9.14 class #37: Cerebellar system

Readings:

Nauta & Feirtag, "Chapter15, Cerebellar cortex." [Read this first, as an introduction to the cerebellar anatomy.]

Brodal, Per,"Chapter 14, The cerebellum",*The Central Nervous System. Structure and function,* 2nd edition. Oxford Univ. Press.,1998, pp. 393 - 418.

Altman & Bayer, selected figures from book referenced below (Handouts). [Study all of them, using them to supplement the Nauta and Brodal readings: there is considerable overlap with these, but Altman & Bayer are the most up to date. Pay special attention to the most unique figures (they are also the simplest): 5-6 and 5-8.

Goldowitz, Dan, and Hamre, Kristen," The cells and molecules that make a cerebellum",*Trends in Neuroscience* ,1998, *21*: 375-382.

Also recommended:

Altman, J. and Bayer, S.A., *Development of the cerebellar system, in relation to its evolution, €structure, and functions.*

"Chapter. 1, Comparative anatomy of the cerebellum: an evolutionary perspective", pp. 2 - 25.
"Chapter 2, Basic cellular organization and circuitry of the cerebellar cortex", pp. 26 - 43.
"Chapter 3, Lobular distribution of precerebellar mossy fibers in the cerebellar cortex", pp. 44 - 53.
"Chapter 4, Translobular distribution of olivary climbing fibers, and the translobular zones of the cerebellar cortex", pp. 54 - 65.
"Chapter 5, Afferent and efferent connections of the cerebellar deep nuclei", pp. 66 - 79.
Etc. New York, CRC Press,1996.

Ramon y Cajal, S.,"Chapter 5: Cerebellar histogenesis", *Histology of the nervous system, vol. 2*. Oxford Univ. Press. (1995, English translation)pp. 66 - 86.

Questions:

1. Contrast the general nature of cerebral neocortex and cerebellar cortex.

2. What are the three functionally different parts of the cerebellum, according to Brodal ?

3. What cranial nerve is most intimately connected with the cerebellum, in its sensory fibers ? What cranial nerve nuclei are most closely connected with this nerve, via its secondary sensory cell groups and via the cerebellum?

4. What is the "spinocerebellum" and what are its two major input pathways from the spinal cord?

5. Describe the basic cerebellar pathways to and from the neocortex.

6. How is the red nucleus involved in cerebellar circuitry?

7. Describe the two major inputs to the cerebellar cortex and the one major output from this cortex. How do each of the inputs affect the Purkinje cells, anatomically and physiologically ? (Be sure you know what a P. cell is!)

8. Describe the ventral thalamic nuclei in terms of inputs from medial lemniscus, cerebellum and basal ganglia, and note the corresponding neocortical areas.

9. Describe the unique migration pattern in development of the cerebellar granule cells.

10. What is the evidence that the cerebellum is important for learning?

11. How have experiments using the chick-quail chimera changed the beliefs of neuroscientists about the embryonic origins of the cerebellum?

12. What kind of evidence supports the idea that Purkinje cell number has a regulatory influence on granule cell population size?