

THE UNIVERSITY OF CONNECTICUT
Graduate School
Meds 384, Mammalian Neuroanatomy
LIMBIC SYSTEM

Barr's: Chapters 18**GENERAL FEATURES OF THE OLFACTORY CORTEX & LIMBIC SYSTEM**

The limbic system combines neocortex with the oldest parts of the telencephalon, thalamic, and hypothalamic structures. The six-layered neocortex is distinguished from paleocortex (old cortex) and the archicortex (ancient cortex) which both have only three layers. Together, these regulate the expression of emotion and add emotional content to the activity of the neocortex. For each of the major structures in the limbic lobe of the telencephalon, it will be necessary to identify the related subcortical structures.

PALEOCORTEX AND BASAL FOREBRAIN

The paleocortex consists of three parts: piriform, olfactory cortex, and entorhinal cortex. We will identify these in the human and the rat.

Nucleus Basalis of Meynert

In CNS 41, dorsal to the olfactory cortex and ventral to the anterior commissure. This is considered one of the basal forebrain nuclei that contain large cholinergic neurons. The others are the nucleus of the diagonal band and the septal area.

Olfactory & Piriform Cortex

Olfactory cortex is devoted to the sense of smell and is the target of the olfactory tract. Find the olfactory tract in CNS-41 locate above the optic nerve. At this level, olfactory cortex consists of the anterior tubercle (also called the anterior perforated substance).

Primary olfactory cortex is at the level of CNS-40. It is the rostral part of the piriform cortex. At this level the medial aspect of the temporal lobe makes a bulge called the uncus.

Located more posterior to olfactory cortex, the piriform cortex covers the interior surface of the temporal lobe medial to the collateral sulcus. Look for the piriform cortex at the level of the amygdala, CNS-39.

Nucleus Accumbens

In CNS 43, ventral to the internal capsule. Part of the basal ganglia, but may function more like basal forebrain nuclei. Contains many neurons with cocaine and morphine receptors. Studied as a site related to addictive behaviors.

HIPPOCAMPUS (ARCHICORTEX) AND ENTORHINAL CORTEX

In CNS-36, 35, 34, and 29 find the hippocampus and entorhinal cortex. The hippocampus

is the only component of archicortex. It is found in the medial temporal lobe. Medial to the hippocampus is the parahippocampal gyrus that contains the entorhinal cortex. Parahippocampal cortex is the major cortical input to the hippocampus.

Major outputs of the hippocampus are to the septal nuclei (CNS-42) and the mammillary bodies (CNS-33 and 37). These outputs follow the fornix. Trace the route of the fornix in CNS-28, 29, 37, 39, 40, 41.

AMYGDALA

Rostral to the hippocampus in the temporal lobe, the amygdala can be seen in CNS-33, CNS-39. Part of old telencephalon, it has cortical and subcortical components. Generally, it is at the level of the uncus and includes the olfactory cortex superficially. However, the bulk of the amygdala is subcortical and not directly related to smell.

Amygdala receives inputs from neocortex directly and from subcortical sources: e.g. thalamic nuclei, solitary nuclei. Outputs are ventral pathways to the hypothalamus and dorsal pathways to the thalamus via the stria terminalis. Trace the stria terminalis from the amygdala to the mediodorsal nucleus in CNS-35, 38, 47. Outputs from the amygdala can also project directly to the brainstem, e.g. to dorsal motor nucleus of vagus.

CINGULATE CORTEX

Gross Structure of the Cingulate Cortex

Identify the cingulate cortex on the medial surface of the brain in CNS-28. It is part of the neocortex. Trace the extent of the cingulate cortex on the medial surface of the gross half brain.

Connections of the Cingulate Cortex

The cingulate cortex receives inputs primarily from the association areas of neocortex and anterior thalamic nuclei. Find the anterior thalamic nuclei in Slide CNS-40.

Outputs of the cingulate cortex are to the neocortex, parahippocampal cortex, and anterior thalamus. Eventually, the cingulate gyrus will receive inputs from the anterior thalamic nuclei whose major inputs are from the mammillary bodies in the hypothalamus. Find the mammillary bodies in CNS-33 and 37. Next, find the major projection from the mammillary body to the anterior thalamic nuclei, the mammillothalamic tract, in CNS-37, 39, 40.

Test your skills on these HORIZONTAL SECTIONS

Examine CNS-44 to CNS-47. Identify the corpus callosum, internal capsule, and cerebral peduncle. Attempt to identify as many structures in these sections as possible.

