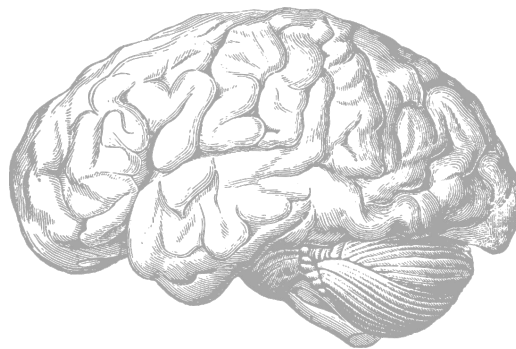




# Anatomy of the Cerebellum and the Relevant Connections

## CNS Block



### Color Index







- ◆ Main Text
- ◆ Female Slides
- ◆ Male Slides
- ◆ Drs' Notes
- ◆ Important
- ◆ Extra info

[The Editing File](#)



# 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**.

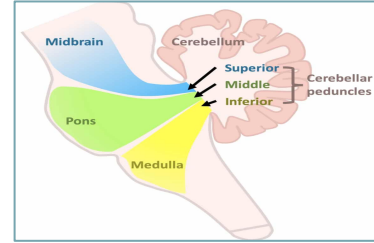


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# The Cerebellum

## Origin & Position

from **hindbrain**, lies behind pons & medulla and separated from them by **fourth ventricle**.



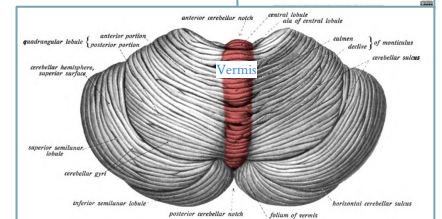
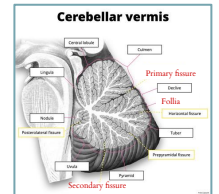
## Connection to brainstem

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

### Anterior lobe

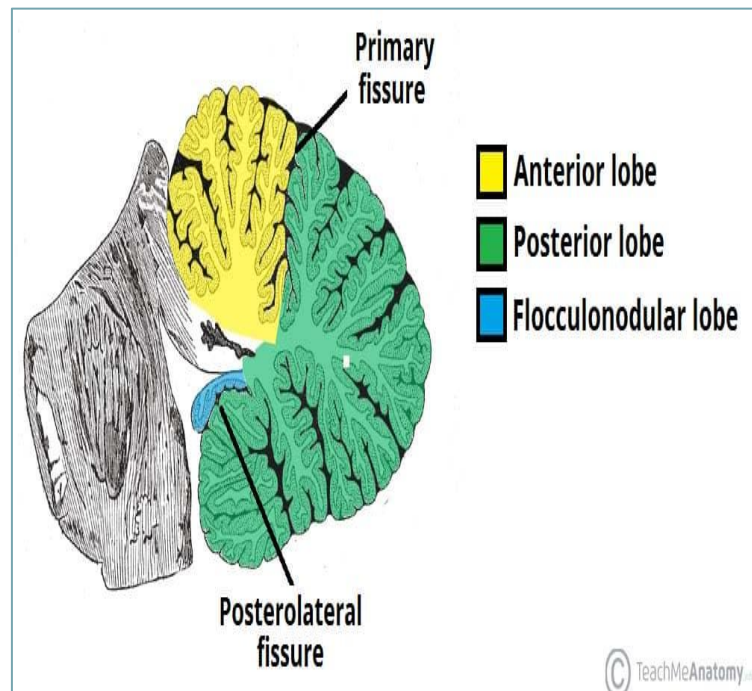
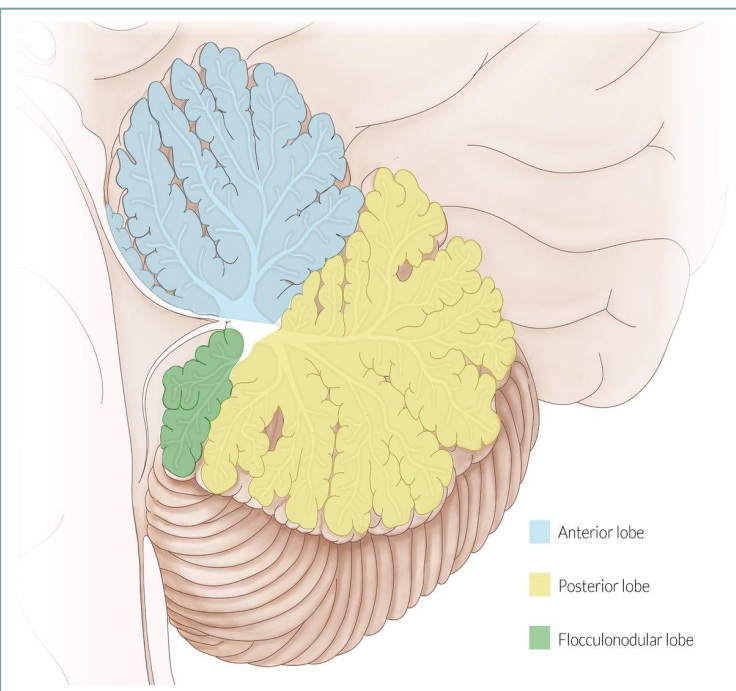
in front of primary fissure, on the superior surface.

### Posterior (middle) lobe

Behind primary fissure (Between Primary & Secondary fissures = posterolateral)

### Flocculonodular lobe

In front of secondary (Posterolateral) fissure on the inferior surface



How can we differentiate between the upper surface and the lower surface of the cerebellum ?

The **upper surface**: is continuous with the cerebellar hemisphere which makes it hard to distinguish the vermis

The **lower surface**: is separated by a deep groove called the VALLECULA which makes it easy to distinguish the vermis

The Cerebellum Internal Structure and Nuclei of Cerebellum

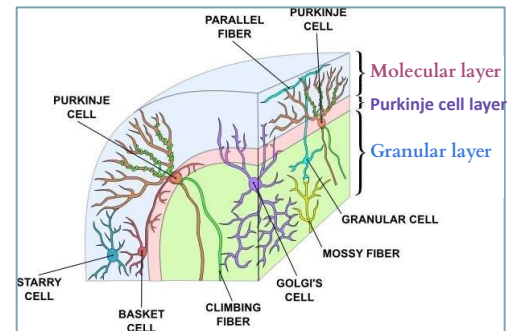
# CONSTITUENTS

## (Internal Structure and Nuclei of Cerebellum)

MCQ

Outer grey matter  
(cerebellar cortex)

- Divided into 3 layers:
1. Outer molecular layer
  2. Intermediate Purkinje cell layer
  3. Inner granular layer



Inner white matter  
(cerebellar medulla)

### Afferent Fibres:

- **Climbing fibres:** from inferior olivary nucleus, relay to **purkinje cells** (direct route 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.

- **Axons of purkinje cells are the only axons to leave the cortex to medulla:**

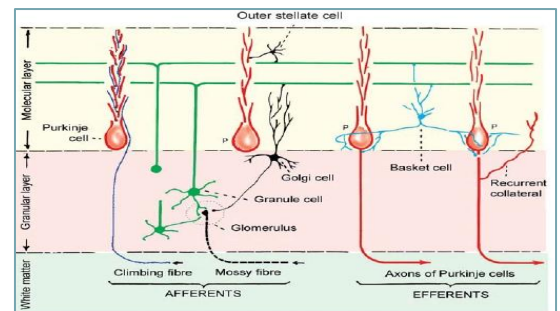
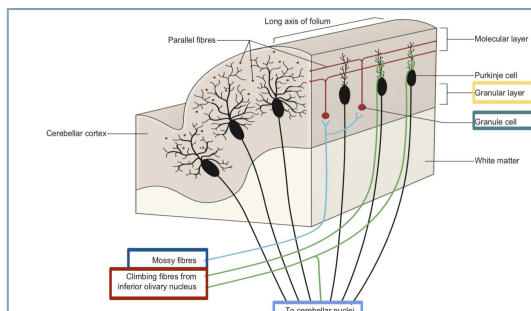
1. The great majority of axons do not leave cerebellum & end in deep cerebellar nuclei **specially Dentate nucleus.**
2. Some of axons leave cerebellum as efferent fibres.

### Efferent Fibres:

Most of efferent fibres are axons of deep cerebellar nuclei.

**Main efferents go to nuclei of brainstem & thalamus :**

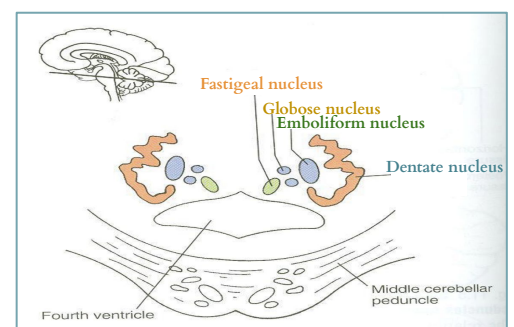
1. Vestibular nuclei (**cerebello-vestibular tract**).
2. Red nucleus (**Dendato-rubro-thalamic tract**).
3. Ventral lateral nucleus of thalamus (**Dendato-thalamic tract**).



Deeply seated nuclei in white matter:

from medial to lateral:

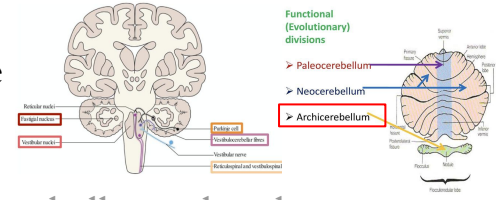
1. **Fastigeal nucleus:** smallest one.
2. **Globose nucleus.**
3. **Emboliform nucleus.**
4. **Dentate nucleus:** largest one.



# Functional Subdivisions of the Cerebellum

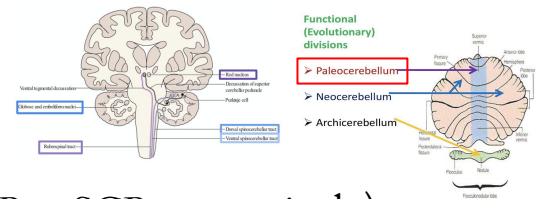
## 1 ARCHICEREBELLUM

- **Vestibular Part of cerebellum:** flocculonodular lobe
- **Nuclei:** fastigial
- **Afferents:** from vestibular nuclei (Vestibulocerebellar fibers), (through ICP) "inferior cerebellar peduncle"
- **Efferents:** cortical (purkinje cell) Fiber's 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 Vestibulo-ocular Reflex).



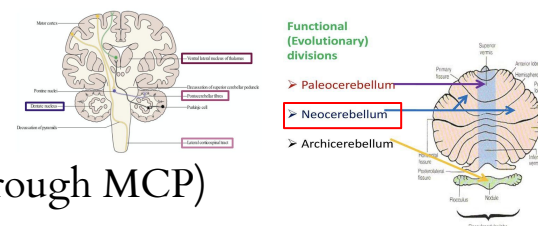
## 2 PALEOCEREBELLUM

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



## 3 NEOCEREBELLUM

- **Cerebral part of cerebellum:** rest of cerebellum
- **Nuclei:** dentate
- **Afferents:** from pons (Pontocerebellar fibers) (through MCP) "middle cerebellar peduncle"
- **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 tremor (on performing voluntary movements)
  2. Incoordination of leg: unsteady gait
  3. Incoordination of eye movements: nystagmus
  4. Slowness of speech: dysarthria (**difficulty of speech**)



## Summary

- **Anatomically**, the cerebellum is divided into:
  - anterior, posterior & flocculonodular lobes.
- **Developmentally & functionally**, it is divided into: archi- paleo- & neocerebellum.
- **Archicerebellum (flocculonodular lobe)** is the **oldest** part of cerebellum, related to fastigial nucleus, connected to vestibular nuclei & concerning for control of body balance.
- **Paleocerebellum (vermis & paravermis)** is related to **globose & emboliform** nucleus, connected to **spinal cord & red nucleus** & concerning for regulation of posture & muscle tone.
- **Neocerebellum (most of human cerebellum)** is related to **dentate** nucleus, connected to **pons, thalamus**. Its final destination is to motor cortex. It is concerned with coordination of voluntary movements.
- Cerebellar lesions lead to **ipsilateral** incoordination (ataxia).

# MCQs

Q1. Which one of the following nuclei is **related** to neocerebellum?

Female Slides

A. Fastigial nucleus

B. Dentate nucleus

C. Globose nucleus

D. Emboliform nucleus

Q2. To which part of the CNS the flocculonodular lobe send its efferent fibers?

Male Slides

Female Slides

A. Red nucleus

B. Pons

C. Vestibular nuclei

D. Motor cortex

Q3. The largest nucleus in the cerebellum can be seen by naked eye is:

Female Slides

A. Fastigial nucleus

B. Globose nucleus

C. Dentate nucleus

D. Emboliform nucleus

Q4. Which part in cerebellum is concerned with coordination of movement?

Female Slides

A. Vermis

B. Paravermis

C. flocculonodular lobe

D. Neocerebellum

Q5. Which nucleus contribute to the balance function of cerebellum?

Female Slides

A. Dentate nucleus

B. Fastigial nucleus

C. Globose nucleus

D. Emboliform nucleus

Q6. Which one of the following nucleus is related to archicerebellum?

Male Slides

A. Fastigeal nucleus

B. Dentate nucleus

C. Globose nucleus

D. Emboliform nucleus

A1. B A2. C A3. C A4. D A5. B A6. A

**FOR ANKI FLASHCARDS**





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