9.14
Classes #3-4: Steps to the CNS of chordates
Monday, February 7; Wednesday, February 9.

Readings:

Allman ch. 2-4 pp 16-83.
Swanson [ch 3 pp 29-39] [Recommended but not assigned.]
Striedter [ch 2 pp 19-50]; assigned pp 37-44.

Questions on readings:

1) What is the method of comparing brain weights introduced by Harry Jerison in his 1973 book, *Evolution of the Brain and Intelligence*? This method is used in many figures in the books for this class, especially in Georg Striedter's recent book.

2) What are the four major groups of vertebrate animals in which there has been an evolution of marked expansions in brain size. (There is much variation in each of these groups.)

3) Serotonin is an important neuromodulator substance released at the axonal endings of certain neurons. Which animals have such serotonergic neurons? What is the type of function of these neurons emphasized by Allman?

4) Using only a few words for each, contrast the methods used to study brain localization by Franz Josef Gall and Johann Spurzheim, Pierre Flourens, Paul Broca, John Hughlings Jackson, and Gustav Fritsch and Eduard Hitzig, and Clinto Woolsey.

5) How did Tatsuji Inouye, an ophthalmologist in Japan, first discover the topographic organization of the primary visual cortex in humans? How has his map been confirmed and extended for humans recently?

6) According to Striedter (and many others, including Butler and Hodos), what is the problem with using some kind of "scale of nature" (Latin *scala naturae*) to rank different species and use such a ranking to understand evolution?

7) What is a cladogram? Cf. Darwin's sketch reproduced on p. 29 of Striedter's book. The modern neuroscientist Glen Northcutt has used cladistics ("neurocladistics") extensively in his studies of brain evolution.

The origins of behavior and its brain

Adaptive function, especially behavior, is the main driver of evolution.

Many of the functions of the body are influenced or controlled by the nervous system, and behaviors are the province of the central nervous system (CNS).

Therefore, the evolution of the CNS is fully correlated with—a reflection of—behavioral change in phylogeny. Whatever the mechanisms of CNS changes, their consequences resulted in the behavioral changes that caused a perpetuation and proliferation of the underlying genes.

When we trace the main outlines of brain evolution, we are sketching the pathways of functional changes that led to present-day ability repertoires, and we could note as well some that failed to endure.

Our artistry is guided by the study of comparisons of extant species—their CNS and their behaviors—and by the development of both brain and behavior, and by paleontology.

We undertake this composition with the goal of introducing you to brain structure—neuroanatomy—in a way that helps you understand not only what it is but why it is so. Knowing why will inspire you to remember what is there.