



THE CEREBELLUM



CNS

Semester 1, Year 3 •

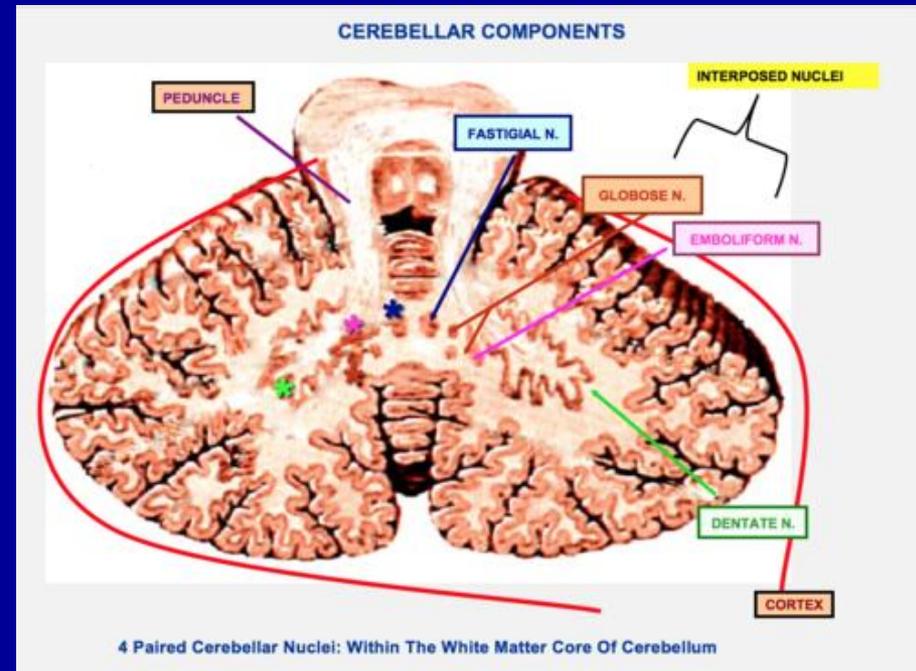
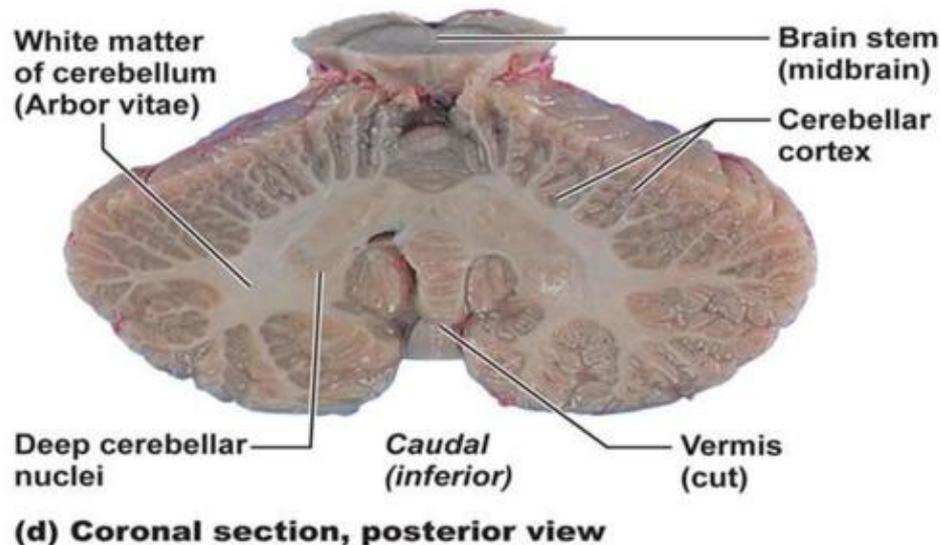
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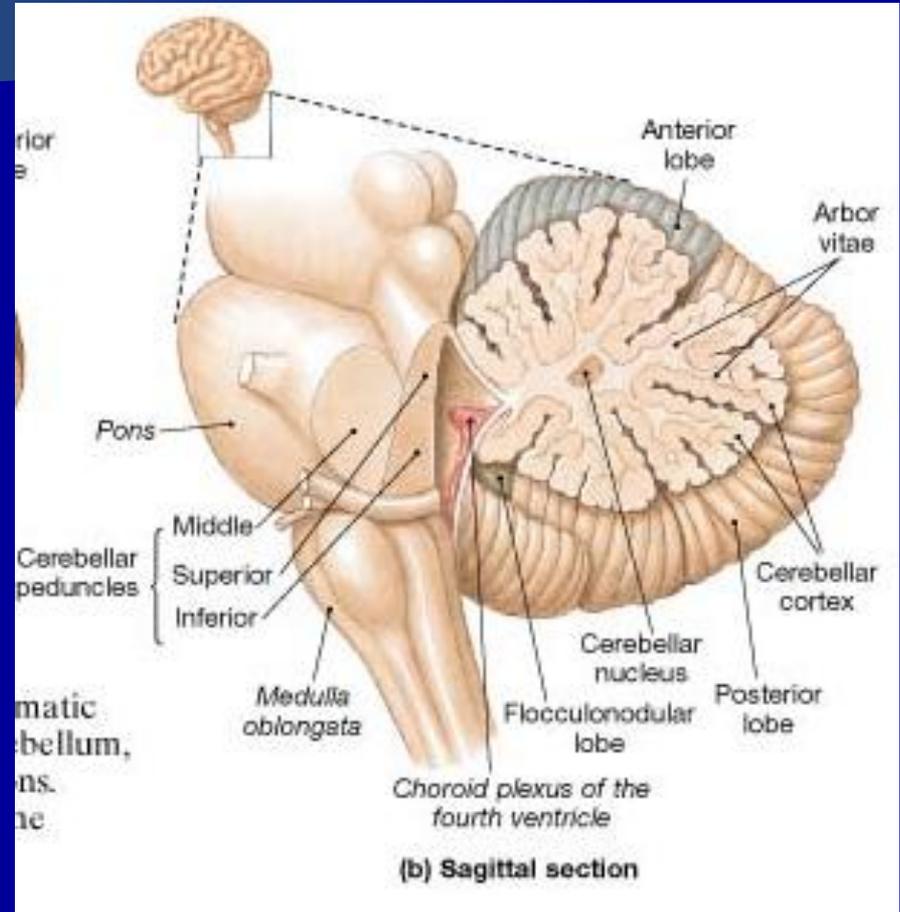
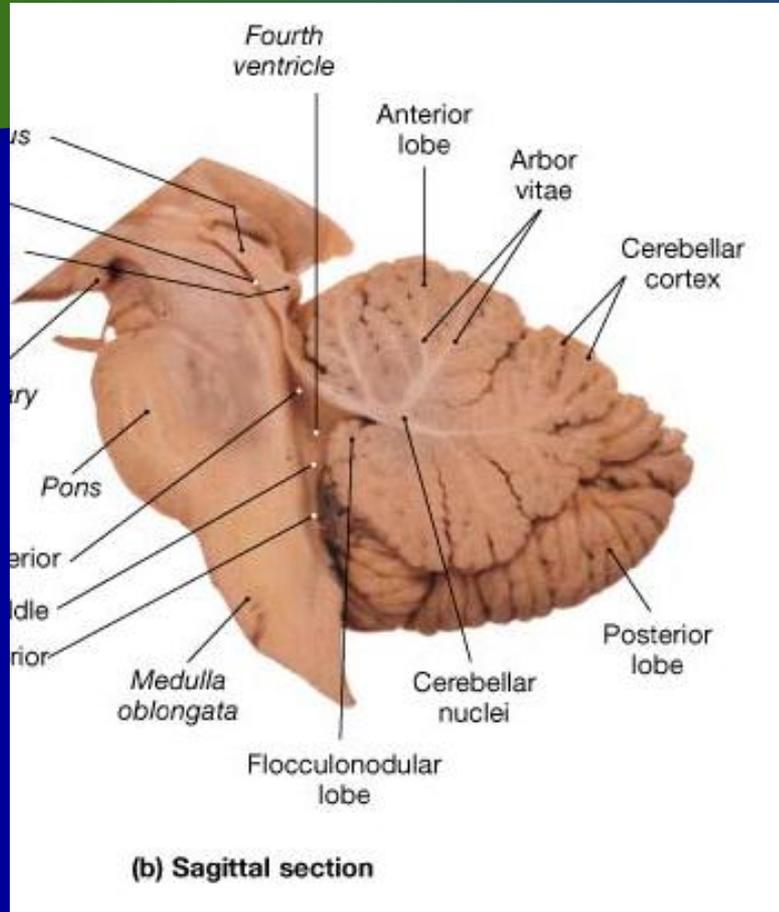
The cerebellum

- Two cerebellar hemispheres connected together by the vermis
- Composed of
 - central white matter
 - Grey cortex
 - Deeply placed nuclei

The Cerebellum – White and Gray Matter

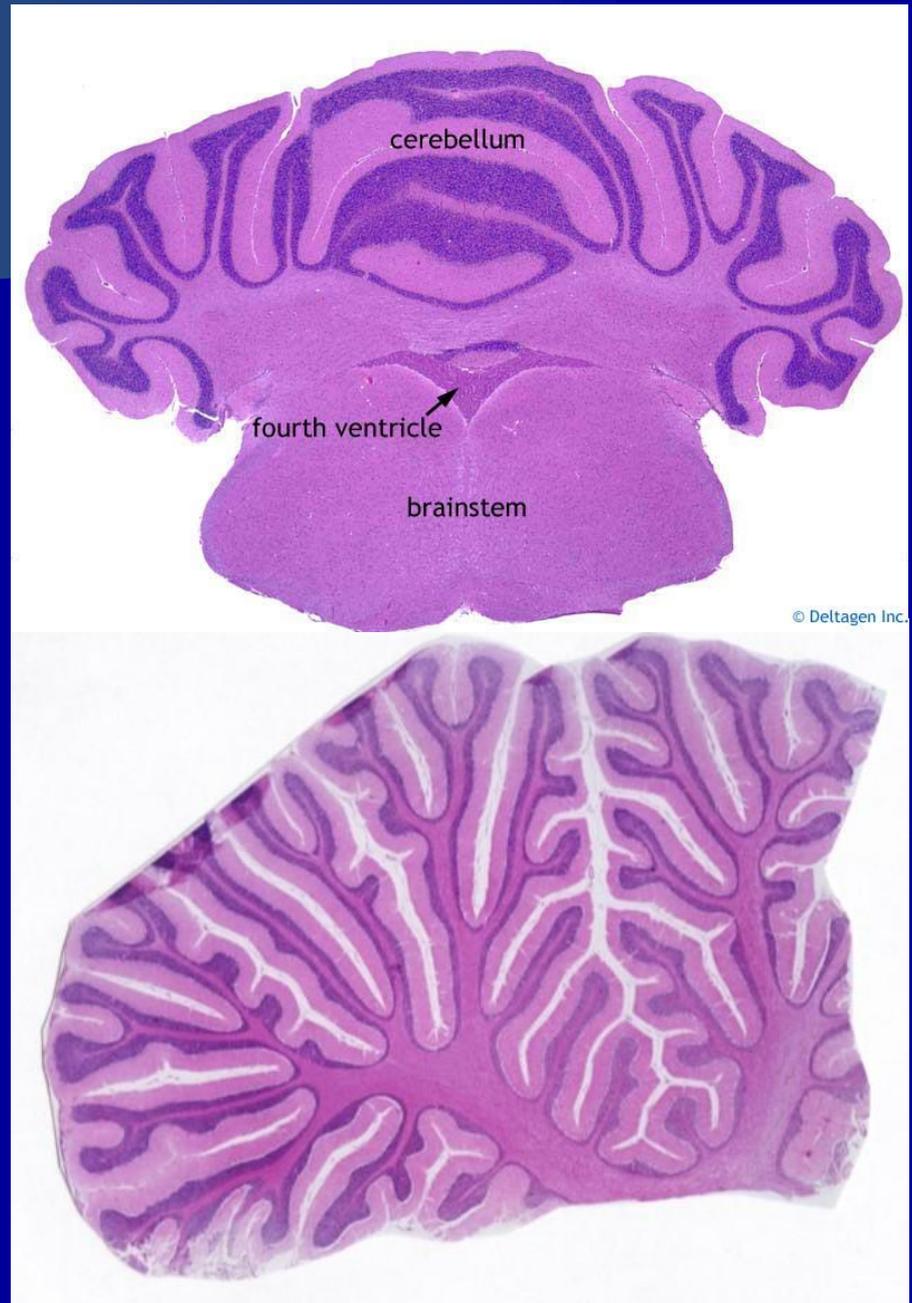


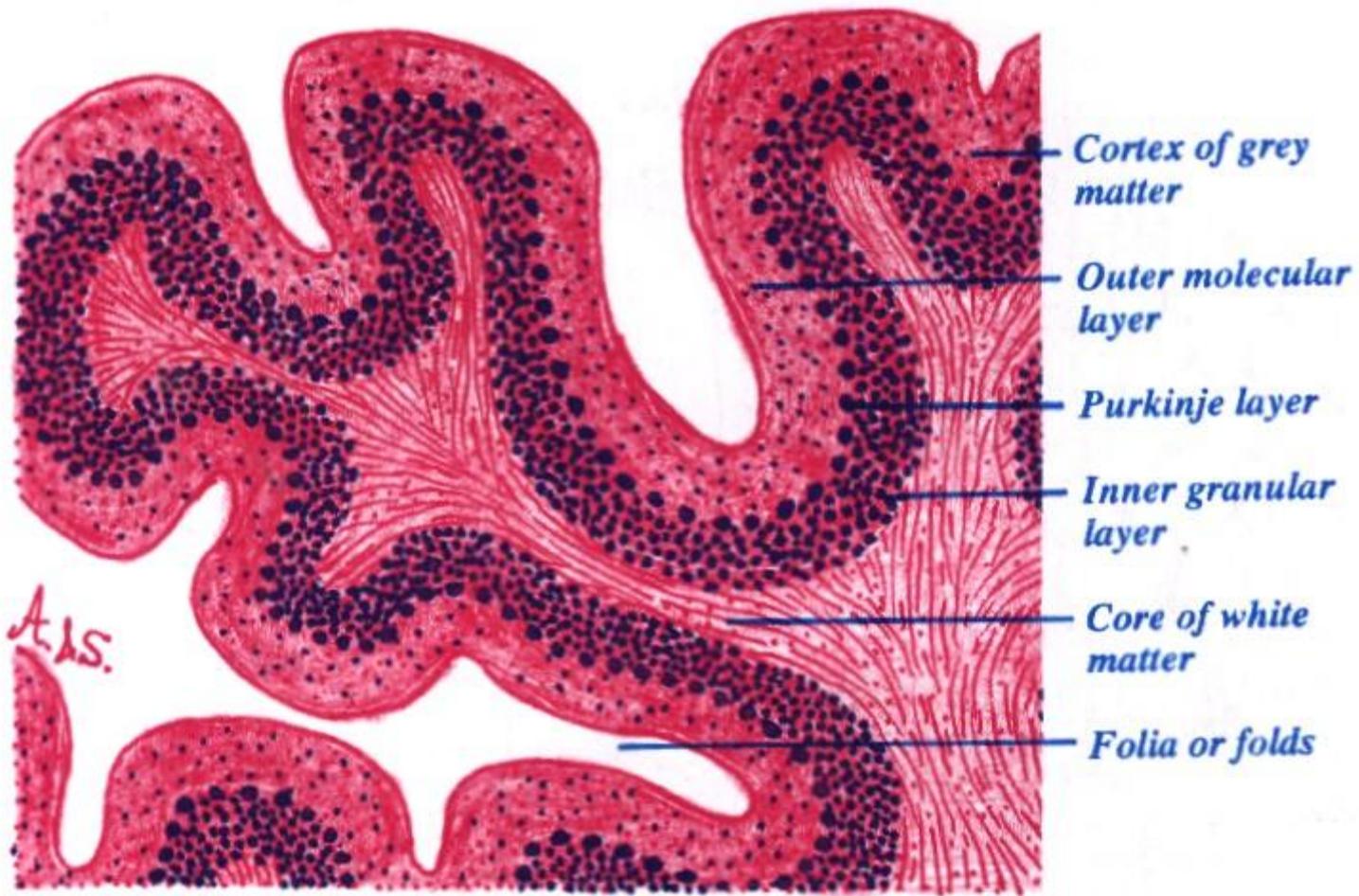
The cerebellum contains more than half of neurons in brain. The thickness of cerebellar cortex is the same everywhere 0.6 mm.



- The section can be known by the naked eye due to presence of **folia**

- Each folium consists of a central core of white matter (pale) & a covering cortex of grey matter (**darker**)





Vertical section :

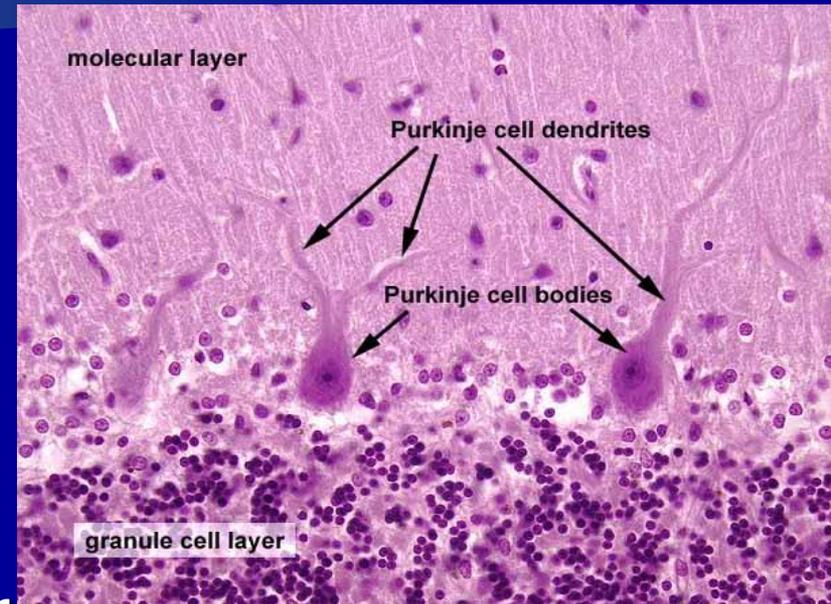
1) **Molecular layer** : pale as it is formed of fibers mainly

2) **Purkinje cell layer** :

thin layer

occupied by purkinje cells

- Large cells with large rounded nuclei
- Pyriform in shape
- Situated far from each other



3) **Granular layer** : deeply stained (very small cells)

The cerebellar cortex

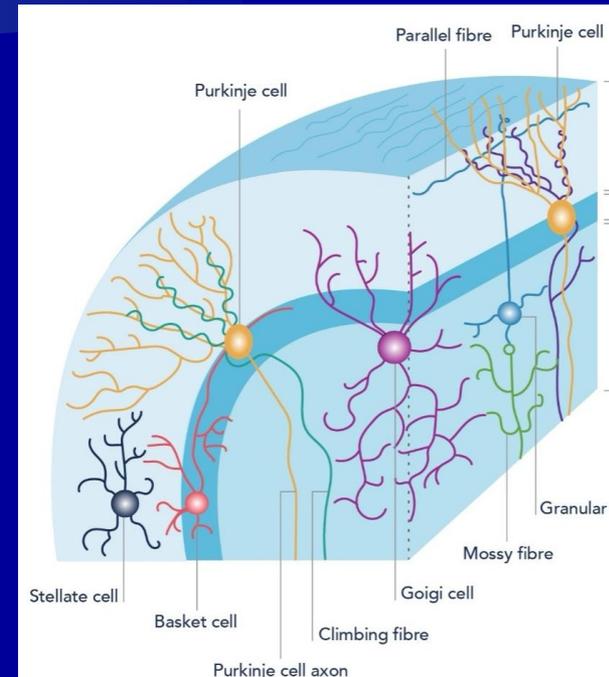
a) Outer molecular layer

- Contains nerve cell bodies,
- nerve fibers & neuroglia

■ Neurones :

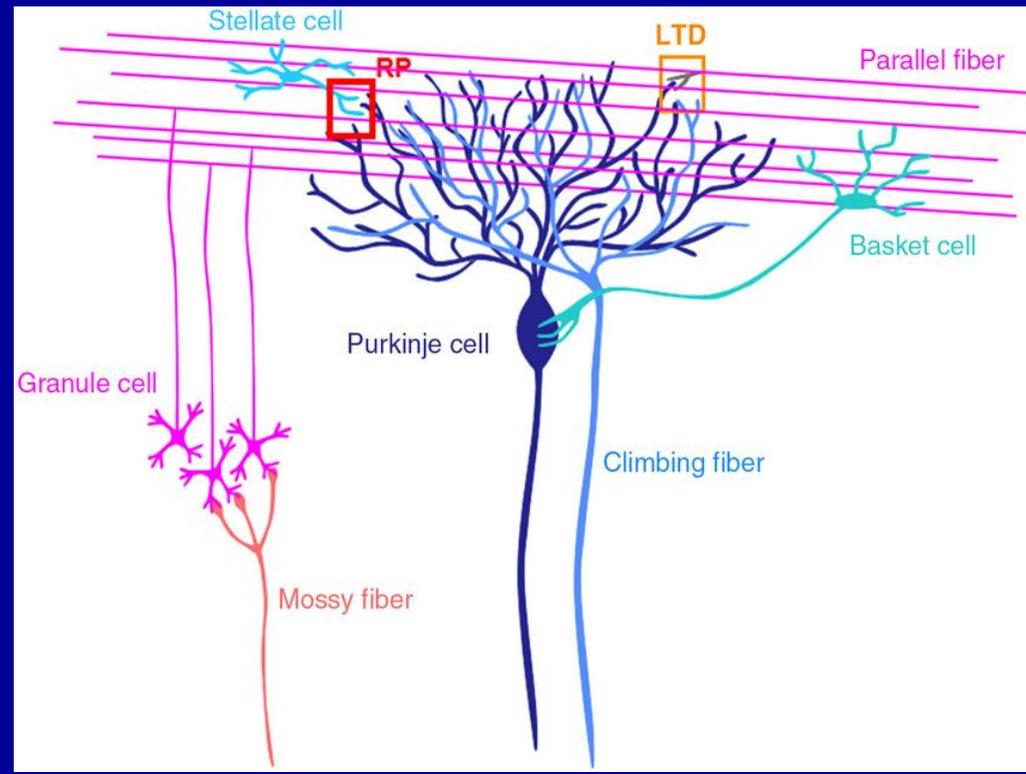
1- Outer stellate molecular cells

They have star-like shape soma and many radiating dendritic processes.



2- Inner basket cells They have multipolar cell body, free branching dendrites containing smooth spines, highly branched axon that arborized in the form of basket

surrounding the soma of purkinje cells

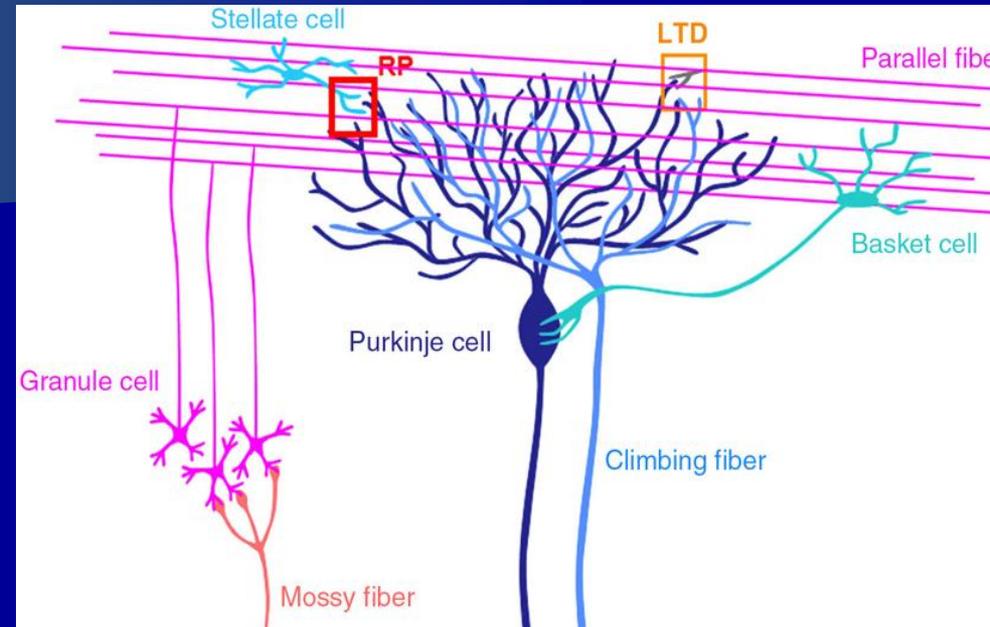


Fibers

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

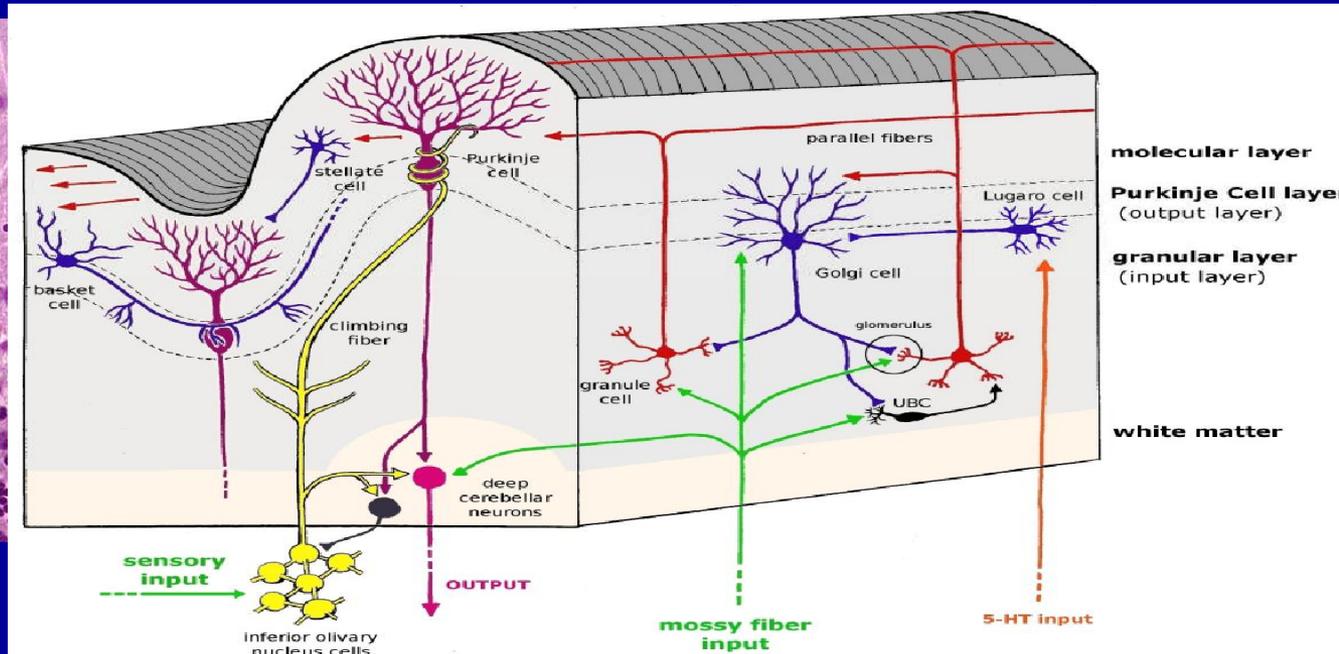
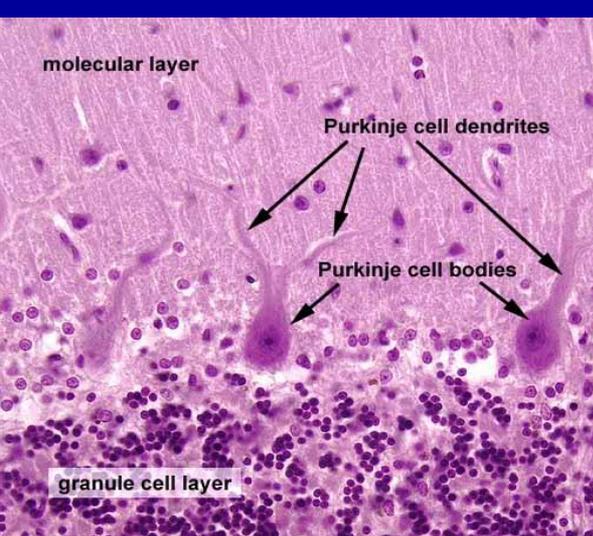
N.B.

- The fibers run parallel to the surface
- Neurones are few & unmyelinated nerve fibers are numerous
- Climbing fibers cross the granular layer without stopping in it



b) Middle purkinje cell layer

- Flask shaped cells
- Arranged in a single layer
- They are Golgi type I neurones
- Their dendritic arborization pass to external molecular layer in one plane
- Their axons pass through granular layer to relay in deep cerebellar nuclei

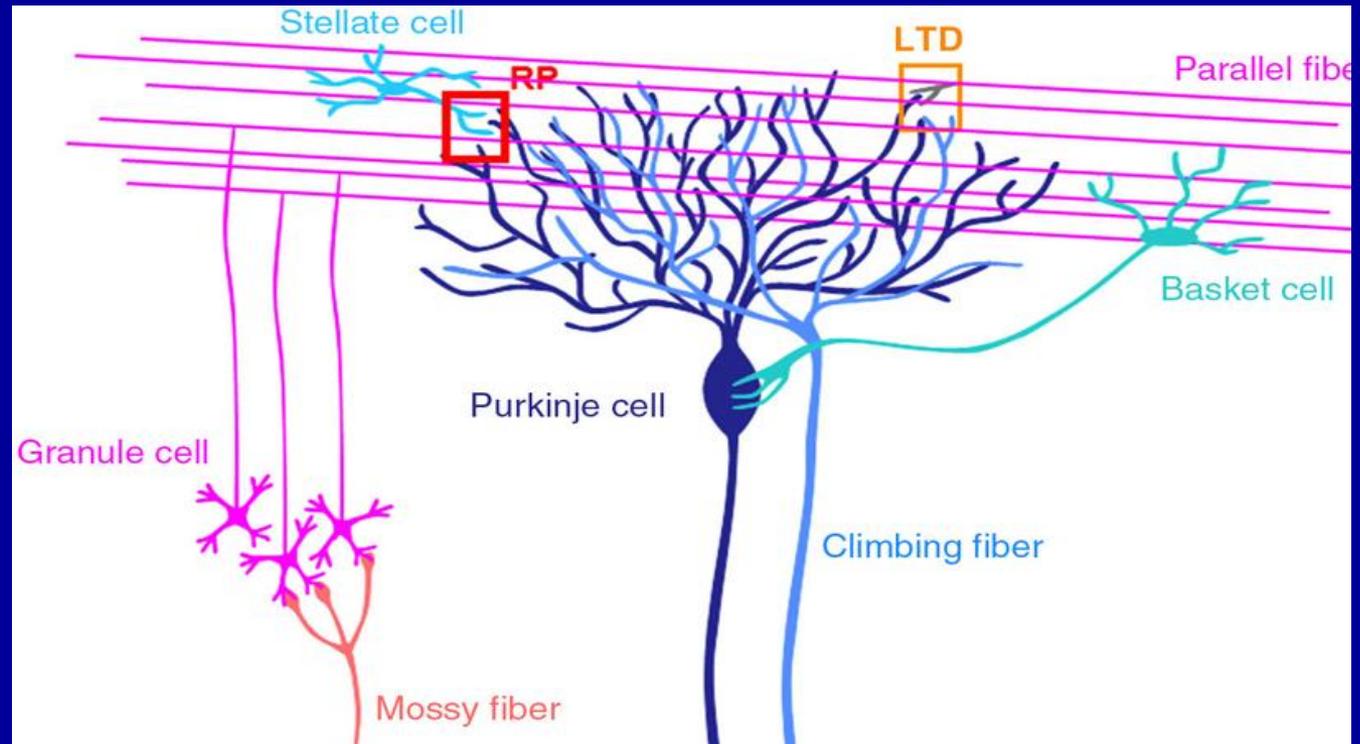


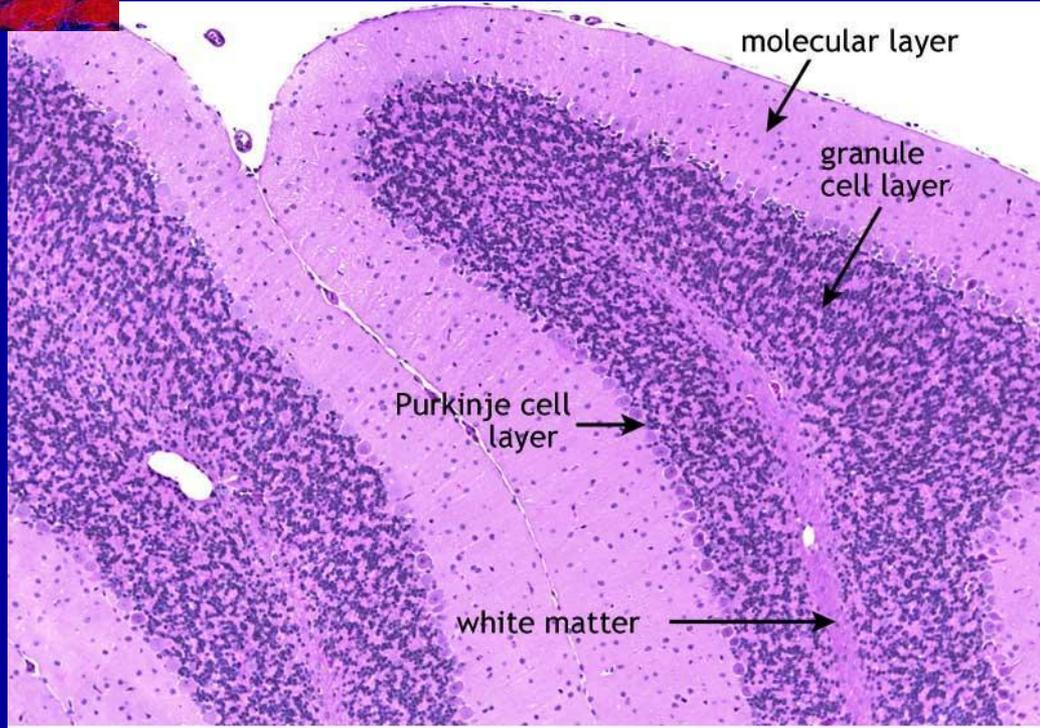
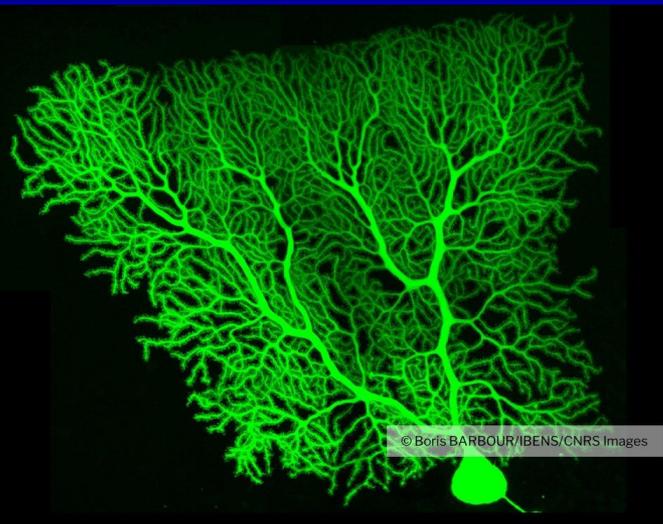
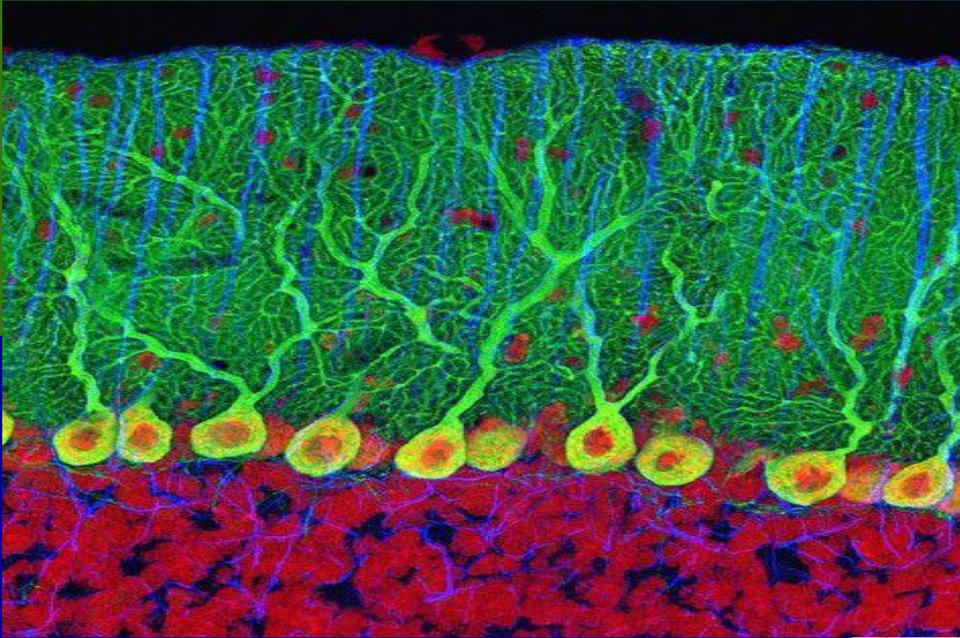
It receives impulses from other layers of cerebellar cortex

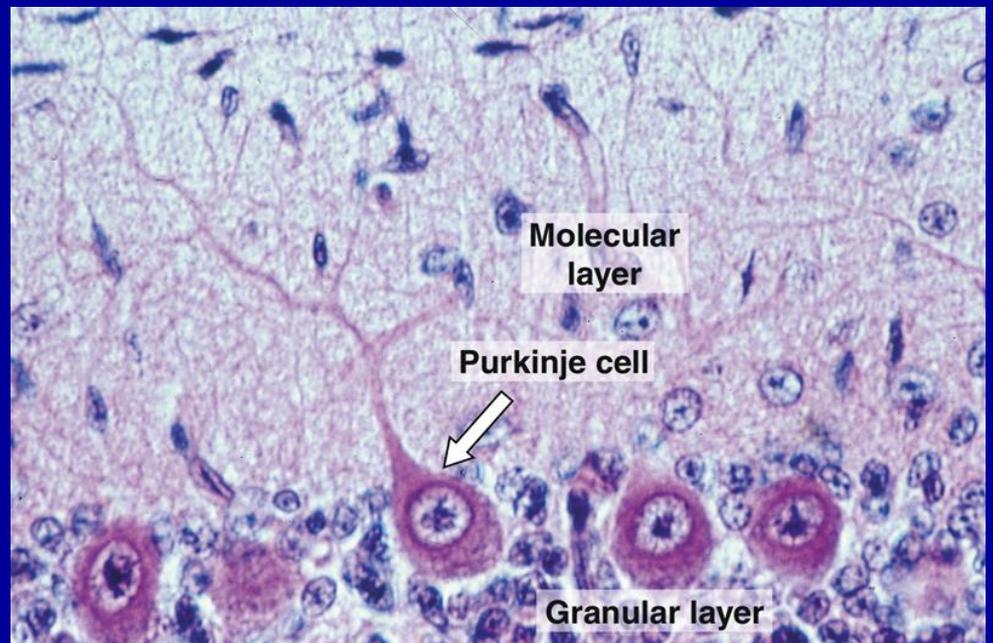
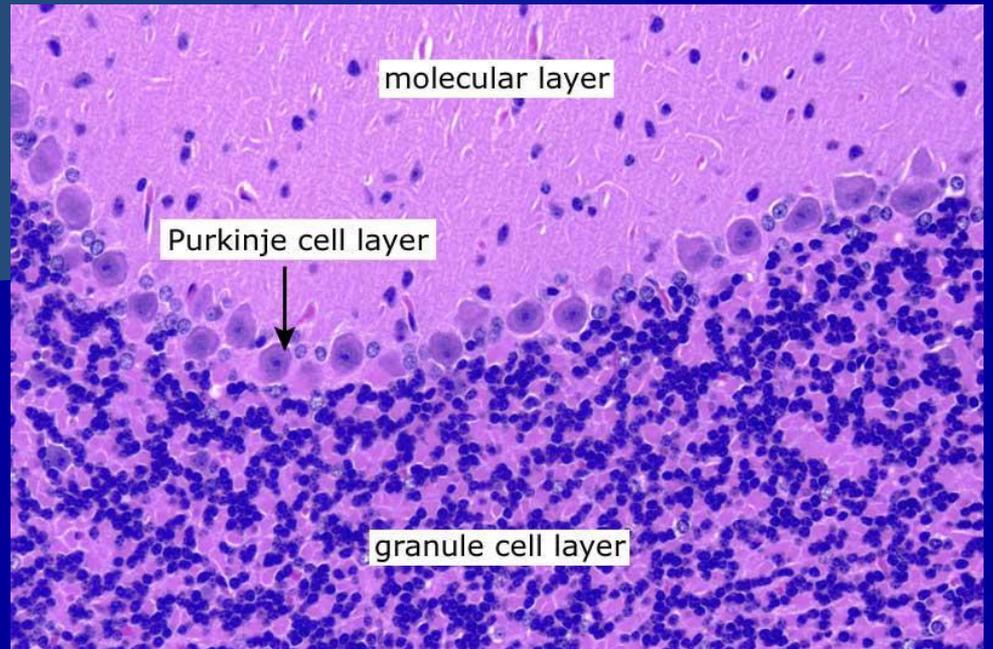
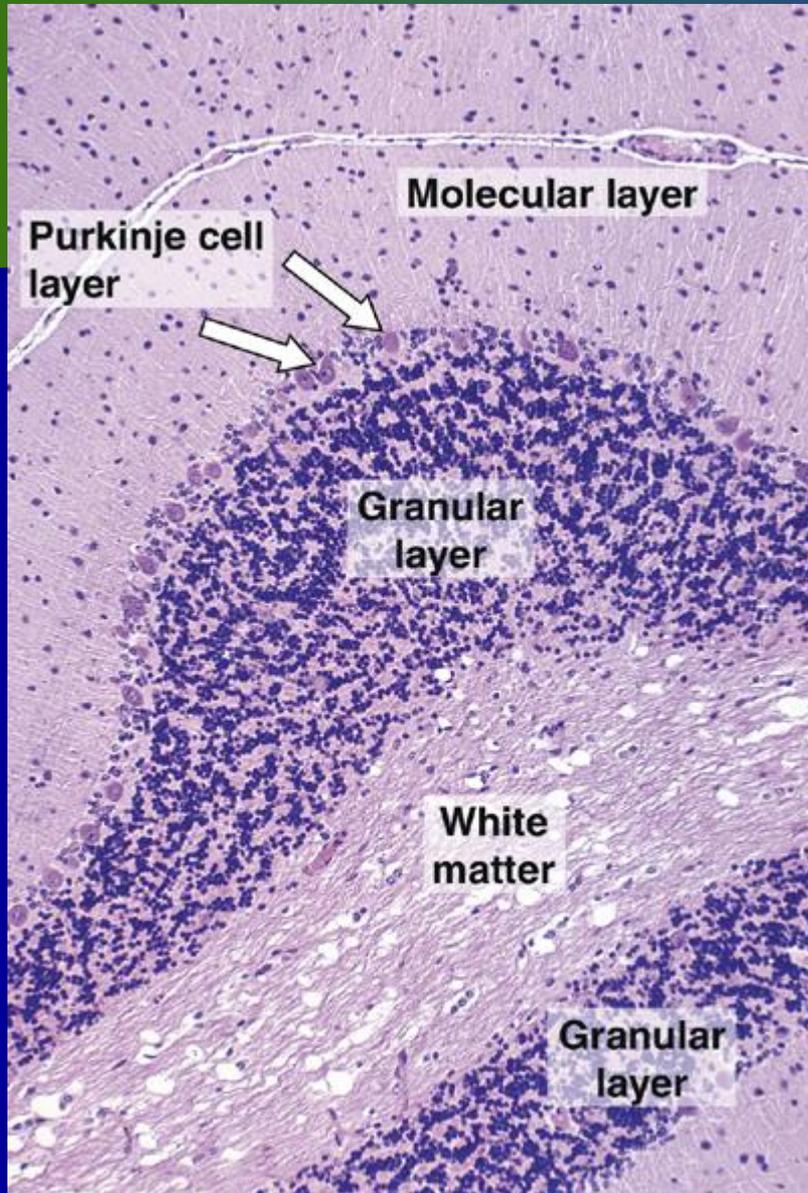
1) They receive impulses from pons through the climbing fibers

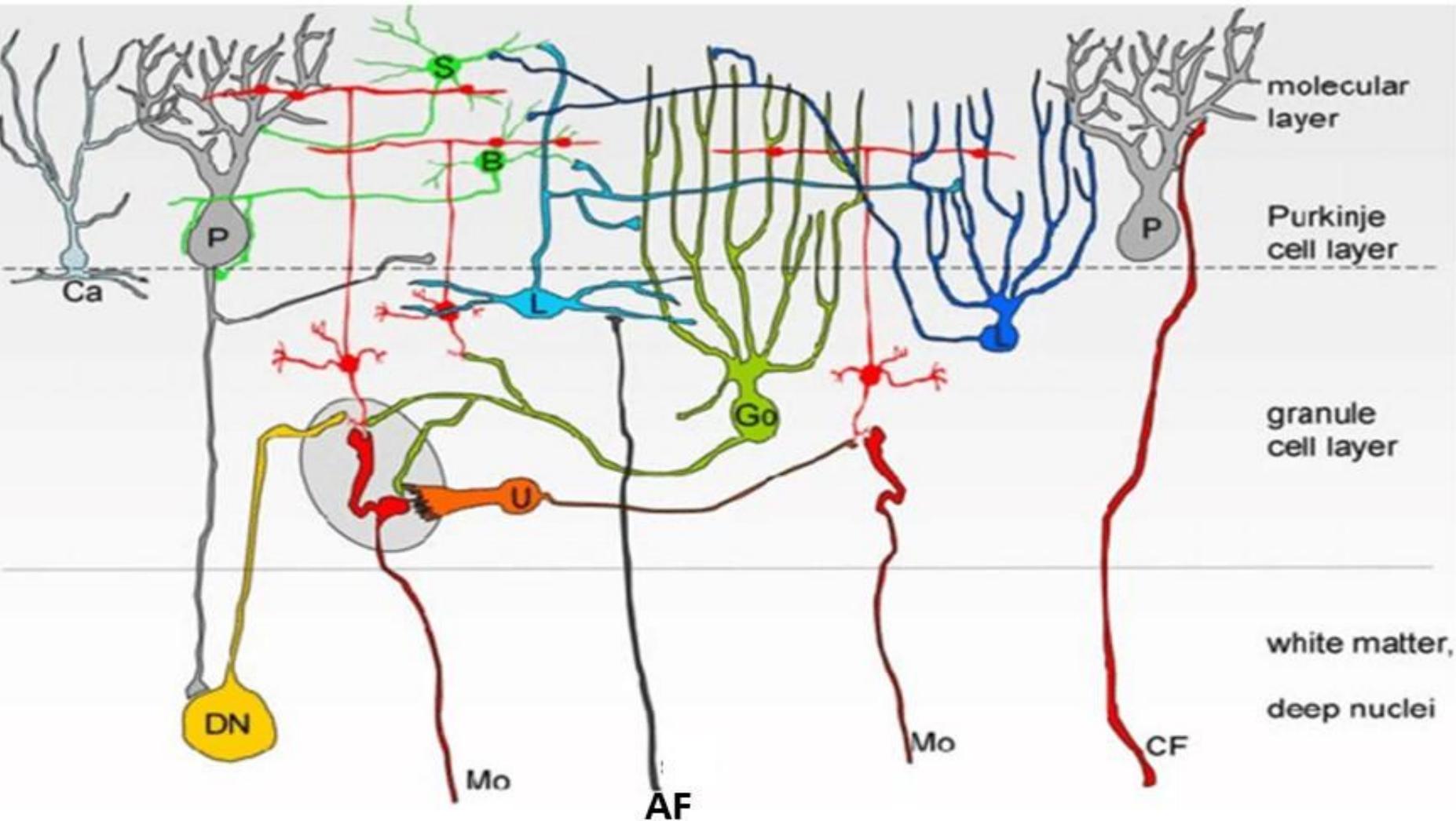
2) Receive impulses from the granular layer

3) They synapse with cells of molecular layer









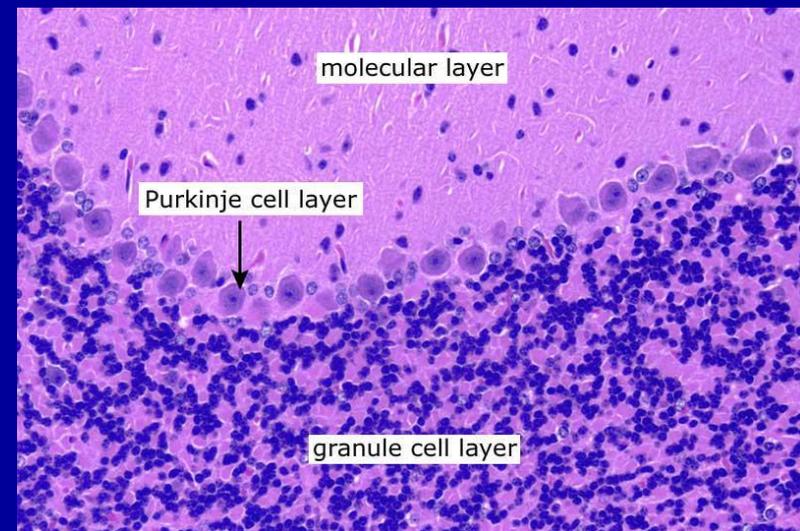
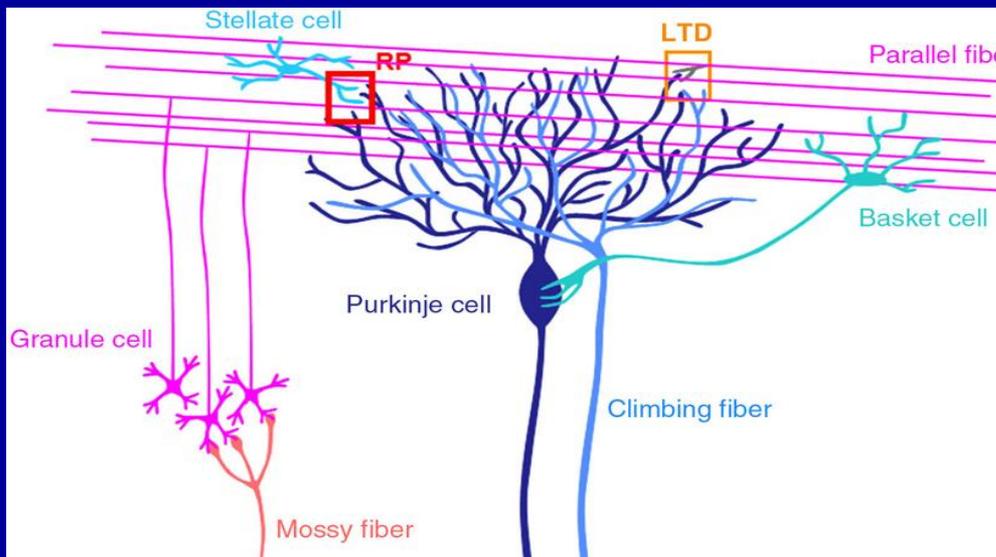
Projecting neurons: P= Purkinje cell

Interneurons: S= stellate, B= basket, Ca= candelabrum, L= Lugaro cells,
 U= unipolar brush cells, G= granule cells, Go= Golgi type II

Fibers: CF=Climbing fibers, Mo=mossy fibers, AF= Afferent fibers

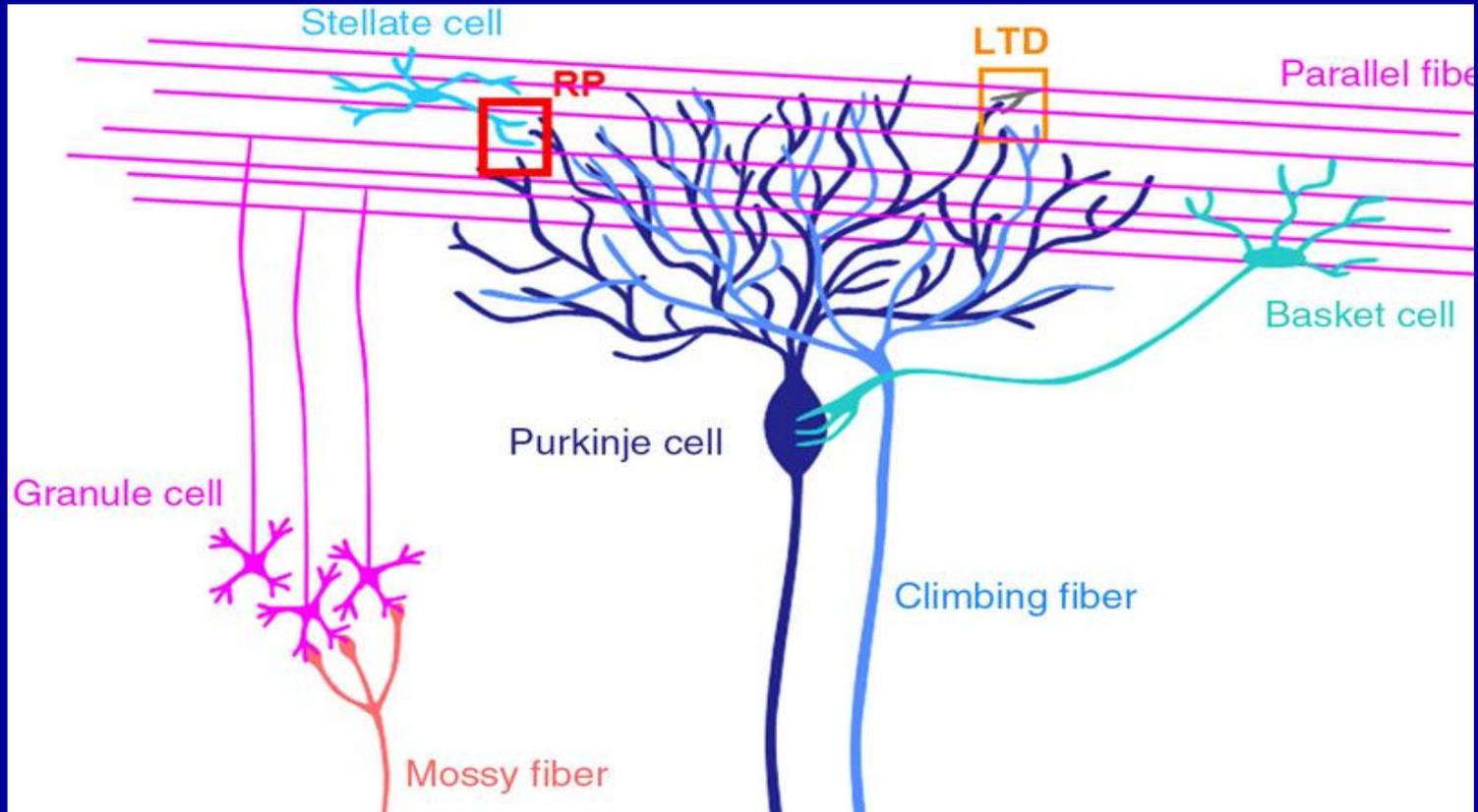
C) Inner granular (nuclear) cell layer

- Very small cells with densely stained nuclei & scanty cytoplasm (nuclear layer)
- Their axons pass into molecular layer (T-shaped branches = parallel fibers)
- Their dendrites synapse with some afferent fibers coming to cerebellum (Mossy fibers)



Axons of purkinje cells cross this layer to cerebellar nuclei

Climbing fibers pass through the granular layer to terminate in purkinje cells

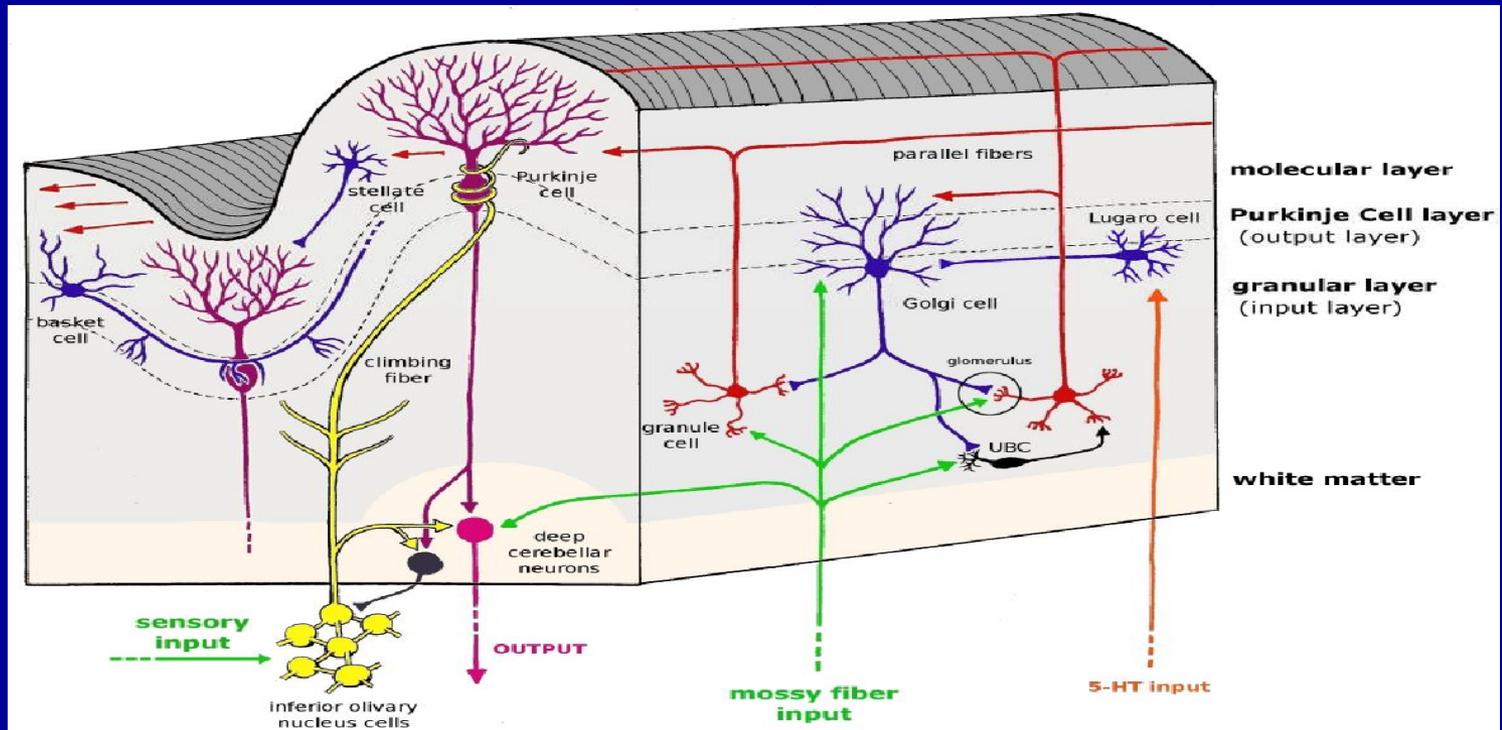


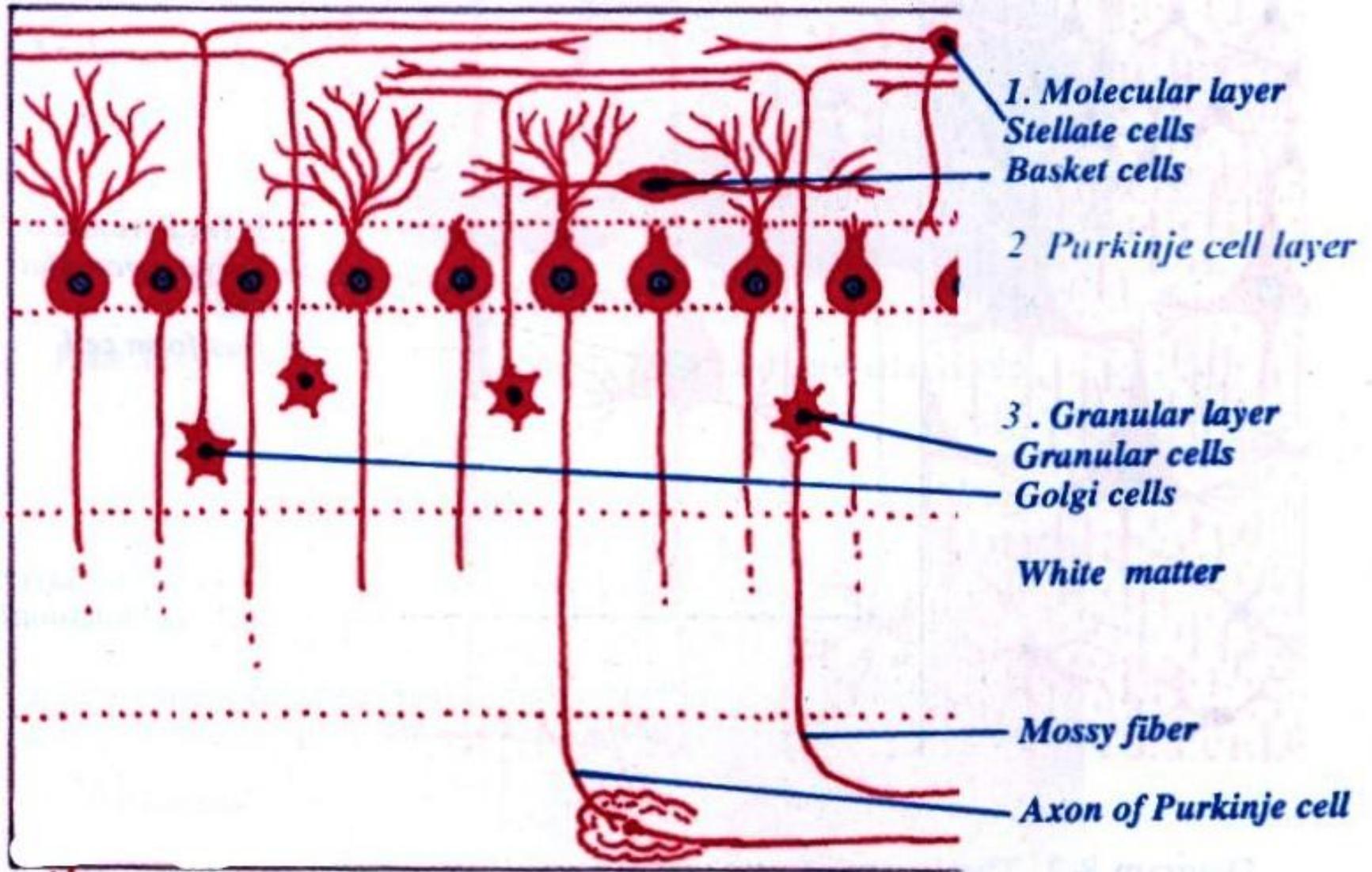
Inner granular (nuclear) cell layer

Golgi cells (Type II): They are large, stellate inhibitory neurons, scattered in the superficial part of granular cell layer.

Their dendrites enter the molecular layer, where they branch profusely and synapse with parallel fibers and dendrites of Purkinje cells. Some dendrites ramify in the granular layer.

Their axons also branch profusely, share in the formation of cerebellar glomeruli (complex synapses between.....).

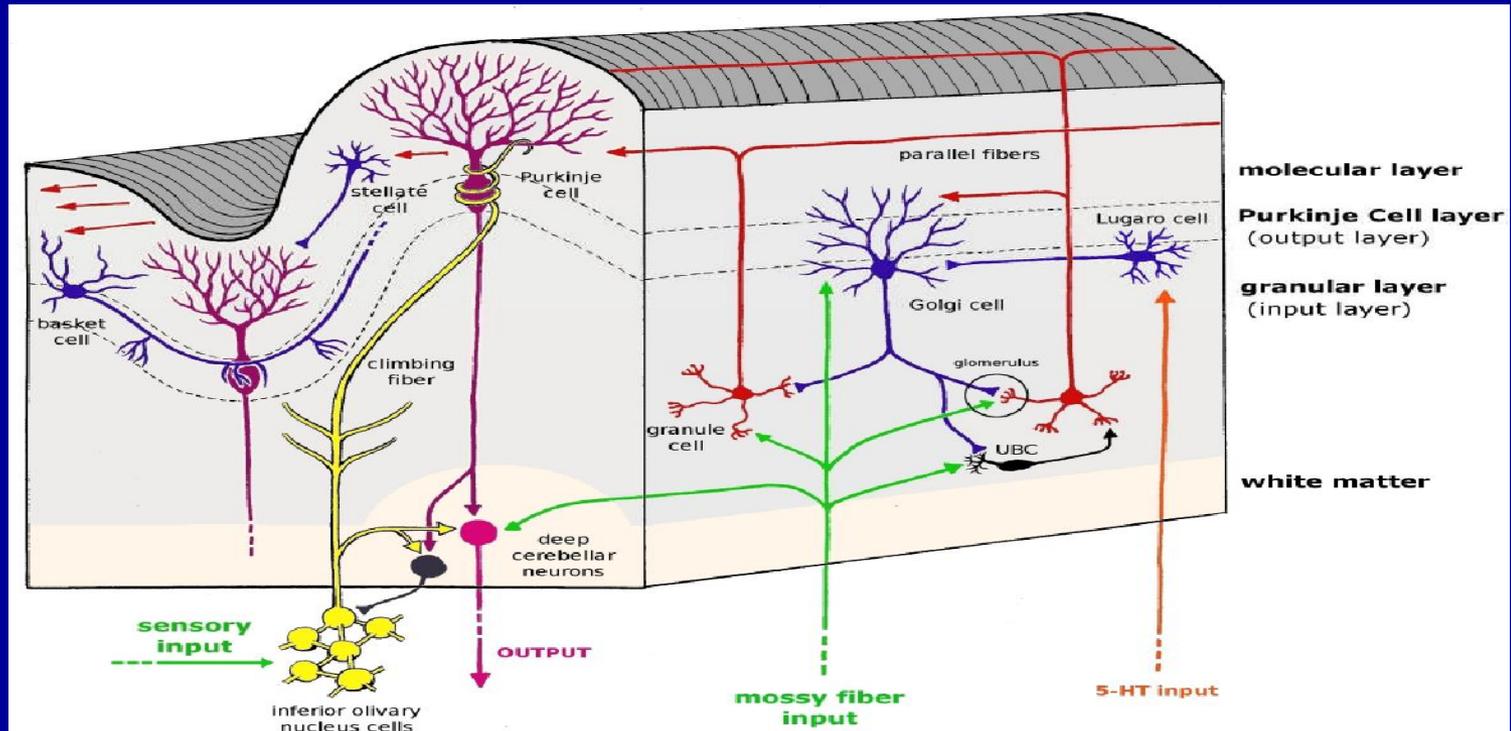




Cerebellar white matter

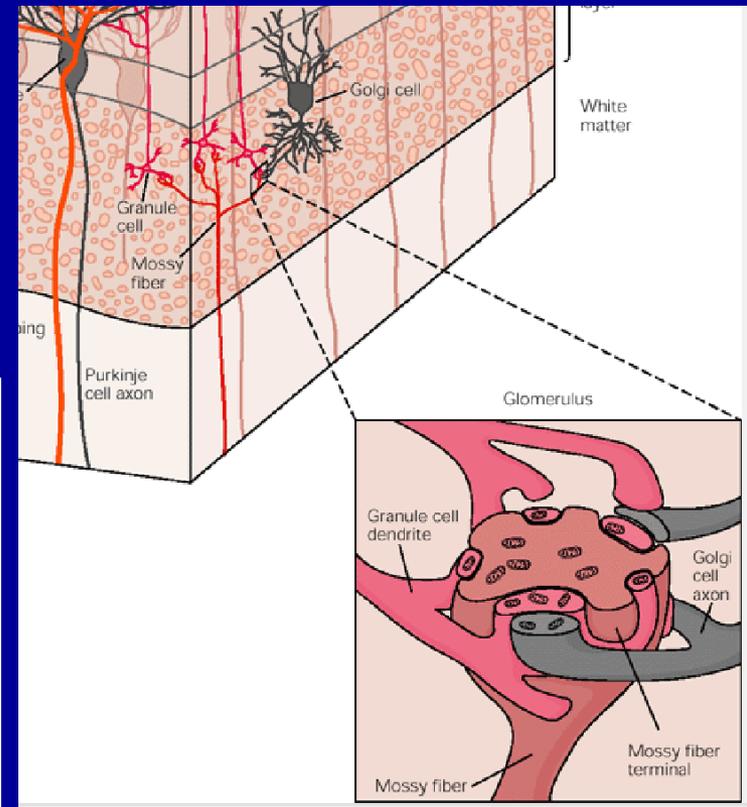
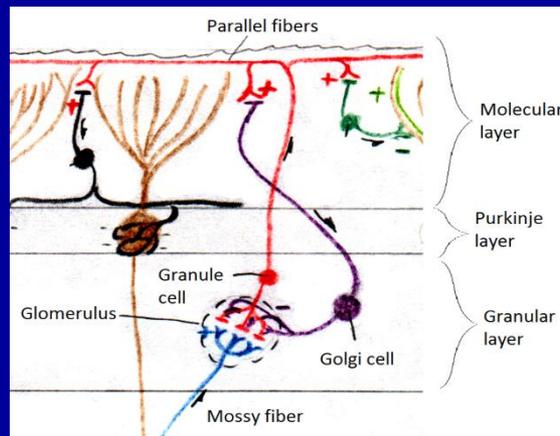
(1) Afferent fibers (input).

A- Climbing fiber system: These fibers are olivocerebellar. They pass through granular and Purkinje layers, reaching the molecular layer to synapse and associate with dendritic tree of Purkinje.



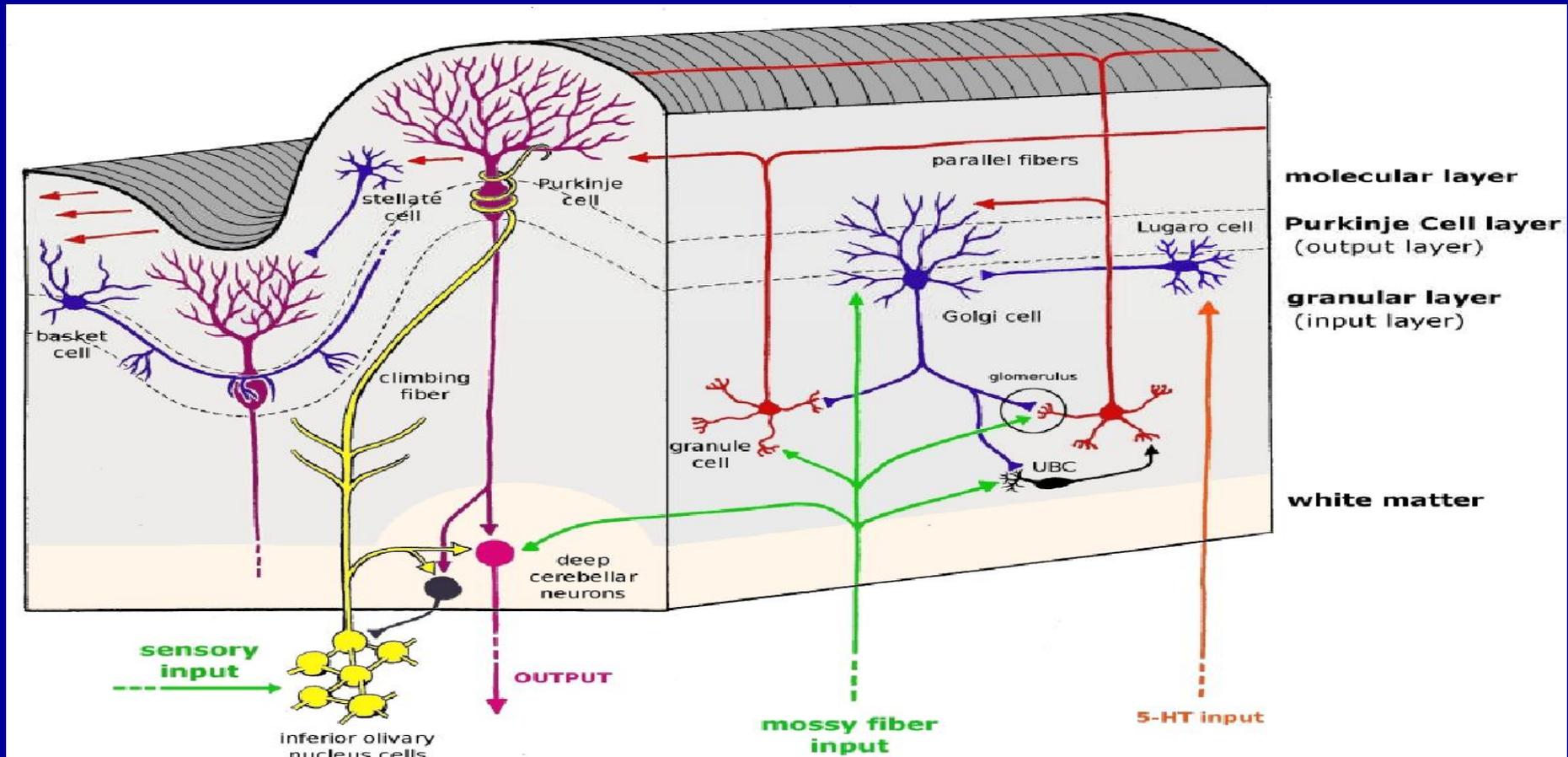
B- Mossy fiber system: (majority) comes from nearly all the CNS except inferior olives. Each fiber ends by about 50 rosette like structures. Each rosette synapses with 20 granule cells in the cerebellar glomerulus. So each mossy fiber has connection with about 1000 granule cells.

C- recurrent collaterals: side branches from axons of purkinje ends on dendrites of golgi cells



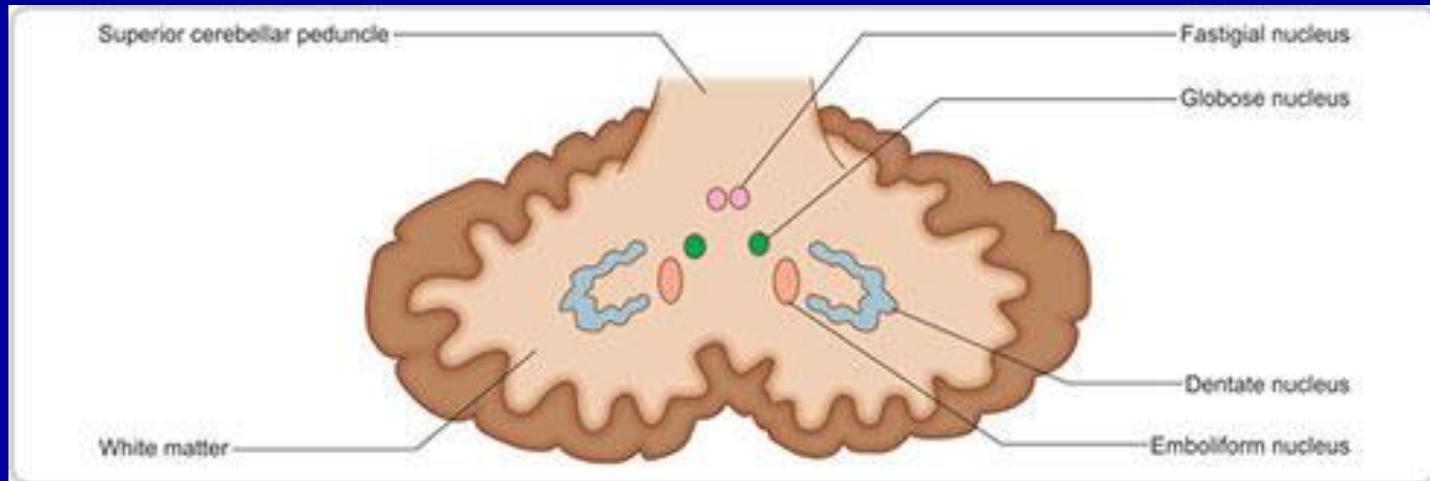
(2) Efferent fibers:

Axons of Purkinje cells : most Purkinje axons end in deep cerebellar nuclei



Efferents from deep cerebellar nuclei:

- a) Dentate nuclei project mainly to thalamus.
- b) Emboliform and Globose nuclei project mainly to red nucleus and inferior olive.
- c) Fastigial nuclei projects mainly to vestibular nuclei

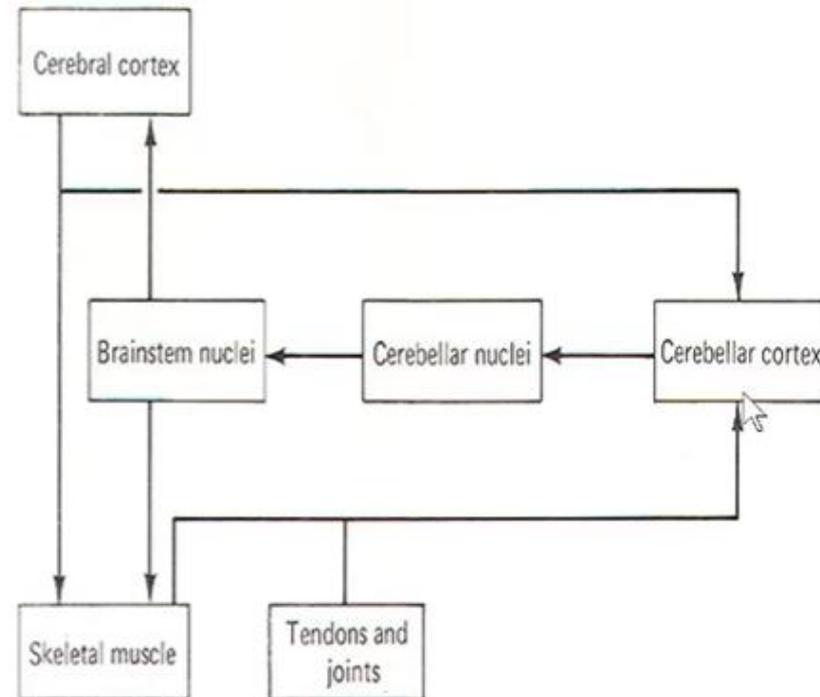


Functions of cerebellum

- **Functions:**

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

2- Co-ordination of voluntary movement.



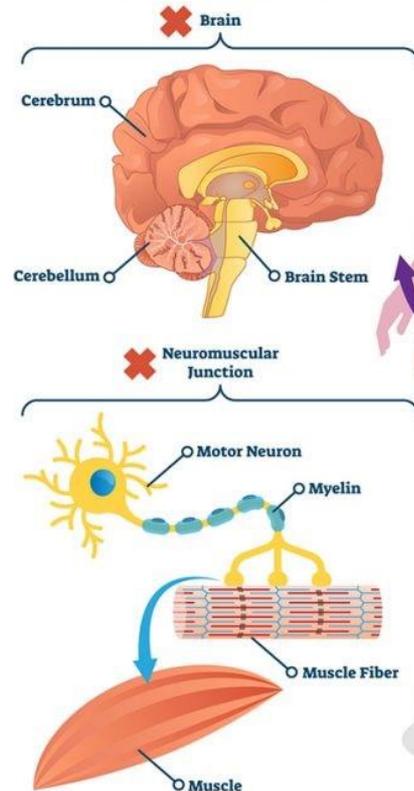
Diseases of cerebellum

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

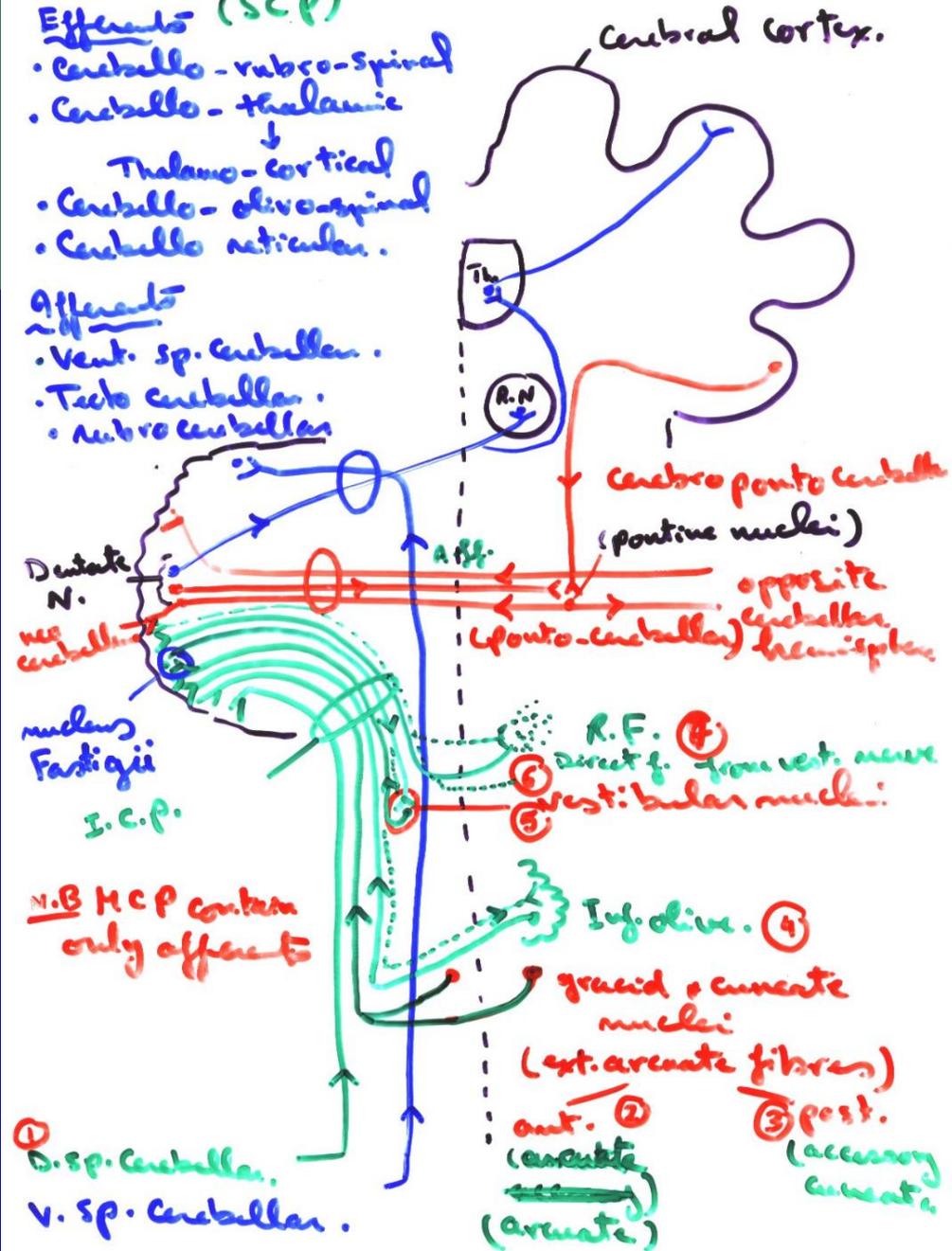


Efferents (SCP)

- Cerebello-rubro-spinal
- Cerebello-thalamic
- ↓ Thalamo-cortical
- Cerebello-olivo-spinal
- Cerebello-reticular.

Afferents

- Vent. sp. Cerebellar.
- Tecto cerebellar.
- Rubro cerebellar





*Thank
You*