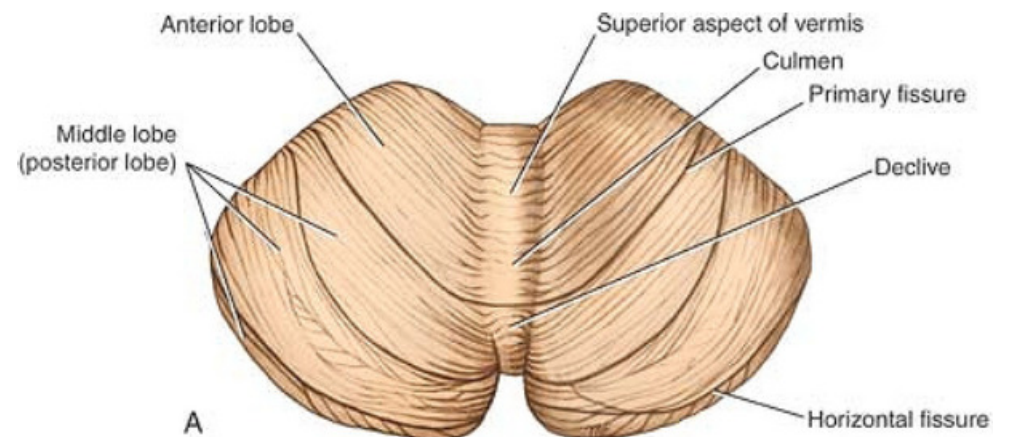
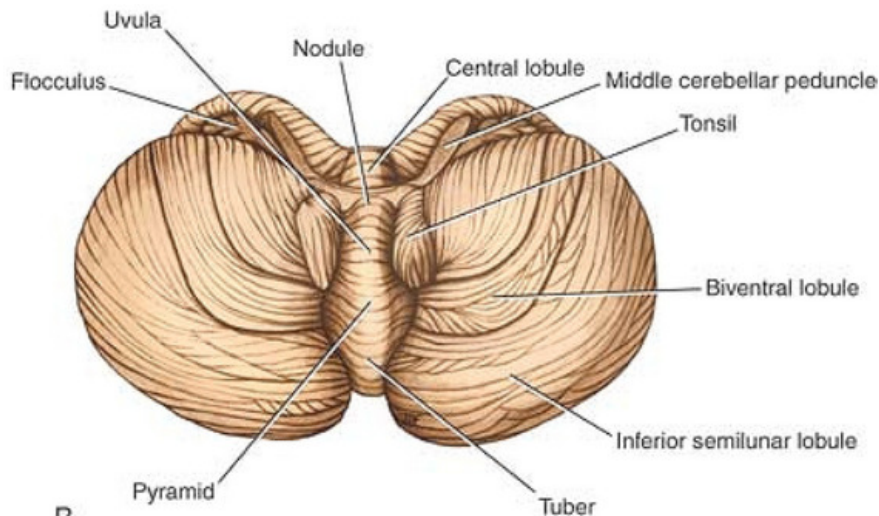
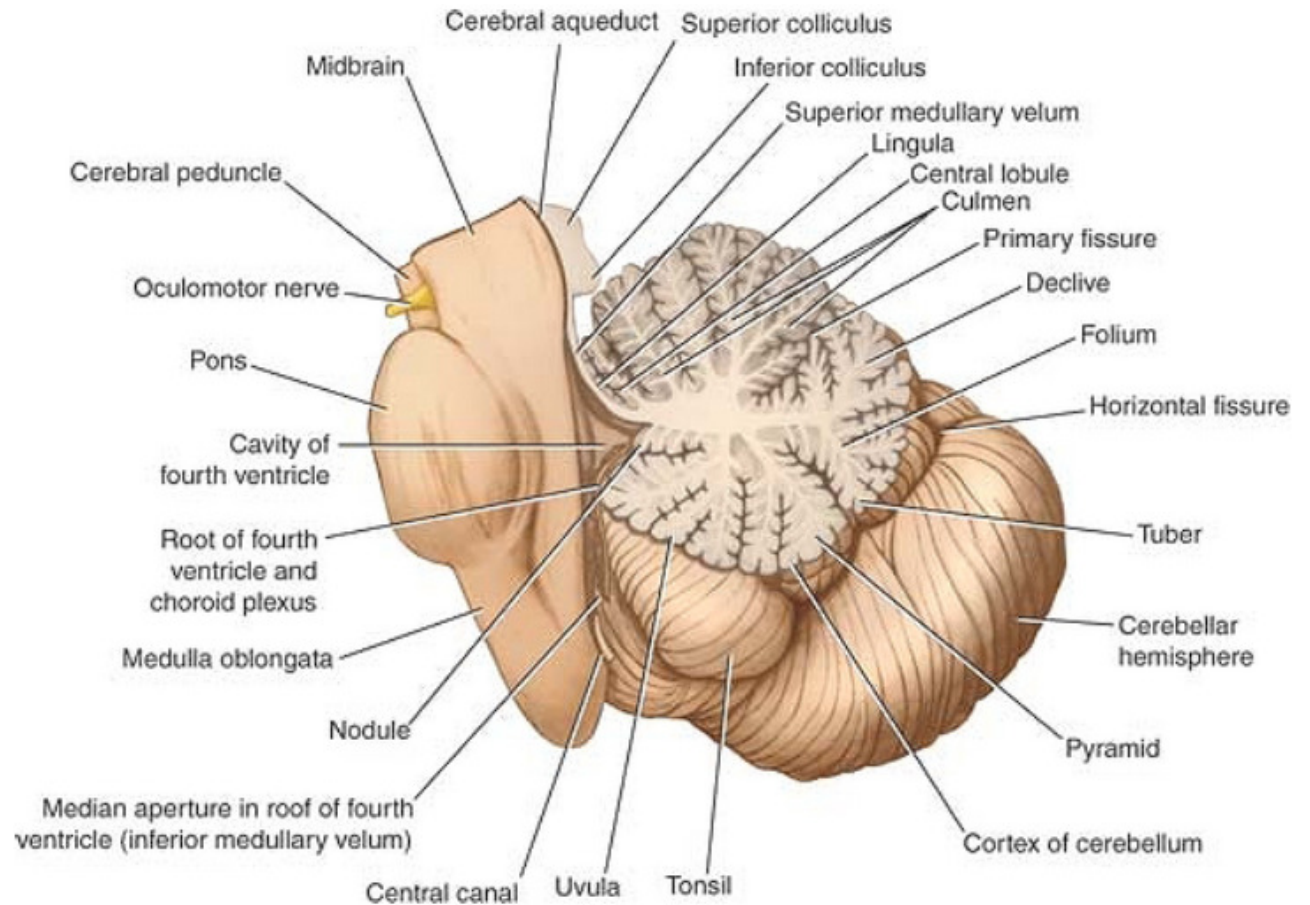


# The Cerebellum

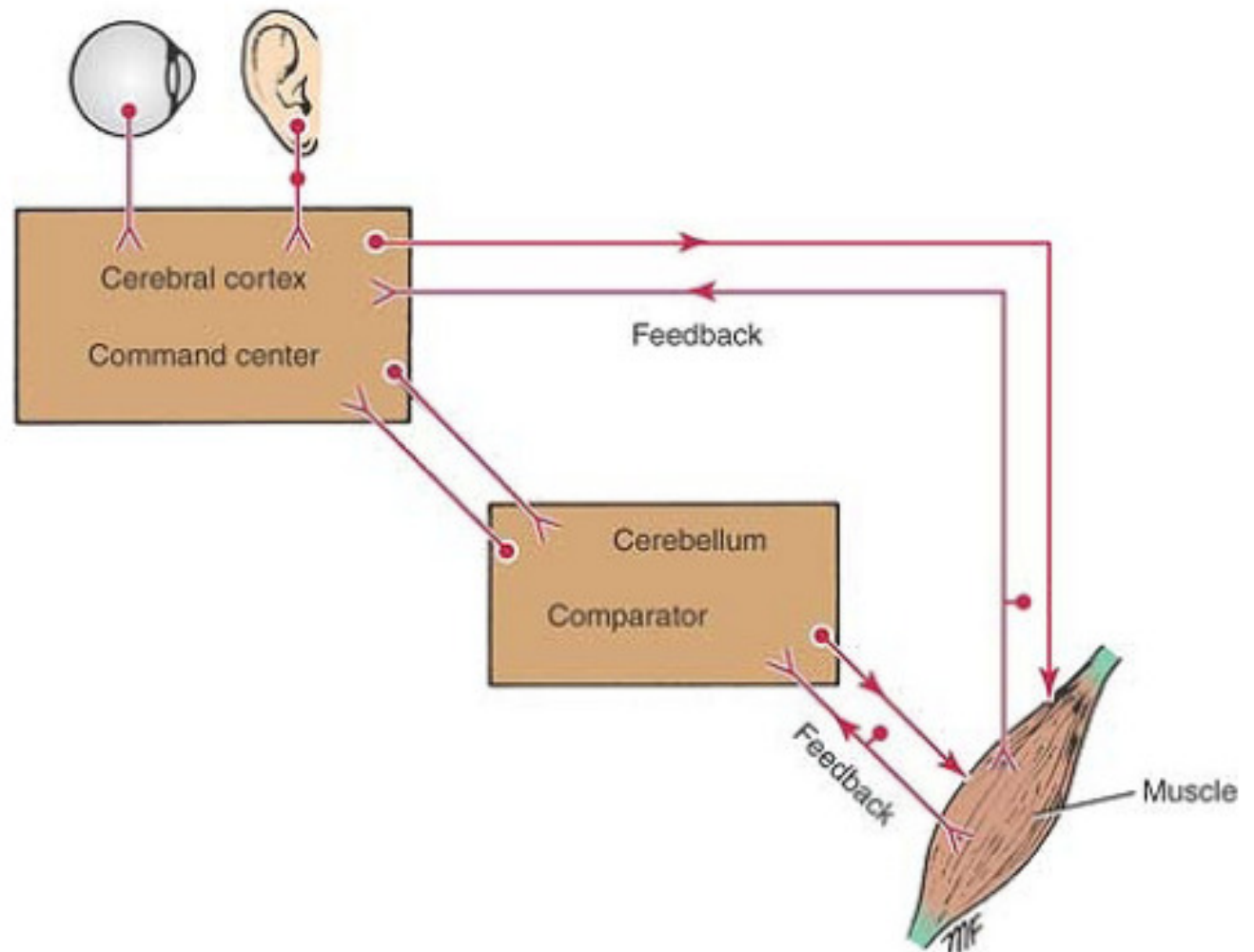
# Cerebellum

- Located below tentorium cerebelli within posterior cranial fossa.
- Formed of 2 hemispheres connected by the vermis in midline.
- Gray matter is external.
- White matter is internal, contain several deep nuclei with the largest is the dentate nucleus.



# Functions of Cerebellum

- Maintenance of posture and balance.
- Maintains muscle tone.
- Coordinates voluntary motor action.



# Cerebellum

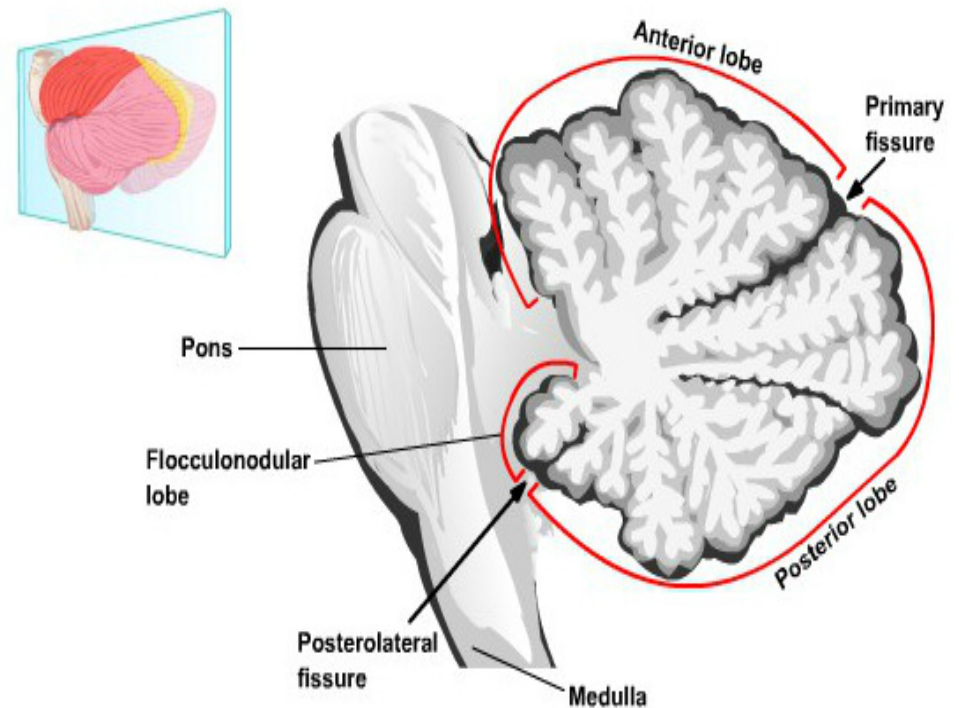
## Three lobes

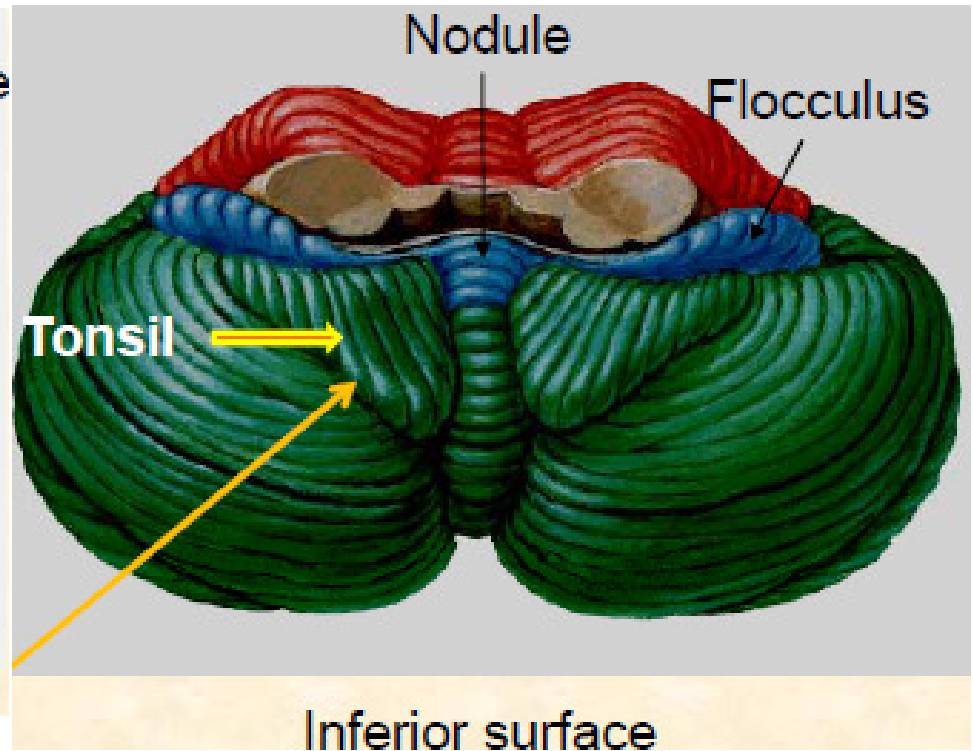
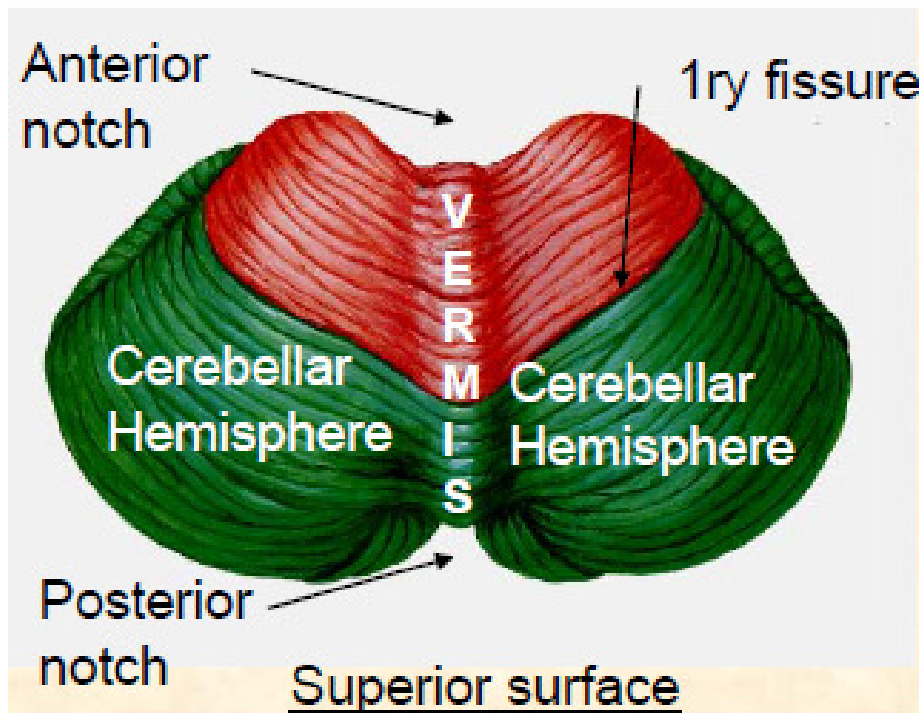
1. Anterior lobe
2. Posterior lobe
3. flocculonodular lobe

## Two main fissures:

➤ The **primary fissure** separates the **posterior lobe** from the **anterior lobe**

➤ The **posterolateral fissure** (**uvulonodular fissures**) separates the **flocculonodular lobe** from the **posterior lobe**





➤ **Anterior and Posterior notches**

➤ **Primary fissure:** separates the anterior & posterior lobes.

➤ **Horizontal fissure:** Extends between the middle cerebellar peduncles

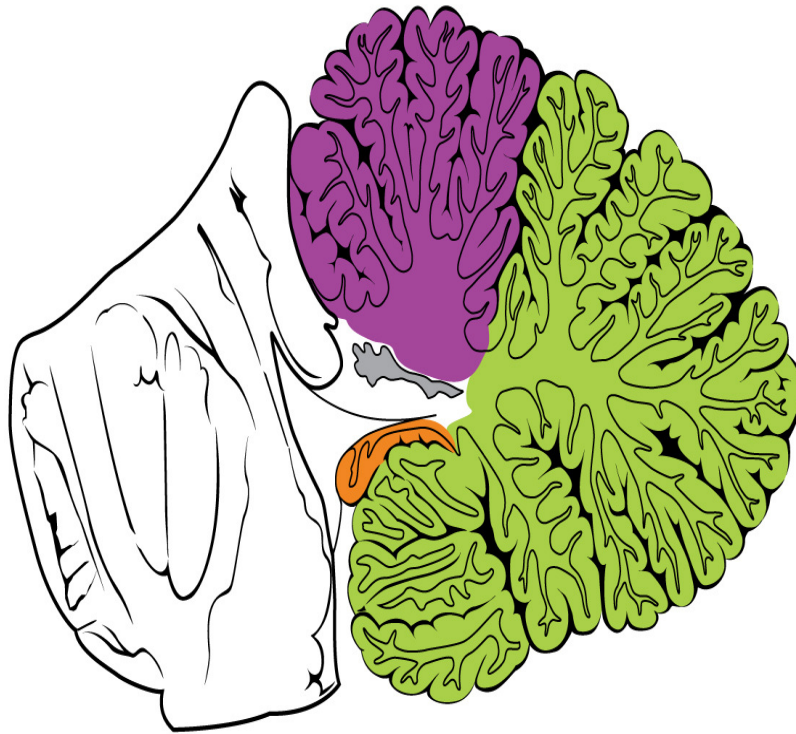
➤ **Posterolateral fissure:** Separates the flocculus and nodule from the rest of the cerebellum.

➤ **Cerebellar tonsil :** on either sides of uvula

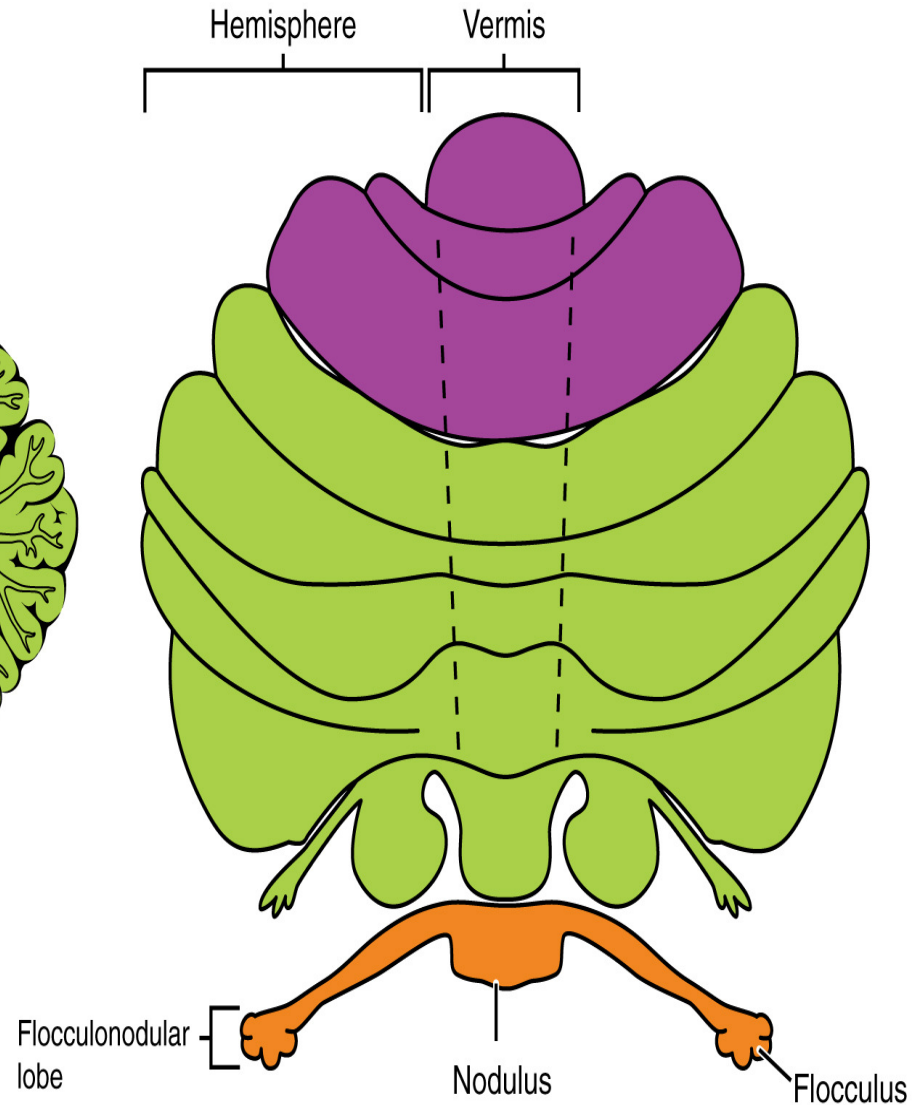
➤ **Retrotonsillar fissure :** separates tonsil from the rest of cerebellum



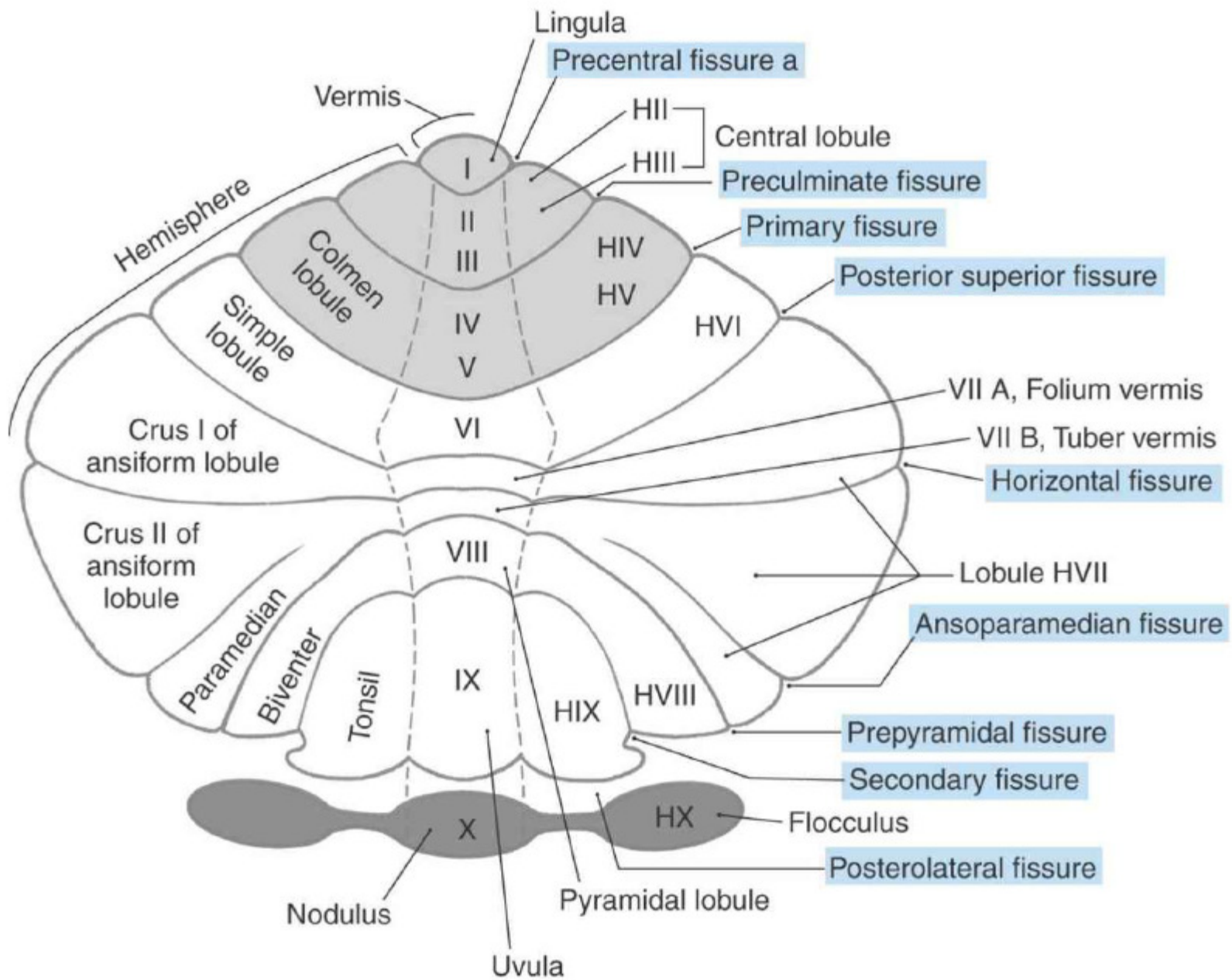
Midsagittal section of cerebellum



Superior view of an "unrolled" cerebellum



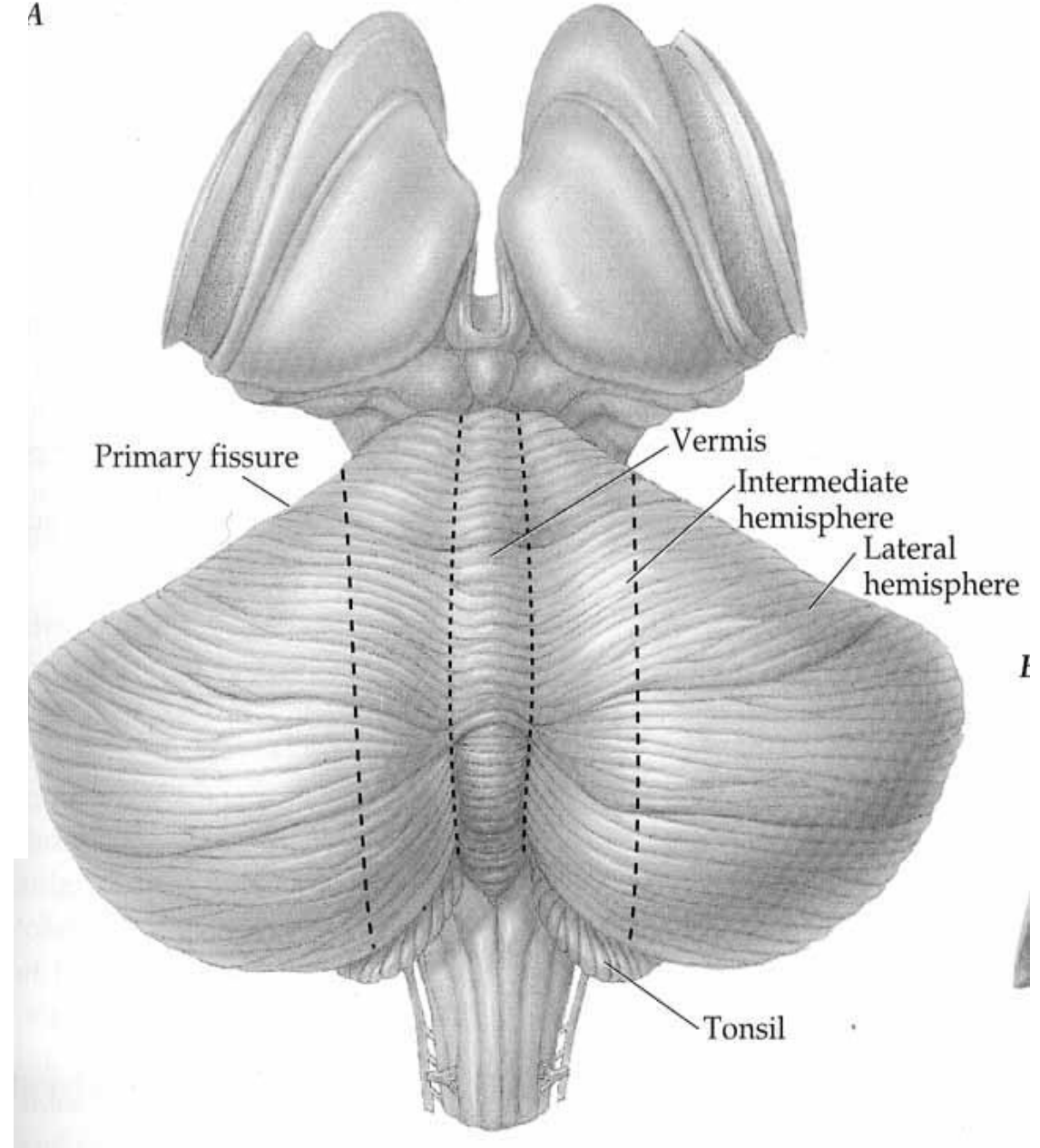
Cortex = organized into groups of folia = 10 lobules and 3 lobes,



Major anatomical divisions (reflecting functional regions)

1. **vermis**
2. **intermediate zone**
3. **lateral hemispheres**

➤no clear morphological borders between the intermediate zone and the lateral hemisphere that are visible from a gross specimen.

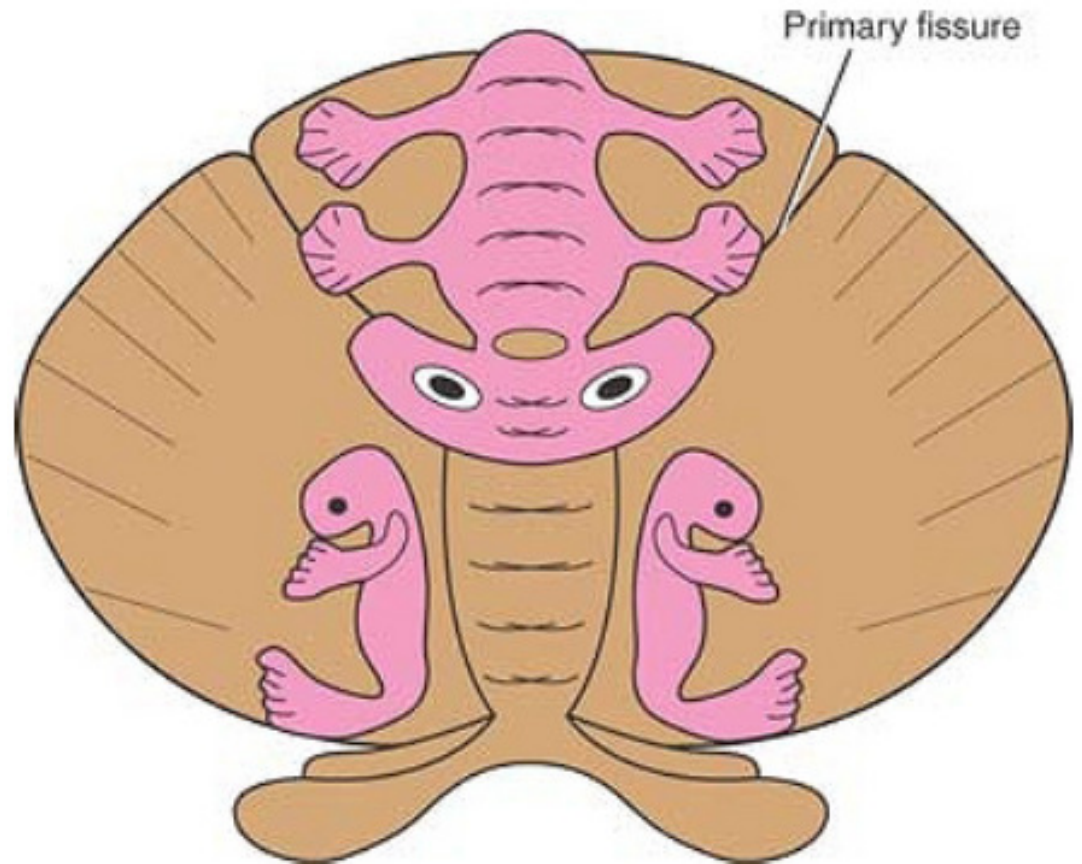




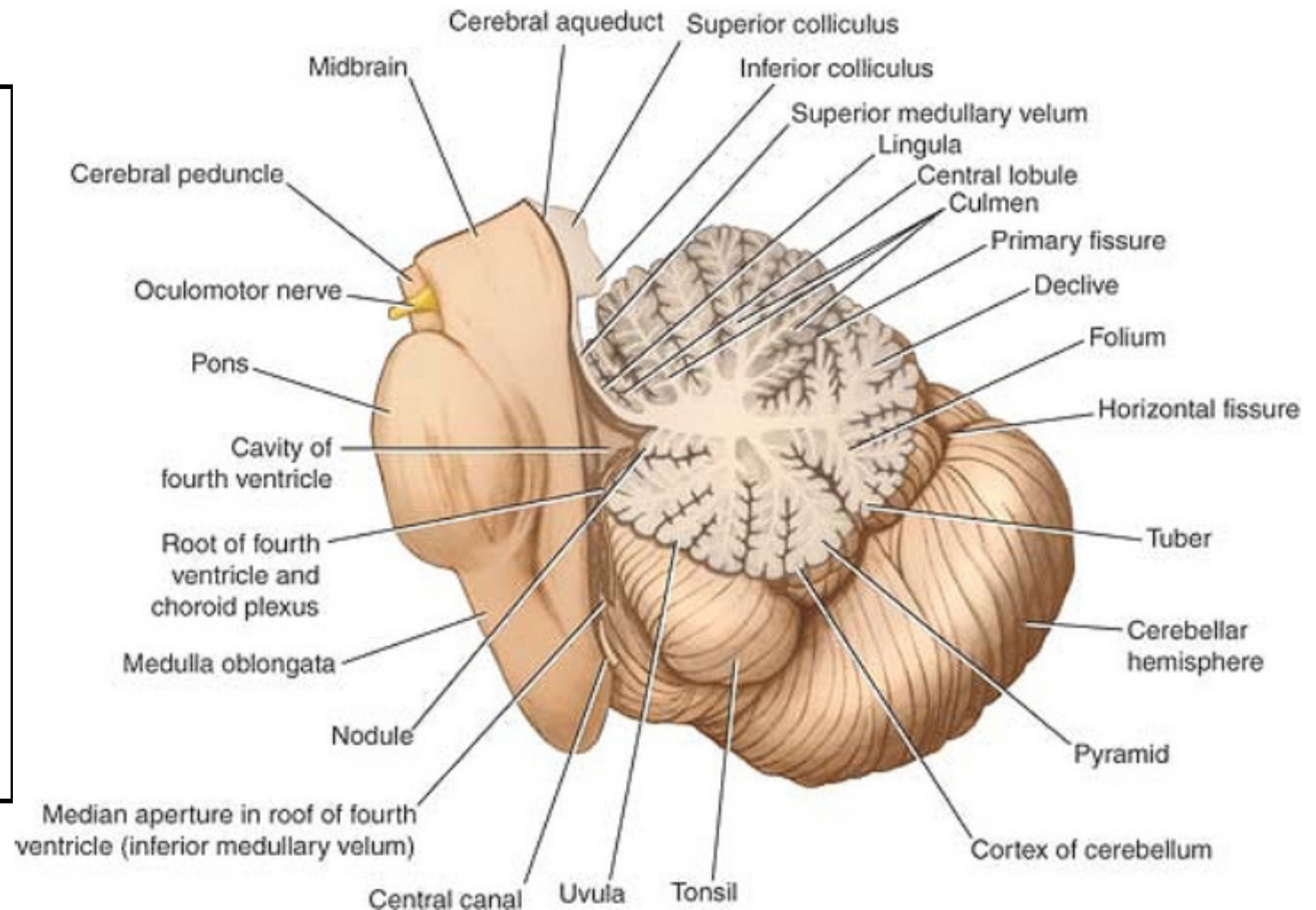
**Vermis** : influences the movements of the long axis of the body  
(neck, shoulders, thorax, abdomen and hips)

**Intermediate zone**: control muscles of the distal parts of the limbs  
(hand and feet)

**Lateral zone**: concerned with planning of sequential movements of the entire body



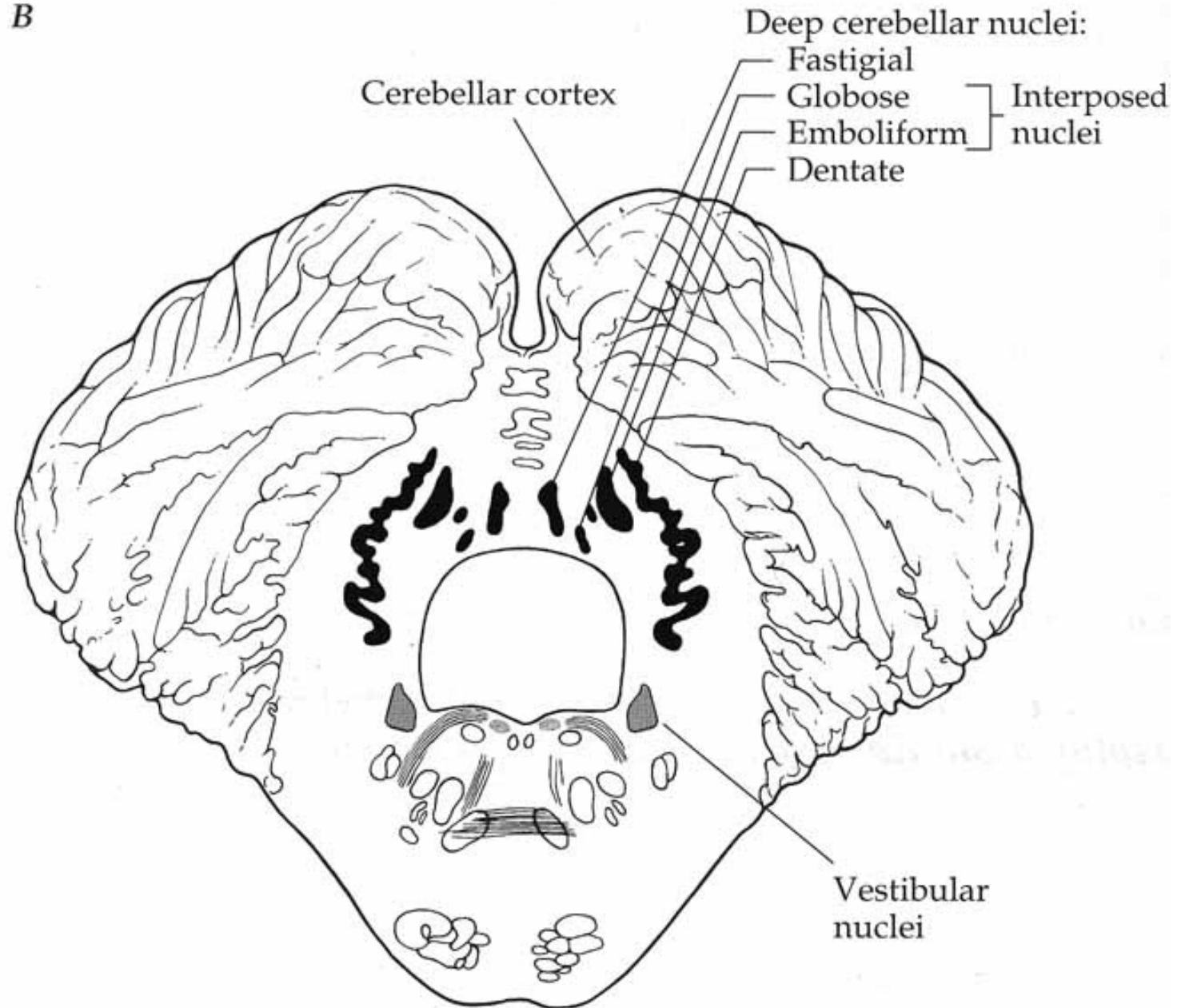
The cerebellum is composed of an outer covering of gray matter called the **cortex** and inner white matter Embedded in the white matter of each hemisphere three masses of gray matter forming the **intracerebellar nuclei**



Each ridge or gyrus in cerebellar cortex is called a **folium**, with a branched appearance called the **arbor vitae** (white matter)

# Deep cerebellar Nuclei

*B*





# Structure of cerebellar cortex

## 1- molecular layer

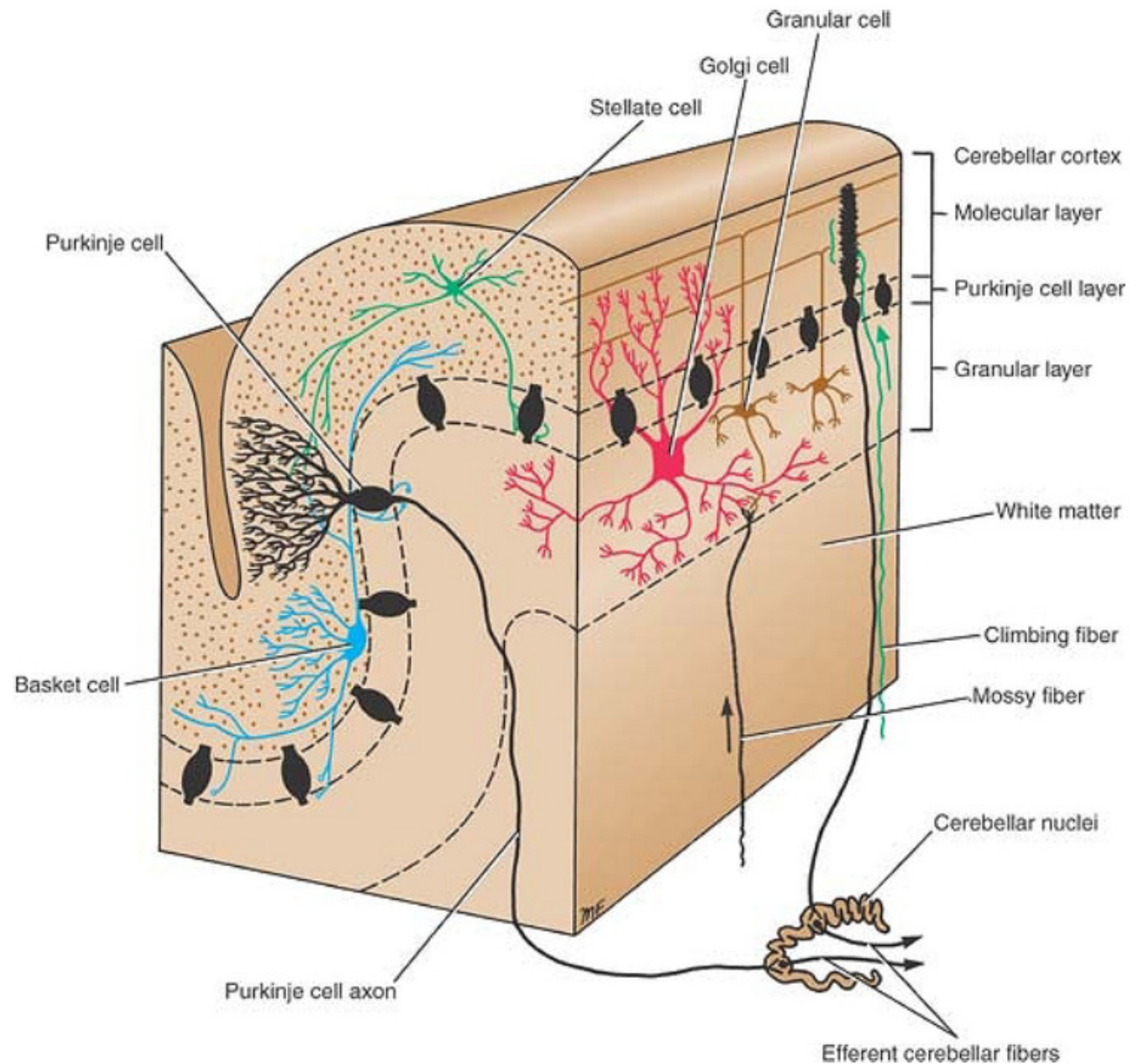
- stellate cell
- basket cell
- consisting of axons of granule cells (parallel fibers) and dendrites of Purkinje cells

## 2- Purkinje cell layer

- large neuronal cell bodies (Purkinje cells) Flask shaped cells

## 3- granular layer

- small neurons called granular cells
- Golgi cells: (Inhibitory)



# Cerebellar cortical mechanisms

**Input** to the cerebellar cortex:

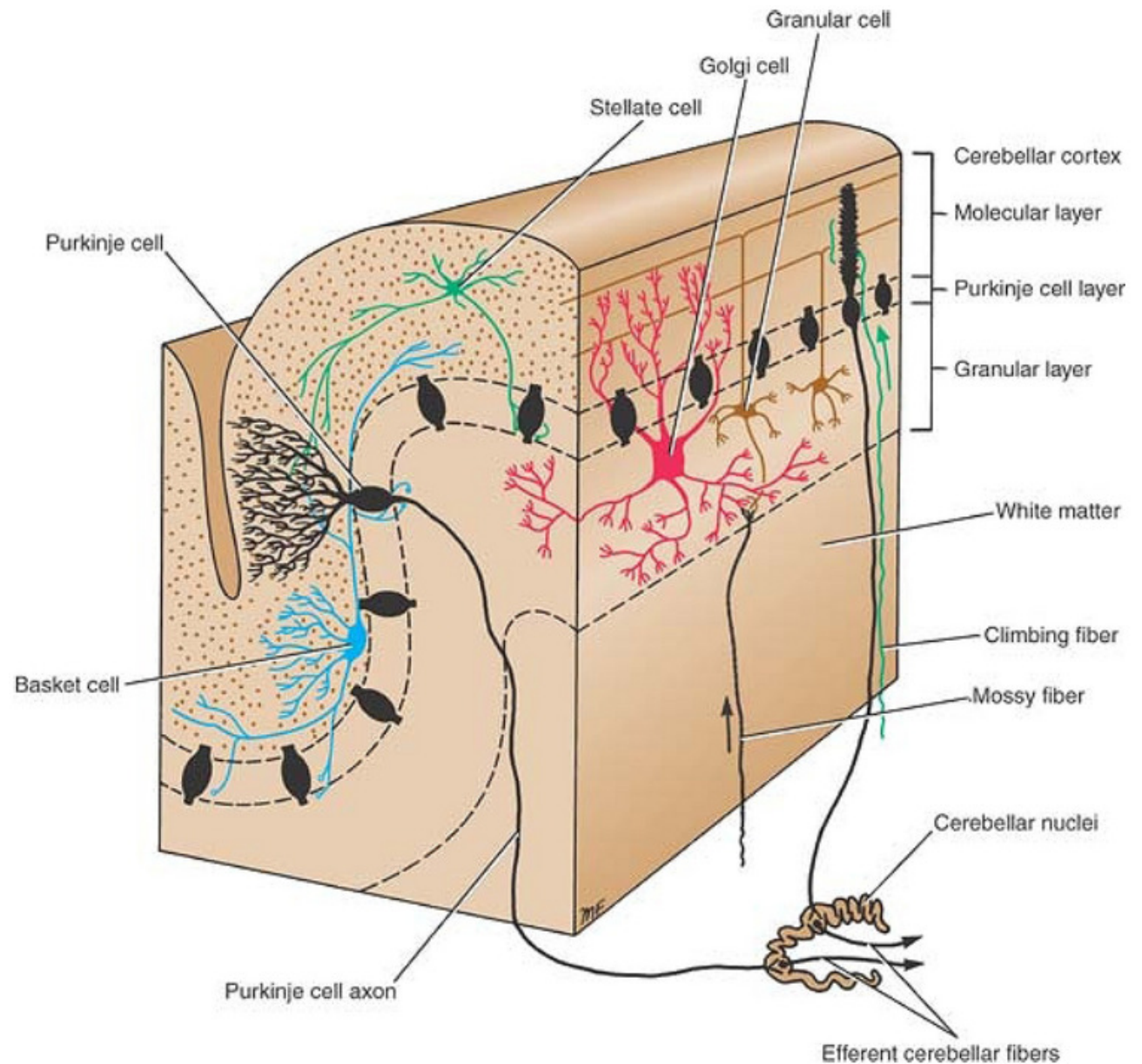
**1- Climbing fibers:**

terminal fibers of the olivocerebellar tracts

**2- Mossy fibers:**

terminal fibers of all other cerebellar afferent tracts

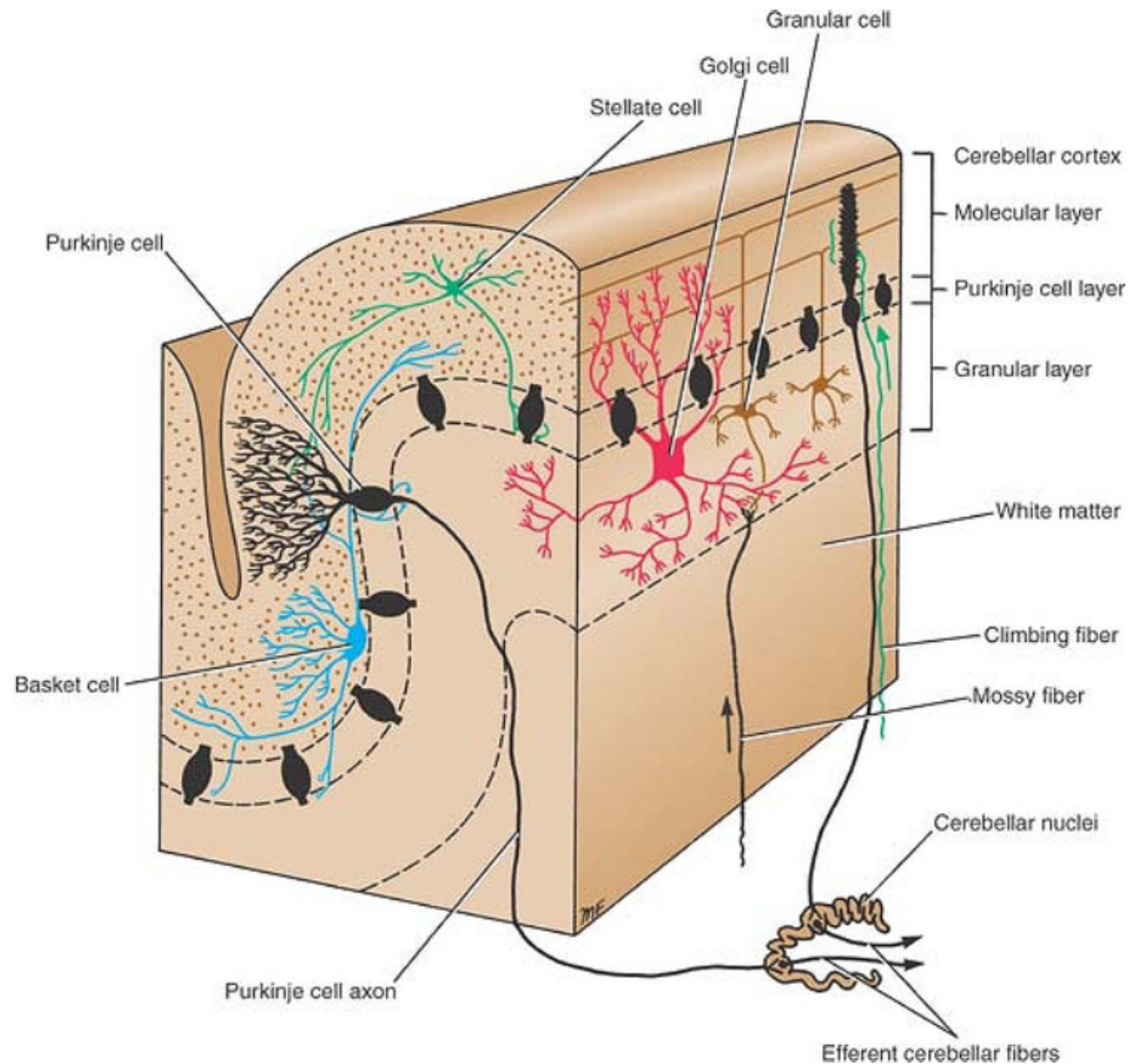
Both are **excitatory** to purkinje cells





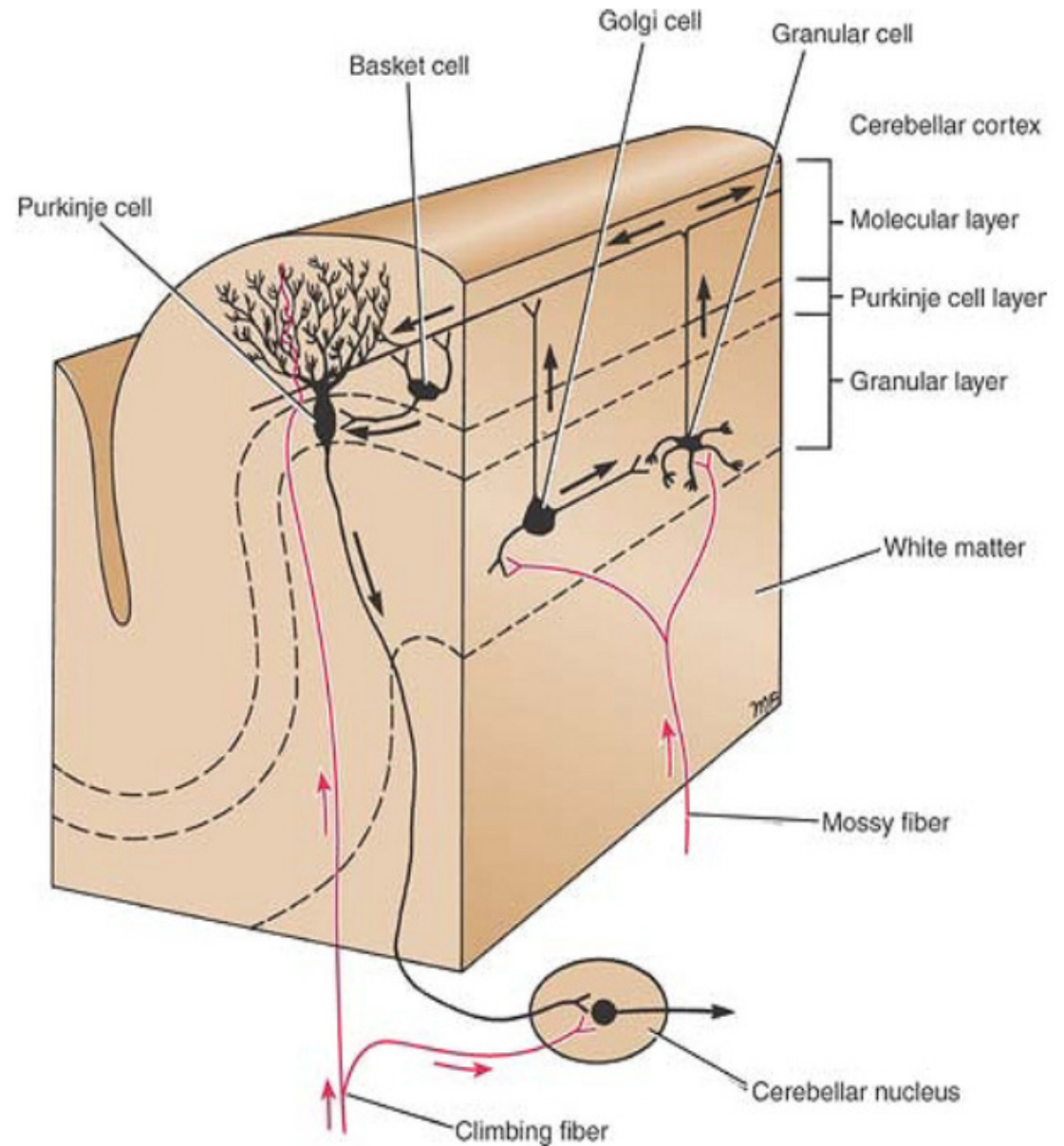
# Cerebellar cortical mechanisms

- a single purkinje neuron makes synaptic contact with only one climbing fiber
- one climbing fiber makes contact with one to ten purkinje neurons
- a single mossy fiber may stimulate thousands of purkinje cells through the granule cells
- Granule cells receive input from mossy fibers and project to the Purkinje cells



## Cerebellar cortical mechanisms

1. Purkinje Cells - the only output neuron from the cortex utilizes GABA to inhibit neurons in deep cerebellar nuclei
2. Granule Cells- intrinsic cells of cerebellar cortex; use glutamate as an excitatory transmitter; excites Purkinje cells via axonal branches called “parallel fibers”
3. Basket Cells and stellate cells- inhibitory interneuron; utilizes GABA to inhibit Purkinje cells

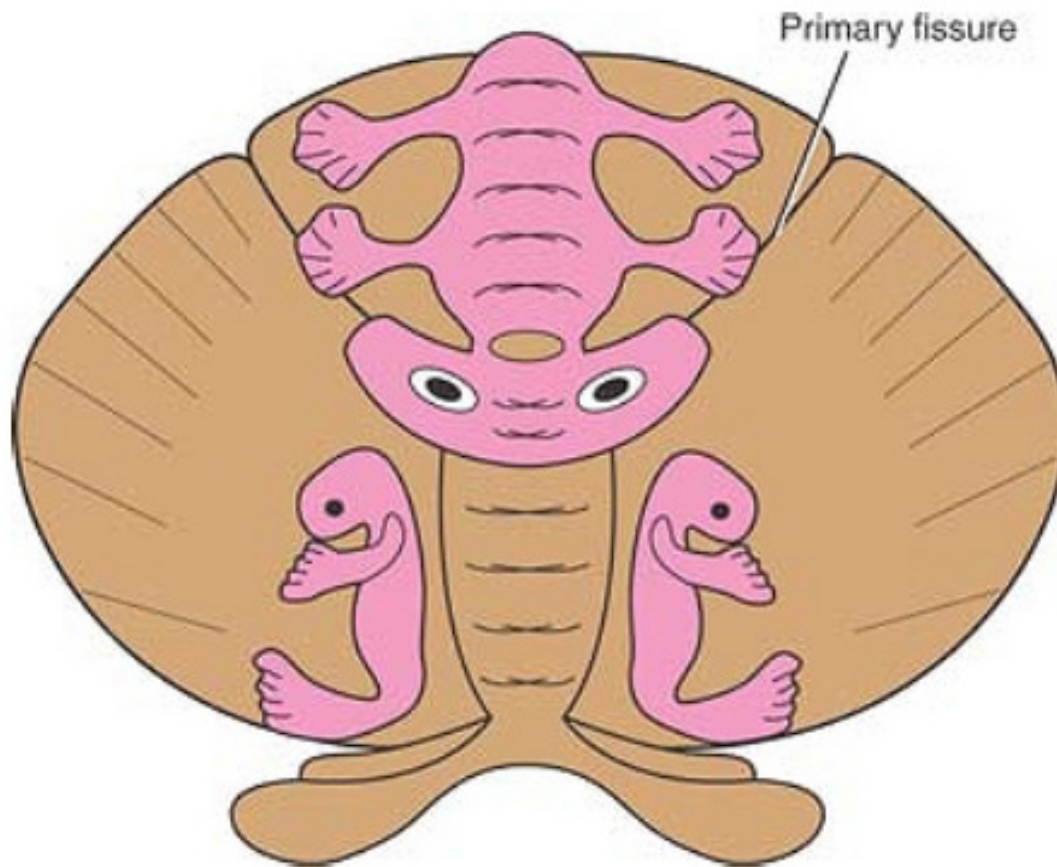


## Functional anatomy

A. Spinocerebellum

B. Cerebrocerebellum

C. Vestibulocerebellum





# Vestibulocerebellum

## ➤ Archicerebellum

➤ small flocculonodular cerebellar lobes and adjacent portions of the vermis

# Spinocerebellum

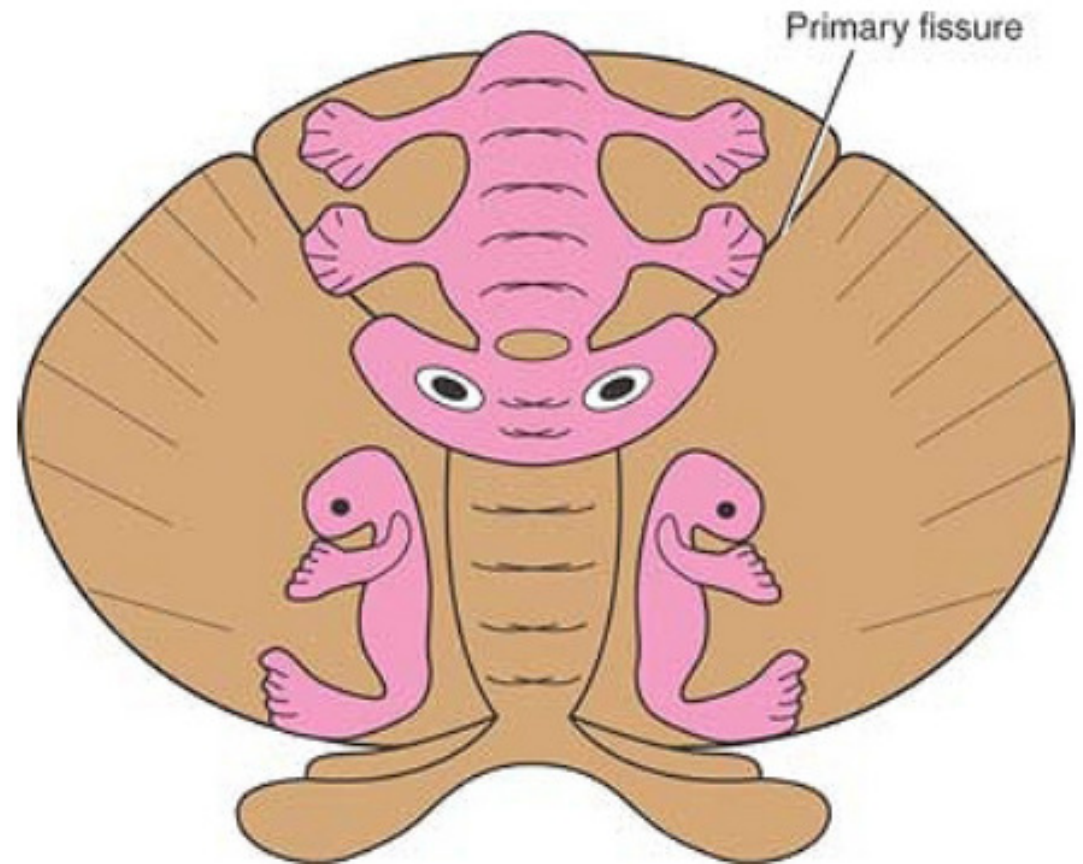
## ➤ Paleocerebellum

➤ most of the vermis of the posterior and anterior cerebellum plus the adjacent intermediate zones on both sides of the vermis.

# Cerebrocerebellum

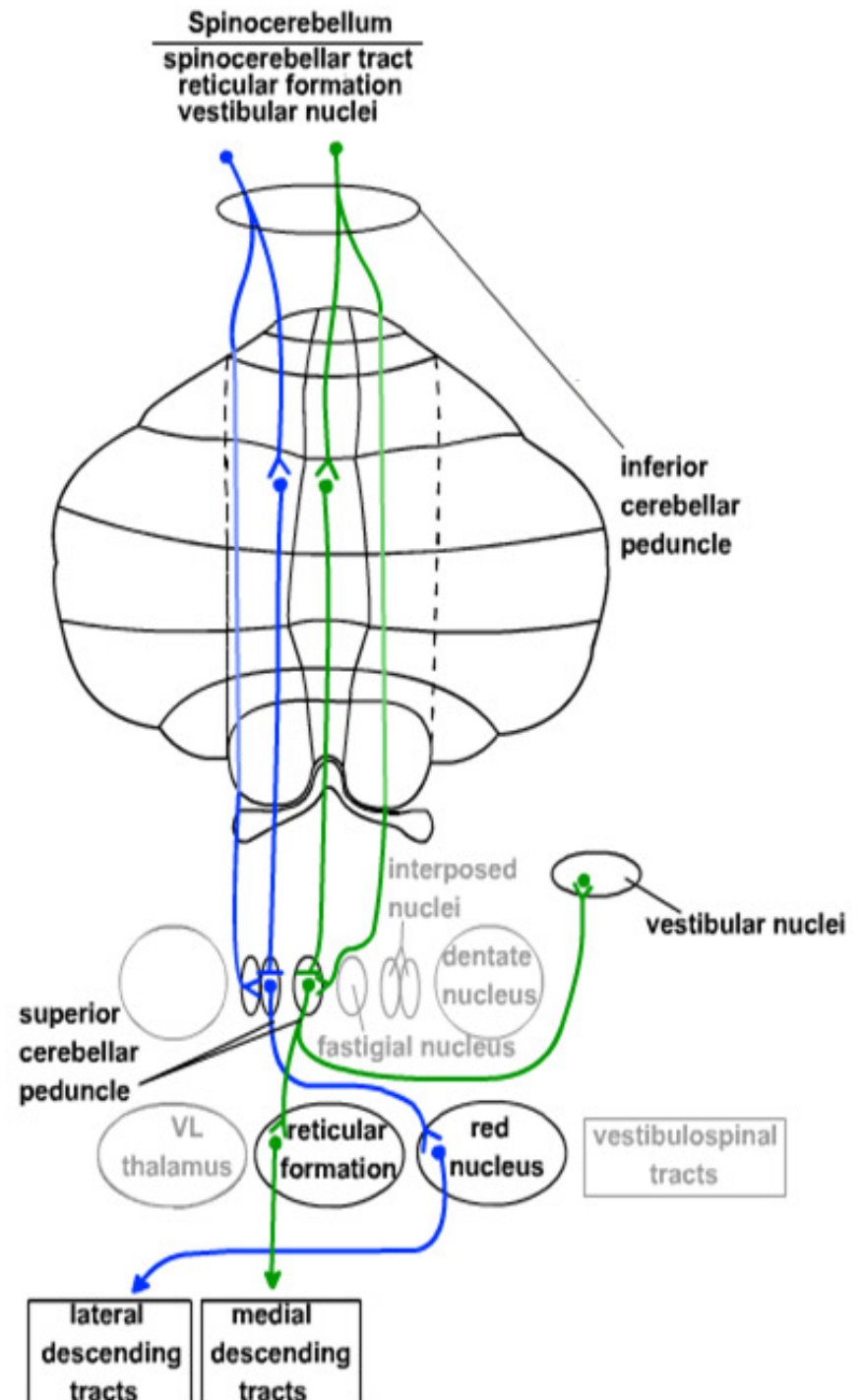
## ➤ neocerebellum

➤ lateral zones of the cerebellar hemispheres, lateral to the intermediate zones



# Spinocerebellum

- comprises the vermis + intermediate hemisphere of the cerebellar cortex, as well as the **fastigial** and **interposed nuclei**.
- projects through fastigial and interposed nuclei.
- has a somatotropic organization.
- it receives major inputs from the spinocerebellar tracts.
- Its output projects to rubrospinal, vestibulospinal, and reticulospinal tracts
- It is involved in the integration of sensory input with motor commands to produce adaptive motor coordination
- controls posture and movement of trunk and limbs.





# Spinocerebellum

the **vermis** will send efferents through fastigial n.

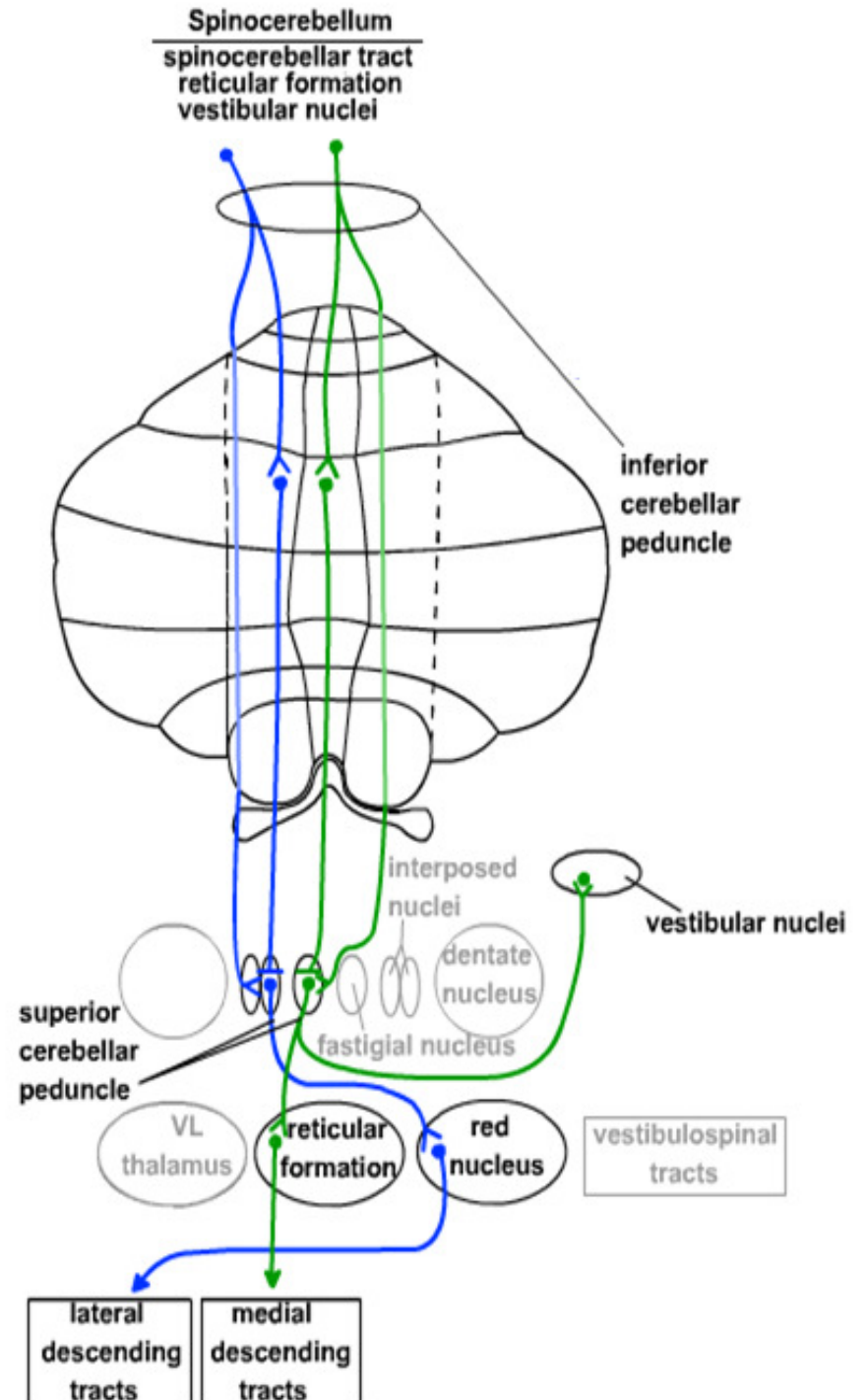
Inferior cerebellar peduncles

Medial descending pathways:  
(Anterior column)  
**A**-fastigial vestibular pathway  
(*vestibulospinal tract*)  
**B**-fastigial reticular pathway  
(*reticulospinal tract*)

VL

1° motor ctx descends

Medial (anterior)  
Corticospinal tract



# Spinocerebellum

The **intermediate hemisphere** will send efferents through interposed n.

Superior cerebellar peduncle

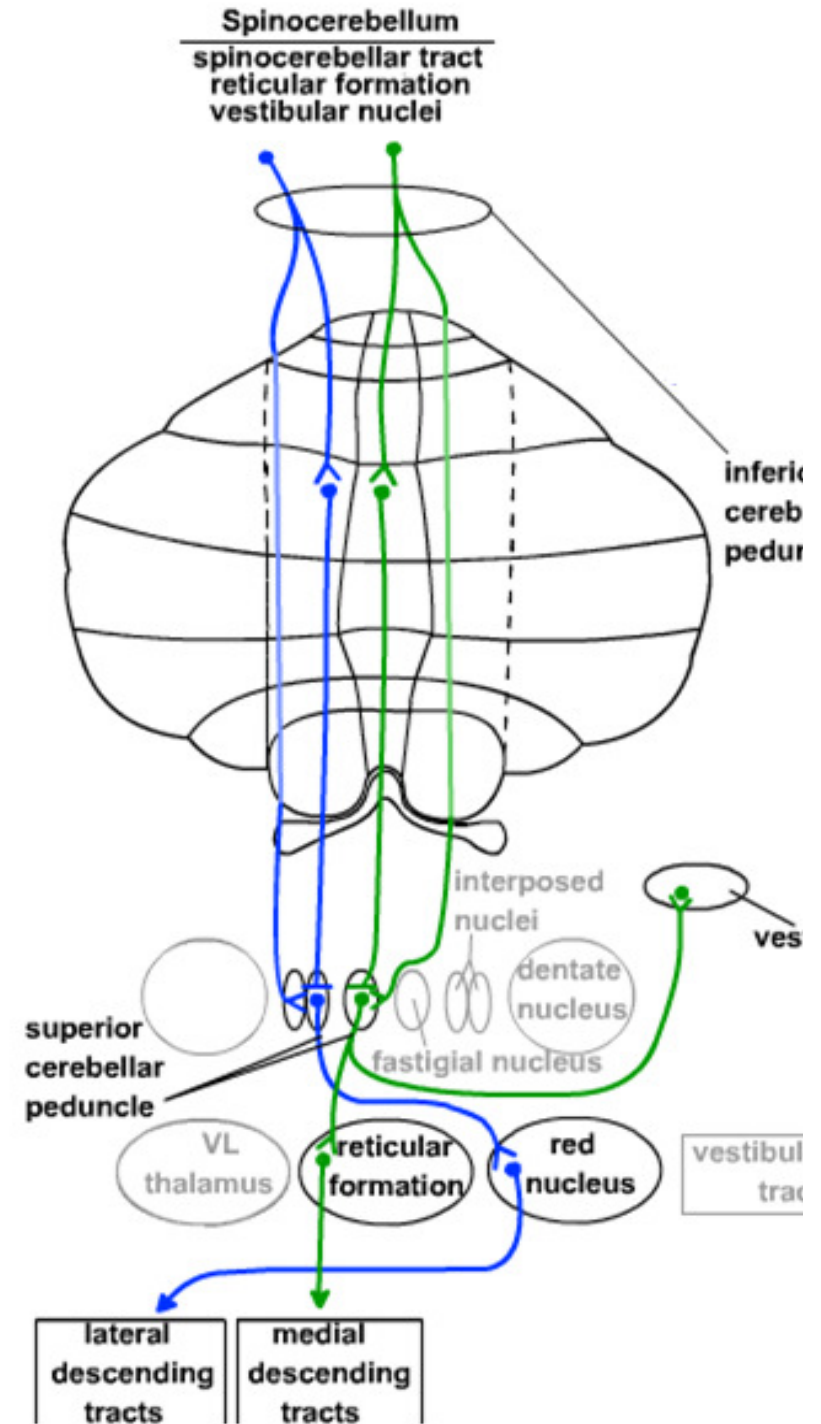
Red nucleus

VL

Globose-emboliform-rubral pathway  
(*Rubrospinal tract*)

1° motor ctx descends

Lateral cortico-spinal tract



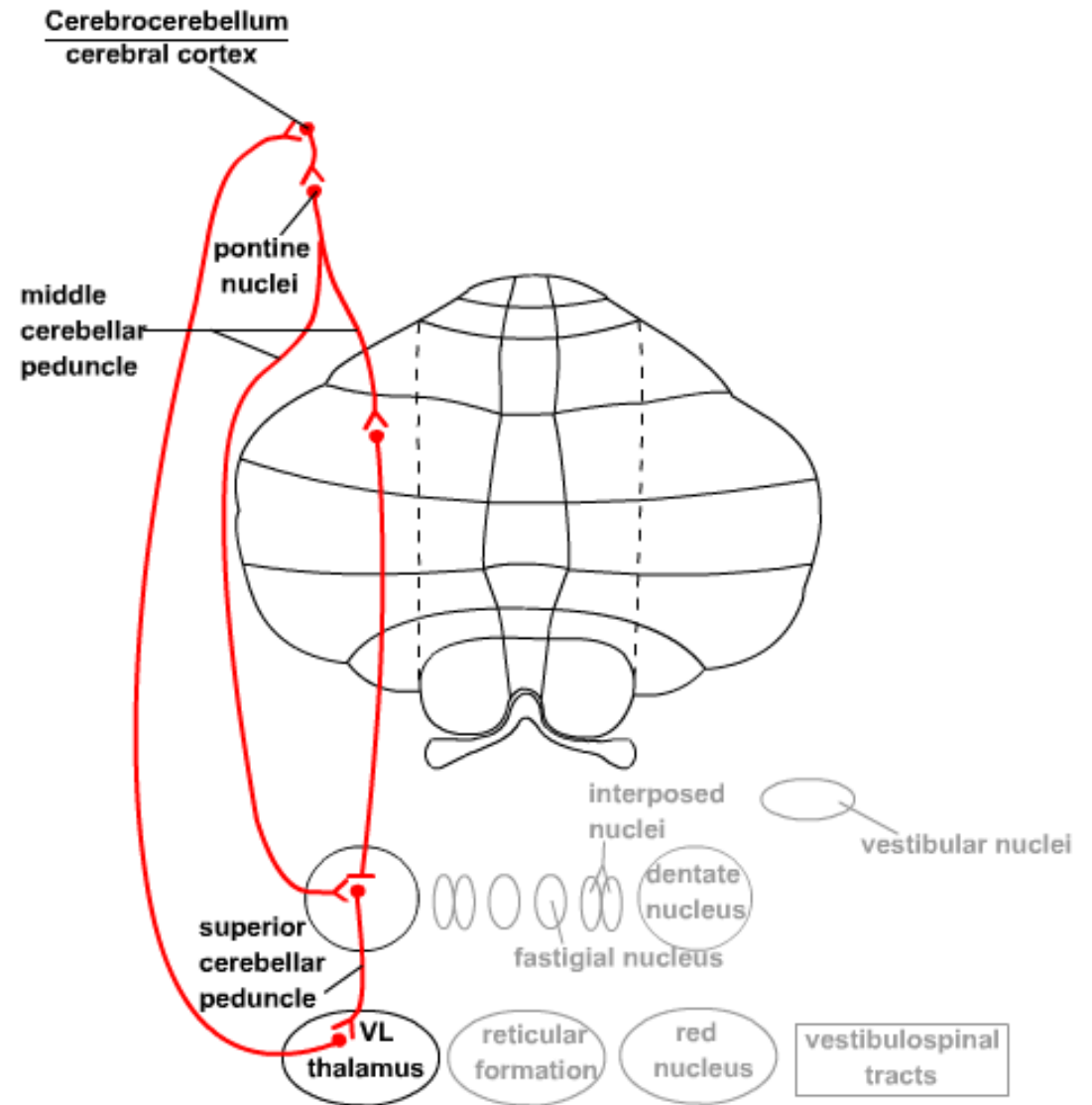
# Cerebrocerebellum

- participates in the planning of movement
- located in the lateral hemisphere
- projects to the dentate nucleus
- from its extensive connections with the cerebral cortex, via the pontine nuclei (afferents) and the VL thalamus (efferents). It is involved in the planning and timing of movements.

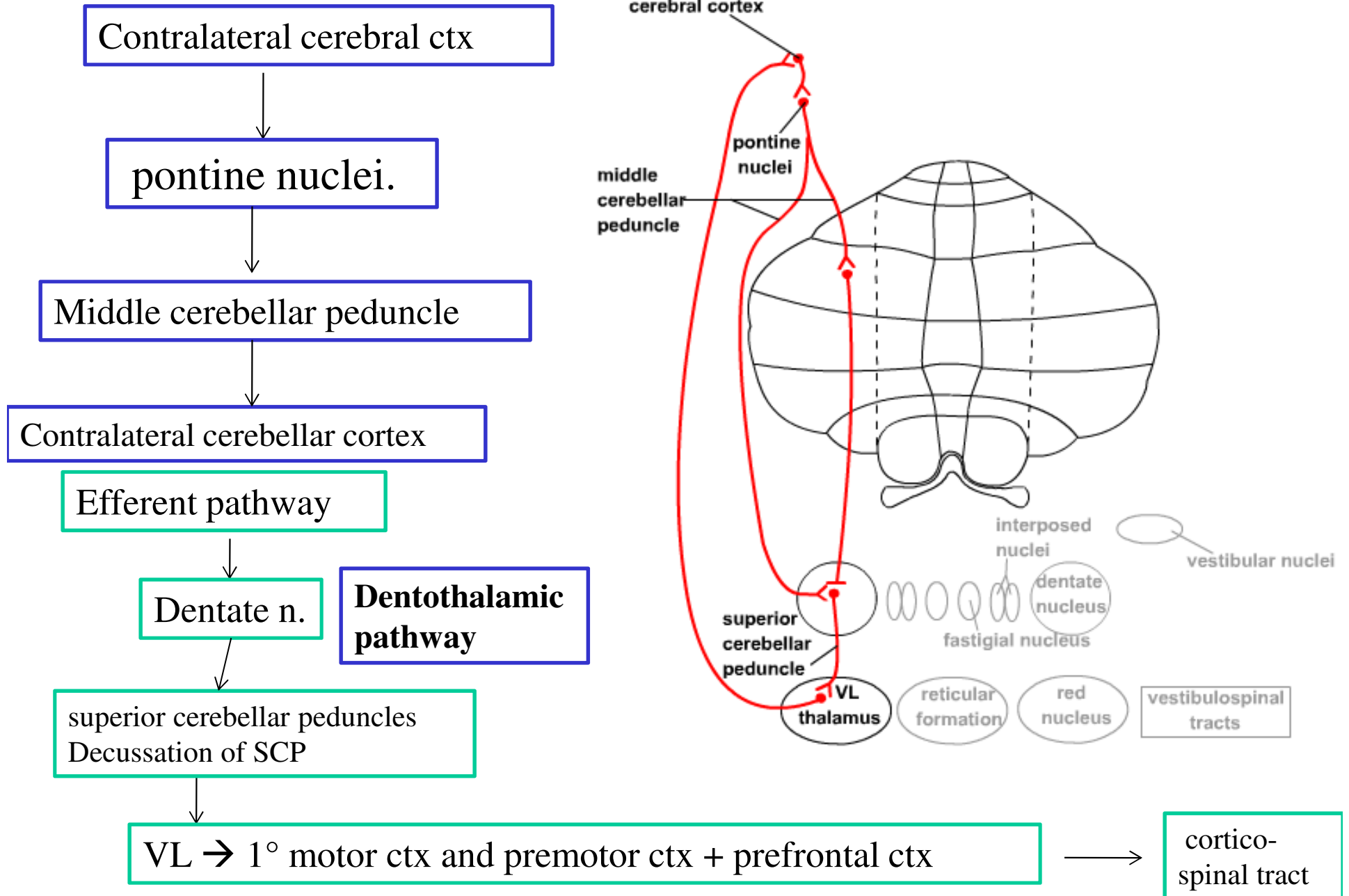
-- **Afferent input** : from entire contralateral cerebral cortex

-- **Efferent pathway** : thalamus

comprising the **lateral hemispheres** and the **dentate nuclei**



# Cerebrocerebellum



# Vestibulocerebellum

- functions in maintaining balance and controlling head and eye movements.
- located in flocculonodular lobe.
- projects to vestibular nuclei.
- it is involved in vestibular reflexes (such as the vestibuloocular reflex) and in postural maintenance.

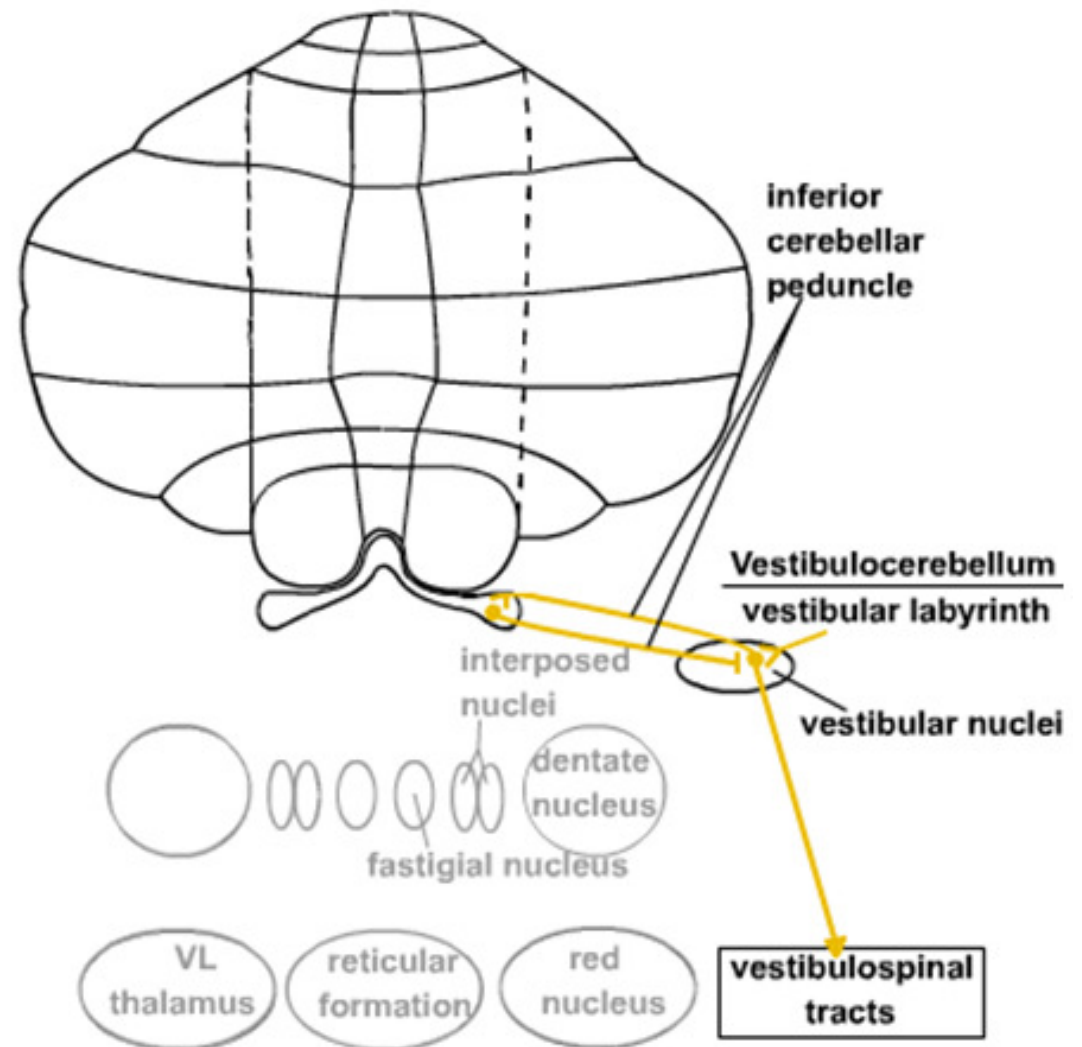
## Afferent input:

vestibular nerve and vestibular nuclei.

## Efferent path

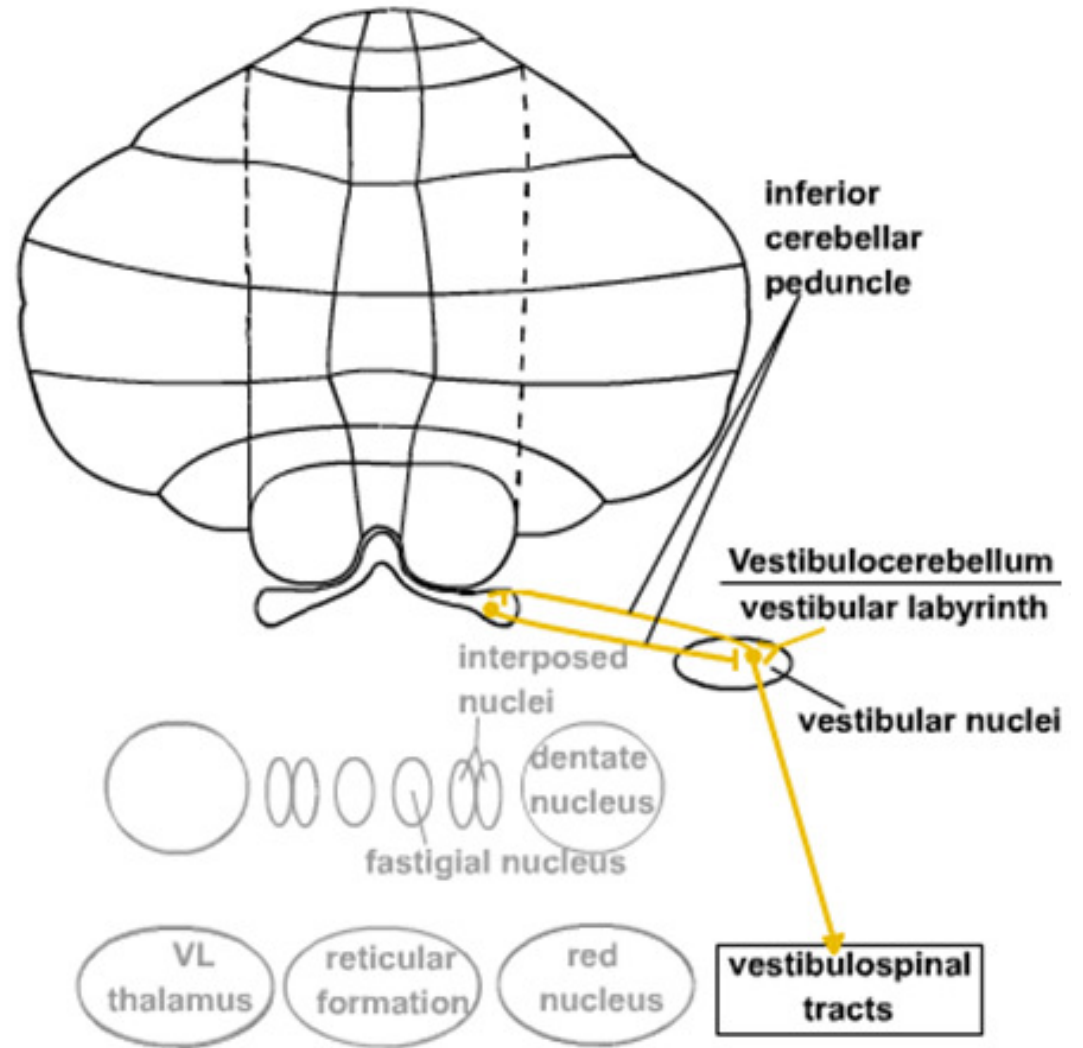
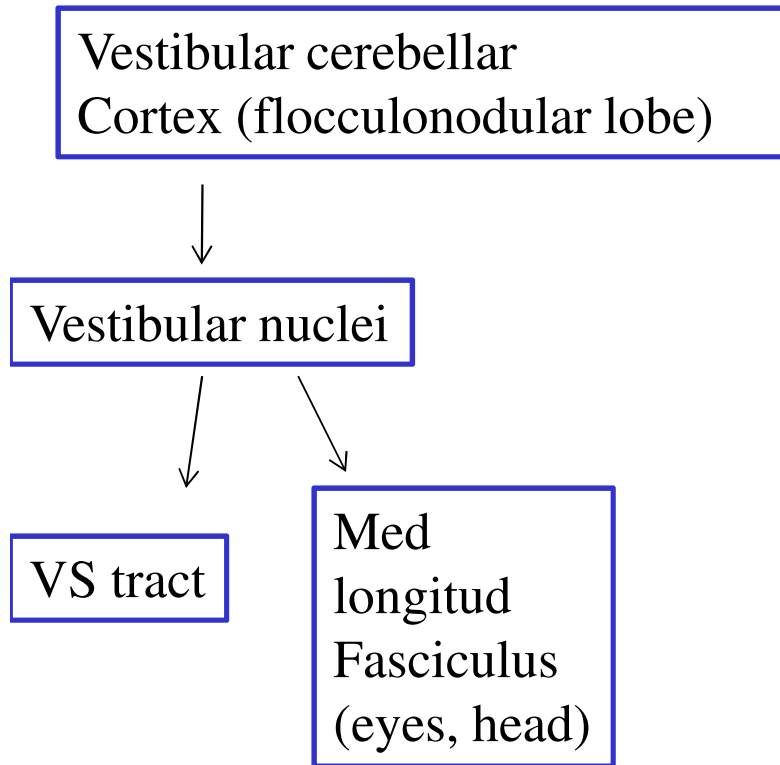
**vestibular nuclei**

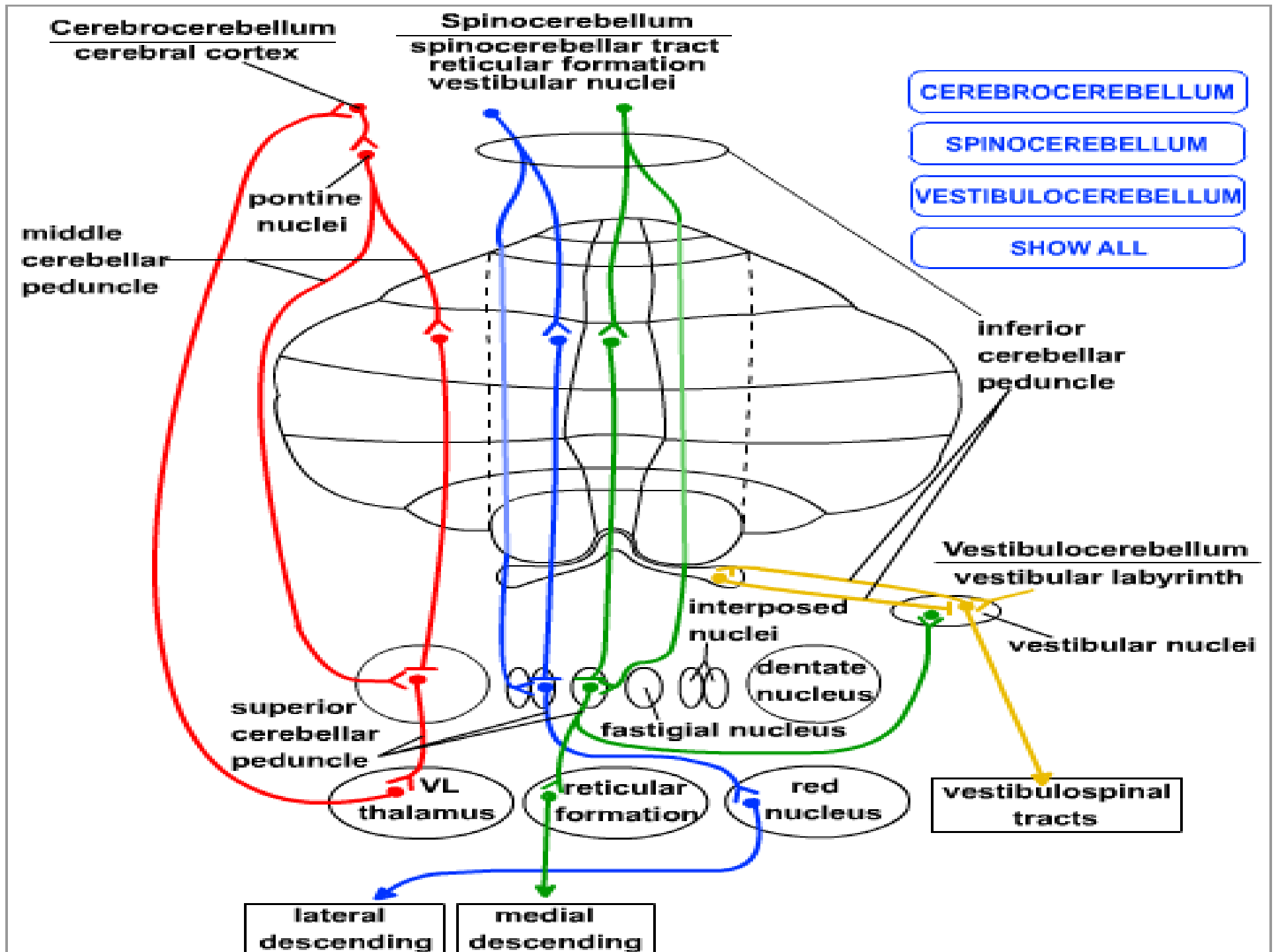
comprises the **flocculonodular lobe** and its connections with the **lateral vestibular nuclei**



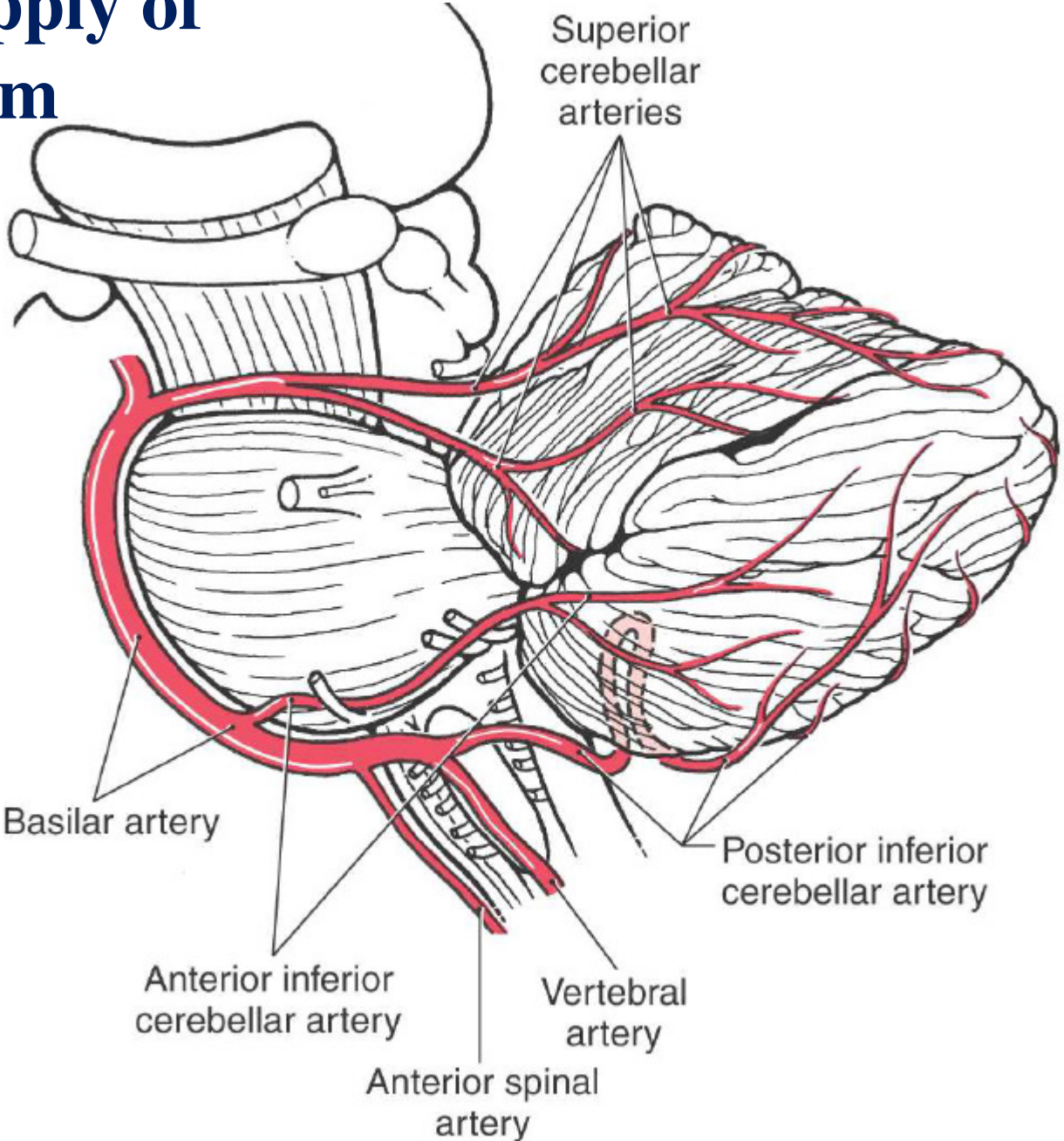


# Vestibulocerebellum



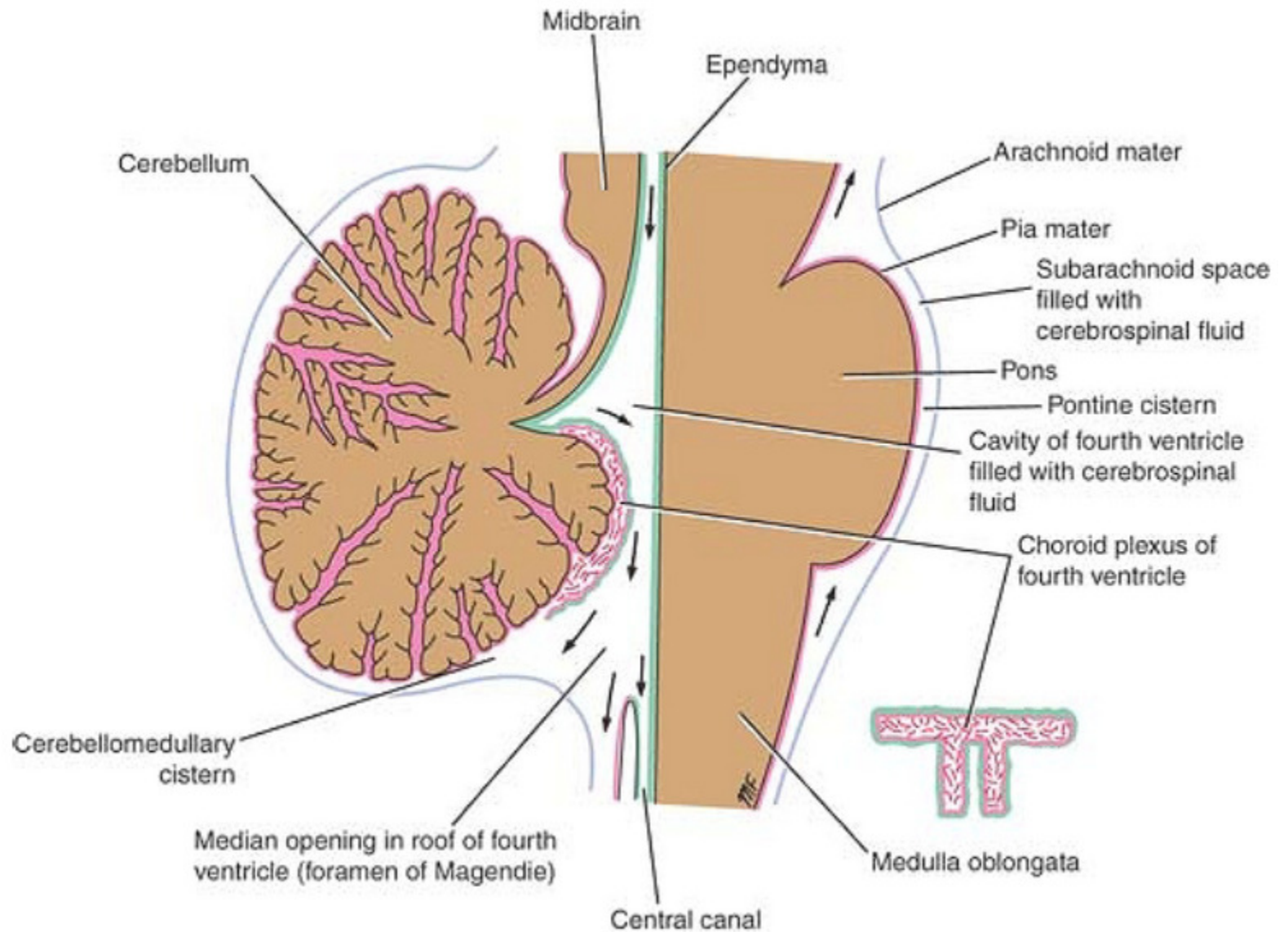


# Blood supply of cerebellum



# Fourth ventricle

- **Anteriorly:** pons and the superior half of the medulla oblongata
- **Posteriorly:** cerebellum

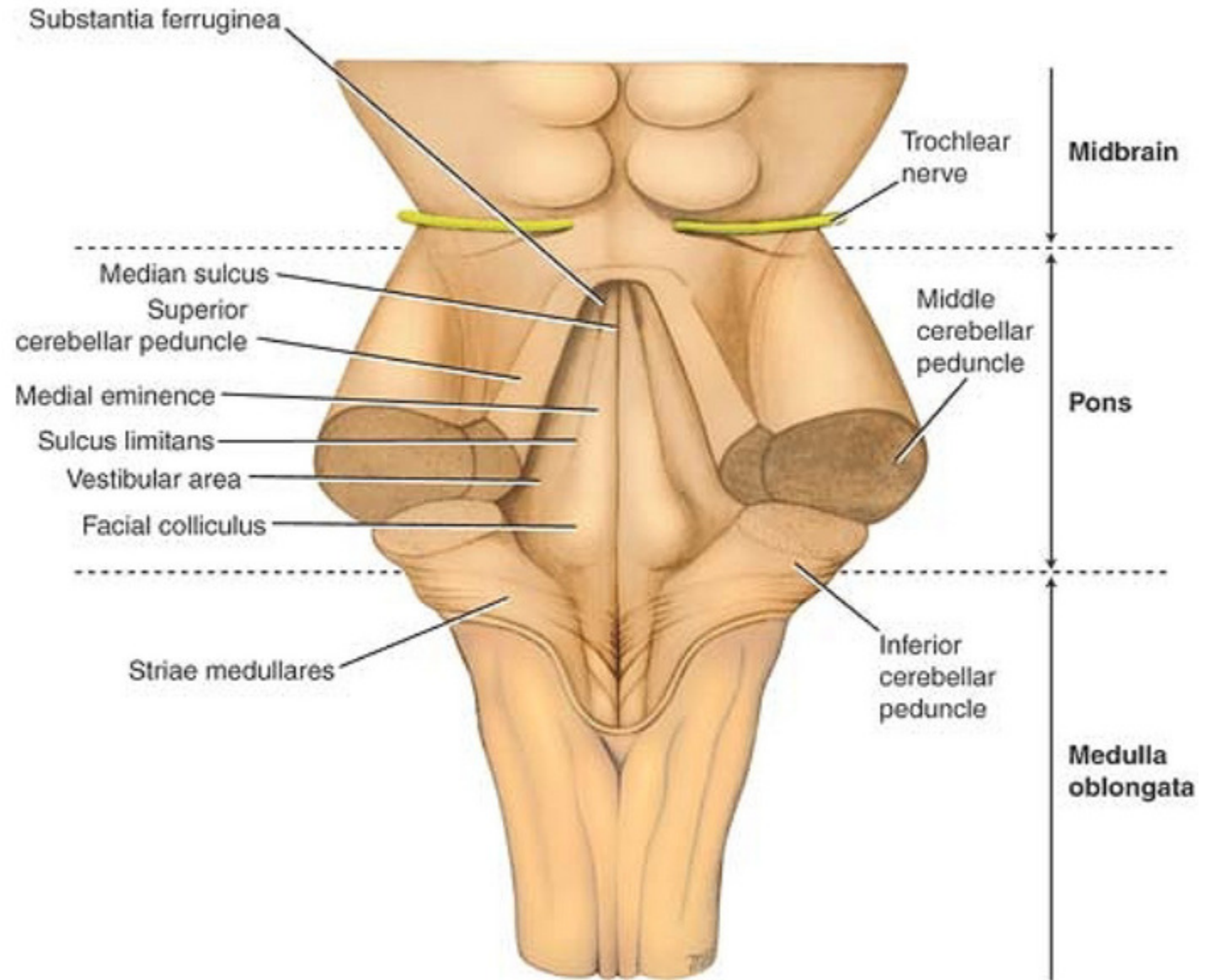




# Fourth ventricle



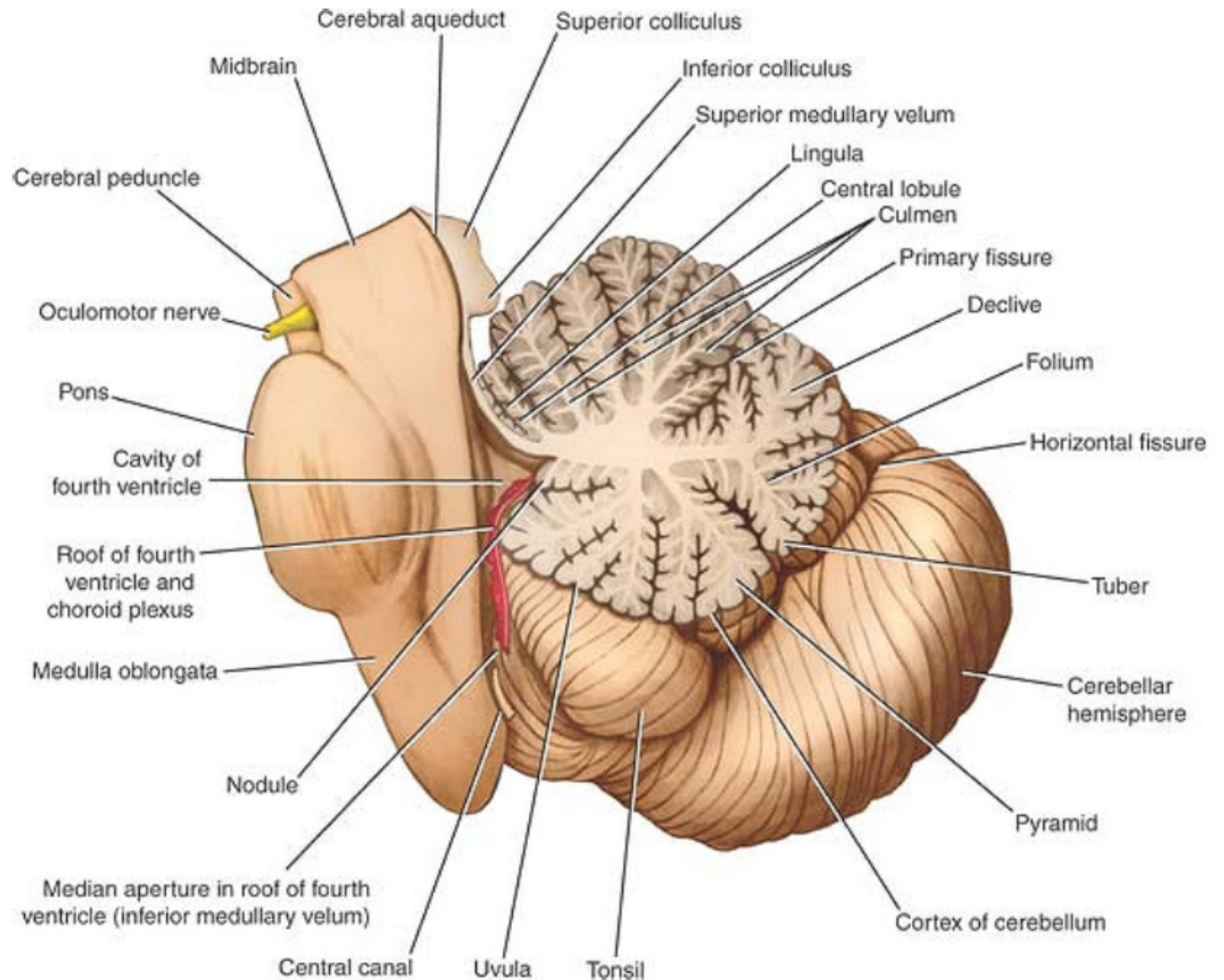
- **Lateral Boundaries:**
  - **Superiorly:** Superior cerebellar peduncle
  - **Inferiorly:** Inferior cerebellar peduncle



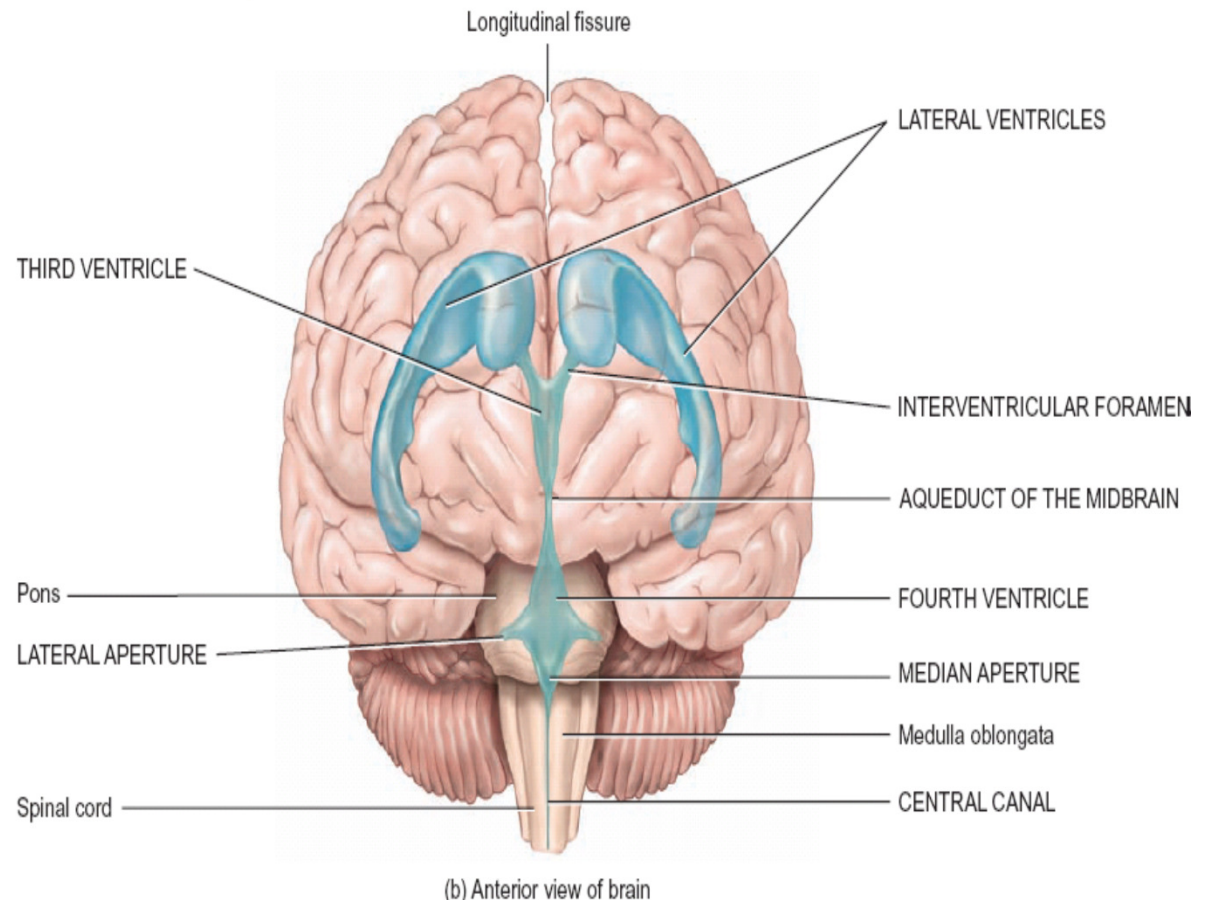
# Fourth ventricle: Roof or posterior wall



- **Superiorly:** two superior cerebellar peduncles and superior medullary velum (connecting sheet of white matter)
- **Inferiorly:** Inferior medullary velum
- median aperture (foramen of Magendie)
- foramina of Luschka: lateral openings of the fourth ventricle



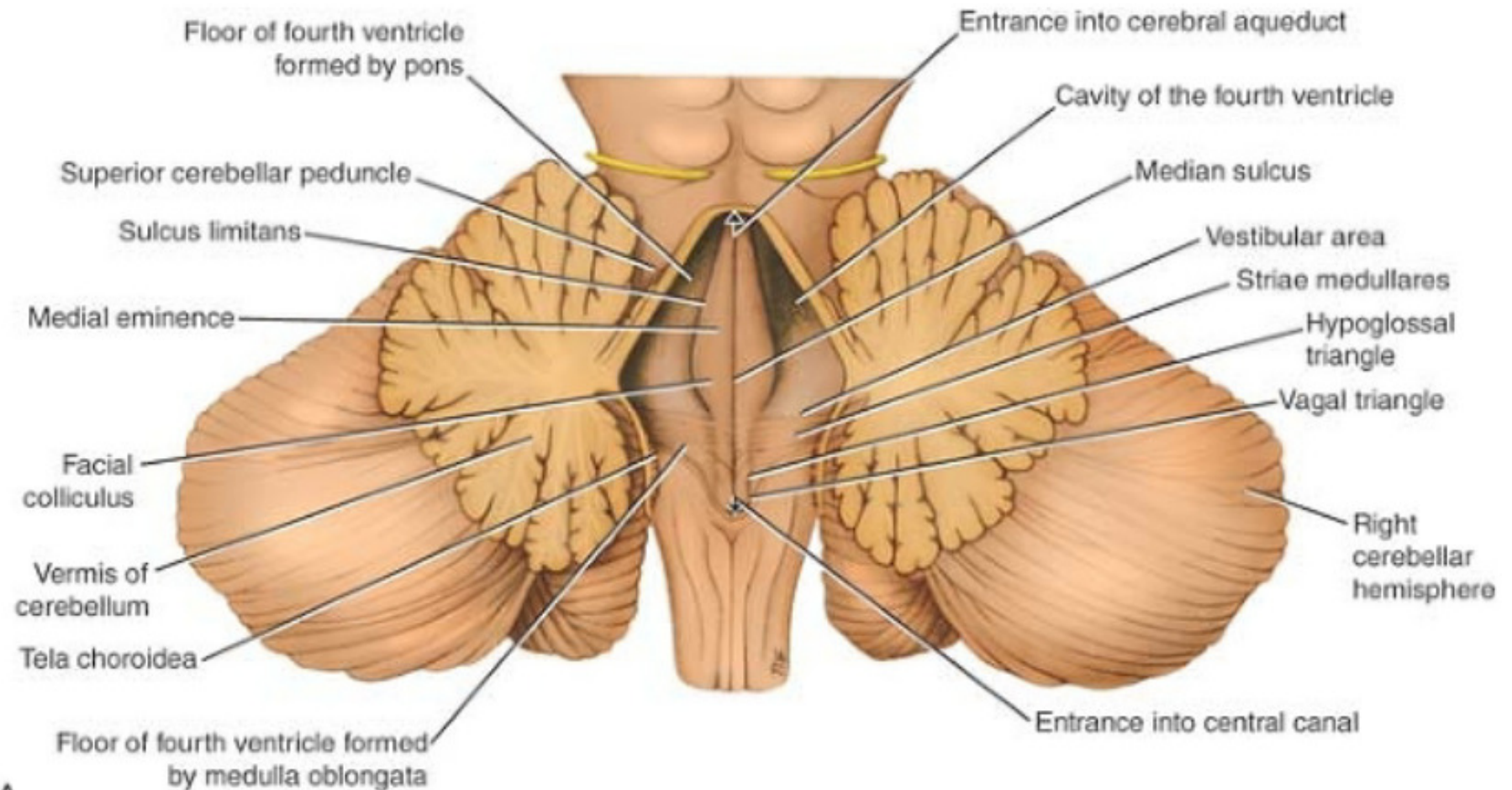
- **Interventricular foramina**  
narrow, oval openings,  
between the two lateral  
ventricles and the third  
ventricle.
- **Aqueduct of the midbrain  
(cerebral aqueduct)**  
passes CSF from third  
ventricle through the  
midbrain, into the fourth  
ventricle.
- CSF enters the  
subarachnoid space through  
three openings in the roof of  
the fourth ventricle: a single  
**median aperture** (Foramen  
of Magendie) and paired  
**lateral apertures**  
(Foramina of Luschka)





# Fourth ventricle: Floor or Rhomboid Fossa

- Diamond-shaped
- Formed by posterior surface of the pons and the cranial half of the medulla oblongata





## Pontine part

- Median sulcus
- Sulcus limitans
- **Medial eminence**
  - **Facial colliculus:**  
overlies nucleus of abducent n. and genu of facial nerve
  - **Hypoglossal triangle**
- **Vestibular area**  
overlies vestibular nuclei
- Acoustic tubercle  
overlying dorsal cochlear nucleus
- **Inferior fovea**  
(Vagal triangle)

