

THE CEREBELLUM & ITS RELEVANT CONNECTIONS

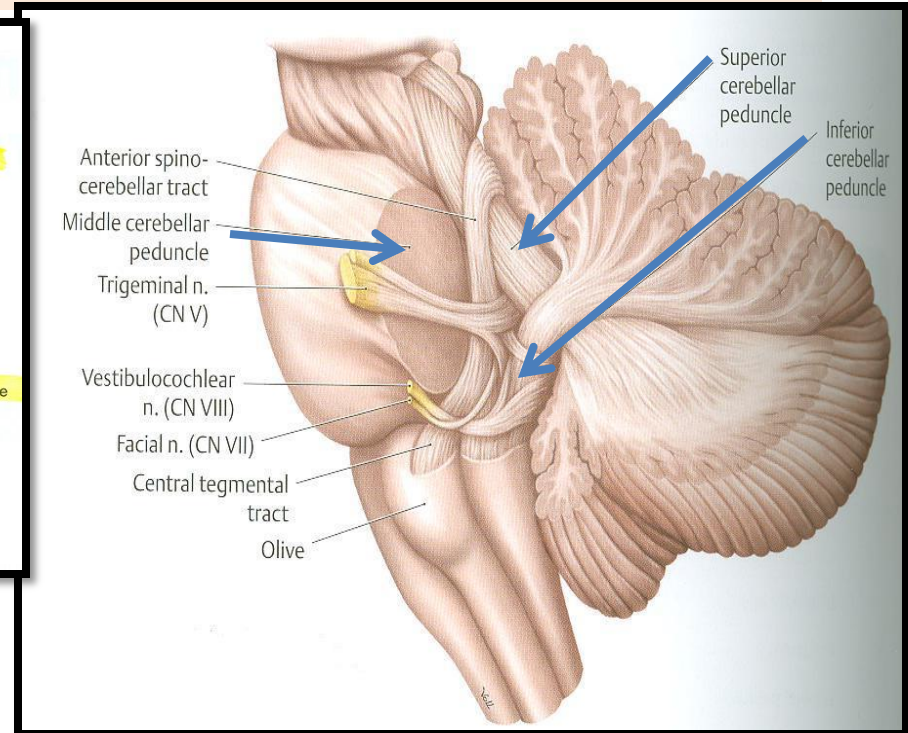
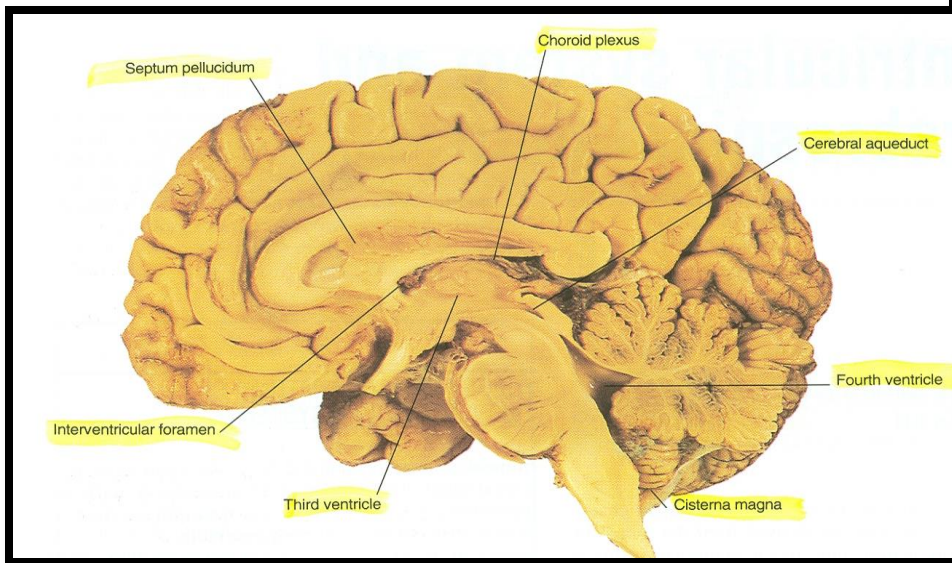
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OBJECTIVES

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



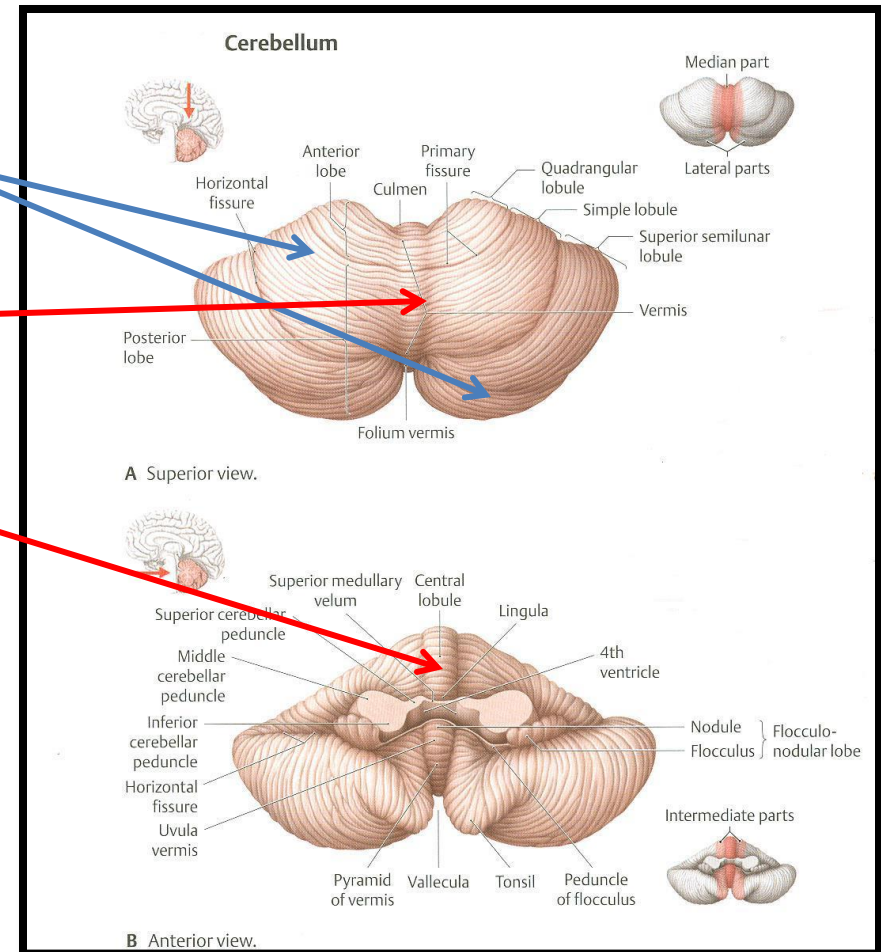
ORIGIN: from hindbrain, separated from pons & medulla by fourth ventricle.

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

EXTERNAL FEATURES

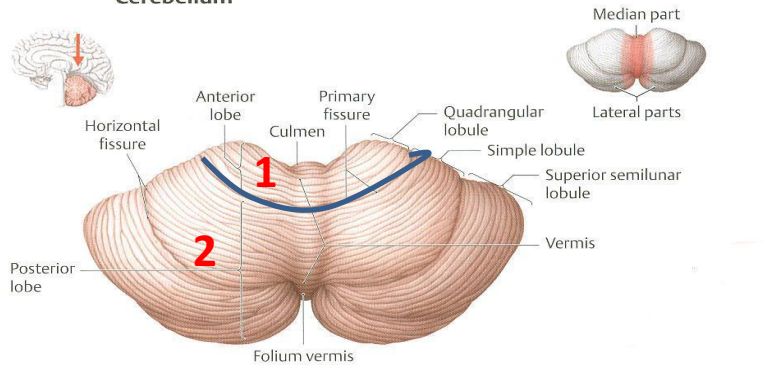
❑ It consists of two cerebellar hemispheres joined in midline by the **vermis**.

❑ Its surface is highly convoluted forming folia separated by fissures.

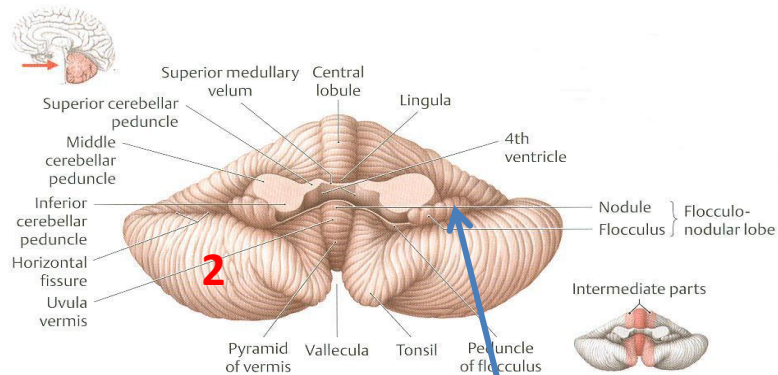


ANATOMICAL SUBDIVISION

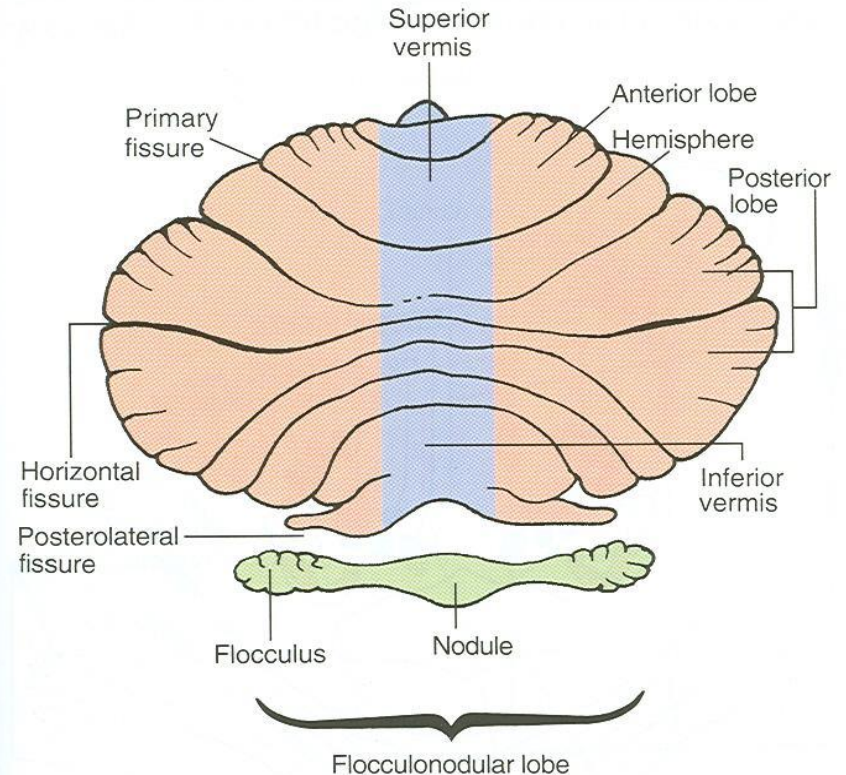
Cerebellum



A Superior view.

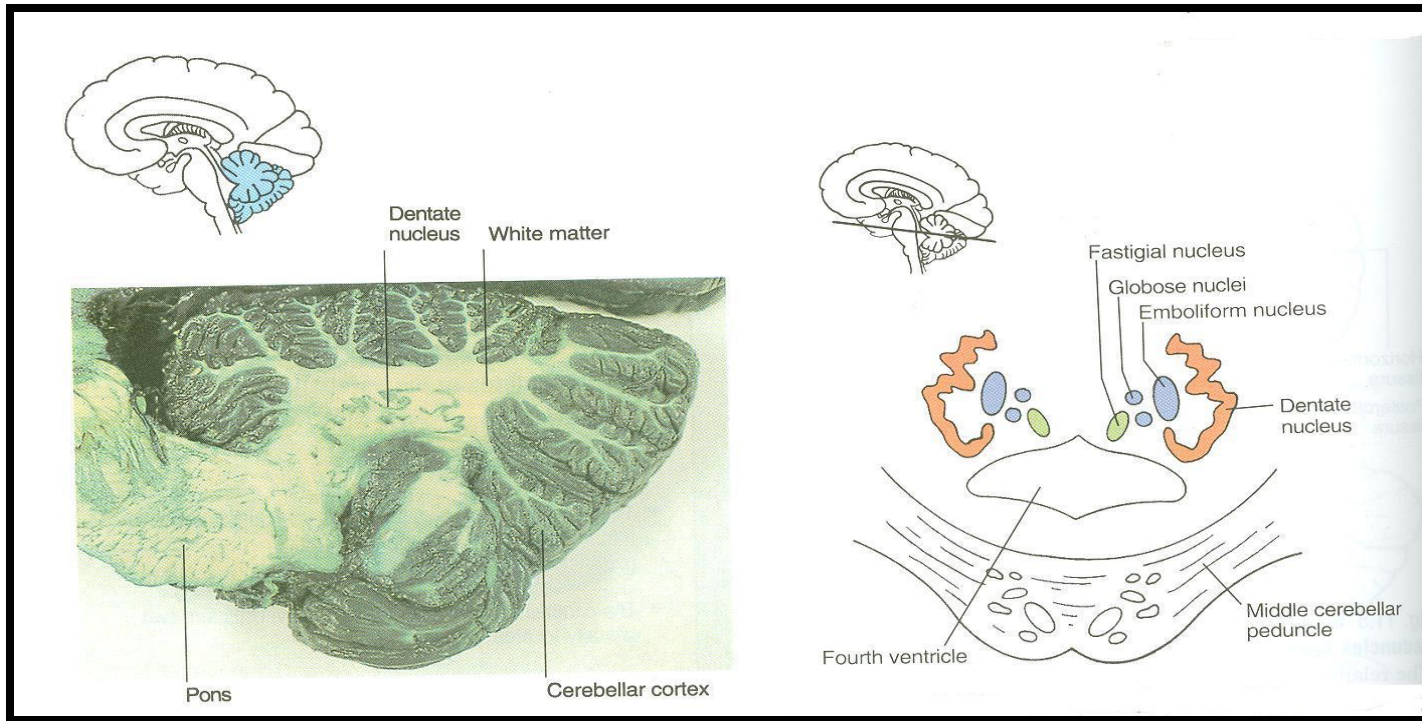


B Anterior view.



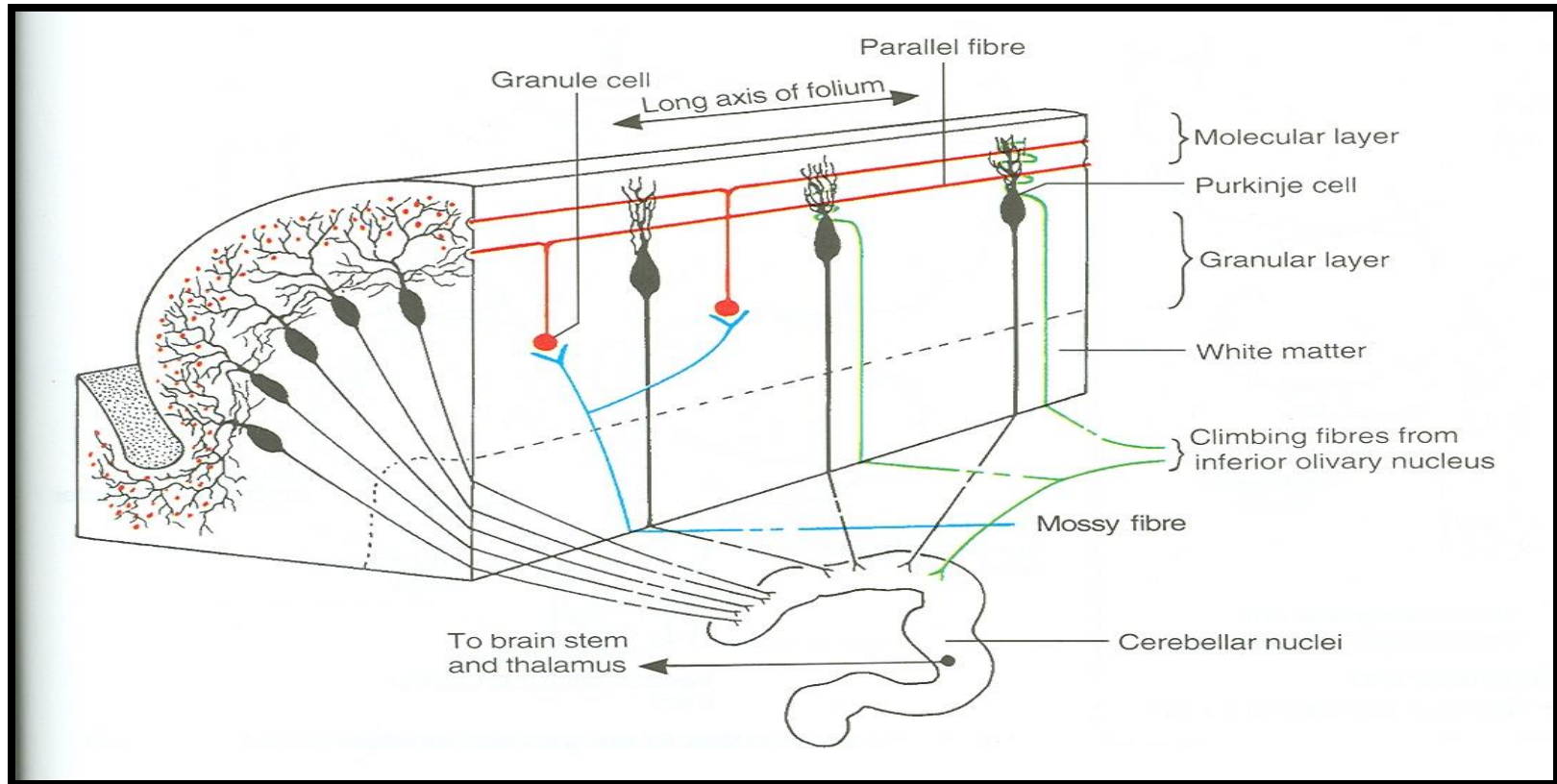
1. **Anterior lobe:** in front of primary fissure
2. **Posterior (middle) lobe:** behind primary fissure
3. **Flocculonodular lobe.**

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

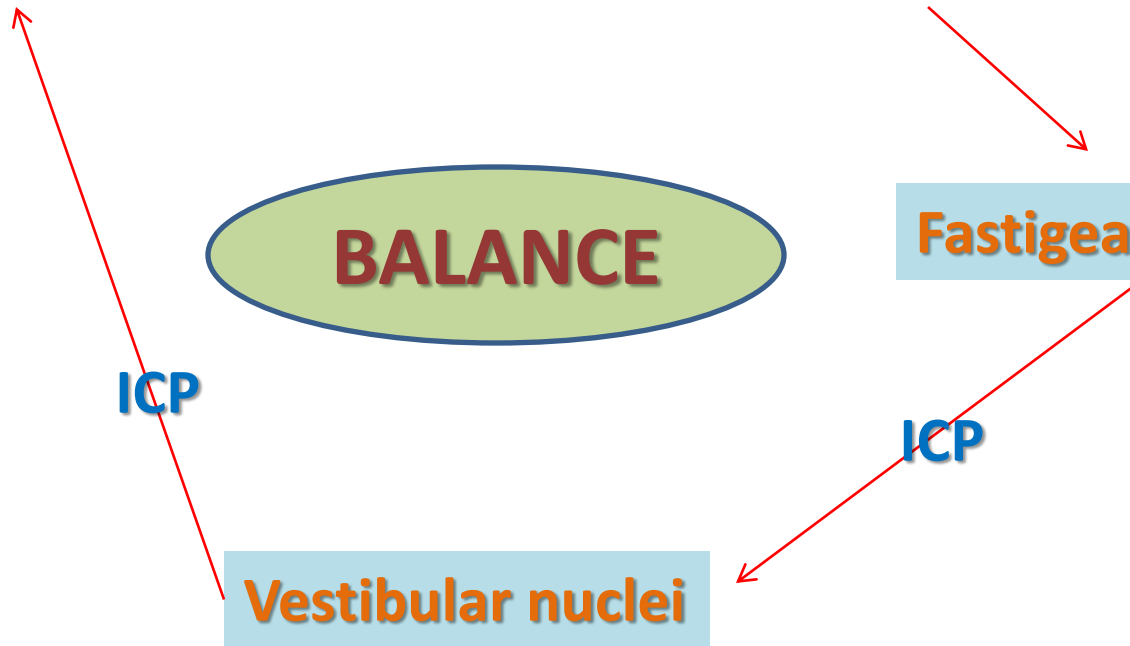
BALANCE

Fastigeal nucleus

ICP

ICP

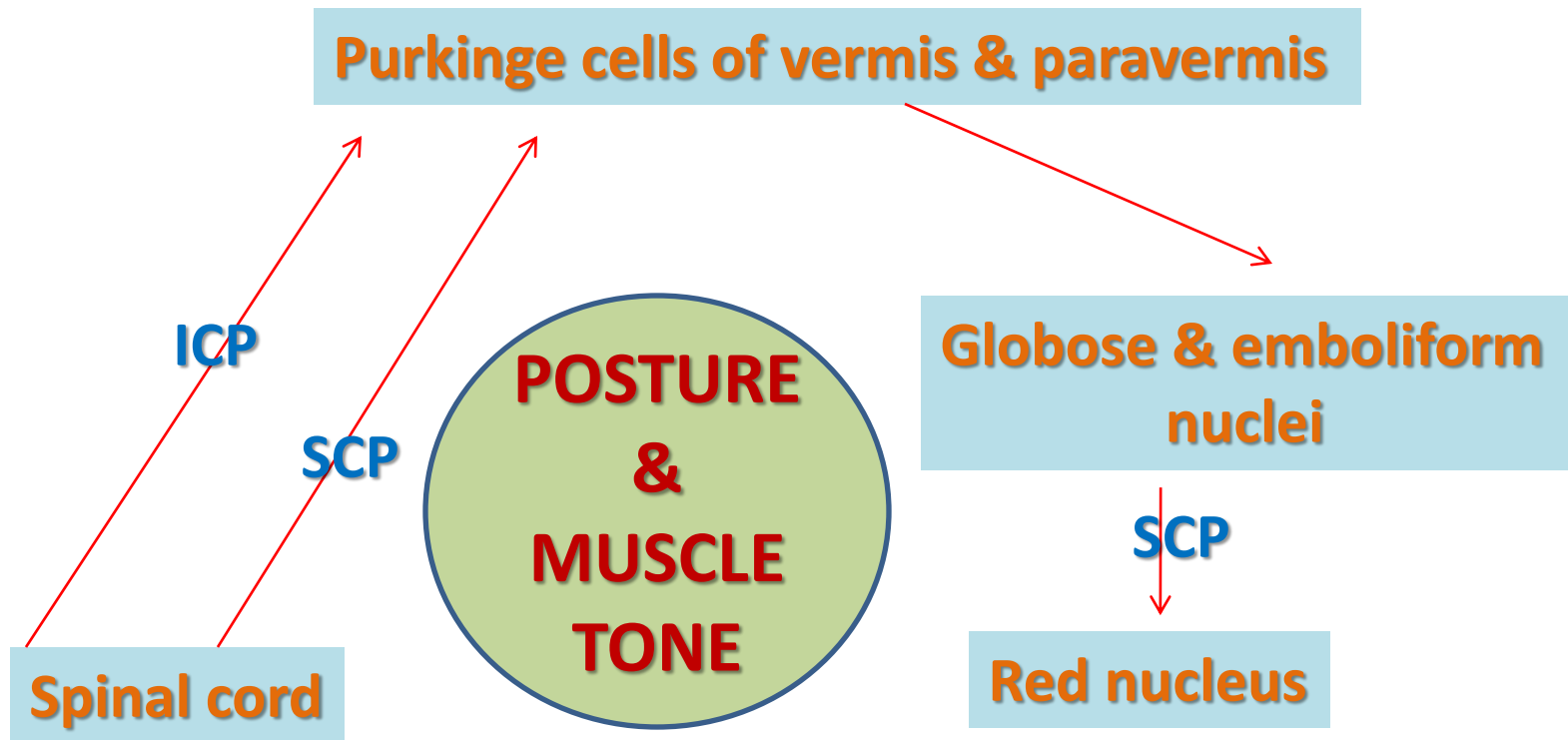
Vestibular nuclei



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



THANK YOU