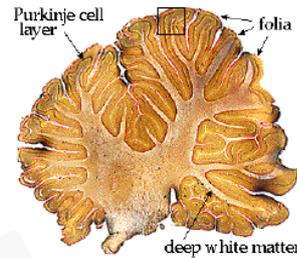


General Structure of the Cerebellum

- The cerebellum consists of **two cerebellar hemispheres** connected together by the **vermis**.
- It is composed of:
 - **Central white matter**
 - **Grey cortex**
 - **Deeply placed nuclei**
- The cerebellum contains **more than half of the neurons in the brain**.
- The thickness of the cerebellar cortex is **uniform everywhere (0.6 mm)**.
- A cerebellar section can be identified by the naked eye due to the presence of **folia**.
- Each **folium** consists of:
 - **A central core of white matter (pale)**
 - **A covering cortex of grey matter (darker)**



Vertical Section of the Cerebellar Cortex

The cerebellar cortex is composed of **three layers**:

1. Molecular Layer (Outer Layer)

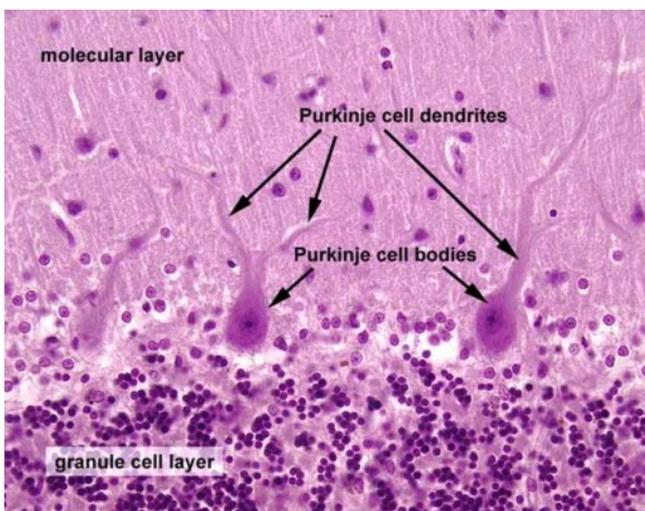
- Pale in appearance because it is mainly formed of fibers.

2. Purkinje Cell Layer (Middle Layer)

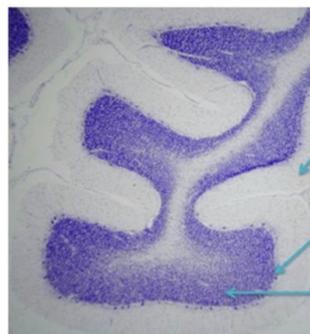
- Thin layer occupied by **Purkinje cells**.
- Purkinje cells are:
 - Large cells with large rounded nuclei
 - Pyriform (flask-shaped)
 - Situated far from each other

3. Granular Layer (Inner Layer)

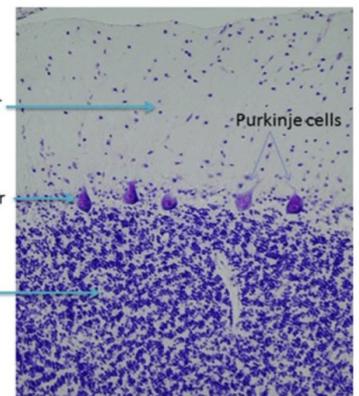
- Deeply stained
- Composed of very small cells



Complex folding of the cerebellar cortex



High-power micrograph of the cerebellar cortex



Detailed Structure of the Cerebellar Cortex

A. Outer Molecular Layer

Contents:

- Nerve cell bodies
- Nerve fibers
- Neuroglia

Neurons:

1. Outer stellate molecular cells

- Star-like soma
- Many radiating dendritic processes

2. Inner basket cells

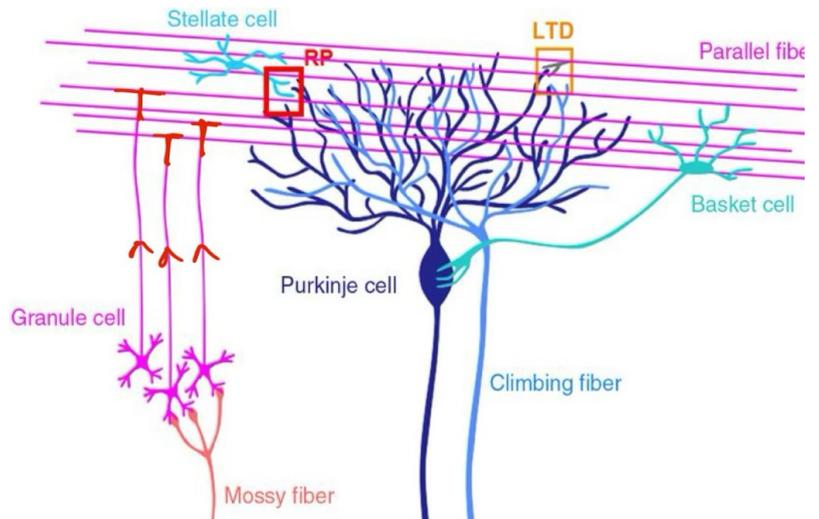
- Multipolar cell body
- Free branching dendrites with smooth spines
- Highly branched axon forming a basket
- Basket surrounds the soma of Purkinje cells

Fibers:

1. Dendrites of Purkinje cells
2. Axons of granular cells
3. Terminal ends of climbing fibers (from white matter)

Notes:

- Fibers run parallel to the surface
- Neurons are few
- Unmyelinated nerve fibers are numerous
- Climbing fibers cross the granular layer without stopping in it



B. Middle Purkinje Cell Layer

- Composed of **flask-shaped Purkinje cells**
- Arranged in a **single layer**
- Golgi type I neurons
- Dendritic arborization passes into the external molecular layer in one plane
- Axons pass through the granular layer to relay in **deep cerebellar nuclei**

Inputs received by Purkinje cells:

1. Impulses from the pons through **climbing fibers**
2. Impulses from the **granular layer**
3. Synapses with cells of the **molecular layer**



C. Inner Granular (Nuclear) Cell Layer

- Very small cells
- Densely stained nuclei
- Scanty cytoplasm (nuclear layer)

Connections:

- Axons pass into the molecular layer forming **T-shaped branches (parallel fibers)**
- Dendrites synapse with afferent fibers coming to the cerebellum (**mossy fibers**)
- Axons of Purkinje cells cross this layer to cerebellar nuclei
- Climbing fibers pass through this layer to terminate in Purkinje cells

Golgi Cells (Type II)



- Large stellate inhibitory neurons
- Located in the superficial part of the granular layer
- Dendrites:
 - Enter the molecular layer
 - Branch profusely
 - Synapse with parallel fibers and dendrites of Purkinje cells
 - Some dendrites ramify in the granular layer
- Axons:
 - Branch profusely
 - Participate in formation of **cerebellar glomeruli**
 - Form complex synapses

Cerebellar White Matter

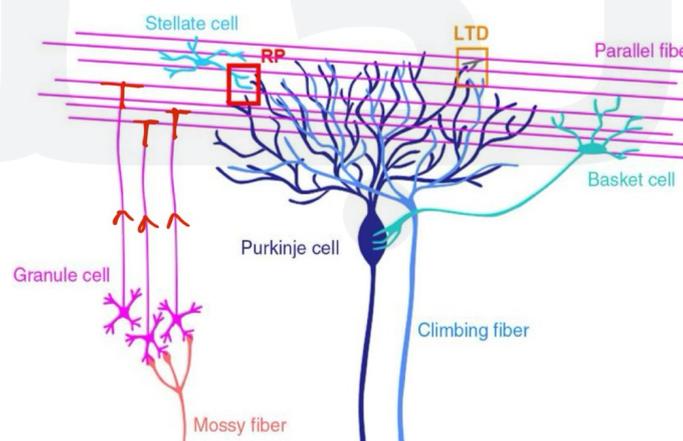
1. Afferent Fibers (Input)

A. Climbing Fiber System

- Olivocerebellar fibers
- Pass through granular and Purkinje layers
- Reach the molecular layer
- Synapse with dendritic tree of Purkinje cells

B. Mossy Fiber System (Majority)

- Comes from nearly all CNS except inferior olives
- Each fiber ends in about **50 rosette-like structures**
- Each **rosette synapses with 20 granule cells**
- Each mossy fiber connects with about **1000 granule cells**
- Synapses occur in the **cerebellar glomerulus**



C. Recurrent Collaterals

- Side branches from axons of Purkinje cells
- End on dendrites of Golgi cells

2. Efferent Fibers (Output)

A. Axons of Purkinje Cells

- Most end in deep cerebellar nuclei

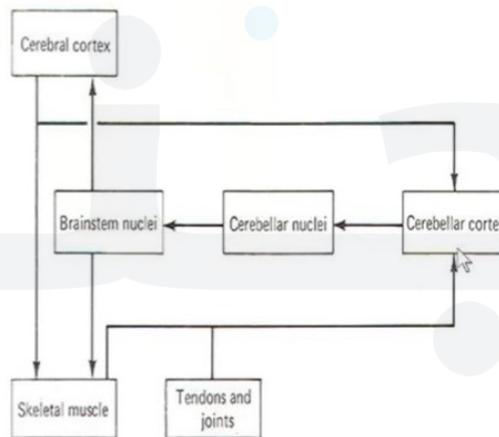
B. Efferents from Deep Cerebellar Nuclei

- **Dentate nucleus** → projects mainly to the **thalamus**
- **Emboliform & Globose nuclei** → project mainly to **red nucleus and inferior olive**
- **Fastigial nucleus** → projects mainly to **vestibular nuclei**

Functions of the Cerebellum

• Functions:

- 1- Receives information from spinal cord & sensory and motor areas of the brain to regulate motor movement.
- 2- Co-ordination of voluntary movement.



Diseases of the Cerebellum

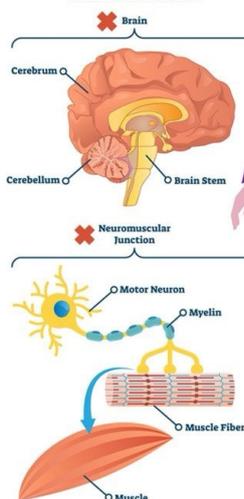
- Cerebellar ataxia



ATAXIA

Ataxia is a Degenerative Disease of the Nervous System Consisting of Lack of Voluntary Coordination of Muscle Movements

ATAXIA is a Clinical Manifestation Indicating **DYSFUNCTION** of the Parts of The NERVOUS SYSTEM that COORDINATE MOVEMENT



ATAXIA SYMPTOMS



Lack of Coordination



Eye Movement Abnormalities



Slurred Speech



Trouble Eating and Swallowing



Heart Problems



Tremors and Deterioration of Fine Motor Skills



Gait Abnormalities



Difficulty Walking and Poor Balance



DR . AMIRA OSMAN

DONE BY : RACHAD MRAYAT

لَا حَوْلَ وَلَا قُوَّةَ إِلَّا بِاللَّهِ

"من كوز الجنة"