CEREBELLUM - cortex

CEREBELLAR CORTEX

- trahinga ("krisfalini") vi vienodai skulptūra viename
  paviršinyje

- sudaryta iš trijų sluoksnių ir perkinio tipo neuronų:
  NA-256 [vinkle 56°]

MOLLEULAR layer

1) Stellate (s. order stellate) cells

   AF (AFFERENT CONNECTIONS): parallel fibers (dendrites occupy transverse plane)
   EF (AXONAL DISTRIBUTION): Purkinje dendrites

2) Basket (s. inner stellate) cells

   AF: parallel fibers (dendrites occupy transverse plane)
   EF: Purkinje perikarya (aksonai sudaro "kreipželmis" glikin
   Purkinje perikarya) Basket fibers

   (aksonai eina in transverse plane,
   lygiagretai folium paviršini
   TANGENTIAL fibers)

   ↑ interfolial and infranulary connections
   (gali periti į gretimuo folium)

PURKINJE layer - only one cell thick!

3) Purkinje cells - large perikarya (among biggest neurons in body)

   AF: a) climbing fibers (4:1)
   b) parallel fibers
   c) basket fibers
   d) stellate cells aksonai
   e) is locus caeruleus

   Locus caeruleus (s. cinereus) - a shallow depression of a
   blue color in most rostral portion of rhomboïd form near
   cerebral aqueduct; melanin-pigmented perikarya and non-
   adrenergic axons
Fig. 7-3. Schematic diagram of the cerebellar cortex in sagittal and transverse planes showing cell and fiber arrangements. Purkinje cells and their processes (i.e., axons and dendrites) are shown in blue. Mossy fibers are in yellow; climbing fibers are shown in red. Golgi cells, basket cells, and outer stellate cells are in black. While the dendritic arborizations of Purkinje cells are oriented in a sagittal plane, dendrites of the Golgi cells show no similar arrangement. Layers of the cerebellar cortex are indicated. (From Truex and Carpenter, Human Neuroanatomy, 1969, courtesy of The Williams & Wilkins Company.)
EF:  
1) deep nuclei (vast majority)  
2) vestibular nuclei (i.e. vestibulocerebellum) — small minority that leaves cerebellum!  
3) recurrent collaterals back to themselves and to Golgi cells

Purkinje axons — efferent ves cerebellar cortex, shaidulas
All afferent pathways ultimately converge on Purkinje cell — “final common pathway”

GRANULAR layer

4) Golgi cells (s. Golgi type II neurons)
   dendrites pass hind in p. virtual shellinacinis, orce plakštiuose
   AF:  
   a) mossy fibers  
   b) climbing fibers  
   c) parallel fibers
   EF:  
   granulí

5) Granule cells
   AF:  
   mossy fibers
   EF:  
   a) Purkinje dendrites  
   b) Golgi dendrites  
   c) stellate cells  
   d) basket cells

“T” like axonovi pasišauja i molecular layer in beišininkinio ižgel
shaidulas, sienarios ižgel v. long axis of folium in its area
liai (kaip elektrai laudyn pliaškyt — PARALLEL fibers —
— intrafetal connections; cortanais šaltuoju dendrito medži

granule cells esti mažos, labai susipūdė, mažai ciddplazemos
šviesčios lastelės

GRANULE cells — efferent neurons  
GOLGI, BASKET, STELLATE cells — inhibitory interneurons
PURKINJE cells — efferent neurons
1. **CLIMBING fibers**
   - originate from inferior olivary nucleus (from proprioceptive information)
   - enter molecular layer in 'Lipa' Purkinje dendritic tree (sautkykis: 1 climbing fiber = 1 Purkinje cell)
   - essential for learning of motor tasks!

2. **MOSSY fibers**
   - originate from all other systems (spino-, cuneato-, vestibulo-, pontocerebellar) - proprioceptive information from all body parts + information from cerebral cortex + all other information to cerebellum
   - enter granular layer in 'Stalaktita' core of glomerulus (sautkykis: 1 mossy fiber = thousands of granule cells)
   - affect Purkinje cells

**Cerebellar glomerulus** - synaptic complex, surrounded by glial capsule in granular layer
- Core: mossy fiber ending (rosette)
- Outer core: synaptic synapse:
  1) axons and dendrites of Golgi cells
  2) dendrites of granule cells

- **Scheme:**
  - Input (inhibitory)
  - Output (excitatory)
  - Golgi cell inhibits transmission of mossy fibers to granule cell

*In light microscopy appear as clear spaces in dark granular layer*
Fig. 7-5. Schematic reconstruction of a cerebellar glomerulus based upon electron microscopic studies. A cerebellar glomerulus is formed by one mossy fiber rosette, the dendritic terminals of numerous granule cells (red), and terminals of Golgi cell axons (yellow). Proximal parts of Golgi cell dendrites (blue) also enter the glomerulus and establish broad synaptic contacts with the mossy fiber rosette. The entire nodular structure is ensheathed in a glial capsule. In this reconstruction the glomerulus is shown in a schematic three-dimensional view (based upon Eccles et al., '67). (From Truex and Carpenter, *Human Neuroanatomy*, 1969; courtesy of The Williams & Wilkins Company.)
FIGURE 31. Basic neuronal circuit of the cerebellum. PC, Purkinje cell. PF, parallel fiber. GC, granule cell. MF, mossy fibers. CF, climbing fibers. CNC, cerebellar nuclear cell. Cortical interneurons are omitted. Plus sign (+) indicates excitatory synapses, and minus sign (−) signifies inhibitory synapses. (Reproduced from Patton et al.: Introduction to Basic Neurology, by kind permission of the authors and publisher.)
FIGURE 30. Diagram of cells in a folium of the cerebellum. The Purkinje cells have a large dendritic tree across the plane of the folium, and hence in the view on the right are much more extensive than in the plane parallel to the length of the folium on the left. Mossy fibers synapse with many granule cells in the cerebellar glomeruli. The axons of granule cells enter the molecular layer and divide, each branch running lengthwise in the folium as a "parallel" fiber, synapsing with Purkinje cells and basket cells. Climbing fibers synapse directly with Purkinje cells. Axons of Purkinje cells have recurrent branches to adjacent Purkinje cells and to other cells (not shown). (Reproduced from Gardner: Fundamentals of Neurology, 6th ed., by kind permission of the author and publisher.)
INHIBITORY and EXCITATORY connections in cerebellum:

1. All extrinsic incoming fibers (climbing & mossy) are EXCITATORY.

2. DS neurons — the granule cells (parallel fibers) are EXCITATORY. Wisi hiti ziemos neuronai —

3. Gauna inhibicija iš Purkinje fibers 

4. On glomerulus: 

   1. Inhibitory granule cell

5. Purkinje cells excitation gauna iš climbing fibers
   mossy — parallel fibers

   inhibicija gauna iš internuncios:
   a) Golgi cells
   b) stellate cells
   c) basket cells

Rezumė: nunišalės inhibicinės aiškūs ir įsirengė yra iš CORTEX neuronų tipai (Purkinje, Golgi, stellate, basket)

Cerebellar cortex generates basic electrical rhythm (150-300 Hz)

- incoming stimuli generally alter amplitude of cerebellar rhythm.
Diagram of neural connections in the cerebellum. + and – signs indicate whether endings are excitatory or inhibitory. BC, basket cell; GC, Golgi cell; GR, granule cell; NC, cell in deep nucleus; PC, Purkinje cell. Note that PCs and BCs are inhibitory. The connections of the stellate cells are similar to those of the basket cells, except that they end for the most part on Purkinje cell dendrites.