

9.14

Class #27-28: Hypothalamus and Limbic System

Monday April 11; Wednesday April 13, 2005

Readings (The parts on autonomic nervous system are for review):

Nauta & Feirtag ch 8, 9, pp 108-131 (Innervation of the viscera. Affect and motivation; the limbic system)

Brodal, Per (2004) *The Central Nervous System. Structure and function.* 3rd Edition. Oxford Univ. Press. Chapter 19, The central autonomic system: hypothalamus, pp. 397-414.

Swanson ch 6B pp 117-130 (Drive and motivation. Autonomic nervous system.); ch 7 pp (139-149), 149-155 (The behavioral state system.)

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. 64-66, "The Limbic System".

Reference not assigned:

Giesler, G. J., Jr., Katter, J.T. & Dado, R.J. (1994) Direct spinal pathways to the limbic system for nociceptive information. *Trends in Neuroscience* 17: 244 - 250.

Questions on readings: Brodal.

1. Which major hypothalamic division can be divided into multiple distinct nuclei (e.g., by Le Gros Clark in 1936)? How can the remainder of the hypothalamus be characterized?
2. How can a circulating hormone like angiotensin II control hypothalamic neurons even though it does not pass through the blood-brain barrier?
3. What is diabetes insipidus?
4. What is the importance of afferents to the hypothalamus from the nucleus of the solitary tract in the hindbrain?
5. The cingulate cortex (a paralimbic cortical area above the corpus callosum) projects to the hippocampal formation. Describe the pathway from there to the hypothalamus. How does a pathway go from there back to the cingulate gyrus? (The loop is called "Papez' circuit".) (Note: Brodal on p. 400 summarizes a different pathway from cingulate cortex to hypothalamus *via* the septal nuclei. This is not usually mentioned as part of the Papez' circuit.)

6. How does hypothalamus send influences to the cerebral cortex?
7. A person's mental state can influence the endocrine organs *via* the hypothalamus. The influence can go in the reverse direction: the hypothalamus can influence a person's mental state in major ways. What are some effects of disturbance of the hypothalamus during neurosurgical procedures?

Questions on readings: Nauta & Feirtag

8. In Nauta's view, what is the relative importance of direct hypothalamus to spinal cord pathways *vs.* polysynaptic pathways?
9. What is misleading about the names "autonomic nervous system" and "voluntary (somatic) nervous system"?
10. (Review) Contrast the styles of motor innervation of somatic muscles and smooth muscles (including the contrast between sympathetic and parasympathetic).
11. (Review) How does the innervation of the sweat glands in the skin differ from sympathetic innervation of other organs?
12. How does Nauta define homeostasis?
13. Describe Rudolf Thauer's experiments on disconnection of the hypothalamus in rabbits. The results support Nauta's view of the importance of polysynaptic pathways controlling visceral activities.
14. (Review) Contrast the pathways for hypothalamic control of the two divisions of the neurohypophysis (pituitary). (See also Brodal.)

Questions on readings: Swanson

15. What appears to be the critical forebrain area for "spontaneous locomotor behavior" (intrinsically generated locomotion)?
16. Summarize in general terms the major functions of the "behavioral control column" that extends from rostral hypothalamus to caudal midbrain. (Swanson ch 6)
17. What were the three widely projecting monoamine-containing systems first characterized by Dahlström and Fuxe in the 1960s, and the locations of the cell bodies? Several more diffusely projecting systems have been discovered since that time. Describe one of them with cells located in the hypothalamus. (Swanson ch 7)

18. What is the difference in operation of the parvicellular and magnocellular portions of the autonomic motor system of the hypothalamus? Give examples of functions of each of these portions.