

THE CEREBELLUM & ITS RELEVANT CONNECTIONS

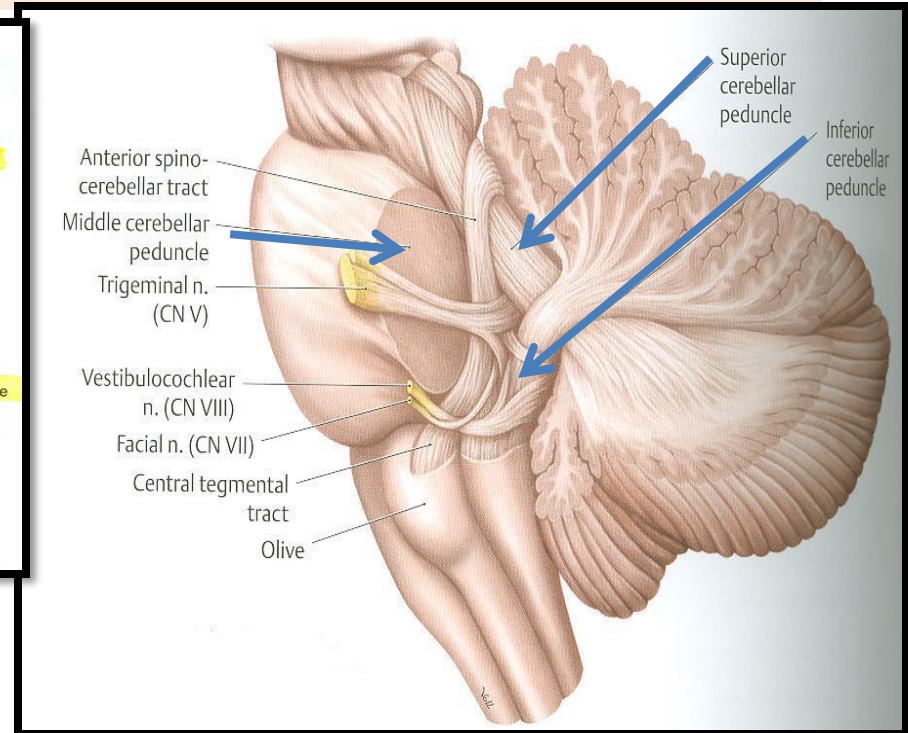
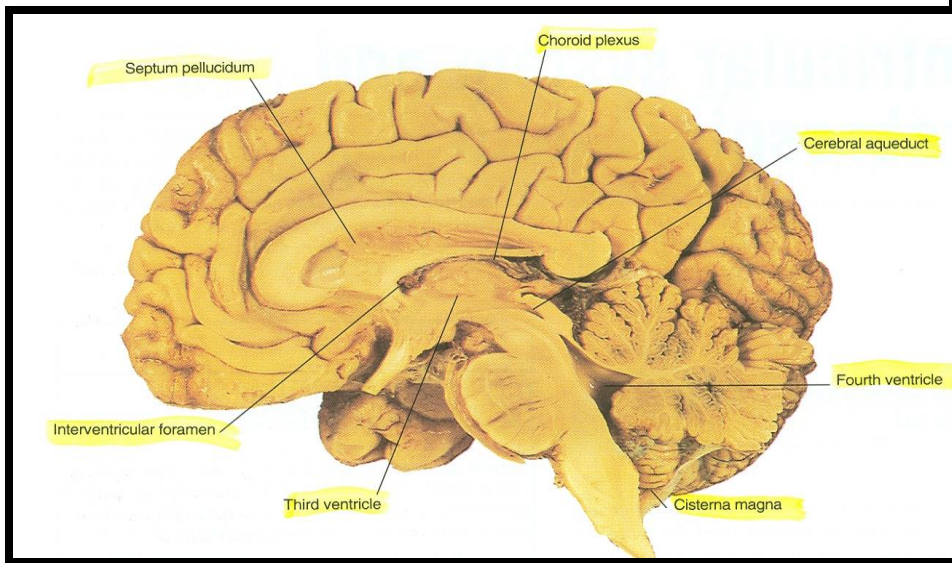
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OBJECTIVES

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.

THE CEREBELLUM

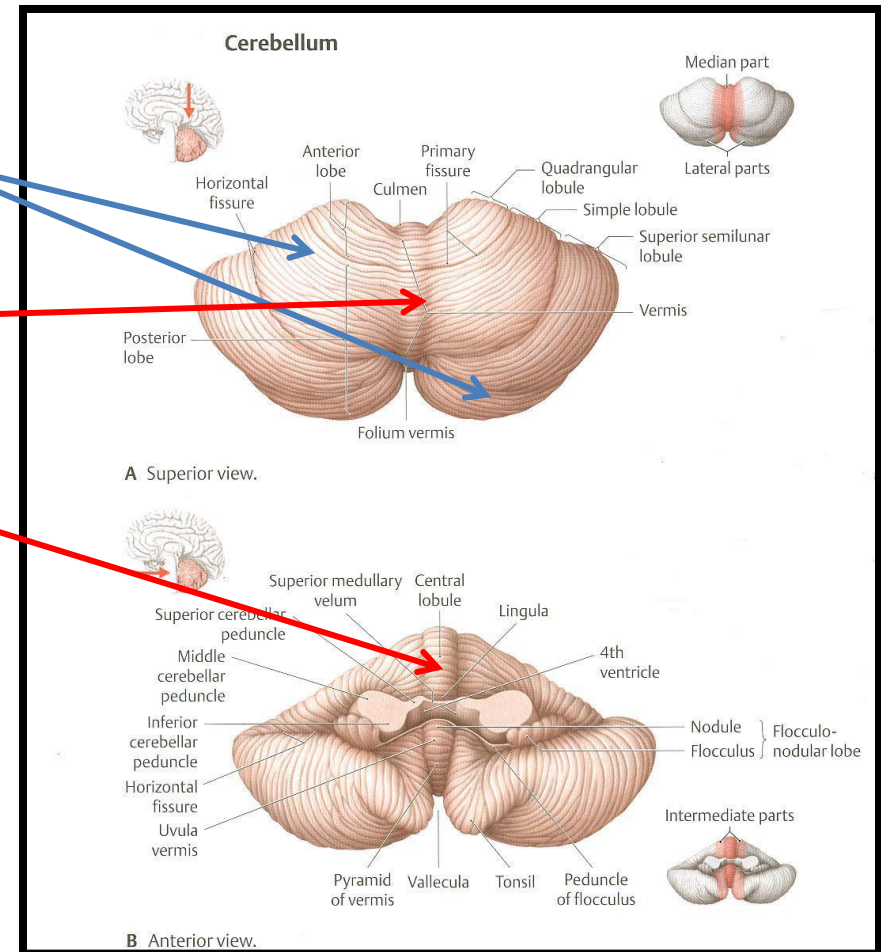


❑ **ORIGIN:** from hindbrain, separated from pons & medulla by fourth ventricle.

❑ **CONNECTION TO BRAIN STEM:** by inferior, middle & superior cerebellar peduncles.

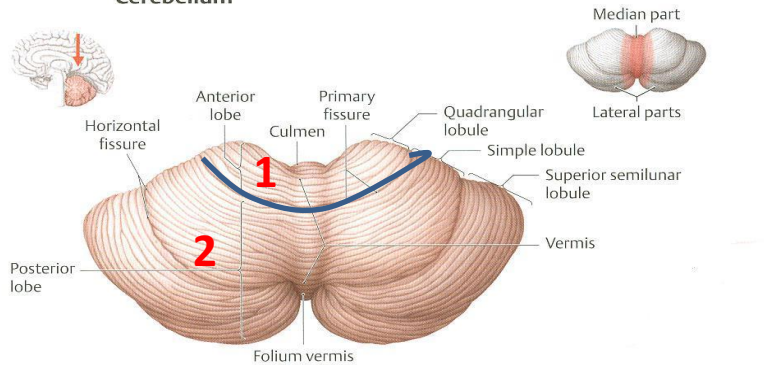
EXTERNAL FEATURES

- ❑ It consists of two cerebellar hemispheres joined in midline by the **vermis**.
- ❑ Its surface is highly convoluted forming folia separated by fissures.

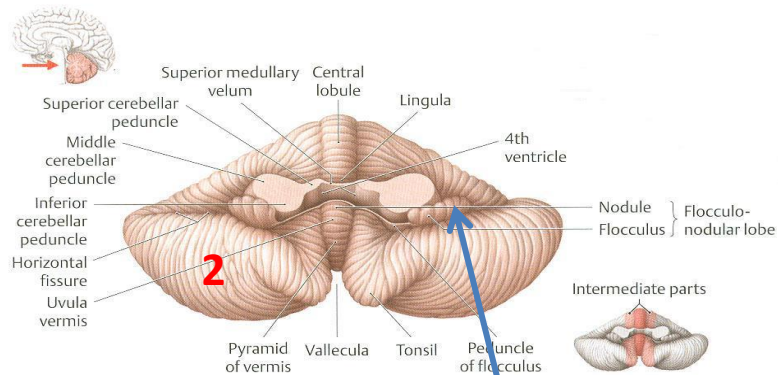


ANATOMICAL SUBDIVISION

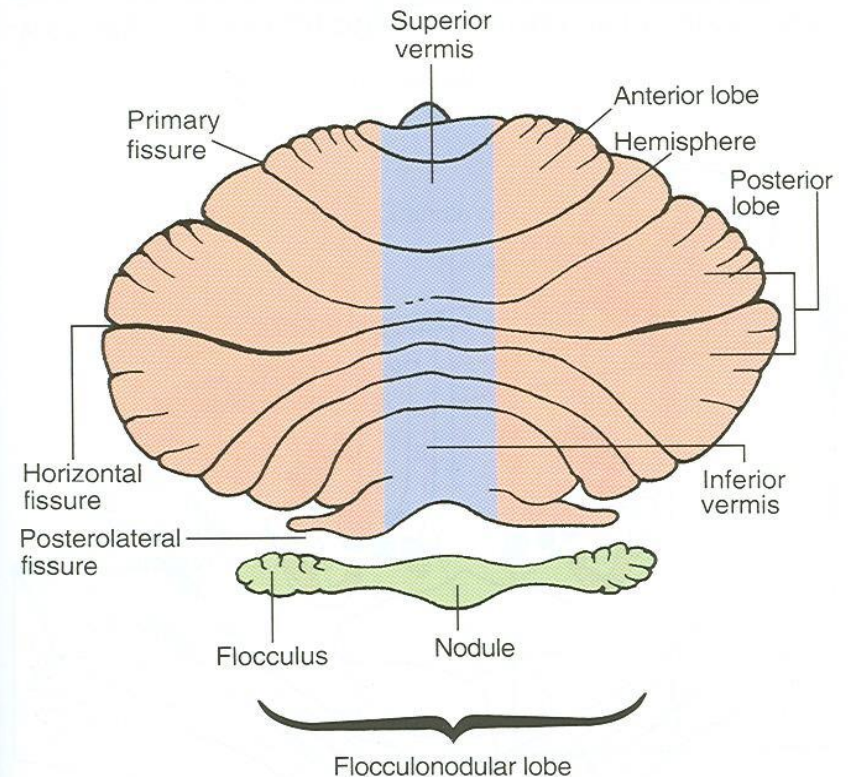
Cerebellum



A Superior view.

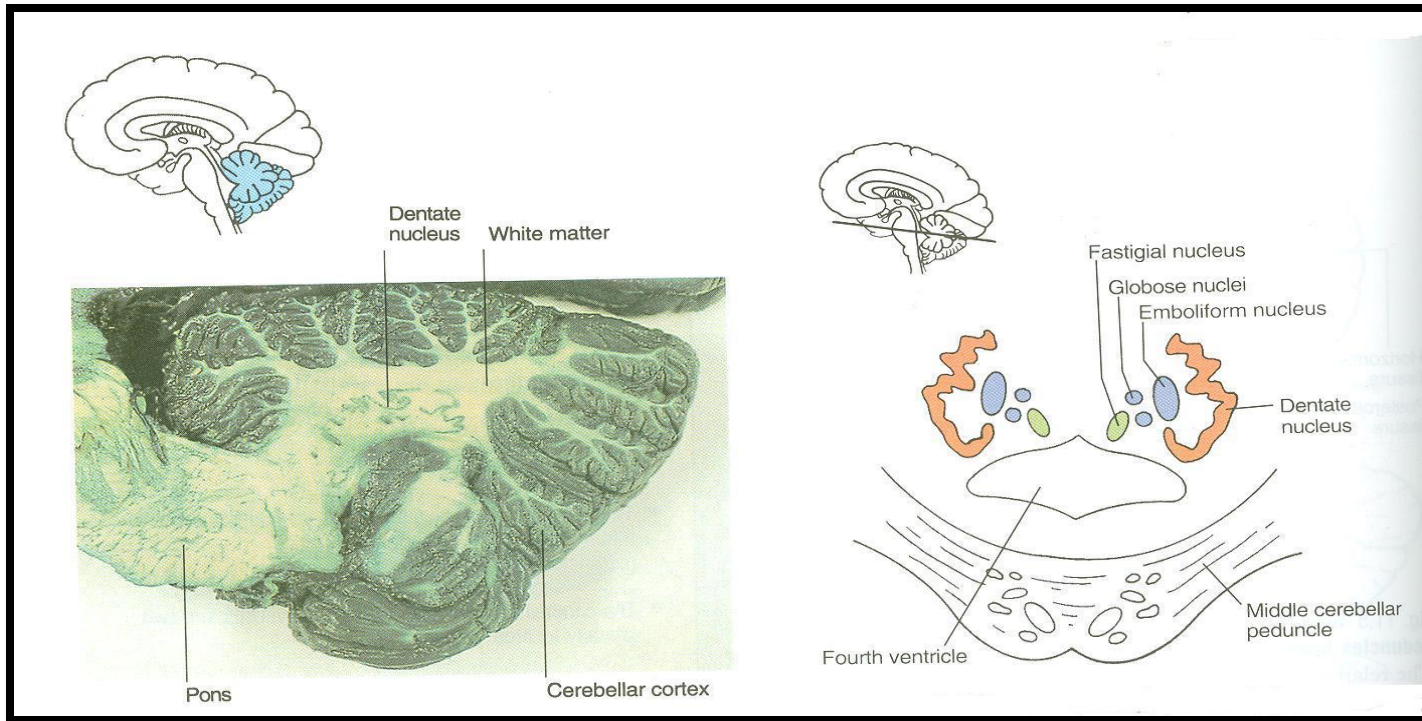


B Anterior view.



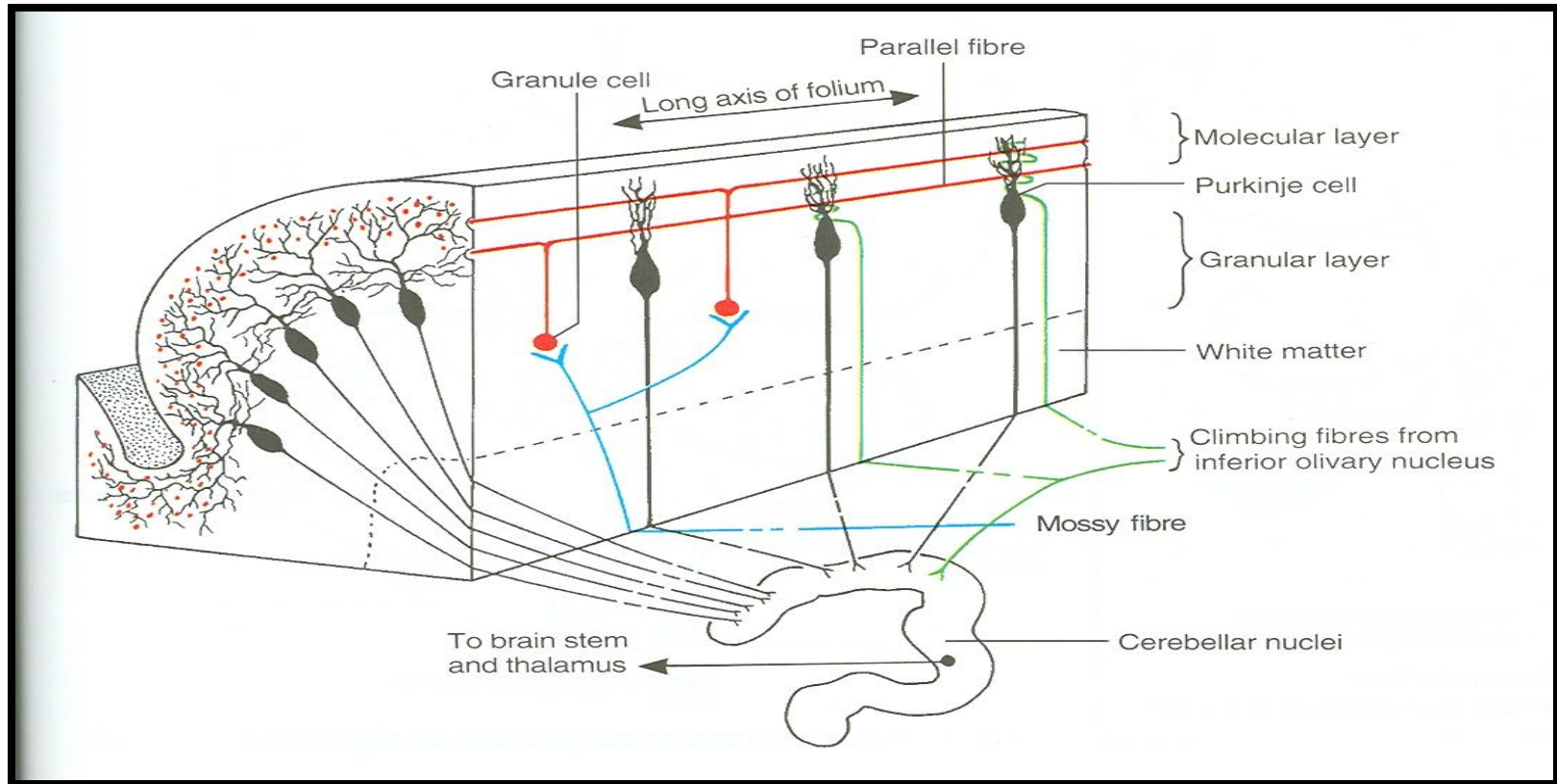
- 1. Anterior lobe:** in front of primary fissure
- 2. Posterior (middle) lobe:** behind primary fissure
- 3. Flocculonodular lobe.**

CONSTITUENTS



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: smallest one.
 - 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**

CEREBELLAR MEDULLA

AFFERENT FIBRES:

- ❑ **Climbing fibres:** from *inferior olivary nucleus*, relay to purkinge 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 purkinge cells

CEREBELLAR MEDULLA

- ❑ **Axons of purkinge 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.**
 - 2. Some of axons leave cerebellum as efferent fibres.**

CEREBELLAR MEDULLA

EFFERENT FIBRES:

- ❑ Most of efferent fibres are axons of deep cerebellar nuclei.
- ❑ Main efferents go to:
 1. *Vestibular nuclei*
 2. *Red nucleus*
 3. *Ventral lateral nucleus of thalamus*

**FUNCTIONAL SUBDIVISIONS
OF
THE CEREBELLUM**

ARCHICEREBELLUM

Purkinge cells of flocculonodular lobe

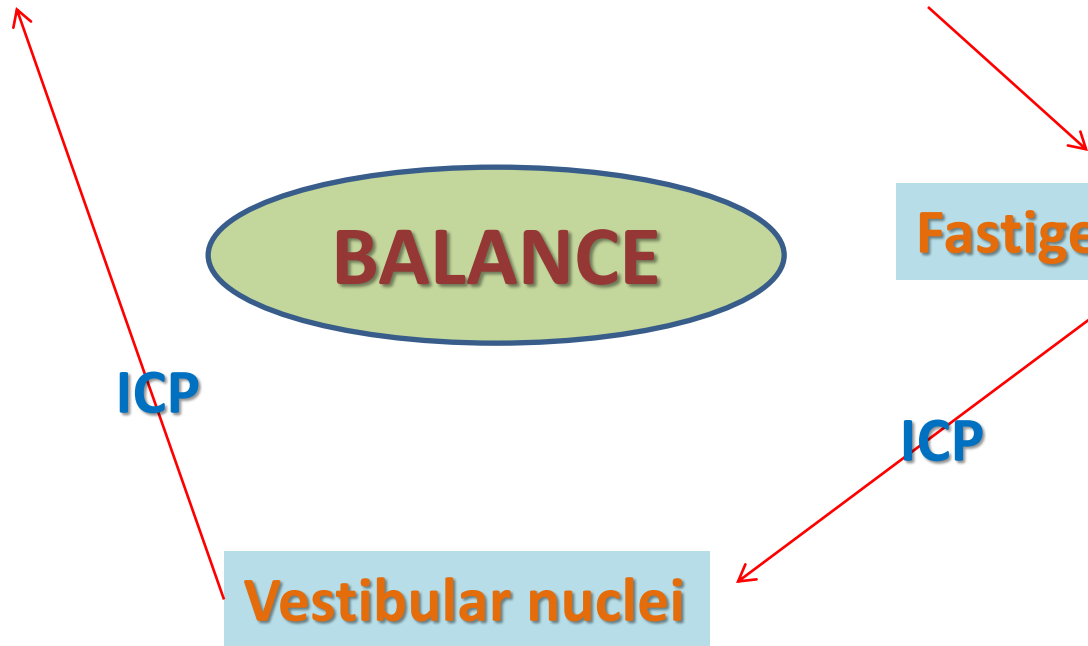
Fastigeal nucleus

BALANCE

ICP

Vestibular nuclei

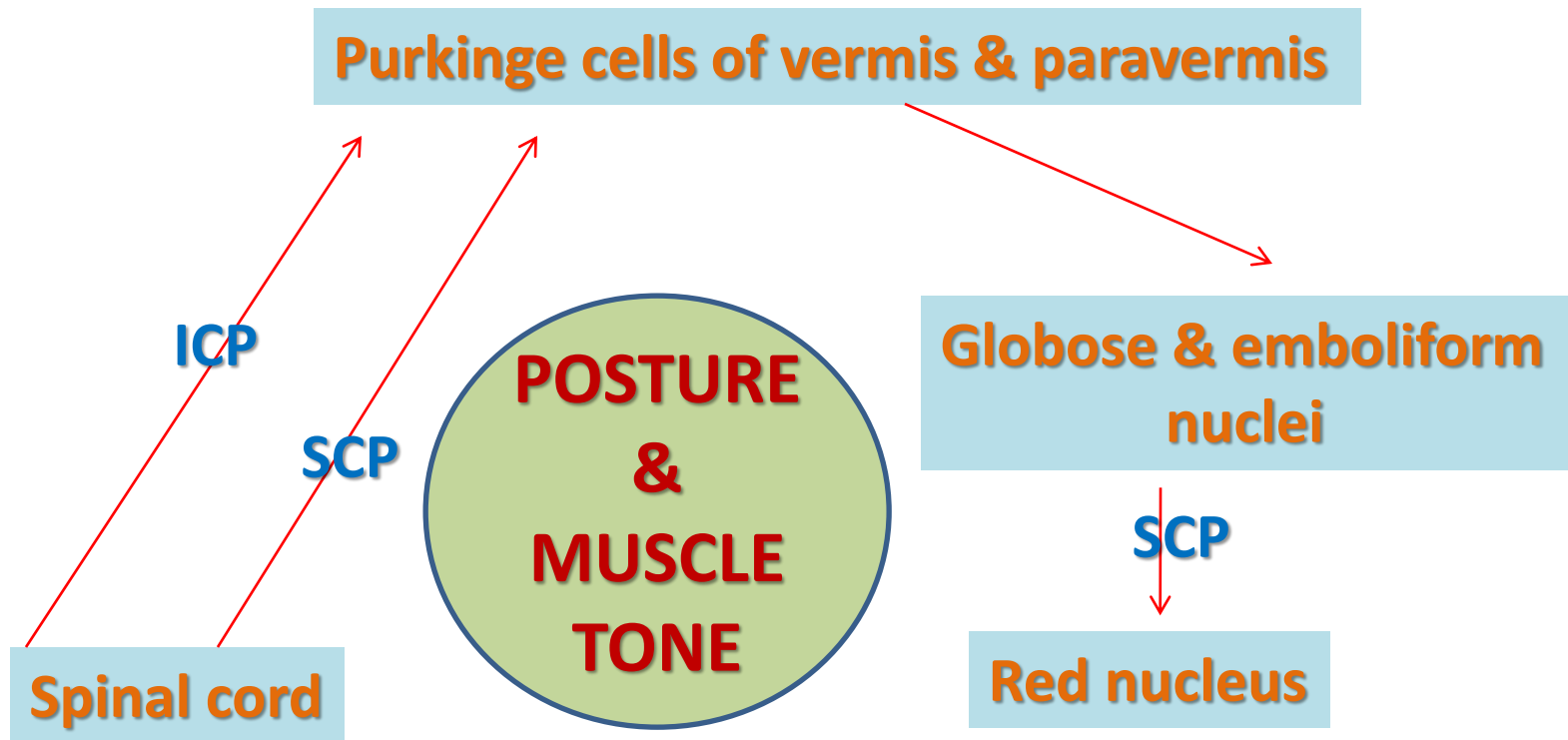
ICP



ARCHICEREBELLUM

- ❑ Part of cerebellum: flocculonodular lobe
- ❑ Nuclei: fastigeal
- ❑ Afferents: from vestibular nuclei (through ICP)
- ❑ Efferents: to vestibular nuclei (through ICP)
- ❑ Function: controls balance

PALEOCEREBELLUM



PALEOCEREBELLUM

- ❑ Part of cerebellum: **vermis & paravermis**
- ❑ Nuclei: **globose & emboliform**
- ❑ Afferents: from **spinal cord** (dorsal & ventral spinocerebellar tracts through ICP & SCP, respectively)
- ❑ Efferents: to **red nucleus** (through SCP)
- ❑ Function: influences posture & muscle tone

NEOCEREBELLUM

Purkinge cells of rest of cerebellum

Dentate nucleus

Red nucleus
&
Ventral lateral nucleus
of thalamus

Motor cortex

MCP

Pons

COORDINATION
OF VOLUNTARY
MOVEMENTS

NEOCEREBELLUM

- ❑ Part of cerebellum: rest of cerebellum
- ❑ Nuclei: dentate
- ❑ Afferents: from pons (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

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

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.

SUMMARY

- ❑ 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).

QUESTION 1

□ Which one of the following nucleus is related to archicerebellum?

1. Fastigeal nucleus ←
2. Dentate nucleus
3. Globose nucleus
4. Emboliform nucleus

QUESTION 2

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

1. Red nucleus

2. Pons

3. Vestibular nuclei 

4. Motor cortex

The image features two large, stylized yellow roses with white and light yellow petals, set against a teal background. The roses are positioned on the left and right sides of the frame. The text "THANK YOU" is written in a bold, blue, sans-serif font across the center of the image, overlapping the petals of both roses. The entire scene is enclosed within a thin orange border.

THANK YOU