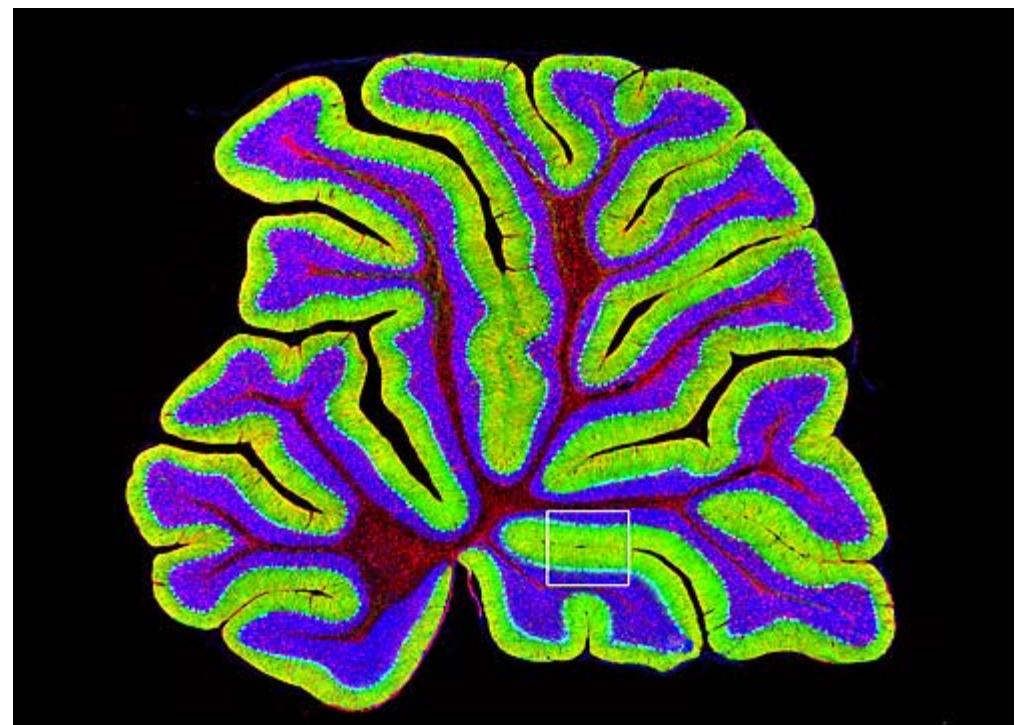
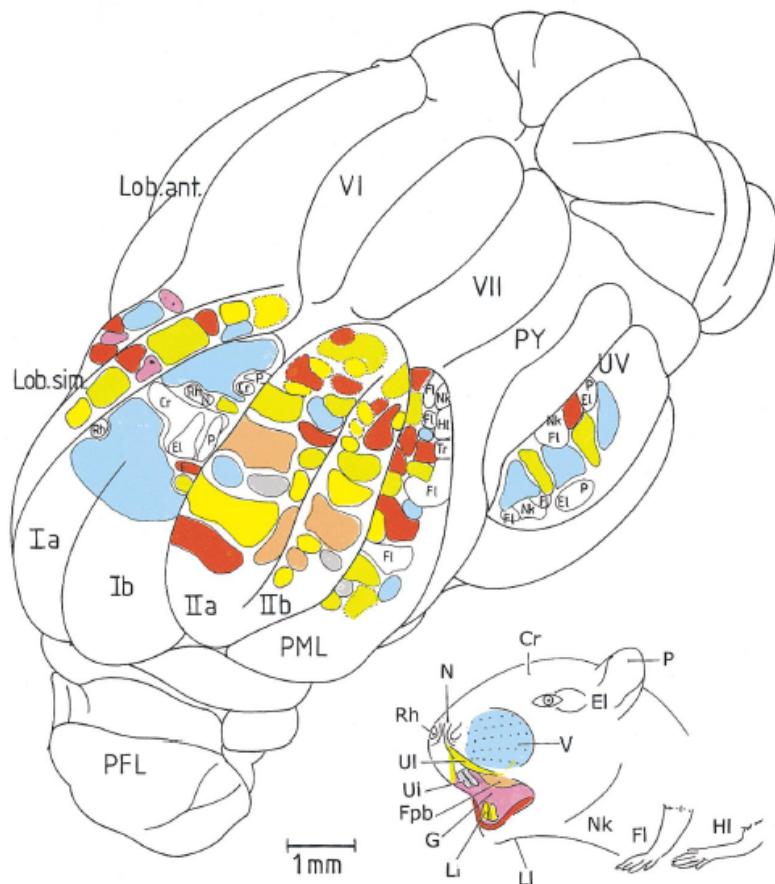


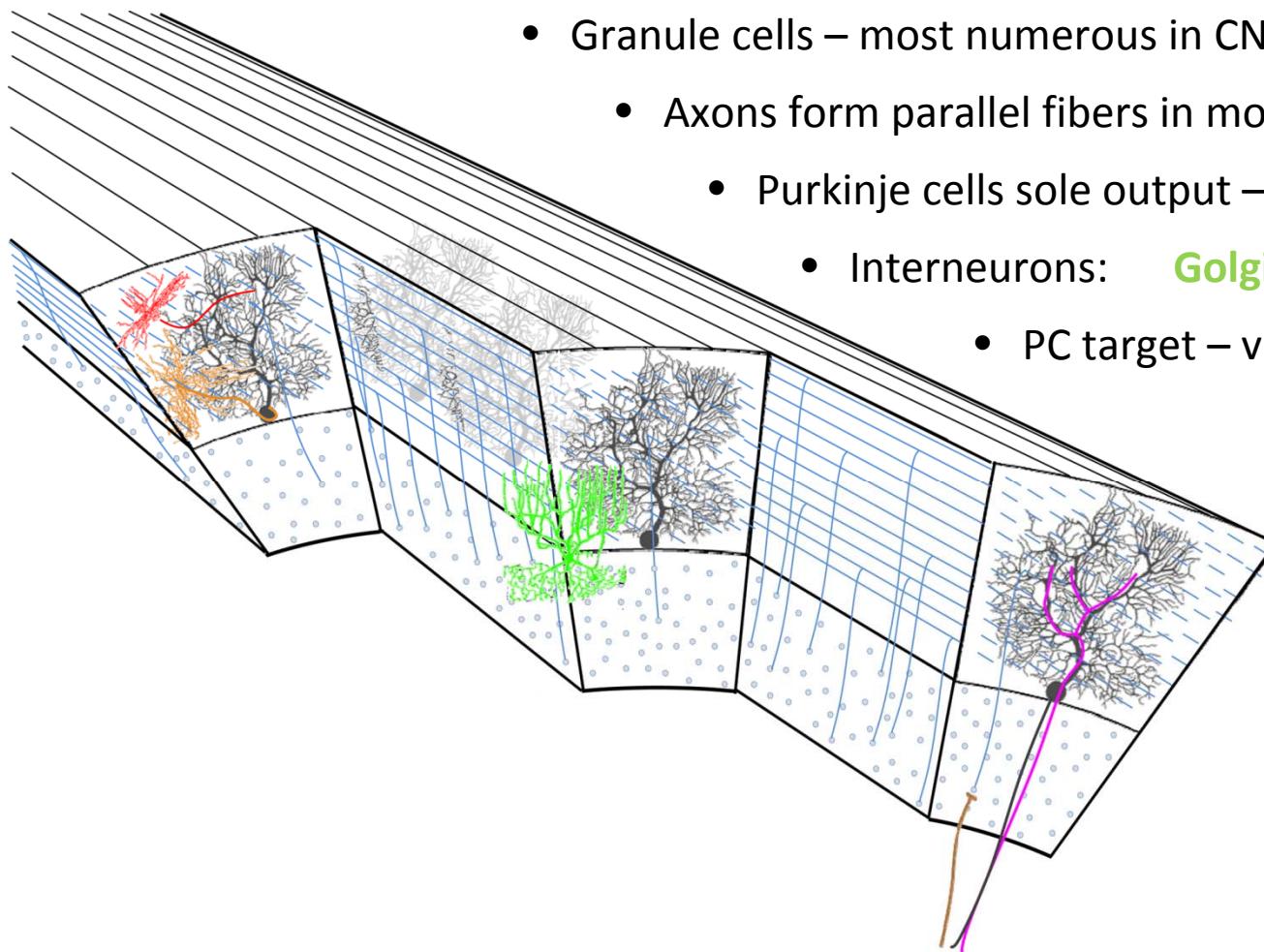
# Anatomy

- Highly folded, surface area 500 cm<sup>2</sup> (compared to 2300 cm<sup>2</sup> of cerebral cortex)
- 3-layered: Granular, Purkinje, Molecular



Voogd, Glickstein (1998) Trends Neurosci, 21:370-375  
slice by Thomas Deerinck

# Cerebellar Cortex



- Granule cells – most numerous in CNS, ~50 billion
  - Axons form parallel fibers in molecular layer, up to 3 mm
  - Purkinje cells sole output – inhibitory
  - Interneurons: **Golgi, stellate, basket**
  - PC target – vestibular and deep nuclei

# Median cell counts in vertebrate cerebellar structures

	Purkinje cells ( $10^3$ )	Granule cells ( $10^6$ )	Inferior olive ( $10^3$ )	Deep nuclei ( $10^3$ )	Purkinje:deep n. cell ratio	Olive:deep n. cell ratio
human	16,500	54,000	1,030	620*	26	1.7
monkey	3,600	3,500	-	260*	14	-
cat	1,500	2,200	140	46*†	33	3.0
rat	400	120	50*	78*	5	0.6
mouse	200	41	30	19	11	1.6
dogfish	35	11	-	1.1*	33	-
					<b><math>20 \pm 12</math></b>	<b><math>1.7 \pm 1.0</math></b>

\*n=1.

†Deiters' nucleus excluded.

From data summarized in  
KWT Caddy and TJ Biscoe  
(1979) *Phil Trans Roy Soc  
Lond Ser B* 287:167-201.  
Additional measurements from  
BB Gould and P Rakic (1981)  
*Exp Brain Res* 44:195-206, R  
Alvarez and R Anadón (1987)  
*J Hirnforsch* 28:133-137, RJ  
Harvey and RMA  
Napper(1991) *Prog Neurobiol*  
36:437-463, JA Heckroth  
(1994) *J Comp Neurol*  
343:173-182, and R Alvarez-  
Otero et al (1996) *J Comp  
Neurol* 368:487-502.

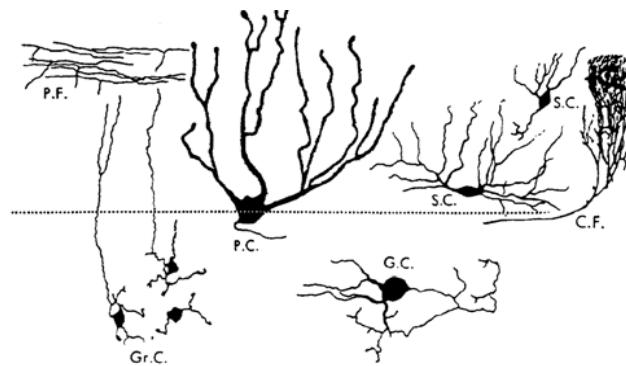


Fig. 5. Neural elements of the dogfish cerebellum. These drawings of Golgi preparations are reproduced from figures prepared by SCHAPER (1898 [25]), by Houser (1901 [12]) and by ARIENS KAPPERS, HUBER, and CROSBY (1936 [1]). The broken line represents the plane of the Purkinje cell bodies and separates the molecular layer from the granular layer. Full description in text

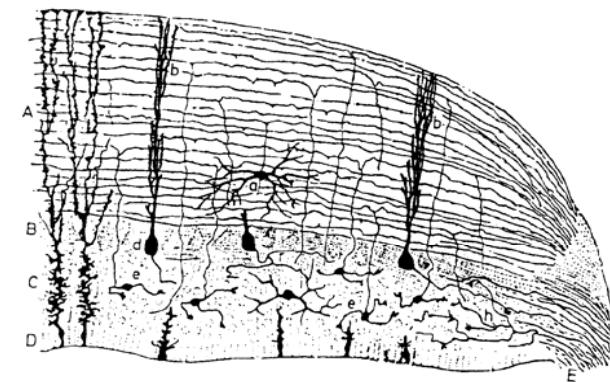
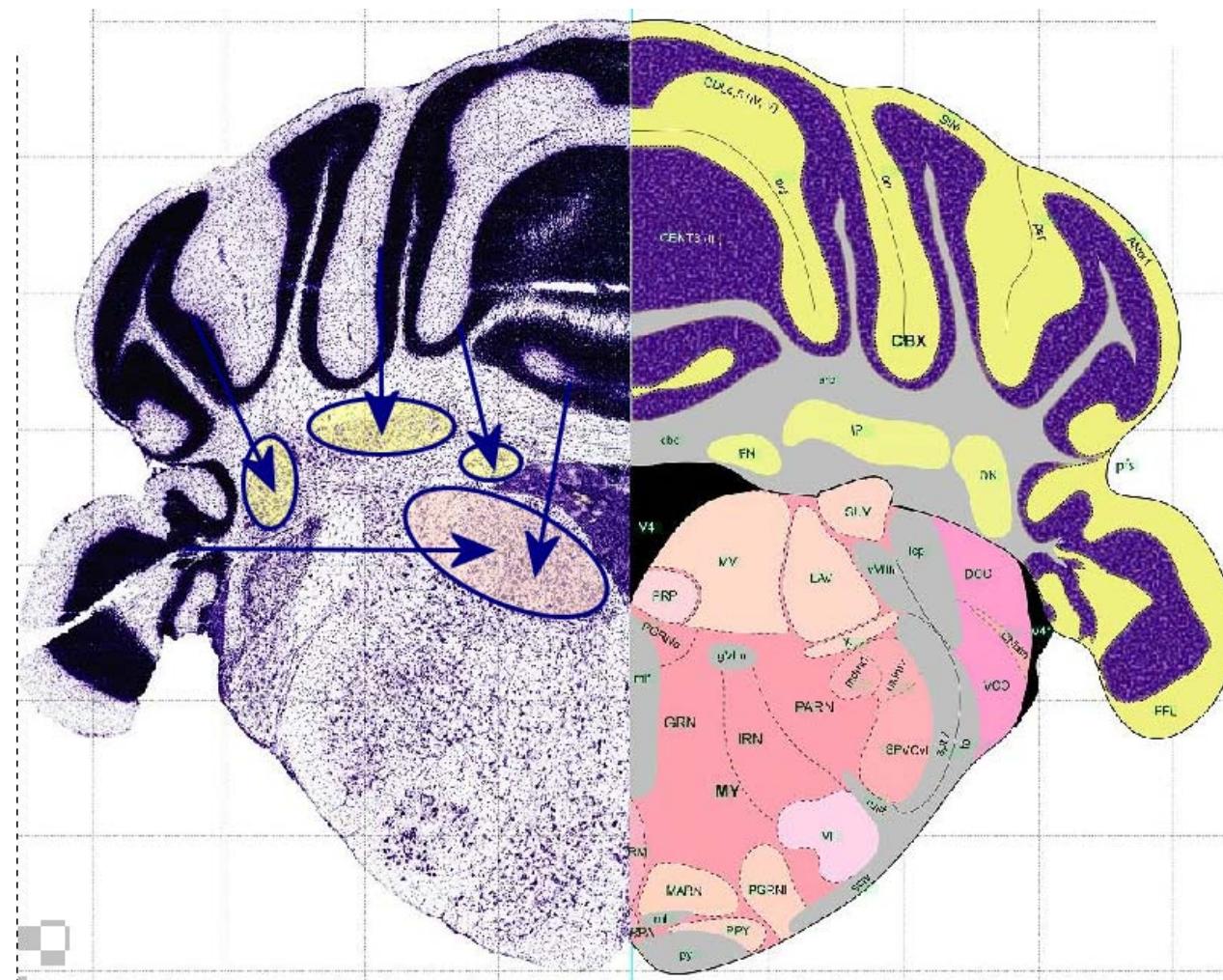


Fig. 6. Drawing of a longitudinal section along the transverse folium of a lizard cerebellum. A, B, C and D show respectively the molecular, Purkinje, granular and ependymal layers and E is the peduncle. Glia cells are shown in j. Full description in text [24]

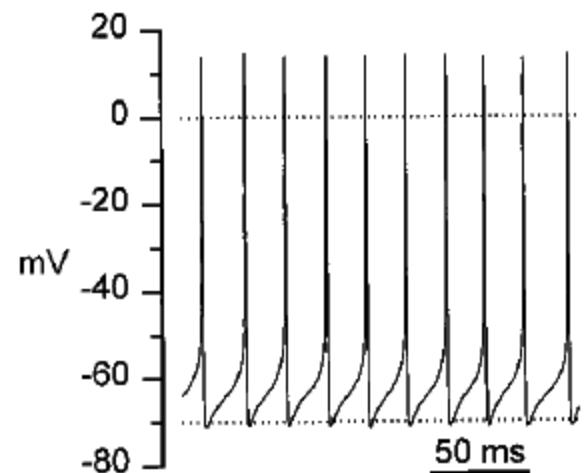
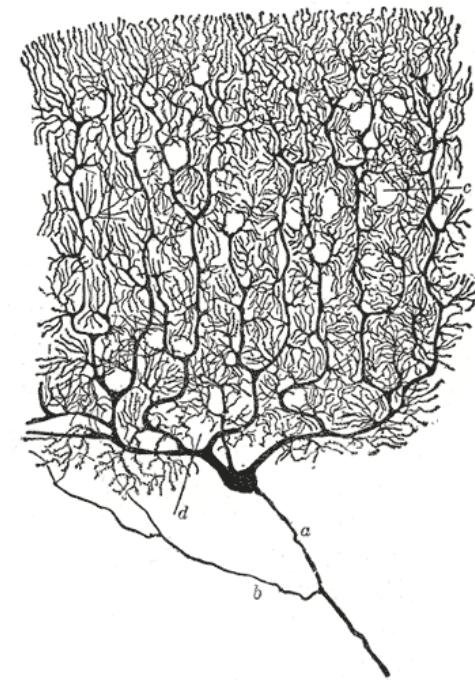
# Cerebellar Output

- All Purkinje cells project to one of the cerebellar nuclei (dentate, interpositus, fastigial) or one of the vestibular nuclei



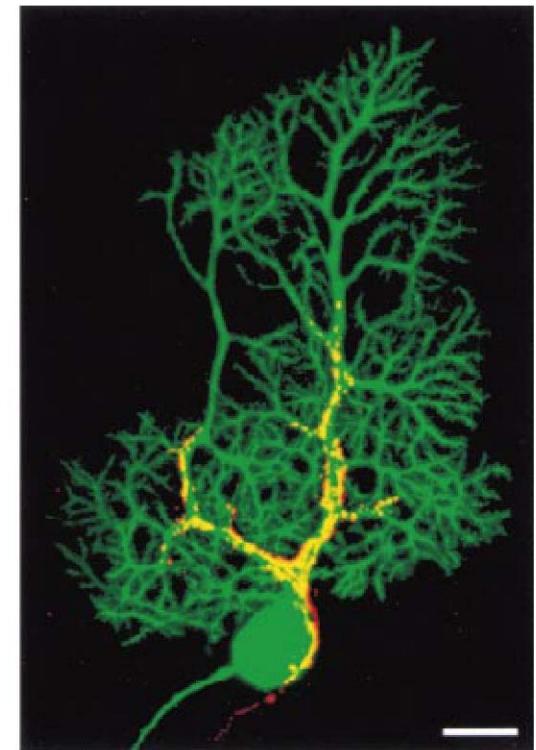
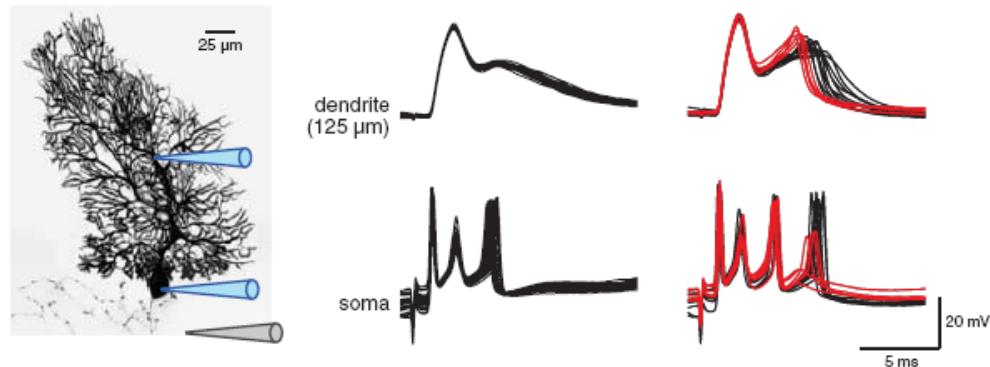
# Purkinje cells

- Dendritic arbors, ~180,000 PF synapses in humans
  - however, at any given time up to 80% of these synapses are 'silent'
  - planar dendritic arbor
  - fast AMPA EPSCs, and slow mGluR1
  - also receives 20-30 inhibitory stellate/basket cells
- GABAergic projection neuron
- Spontaneous pacemaking, 20-100 Hz
  - depends on a 'resurgent' sodium current



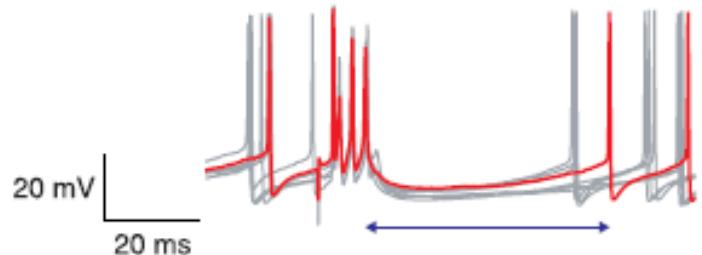
# Climbing fibers and complex spikes

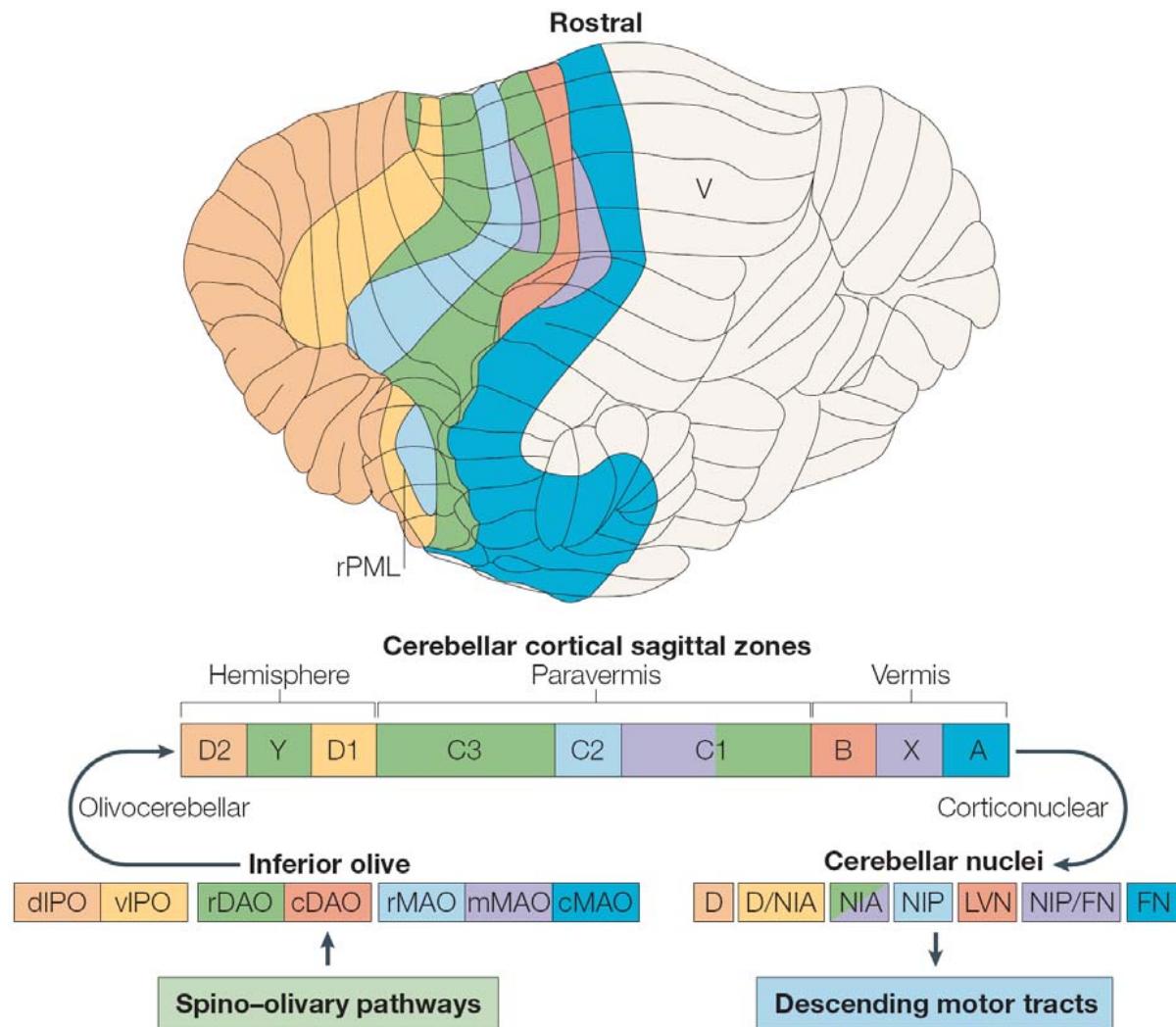
- Strong multisynaptic connection
  - ~25,000 synapses
  - strongest afferent in CNS
  - glutamatergic
- Purkinje cell complex spikes
  - very large EPSP with Calcium spikes



- Complex results in a pause of ongoing simple spike firing

Kreitzer et al. (2000) Neuron, 27:25-32  
Davie et al. (2008) J Neurosci, 28:7599-7609





**Figure 2 | Connectivity of the cerebellum.** The top panel shows a dorsal view of the cat cerebellum, indicating the approximate location of different sagittal zones on the cerebellar surface. In the simplified block diagrams below, matching colours show, for individual cerebellar cortical zones, the sites of origin of climbing fibres in the contralateral inferior olive, and the corresponding corticonuclear output targets in the ipsilateral cerebellar nuclei. Different regions of the inferior olive

Apps and Garwick (2005) *Nat Rev Neurosci* 6:297-311