق الخريف
و شكت للارض حين اندثرت قصر العمر وفقدان الاليف

د.عبدالله مصطفى

Dr. Aiman Qais Afar

2024- 2025

Tuesday 17 December 2024