Class #24: Neocortex, Introduction.

Readings:

Nauta & Feiertag, "chapter 13 ", Forebrain, pp. 220-238; "chapter 16" , Neocortex, pp. 289-307. In chapter 13, the reading becomes heavier and heavier, and could demand too much time; therefore, you can skip from p. 227 when Nauta begins discussing the hippocampal rudiment, to p. 235, where you should begin reading again in earnest about olfactory structures and about association cortex. Concerning the skipped passages: do study all the figures and figure legends.

Brodal, P., "text, ch. 20 part one", (1998),pp. 583-599.

Also recommended:

Nauta, Walle J. H. Nauta,
" Tape 4 (part 7: Cerebral Cortex, 52 min.); Tape 5 (Part 8: Forebrain Dissection, 52 min.)
Also: Tape 6 (part 9: The Temporal Lobe, 24 min.); Tape 7 (part 10: The Fiber Architecture of the Cortical Hemisphere, 25 min. and 28 min.); Tape 8, part 11 (Corona Radiata, 15 min.)",*The gross anatomy of the human brain*, video course, Shering-Plough library.

Questions:

1. What is "temporalization of the hemisphere"? (p. 221; figs. 88, 94) Where would you look for the rodent equivalent of the primate inferotemporal cortex?

2. The "corona radiata", the "internal capsule", the "cerebral peduncle" and the "pyramidal tract" are continuous, from neocortical mantle (outer layers of cells and fibers) to the hindbrain (and then to spinal cord). Name one type of axon which is present in <u>all</u> of these named structures. Then try and name some axons which are <u>not</u> present in all of them.

3. What is the rhinal sulcus?

4. Why did early anatomists mistakenly consider the olfactory peduncle, in the human brain, the most rostral cranial nerve? (The olfactory nerve itself is made up of the axons of the primary sensory neurons of the olfactory epithelium, which course through the cribiform plate at the base of the skull to end in glomerular structures of the olfactory bulb, where they synapse on mitral cells. Thus, they do not form a compact bundle of fibers.)

5. What is Nauta's definition of association cortex (p. 238)? By this definition, we would have to say that the posterior association cortex of primates has been shrinking in recent years! Other definitions will be considered in class.

6. What thalamic nuclei project to the frontal association cortex and to the posterior association cortex, respectively?

7. Contrast: pyramidal cells and stellate cells of the neocortex.

8. Contrast: allocortex (olfactory cortex and hippocampal cortex), and neocortex, as seen in Nissl-stained sections.

9. Layer four of the neocortex is most different in two areas: the motor cortex and the primary visual cortex: summarize the differences.

10. What are the radial fascicles of the neocortex (p. 293-295) ? What three major groups of cortical output axons are found in these fascicles?

11. What is the line of Gennari (see fig. 112) ? [Note: you do not have to memorize the special names of other tangential fiber bands in the neocortex, except for layer 1 (plexiform layer, with few cell bodies), and the white matter below layer 6.]

12. How could an anatomist visualize the ocular dominance stripes in striate neocortex (see fig. 116) ? Compare: Patricia Goldman-Rakic's discovery, with Nauta, of columns in the retrosplenial cortex (posterior limbic system cortex near the posterior end, or splenium, of the corpus callosum) -- see fig. 117.

13. What association fibers of the human cerebral hemisphere are prominent even in gross dissections of the brain (fig. 115) ? These are not evident in brains of small animals like rodents, although some long association fibers do exist in these animals.

Additional questions:

14. What are the different types of cortex? (Neo- paleo- archi-cortex). Give an example of each.

15. What are the names of the two most commonly encountered classes of cortical cells?

16. What is the major morphological characteristic of the neocortex? (Layers). How do different regions of cortex differ from each other? (differences in thickness of the different layers; granular vs agranular, etc.)

17. Describe the connections of the different cortical layers. (We may have time to present this in class. It is not covered well in the readings.)

18. What is the significance of the columnar organization of the cortex?

19. What are the major cortical areas (primary sensory, primary motor, association, limbic). What are "Brodman's areas" and what is the basis of their differentiation?

20. What do the terms "dominant hemisphere" and "non-dominant hemisphere" mean?

21. What portions of the cortex does the corpus callosum connect, and what portions are not connected via this pathway? (Brodal fig. 20.11)

DISCARDED 2000:

7. Association cortex can be unimodal or multimodal. You don't need to know the details of the connections and representations for each modality - read the details only if you are interested. I will highlight in class the points you need to remember from pages 515-523. You should know the location of visual cortex (area 17), visual association cortex (areas 18, 19 and others), somatosensory cortex (areas 3,2,1), somatosensory association cortex, auditory cortex (area 41), auditory association cortex, motor cortex (area 4), premotor cortex - be prepared to identify them if presented with figures such as on page 511 and 520.

9. You don't need to learn the details about language dysfunctions, on page 525 (although if you are curious, it is a very interesting description). But you should know the terms Broca's area and where it is, similarly for Wernicke's area and where it is. And the major functional specializations of Broca's and Wernicke's areas.

10. Similarly for the parietal association area and prefrontal cortex: get the general gist of what is on pages 526-528, what the general functions are of these regions. You should know what agnosia and apraxia mean. Also, the general syndromes that arise when the prefrontal cortex is damaged (read about Phineas T. Gage), and the syndromes that arise with damage to prefrontal cortex. In class, I will highlight details of what you need to remember.

12. What are the functional deficits seen when the corpus callosum is sectioned in the adult human?

13. Describe a classic example of a disconnection syndrome - what is the cortical damage most likely associated with this kind of a syndrome?

14. Optional reading: the sections on Consciousness and Sleep (pages 529-533).