

9.14

Class #27-29: Hypothalamus and Limbic System, part 1

Questions based on Schneider chapter 25 and classes

- 1) Where are the cortical areas that are grouped together as part of the limbic endbrain found in the cerebral hemispheres?
- 2) Compare the two arousal systems of the midbrain. What structures are involved? What are the major types of connections to these structures? What are the effects of electrical stimulation? Is there habituation to repeated stimulation?
- 3) Describe how hypothalamic neurons control secretions from each of the two divisions of the pituitary organ (the hypophysis).
- 4) What hormones are secreted into the bloodstream in the posterior pituitary (neurohypophysis)? Give examples of hormones secreted in the anterior pituitary (adenohypophysis).
- 5) What is diabetes insipidus?
- 6) What homeostatic mechanisms are associated with the hypothalamus? (Give examples.)
- 7) Give specific examples of appetitive and of consummatory behavior. Which parts of the CNS would you expect to be strongly involved in the control of these two types of behavior?
- 8) Where would you expect hunger and satiety cues to influence the CNS? Why?
- 9) What evidence indicates that attack motivation in cats is separate from hunger?

Questions based on Schneider chapter 26 and classes

- 1) The hypothalamus has two major divisions, medial and lateral. What is a major difference between these two divisions?
- 2) Information about the internal environment of the body reaches the hypothalamus via two major means. What are they?
- 3) Describe the basic Papez' circuit. Why has there been a revival of interest in this circuit?
- 4) How are the Papez' circuit structures connected to non-limbic neocortical areas?
- 5) What is the "basal forebrain"? Name some structures of this region.
- 6) Describe two ways that the hypothalamus can influence the neocortex.

- 7) What is a major “reward pathway” in the mammalian CNS?
- 8) Contrast the effects of sudden disconnection of the hypothalamus from more caudal structures, and more gradual disconnection accomplished in many small steps.

Additional questions on readings: Brodal, also Schneider chapter.

- 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 the importance of afferents to the hypothalamus from the nucleus of the solitary tract in the hindbrain?
- 4) 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, although it is certainly related.)
- 5) 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?

Additional questions on readings: Nauta & Feirtag

- 6) In Nauta's view, what is the relative importance of direct hypothalamus to spinal cord pathways *vs.* polysynaptic pathways?
- 7) What is misleading about the names "autonomic nervous system" and "voluntary (somatic) nervous system"?
- 8) (Review) Contrast the styles of motor innervation of somatic muscles and smooth muscles (including the contrast between sympathetic and parasympathetic).
- 9) (Review) How does the innervation of the sweat glands in the skin differ from sympathetic innervation of other organs?
- 10) How does Nauta define homeostasis?

- 11) 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.

Questions on readings: Swanson

- 12) What appears to be the critical forebrain area for “spontaneous locomotor behavior” (intrinsically generated locomotion)? [Review of chapter 14.]
- 13) Summarize in general terms the major functions of the “behavioral control column” that extends from rostral hypothalamus to caudal midbrain. (Swanson ch 6)
- 14) 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? (This is a review of connections reviewed previously with regard to “brain states.”) Several more diffusely projecting systems have been discovered since that time. Describe one of them with cells located in the hypothalamus. (Swanson ch 7; also Schneider chapter 17)
- 15) 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.

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