

## 9.14

### Classes #32-33: Corpus Striatum

Monday April 25, Wednesday April 27, 2005

#### Readings:

- Nauta & Feiertag, figure 48, p. 99. (*Recommended*: pp 97-101.)  
Striedter, ch 8C, pp 287-290 (“Beyond the neocortex”). (It would be useful to read the earlier parts of the chapter, but they are not assigned for this topic.)  
Brodal, Per (1998) *The Central Nervous System: Structure and Function, edition 3*. Chapter 13, The basal ganglia, pp. 286 – 302.  
Mesulam, M.-Marsel . (2001) Behavioral neuroanatomy: Large-scale networks, association cortex, frontal syndromes, the limbic system, and hemispheric specializations. Ch. 1 (pp. 1-120) in Mesulam, M.-M. (ed.), *Principles of Behavioral Neurology*. Philadelphia, F.A. Davis Company. For this class, study pp. 66-71 (Basal ganglia and cerebellum).

#### Additional Readings for second session:

- Olanow, C.W., Kordower, J.H. and Freeman, T.B. (1996) Fetal nigral transplantation as a therapy for Parkinson's disease. *Trends in Neuroscience 19*: 103 - 109.  
Kempermann, G. and Gage, F.H. (1999) New nerve cells for the adult brain. *Sci. American 280*: 48-53.

#### Study Questions:

1. What are the two outputs of the corpus striatum illustrated by Nauta and Feiertag? Use this to explain the meaning of the statement that the major output of the extrapyramidal system is the pyramidal system.
2. Contrast the major source of sensory inputs to the striatum in amphibians and mammals, according to Striedter. Similarly, contrast the major output. (Note: connections that are quantitatively smaller are neglected, although they may be very important in understanding the evolution and functions of the striatum, as noted in classes.)
3. Why do you think the major source of sensory input changed in mammals, i.e., what were the benefits that encouraged the change from the amphibian condition? Thinking along these lines, what would you expect to be the major source of sensory input to the striatum in reptiles? Check this in Striedter. (What about birds?)
4. What is the "ansa lenticularis"?
5. The major “satellites” of the striatum are the substantia nigra and the subthalamic nucleus. How are they connected to the striatum (caudate and putamen, globus pallidus)?
6. What is the limbic striatum? What structures does it include, and how does it differ from the non-limbic striatum?

7. Contrast different routes for sensory information to travel from primary sensory cortical areas, e.g., visual cortex, to motor output systems. Use information from previous 9.14 sessions as well as the new information. Try to describe at least three routes.
8. Contrast the pathways to motor cortex and the pathways to the superior colliculus from the caudate-putamen.
9. What is the "double inhibition" of pathways through the striatum? What neurotransmitter is involved?
10. For an understanding of striatal function, it is important to recognize the discovery of multiple parallel pathways, with possibly opposing effects on movement. Give an example.
11. The corpus striatum is called a cross-roads of limbic and non-limbic systems. What does this mean?
12. Why is it that basal ganglia disease causes hyperkinesias (too much movement)? Give examples of such hyperkinesias, and describe a possible mechanism underlying the disorder.

*Questions on Olanow et al., and on Kempermann and Gage:*

13. Why might the topographic organization of connections not be a critical factor in the functioning of nigrostriatal connections from transplanted tissue?
14. Describe the critical nature of donor age in transplant procedures, and why this might be expected.
15. How can imaging of the living brain be used to assess transplant success?
16. How has neuroanatomical assessment been done using tissue obtained at autopsy? Describe a result.
17. What problem does the size of the human corpus striatum pose for transplant procedures? How far can axons grow from the transplants?
18. How is locus of a transplant within the striatum related to possible functional effects?
19. Why do you think that the functional improvements after transplants have such a slow onset and slow progression?
20. What are one or two future alternatives to transplants of tissue from human fetal substantia nigra?

*Supplementary:*

21. Chemoarchitectural studies have given two very different kinds of information about the caudate and putamen: they have revealed a pattern in overall structural organization, and also cell-type differentiation. What is the pattern, and give examples of cell types according to chemical content. (Brodal, box p 293; several figures)