Questions on Schneider chapters and lectures:

1. For the mammalian midbrain, what are three outputs that influence specific types of movement? Name the structures where these outputs originate.

2. Locomotion is often initiated because of activity generated in what diencephalic structure?

3. Maintaining balance of the body during standing or locomotion depends on reticulospinal pathways from the hindbrain, and on two other descending pathways. What are they?

4. The midbrain tectum controls two major types of movements basic to survival. What are they? How do the output pathways for these two movements differ?

5. Grasping with the hands in large primates is largely controlled by neocortex. What brainstem structure appeared earlier in evolution and controlled this kind of movement?

6. Describe functions of the three major pathways or groups of pathways that were separately destroyed by surgical lesions in the Lawrence and Kuypers study of motor control in the monkey.

7. What is Deacon's rule? What does it predict about the projections (outputs) of the optic tectum in birds, with a very large tectum, and nocturnal mammals, with a much smaller tectum?

8. Name a movement pattern in an animal or human that is largely under the control of hindbrain and spinal cord structures and is centrally generated, once it is triggered.

9. Name two brainstem cell groups or types that have very widespread projections to other parts of the central nervous system. What kind of functions are these projections involved in?

10. What are three major types of movement from a functional point of view?

11. What two sensory modalities most strongly shaped the evolution of the forebrain?

12. What is the basic spatial layout of motor neurons at one of the spinal cord enlargements?

13. Describe the three types of lesions in the Lawrence and Kuypers lesion study of the descending motor system pathways.

14. What are three basic types of explanations of temporal patterns of movements?

15. What was the basic argument in Karl Lashley's paper in 1917 called "The problem of serial order in behavior"?

Questions on additional readings:

Swanson (2003) ch 6)pp 97-122:

1. What are the three major divisions of the motor system? How do the motor neurons differ in these three divisions?

2. Where are the rostral-most somatic motor neurons located? Where are the caudal-most somatic motor neurons located?

3. The muscles that move the lips and the muscles that move the jaw are controlled by different groups of motor neurons that send their axons out through two different cranial nerves. What are these motor neuron groups (brainstem nuclei) and cranial nerves?

4. How does Swanson characterize the motor system as a hierarchy? (His theory is characterized in figures which were inspired by the ethologist Niko Tinbergen and by physiological and anatomical studies.)

Nauta & Feirtag (1986) chapter 7 pp 91-107. [Note: Some of this material will be dealt with again later in a class session on the corpus striatum.]

5. Name the four major tracts descending from the brainstem to the spinal cord (p. 95).

6. Name the two tracts composing the pyramidal motor system. Why is this system called "pyramidal"? (p. 96)

7. On what type of neurons do most of the axons in the corticospinal tract synapse? (p. 96)

8. Name at least two major structures of the extrapyramidal motor system (pp. 97-101).

9. What are the two structures which are referred to as "satellites" of the striatum and pallidum, respectively? What diseases or clinical symptoms are associated with these "satellites"? (pp. 98-99)

10. The *substantia nigra* is found within the _____ (forebrain/midbrain/hindbrain). Many of its neurons contain a black pigment called _____. Its major neurotransmitter is _____.

11. The cerebellum receives input from primary sensory neurons of which sense organ? Through which cranial nerve? Briefly describe some clinical symptoms caused by cerebellar lesions (pp. 102-103).

12. Which eye muscles are responsible for moving the eyes away from the midline (away from the nose)? And towards the midline (towards the nose)? Name two midbrain structures the stimulation of which can elicit eye movements (pp. 104-105).

Striedter (2005) chapter 7, pp. 217-245

13. According to Striedter, in a "typical" mammalian brain an "average" neuron is connected to at least how many neurons? What is the current estimate of the number of neurons in a "typical" human brain? (p. 217)

14. What is the "epigenetic population matching" mechanism in neural development? Why is this mechanism described as "epigenetic"? How can such a mechanism facilitate emergence of morphologically diverse brains in evolution? (pp. 220-221) Name two molecules that might be involved in epigenetic population matching (classes 12-13 lectures).

15. Describe Ebbesson's "parcellation hypothesis" of brain evolution (pp. 228-229). Describe one example supporting this hypothesis (p. 233). How is (the weaker version of) Ebbesson's theory related to patterns of axonal growth during development? (pp. 233-234)

16. What is the "large-equals-well-connected" rule first proposed by Terrence Deacon (1990)? Why is this rule reasonable judging from the perspective of brain development? (pp. 237-238)

17. Name two structures (in two different animals, respectively) that can serve as test cases of Deacon's "large equals well-connected" rule (p. 238). Describe a (hypothetical) situation in which Deacon's rule would fail to explain the observed neuronal projection patterns (you have to synthesize what you have learned from this chapter and classes 12-13).

9.14 Brain Structure and Its Origins

Spring 2009