



18th Lecture

Introduction to Cerebellum and 8th CrN

PHYSIOLOGY TEAM - 430

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Introduction to the cerebellum and 8th cranial nerve

• Cerebellum:

- Cerebellum is derived from a Latin word means "little brain" it is the largest part of the hindbrain, lies behind the pons and medulla Oblongata.
- ✓ **Shape:** Oval shaped, with an approximate weight is 150gm
- ✓ **Location:** Cerebellum is situated in the posterior cranial fossa
- ✓ **Anteriorly:** 4th ventricle, pons, and medulla oblongata
- ✓ **Superiorly:** Covered by Tentorium cerebelli
- ✓ **Inferiorly:** Squamous occipital bone

• The cerebellum is anatomically and physiologically divided into three parts:

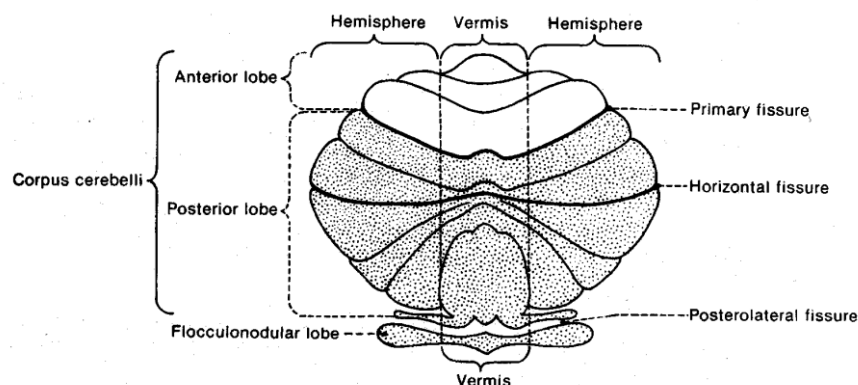
Anatomically	Physiological	Other names (Could be named by either names)	Function
Anterior lobe: in front of primary fissure	Paleocerebellum	Spinocerebellum	- Regulation of muscle tone - Coordination of skilled voluntary movement
Posterior lobe: Behind primary fissure	Neocerebellum	Cerebrocerebellum	- Planning and initiation of voluntary activity
Flocculonodular lobe	Archicerebellum	Vestibulocerebellum	- Maintenance of balance - Control of eye movements

Note:

The cerebellum consists of two large hemispheres, which are separated by a narrow band called "The Vermis"

• Three paired fiber tracts connect the cerebellum to the brainstem

- ✓ Cerebrum → Superior Cerebellar Peduncle → Cerebellum
- ✓ Pons → Middle Cerebellar Peduncle → Cerebellum
- ✓ Medulla Oblongata → Inferior Cerebellar Peduncle → Cerebellum



- **Cerebellum Layers:**

- **Cerebellar Cortex (External):**

- 1) Outer molecular layer (Stellate cells and Basket Cells)
- 2) Intermediate Purkinje cell layer (Purkinje Cells)
- 3) Inner granular layer (Granular Cells and Golgi Cells)

- **Cerebellar Nuclei (Internal within the white matter)**

- 1) Fastigial Nuclei
- 2) Globose Nucleus
- 3) Emboliform Nucleus
- 4) Dentate Nucleus

Note:

Globose and Emboliform also known as interpositus nucleus

- **Cerebellar Cortex:**

- 1) Molecular Layer:**

- **Stellate Cell** → **Taurine** (inhibitory)
- ✓ **Afferent:** Parallel fiber
- ✓ **Efferent:** Purkinje cell dendrite
- **Basket Cell** → **GABA** (inhibitory)
- ✓ **Afferent:** Parallel fiber
- ✓ **Efferent:** Purkinje cell soma
- ✓ Parallel Fiber granule cell axon Purkinje Cell Dendrite

- 2) Purkinje Cell Layer**

- **Purkinje Cell** → **GABA** (inhibitory)
- ✓ **Afferent:** parallel fiber, climbing fiber, stellate cell, basket cell
- ✓ **Efferent:** deep cortical nuclei
- ✓ Are the main output neurons

- 3) Granular Layer :**

- **Granular Cell** → **glutamate** (excitatory)
- ✓ **Afferent:** mossy fiber
- ✓ **Efferent:** Purkinje cell dendrite, basket cell, stellatecell, Golgi cell
- **Golgi Cell** → **GABA** (inhibitory)
- ✓ **Afferent:** parallel fiber, mossy fiber rosette
- ✓ **Efferent:** granule cell dendrite

- Summary for Cerebellar Cortex Cells:

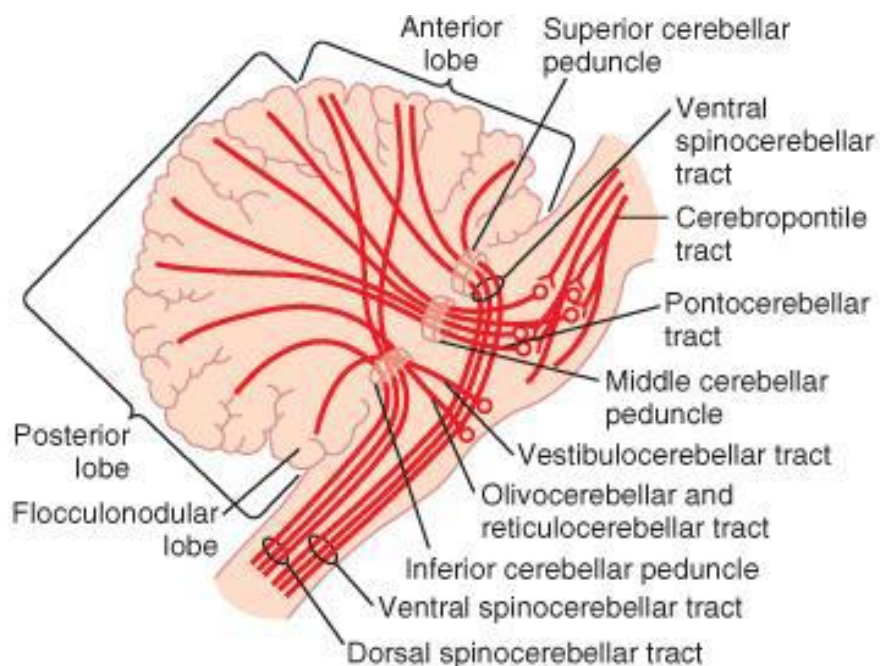
	Stellate Cell	Basket Cell	Purkinje Cell	Granular Cell	Golgi Cell
NT	Taurine	GABA	GABA	glutamate	GABA
Afferent	- Parallel fiber	- Parallel fiber	- Parallel fiber - Climbing fiber - Stellate cell - Basket cell	- Mossy fiber	- Parallel fiber - Mossy fiber rosette
Efferent	- Purkinje cell dendrite	- Purkinje cell soma	- Deep cortical nuclei	- Purkinje cell dendrite - Basket cell - Stellate cell - Golgi cell	- Granule cell dendrite

- Cerebellum: The rule of THREE

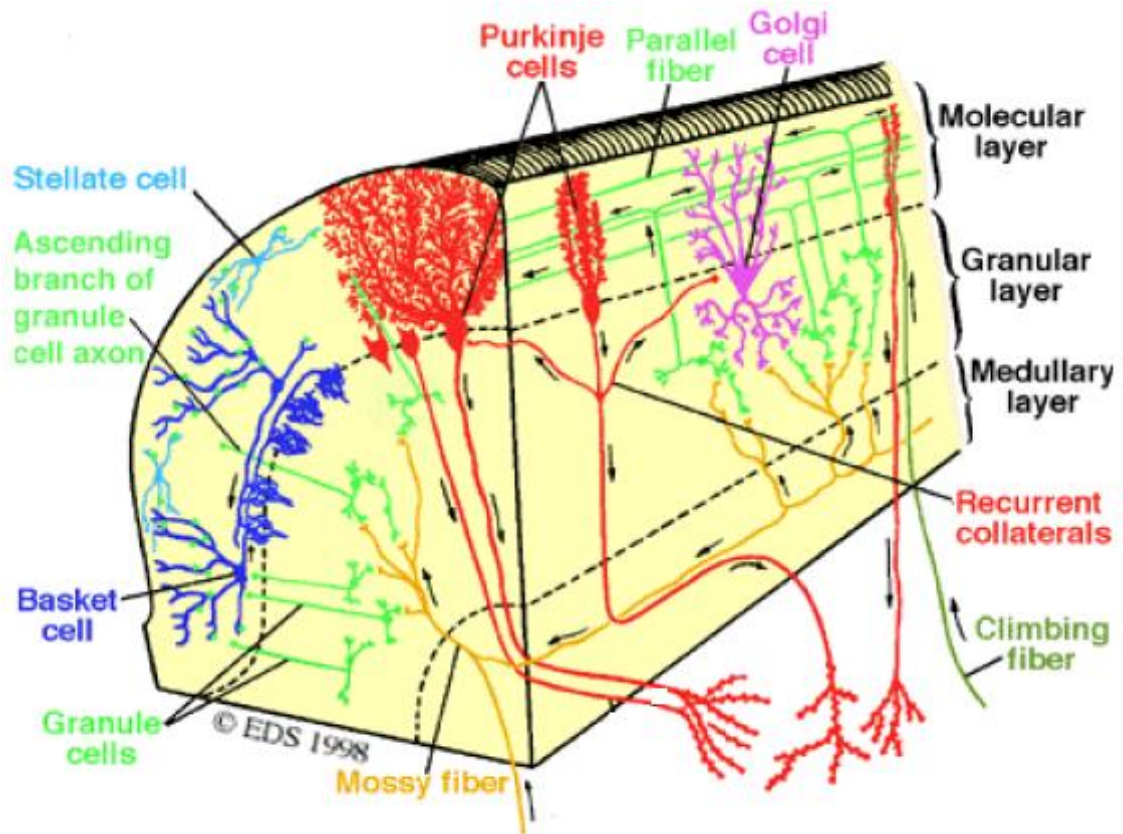
3 Lobes	Flocculonodular Lobe Anterior lobe Posterior lobe
3 Cortical Layers	Molecular layer Purkinje cell layer Granular layer
3 Purkinje's cells afferent paths	Mossy fibers Climbing fibers Aminergic fibers
3 Pairs of deep nuclei	Fastigial Interposed (globose & emboliform) Dentate
3 Pairs of peduncles	Superior (pri.output) Middle (pri.Input) Inferior (pri.Input)
3 Functional division	Vestibulocerebellum Spinocerebellum Cerebrocerebellum

- Principal afferent tracts to the Cerebellum:

Afferent Tracts	Transmits
Vestibulocerebellar	Vestibular impulses from labyrinths, direct & via vestibular nuclei
Dorsal Spinocerebellar	Prorioceptive & exteroceptive impulses from the body
Ventral Spinocerebellar	Prorioceptive & exteroceptive impulses from the body
Cuneocerebellar	Prorioceptive impulses, especially from the head and neck
Tectocerebellar	Auditory & visual impulses via inferior and superior colliculi
Pontocerebellar	Impulses from motor and other parts of cerebral cortex via pontine nuclei
Olivocerebellar	Proprioceptive input from whole body via relay in inferior olive



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- **Types of the cells in Cerebellum:**

- Purkinje Cell
- Granule Cell
- Basket Cell
- Golgi Cell
- Stellate cell
- Climbing Fiber
- Mossy Fiber
- Parallel Fiber
- Inferior Olivary Nucleus
- Deep Cerebellar Nuclei