THE CEREBELLUM & ITS RELEVANT CONNECTIONS

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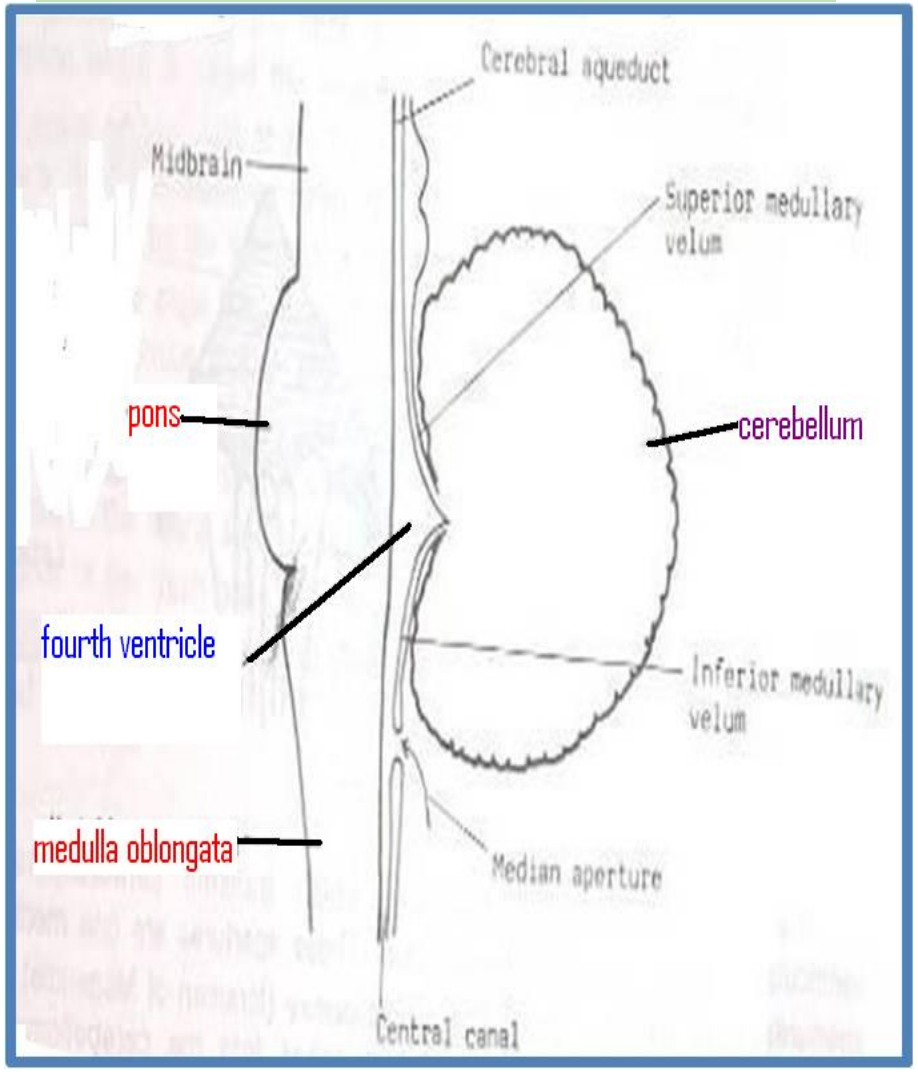
OBJECTIVES

At the end of the lecture, students should:

- ***Describe the External features of the cerebellum (lobes, fissures).***
- ***Describe briefly the Internal structure of the cerebellum.***
- ***List the name of Cerebellar Nuclei.***
- ***Relate the Anatomical to the Functional Subdivisions of the cerebellum.***
- ***Describe the Important connections of each subdivision.***
- ***Describe briefly the Main Effects in case of lesion of the cerebellum.***

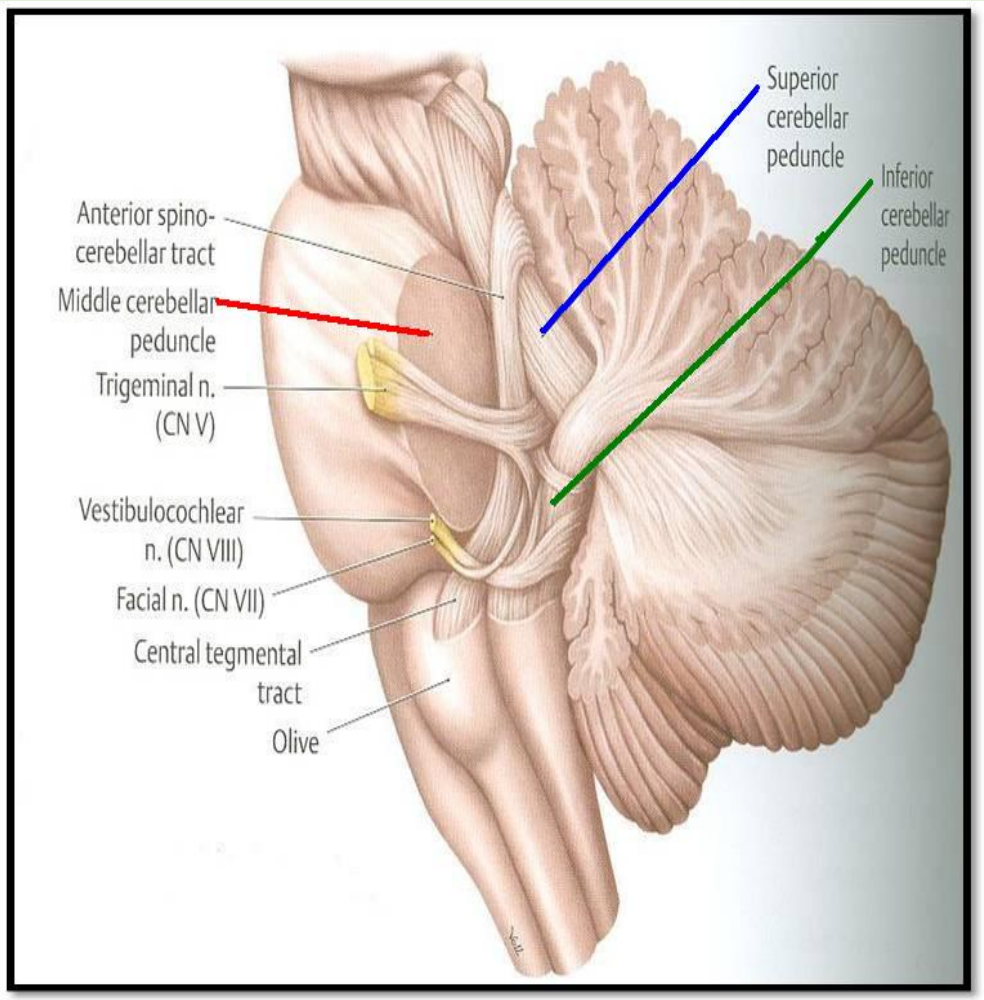
CEREBELLUM



- **ORIGIN :**
- From Hindbrain.
- **POSITION :**
- lies behind Pons & Medulla Separated from them by Fourth ventricle.

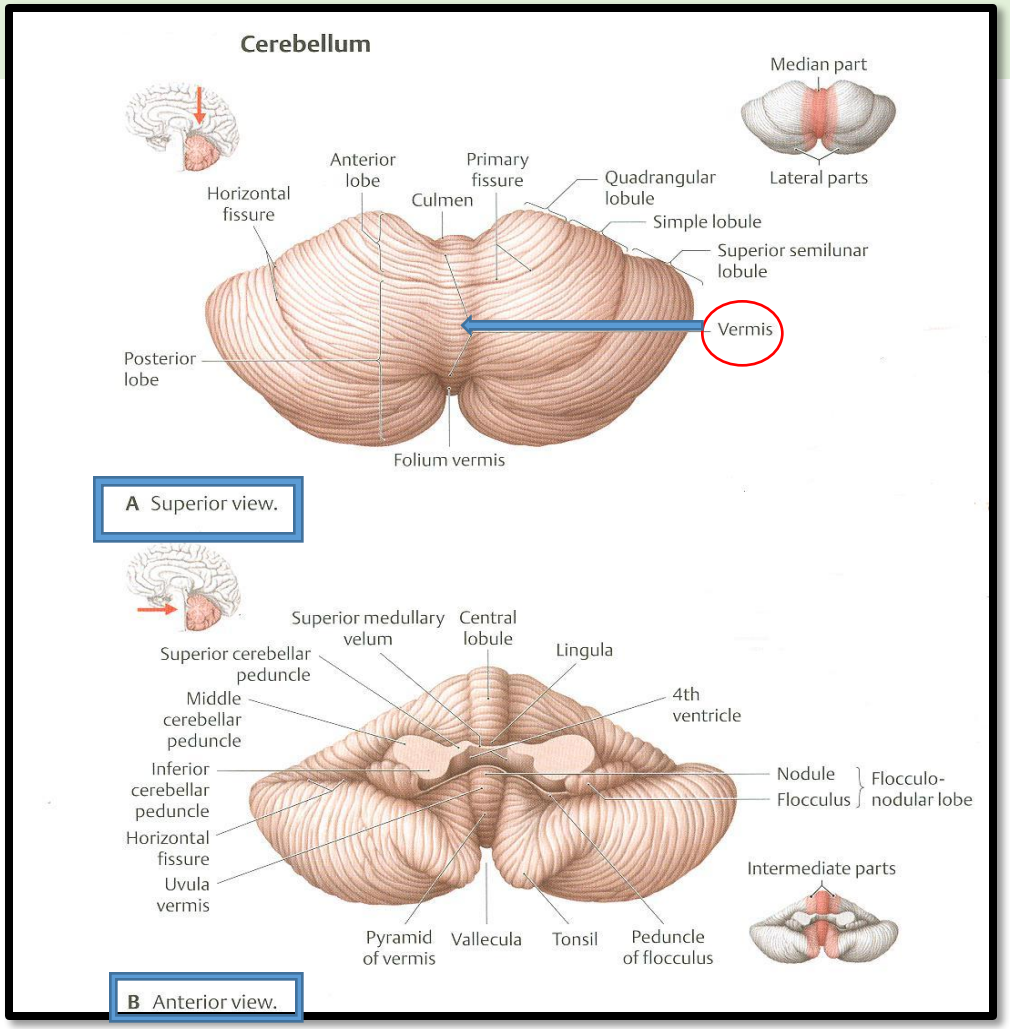
THE CEREBELLUM

- ***CONNECTION TO BRAIN STEM:***
- ***by Inferior, Middle & Superior Cerebellar Peduncles.***

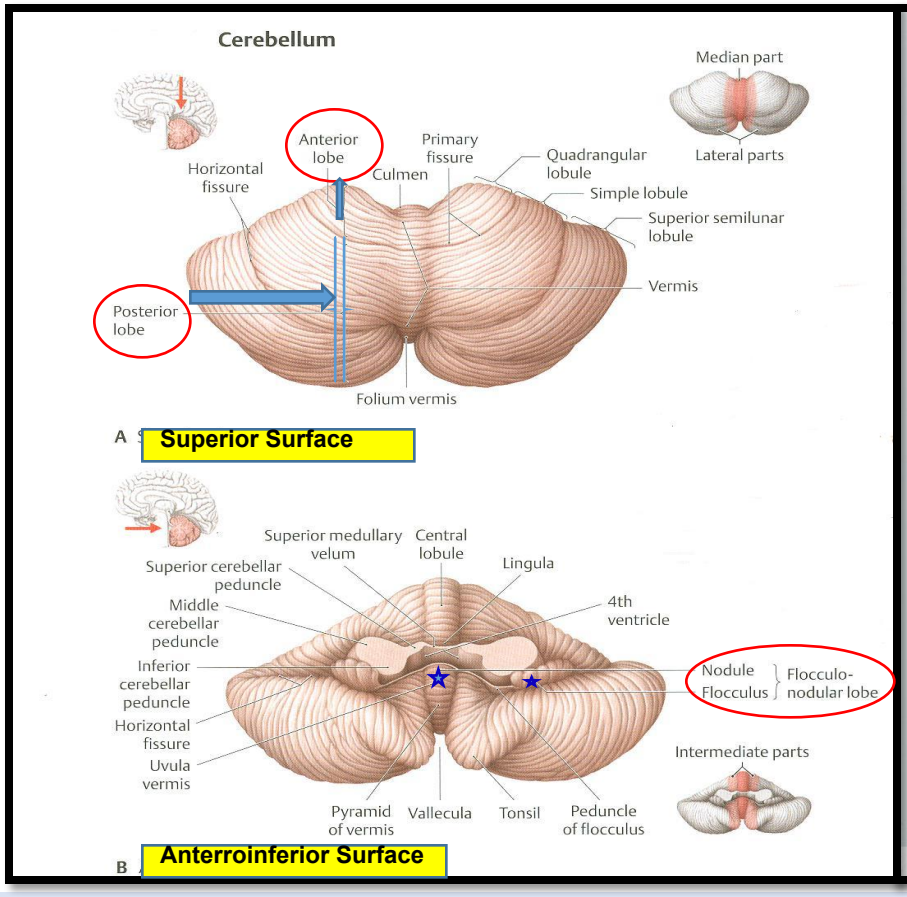


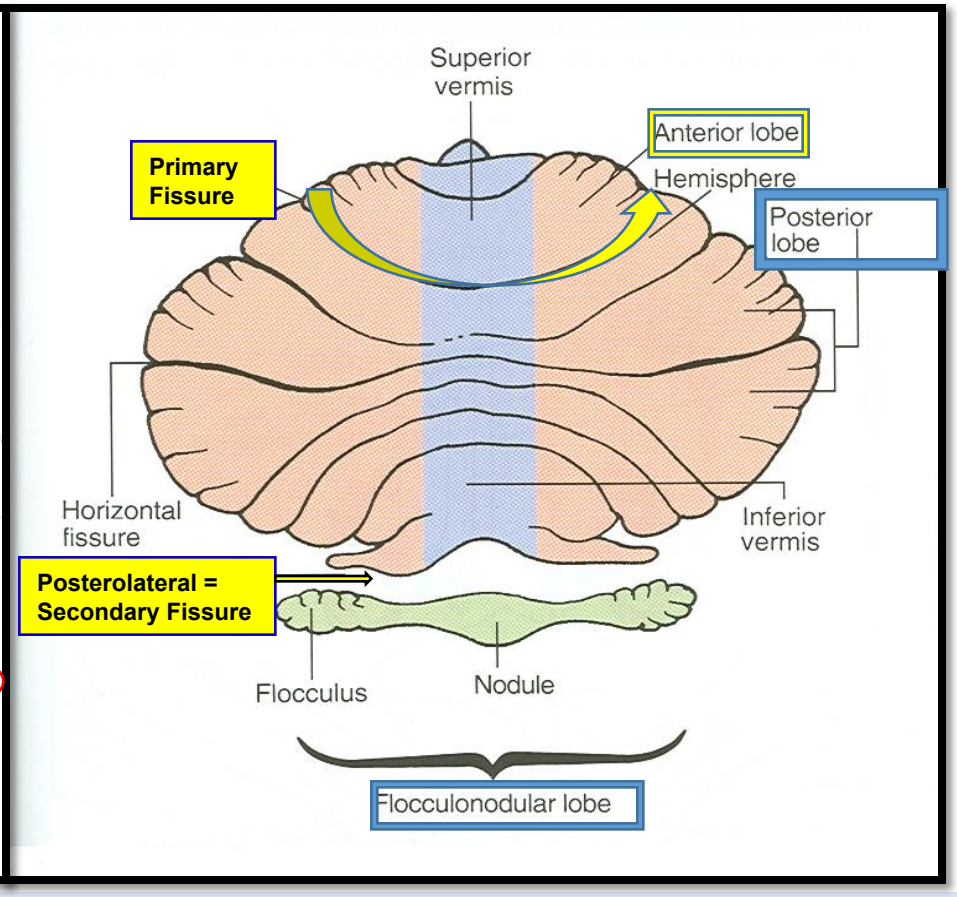
EXTERNAL FEATURES

- *It consists of two Cerebellar Hemispheres joined in midline by the Vermis.*
- *Its surface is highly convoluted forming Folia, separated by Fissures.*



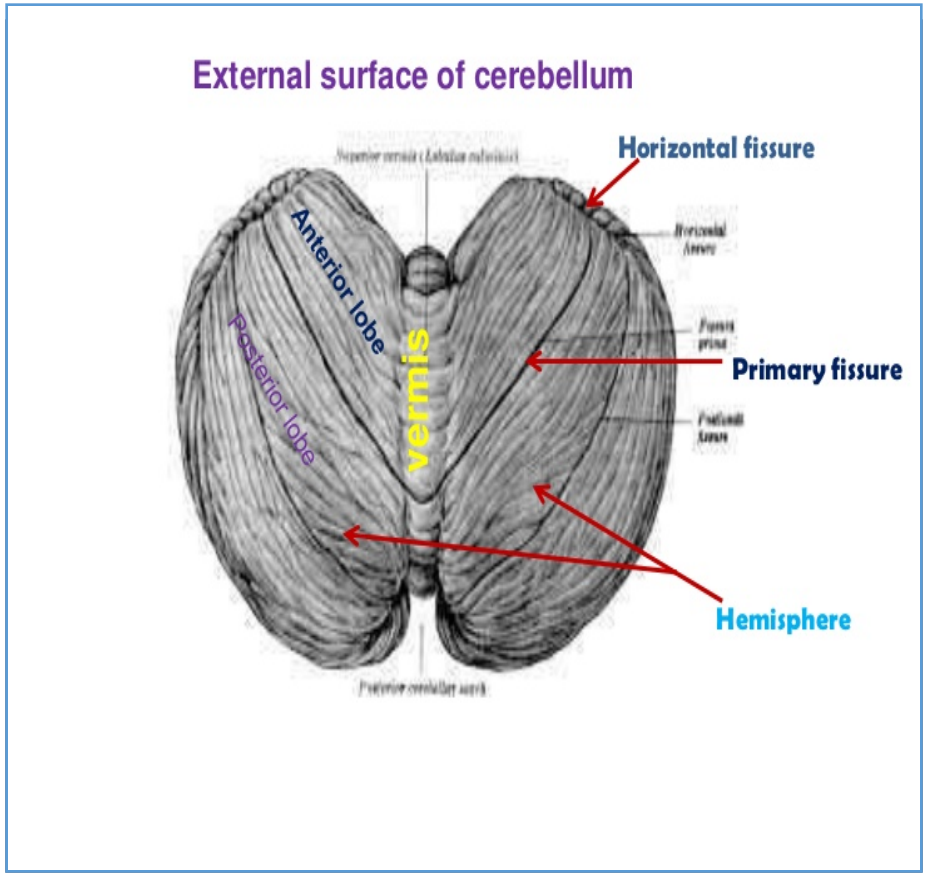
ANATOMICAL SUBDIVISION

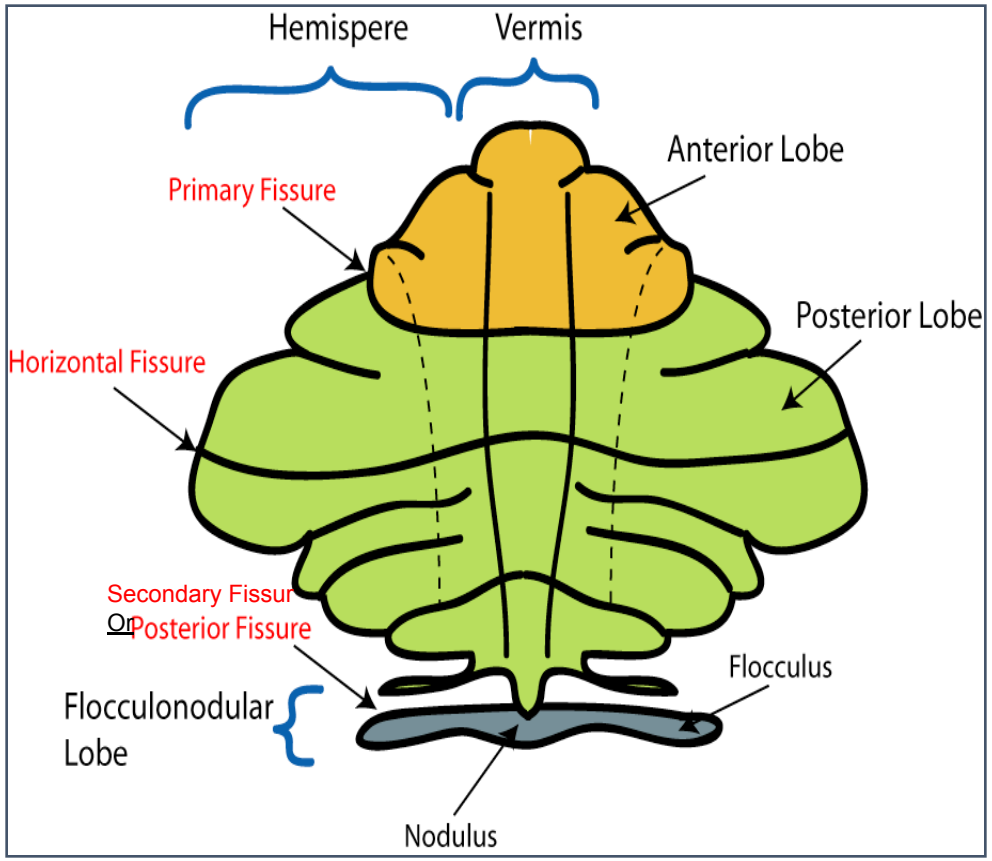




1. ***Anterior lobe:*** in front of **primary fissure,** **on the superior surface.**
2. ***Posterior (middle) lobe:*** behind **primary fissure (Between Primary & Secondary fissures = posterolateral).**
3. ***Flocculonodular lobe: in front of secondary (Posterolateral) fissure, on the inferior surface .***

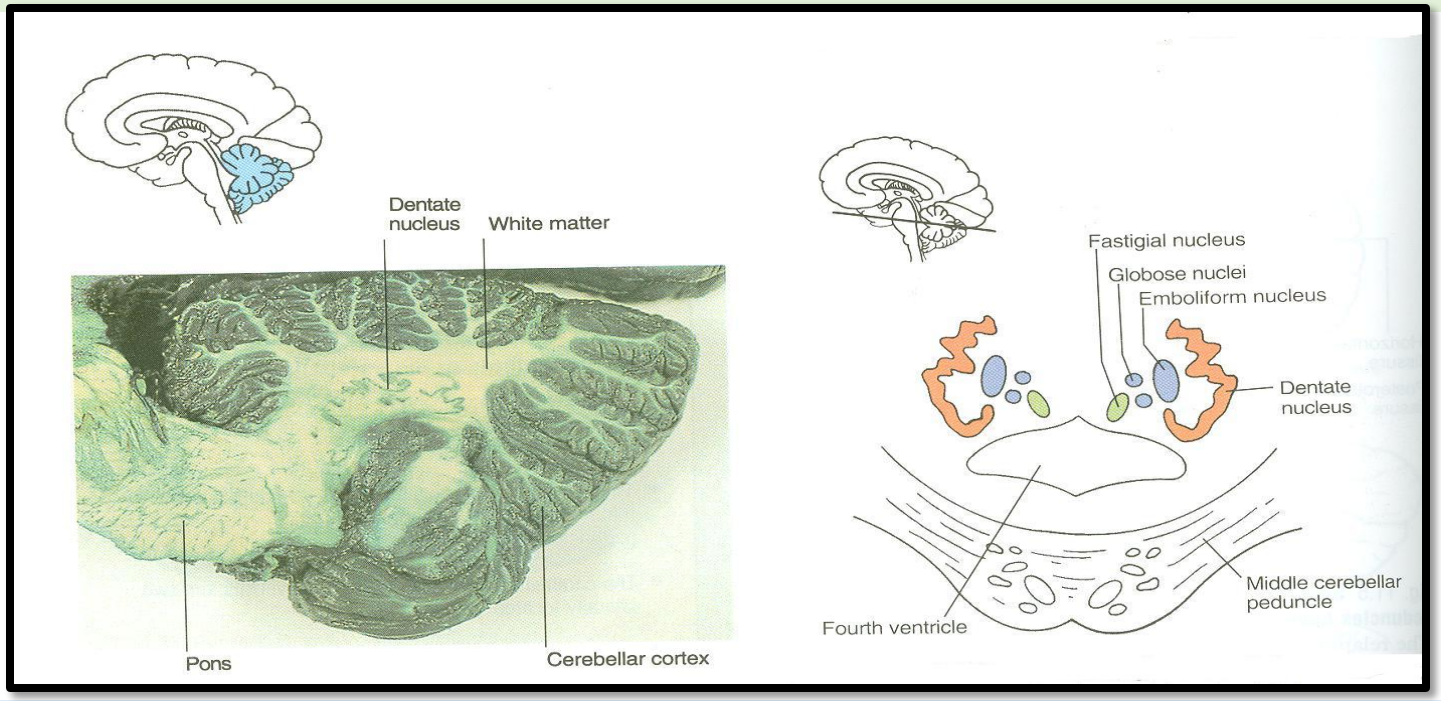
ANATOMICAL SUBDIVISION





CONSTITUENTS

(Internal Structure and Nuclei of Cerebellum)



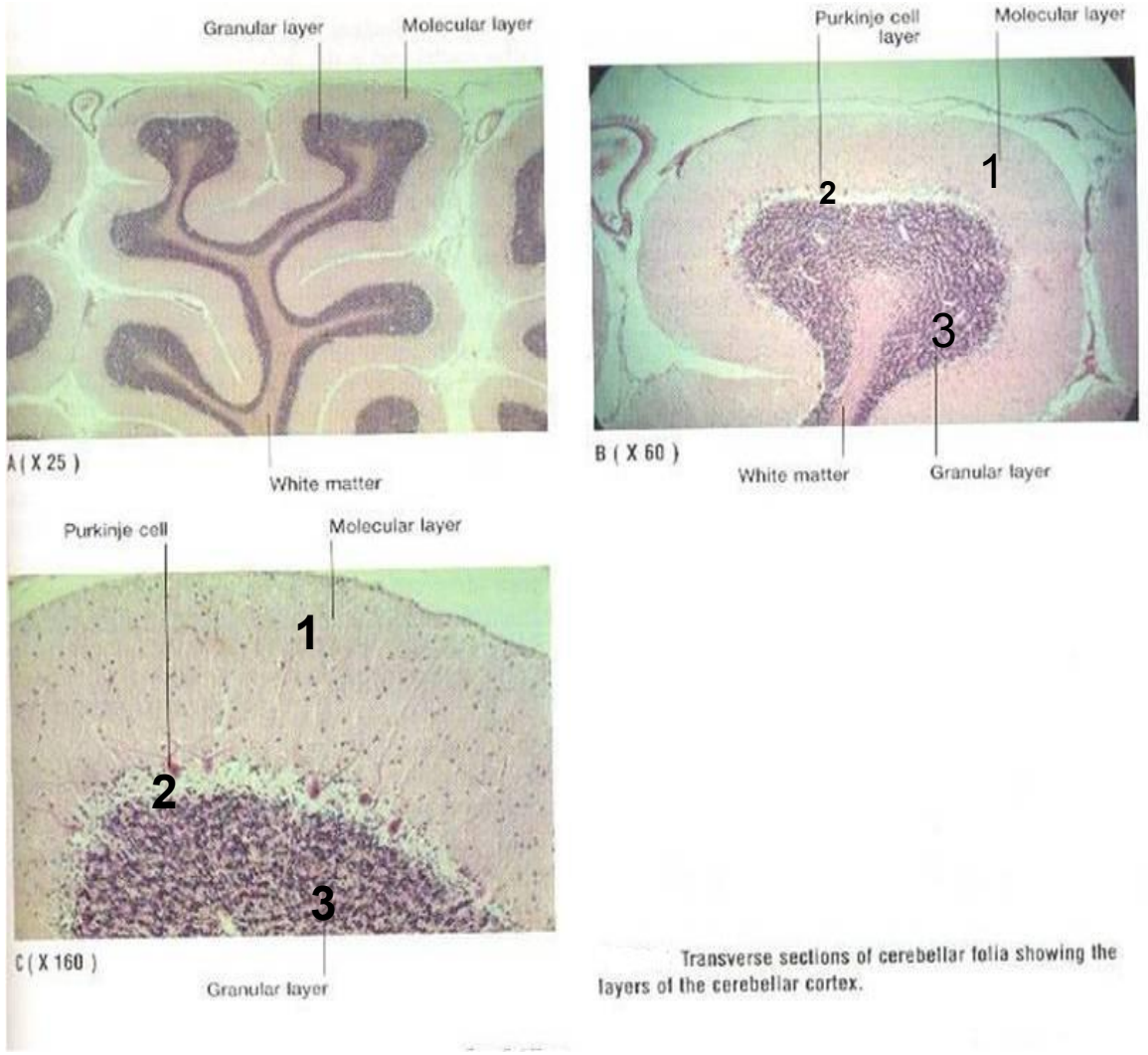
1. ***Outer grey matter:*** cerebellar cortex.
2. ***Inner white matter:*** cerebellar medulla.
3. Deeply seated nuclei in white matter: ***from medial to lateral:***

- ***Fastigial nucleus.***
- ***Globose nucleus.***
- ***Emboliform nucleus.***
- ***Dentate nucleus:*** *largest* one.

CEREBELLAR CORTEX

- **Divided into 3 layers:**

1. **Outer molecular layer**
2. **Intermediate Purkinje cell layer**
3. **Inner granular layer**



Transverse sections of cerebellar folia showing the layers of the cerebellar cortex.

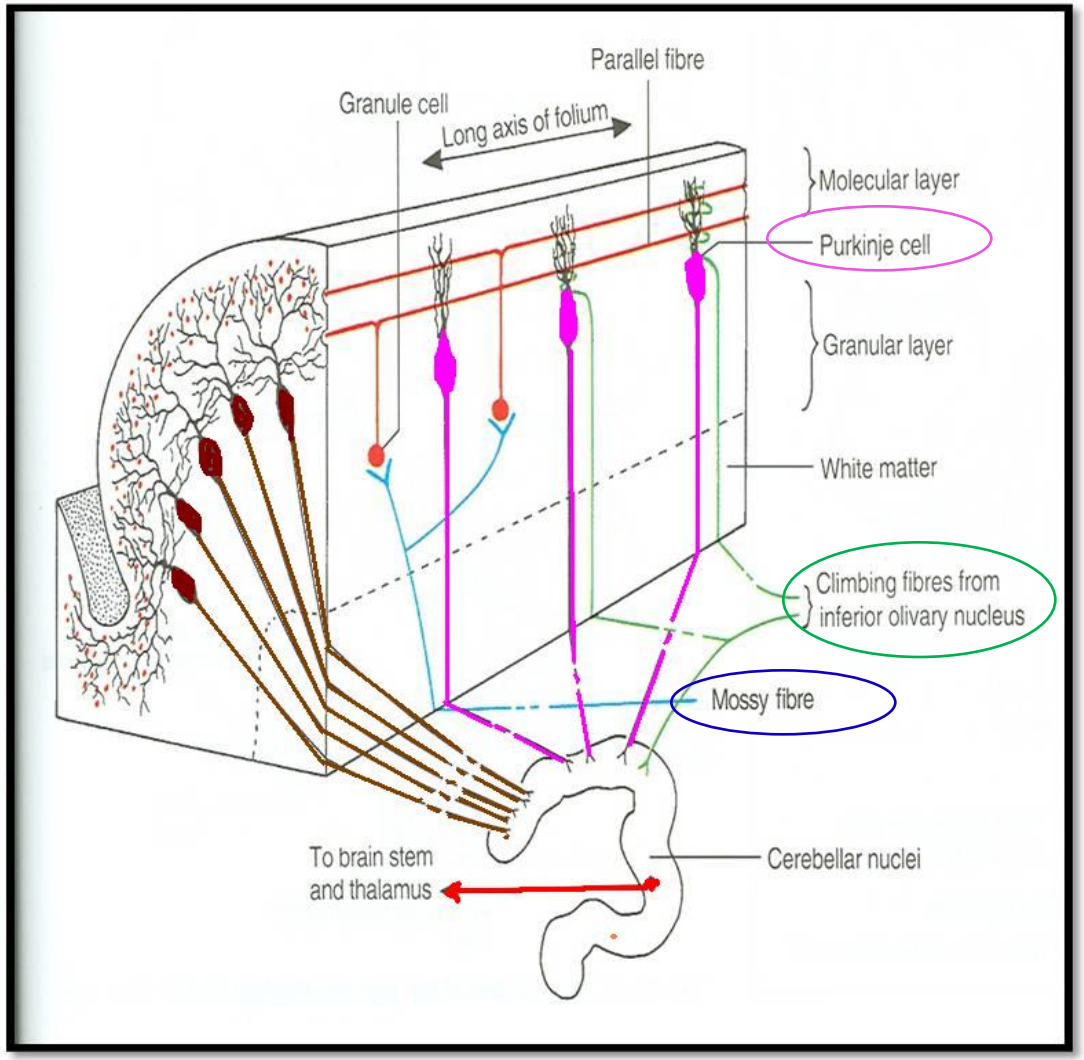
CEREBELLAR MEDULLA

AFFERENT FIBRES:

- **Climbing fibres:** from ***inferior olivary nucleus***, relay to **purkinje cells**
- **Mossy fibres:** rest of fibres:

1. ***From vestibular nuclei***
2. ***From spinal cord***
3. ***From pons***

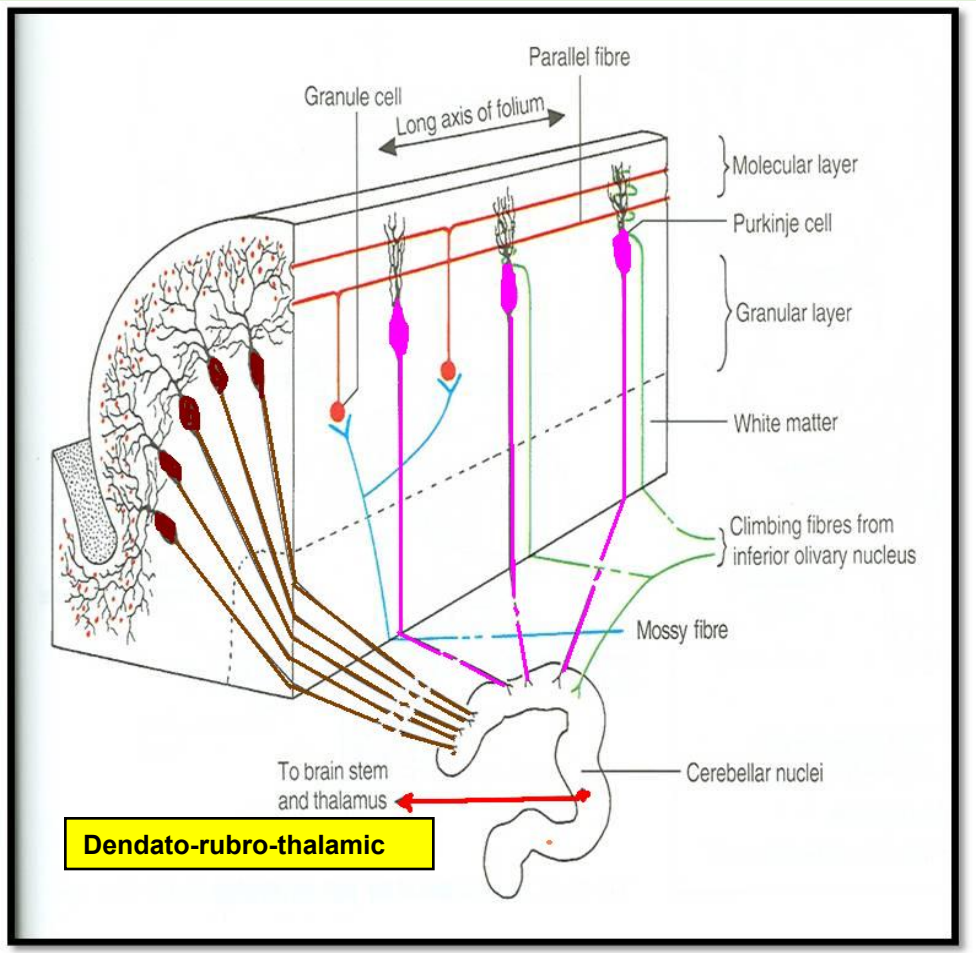
- They relay to granule cells which in turn relay to purkinje cells.
- Finally all afferent fibres passing through the medulla relay to purkinje cells in the cortex.



CEREBELLAR MEDULLA

- **Axons of Purkinje Cells are the only axons to leave the cortex to medulla :**

1. The great majority of axons do not leave cerebellum & end in deep cerebellar nuclei, specially Dentate nucleus.
2. Some of axons leave cerebellum as efferent fibres.



CEREBELLAR MEDULLA

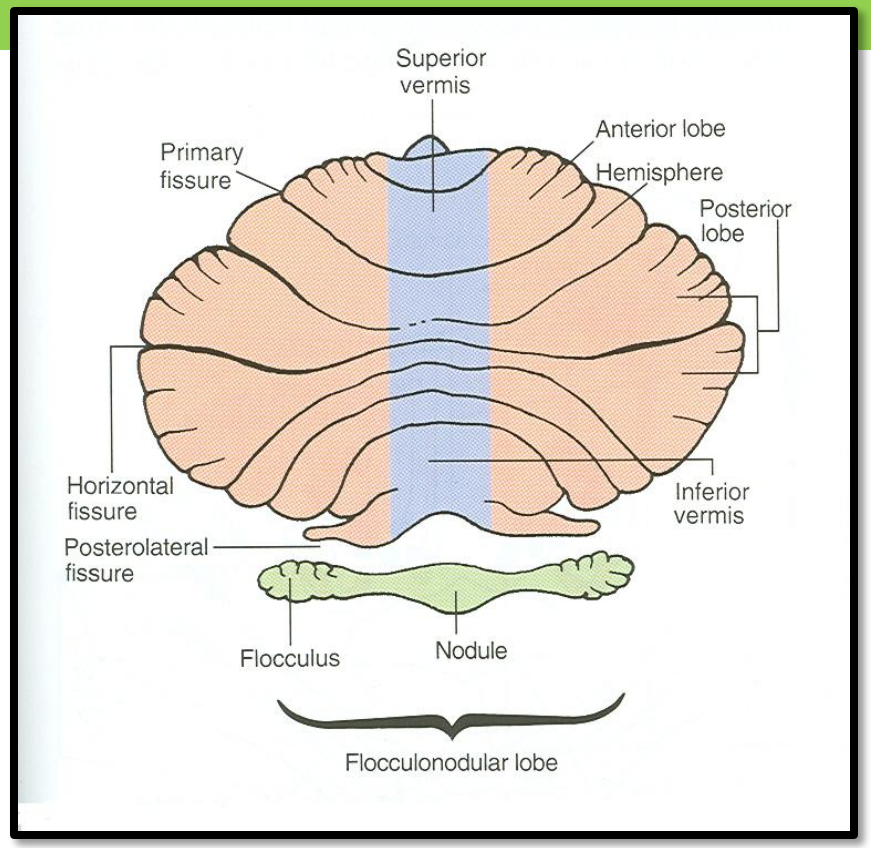
***EFFERENT FIBRES*:**

- ***Most efferent fibres are axons of deep cerebellar nuclei.***
- ***Main Efferents go to nuclei of brainstem& thalamus :***

1. ***Vestibular nuclei (cerebello-vestibular tract).***
2. ***Red nucleus (Dendato-rubro-thalamic tract).***
3. ***Ventral lateral nucleus of thalamus (Dendato-thalamic tract).***

FUNCTIONAL SUBDIVISIONS OF THE CEREBELLUM

ARCHICEREBELLUM



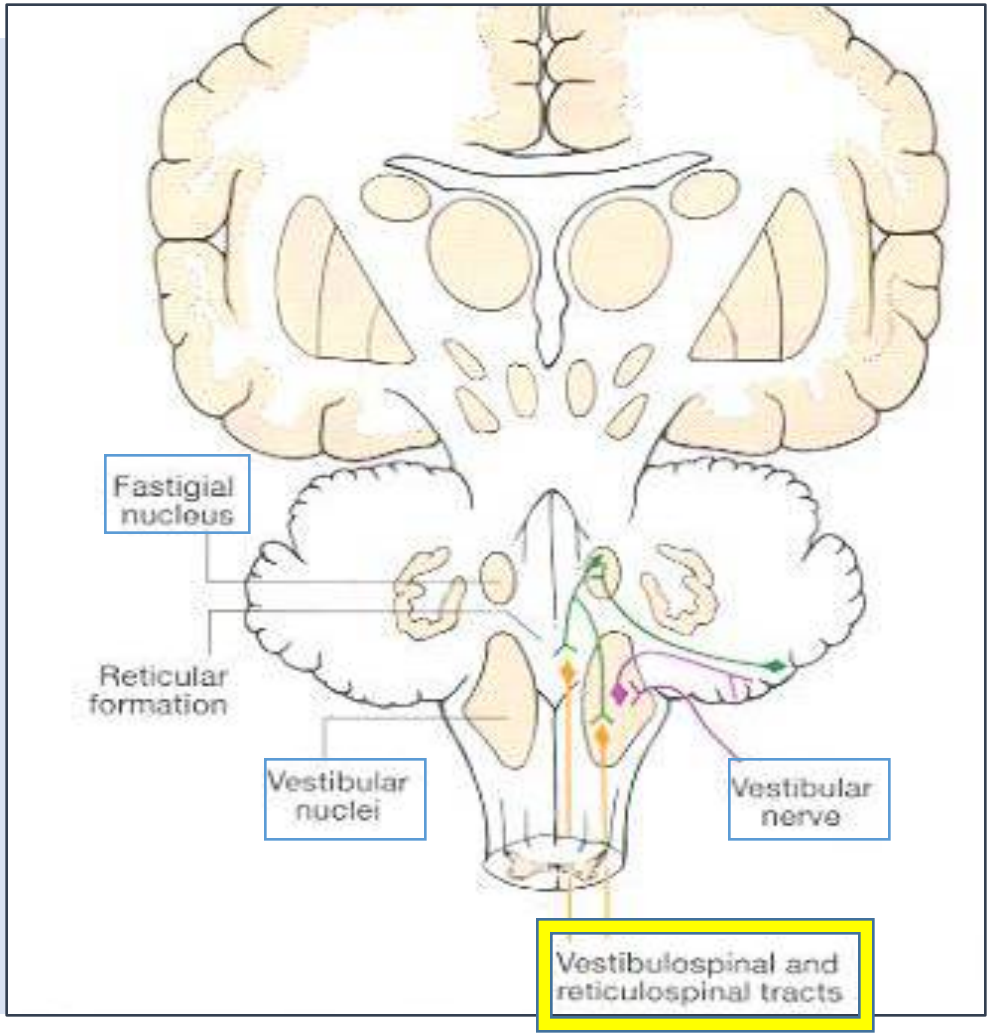
- **<u>Vestibular</u> Part of cerebellum:**
  Flocculo-nodular lobe.

Green = Archi-cerebellum,
Blue= Paleo-cerebellum.
Pink= Neo-cerebellum.

ARCHICEREBELLUM

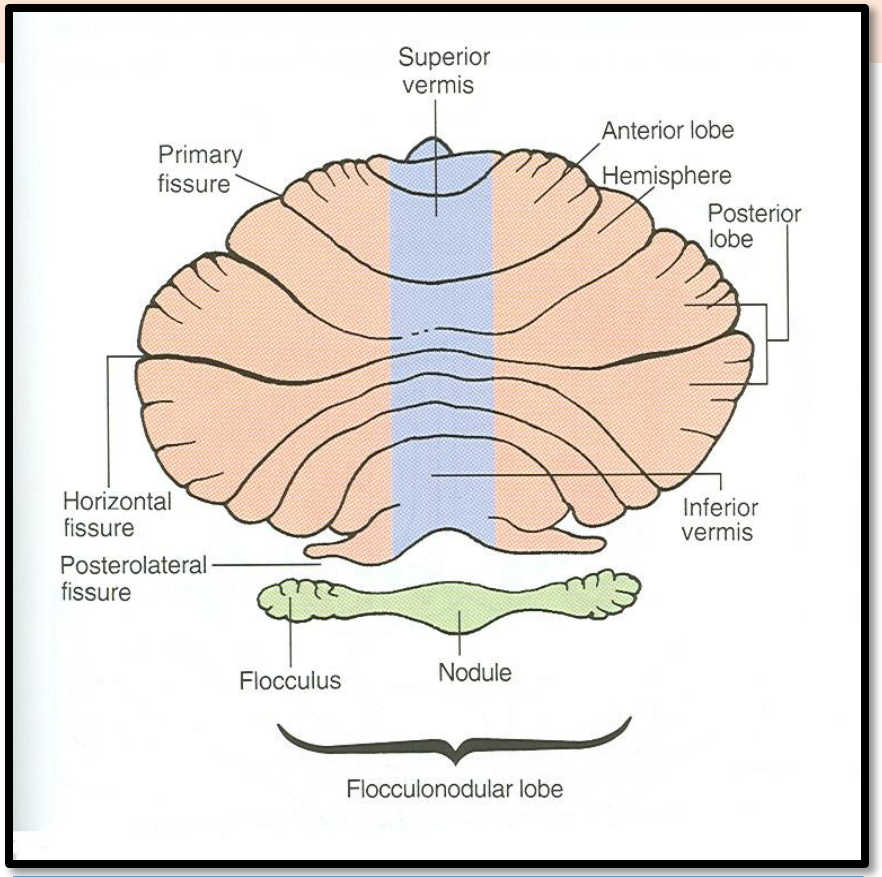
- ***Nuclei Related: Fastigial***
- ***Afferents: from Vestibular nuclei (Vestibulocerebellar fibres),(through ICP)***
- ***Efferents cortical (purkinje cell) Fibres project : to Fastigial nucleus, which projects to vestibular nuclei (through ICP) + to Reticular formation***
- ***Function: controls body Balance (via vestibulospinal & reticulospinal tracts).***

  Control of eye movement (via VO Reflex)



PALEOCEREBELLUM

- ***Spinal* Part of cerebellum:**
  Vermis & Paravermis



Green = Archi-cerebellum,
Blue= Paleo-cerebellum.
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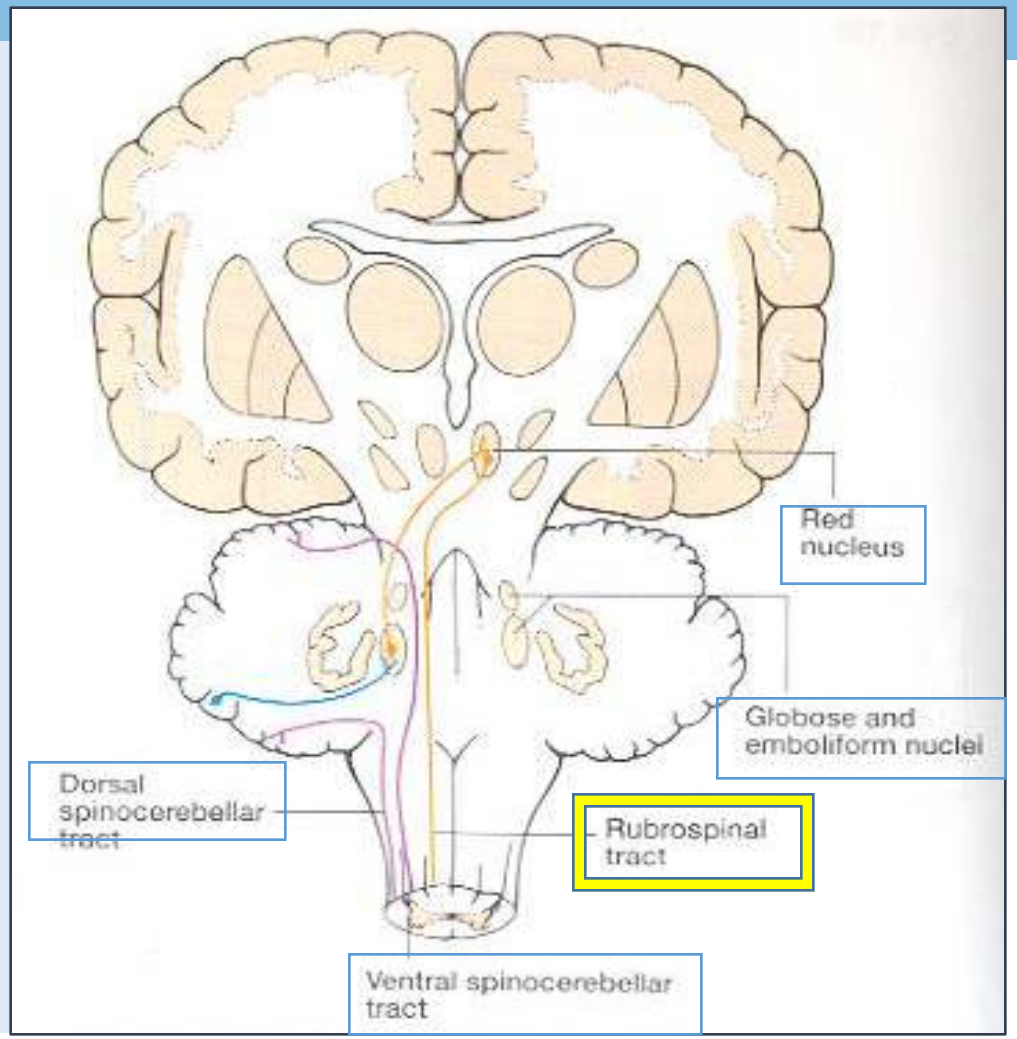
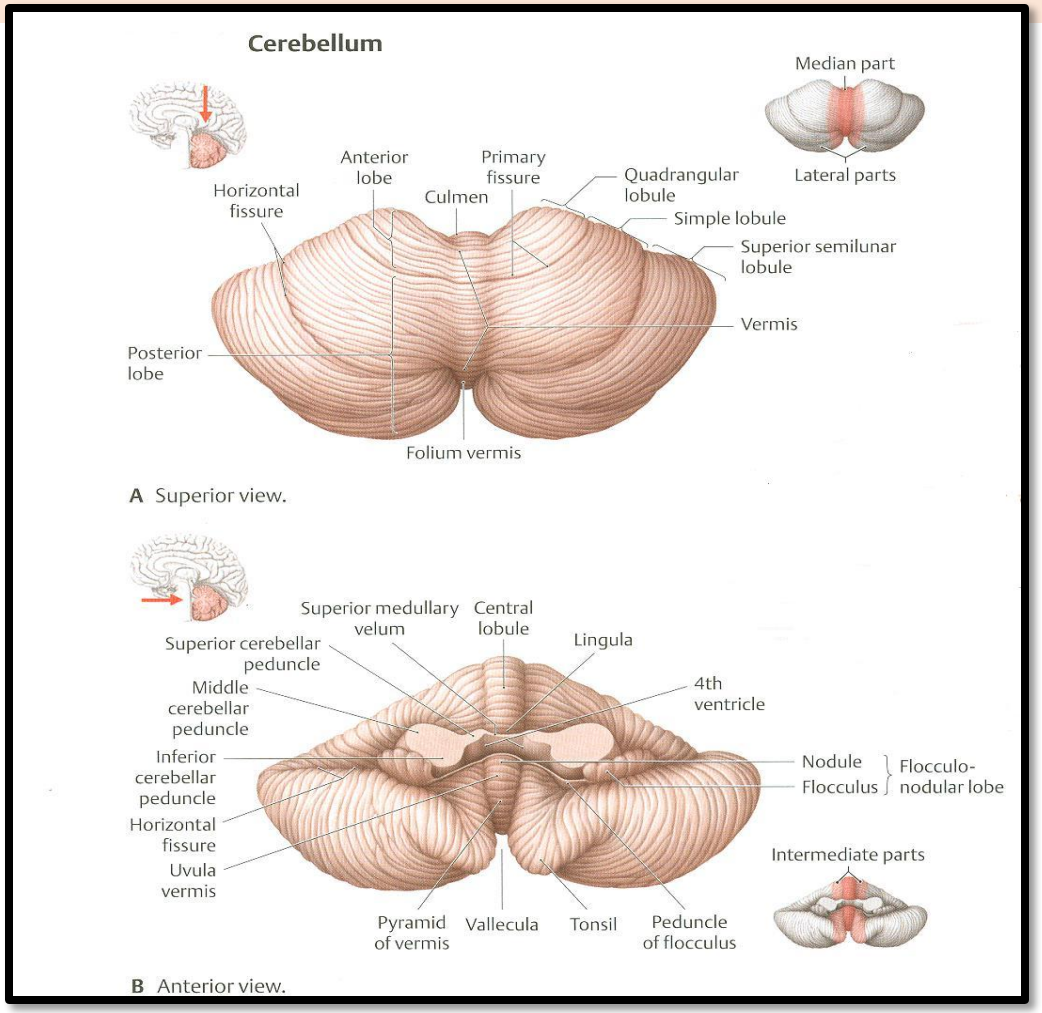
PALEOCEREBELLUM

- **Nuclei Related:** globose & emboliform
- **Afferents:** from spinal cord (dorsal & ventral spinocerebellar tracts through ICP & SCP, respectively)
- **Efferents :** to globose&embliform nuclei which project to red nucleus (through SCP)
- **Function:** controls posture & muscle tone (via Rubrospinal tract).



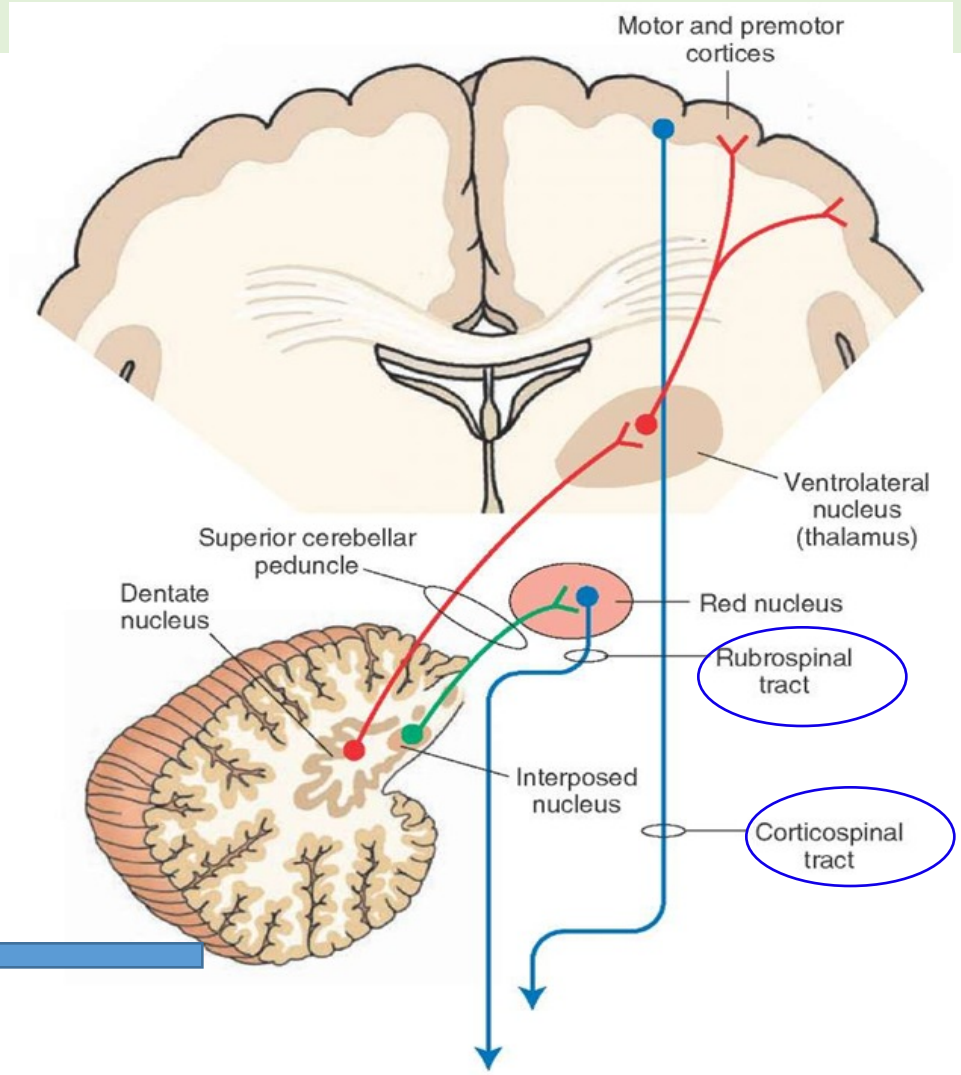
NEOCEREBELLUM



- **Cerebral Part of cerebellum:**
  Rest of Cerebellum.

NEOCEREBELLUM

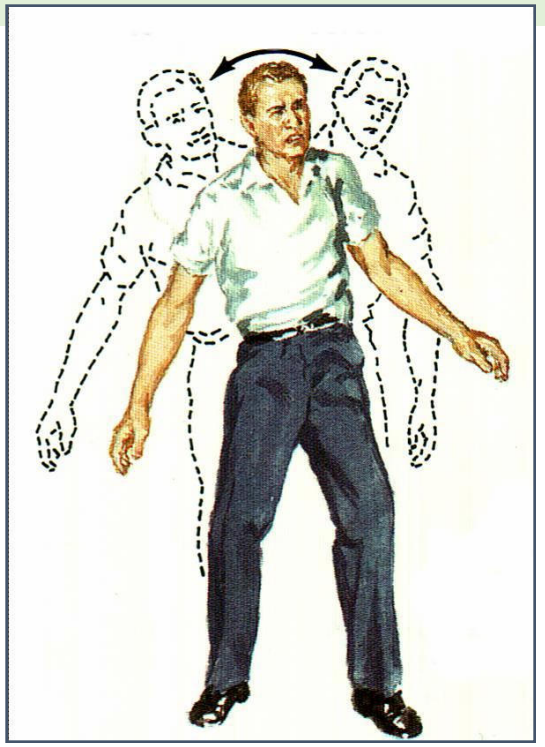
- **Nuclei Related:** Dentate
- **Afferents:** from Pons (Pontocerebellar fibres) (through MCP)
- **Efferents:** to Red nucleus but mostly to Ventral Lateral Nucleus of Thalamus (through SCP) then to motor cortex
- **Function:** coordination of voluntary movements (via descending Corticospinal & corticobulbar tracts or Rubrospinal tract).



CEREBELLAR LESIONS

- **MIDLINE LESION:** Loss of postural control.
- **UNILATERAL LESION:** "Cerebellar ataxia" causes *ipsilateral* :

1. Incoordination of arm: intention tremors (on performing voluntary movements)
2. Incoordination of leg: unsteady gait
3. Incoordination of eye movements: nystagmus
4. Slowness of speech: dysarthria (difficulty of speech).



• I may walk as if I'm drunk.
•I may fall over.
•My speech may be slurred.

THANK YOU