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# Piriform and Entorhinal Cortex of the Rat Brain – Cyto- And Chemoarchitectonics

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## ABSTRACT

The piriform (pyriform) cortex is the ancient cortex of the rostral part of the piriform lobe. The name has traditionally been used as a general term for the rostral olfactory nucleus, the primary olfactory (or piriform) cortex, and the entorhinal region, which forms a more or less pear-shaped structure, at least in macrosmatics like the rat. The entorhinal cortex occupies most of the parahippocampal gyrus and is located on the ventromedial surface of the brain.

The following layers can be distinguished in the entorhinal cortex: molecular, stellate, pyramidal, large cell, small cell, and multiform. The data presented in the article can serve as a fundamental basis for further study of the parts of the rat brain in normal and pathological conditions with further extrapolation of the obtained data to humans.

**Keywords:** Piriform Cortex, Entorhinal Cortex, Rat, Cytoarchitectonics, Chemoarchitectonics

### The Piriform (Pyriform) Cortex

The piriform (pyriform) cortex is the ancient cortex of the rostral part of the piriform lobe.

The name has traditionally been used as a general term for the rostral olfactory nucleus, the primary olfactory (or piriform) cortex, and the entorhinal region, which form a more or less pear-shaped structure, at least in macrosmatics like the rat [4]. Rostrally, the cortex extends into the olfactory tubercle, where it continues into the lateral transition zone of the rostral olfactory nucleus [2-5]. Caudally, it is gradually replaced by the entorhinal region. The cortex is divided into rostral and caudal parts by a transverse line drawn through the caudal pole of the olfactory tubercle [10-14]. The part of the piriform cortex adjacent to the amygdala is sometimes called the periamygdala cortex.

The pear-shaped cortex contains three layers of cells [15-23]. The superficial molecular layer of the piriform cortex contains horizontal neurons, and afferent fibers from the olfactory bulb arrive there [16]. Deeper are the projections of associative fibers from other parts of the piriform cortex and other olfactory areas [20]. Next are the pyramidal and multiform layers (Table 1).

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**Table 1:** Neuronal and transmitter organization of the piriform cortex [28].

| Name of neuron | Cortical layer | Mediator |
|---|---|---|
| Horizontal neurons | molecular | GABA |
| pyramidal neurons | pyramidal | aspartate, glutamate, acetylcholine |
| Polymorphic neurons | granular | GABA |

The piriform cortex forms connections with the amygdala [36] and orbitofrontal [22] cortex and pyramidal neurons the processes of remembering olfactory stimuli in rats [23].

**Entorhinal cortex**

The entorhinal cortex occupies most of the parahippocampal gyrus and is located on the ventromedial surface of the brain.

The following layers can be distinguished in the entorhinal cortex: molecular, stellate, pyramidal, large cell, small cell and multiform. The pyramidal, large cell, and small cell layers are delimited from each other by a separating sublayer [1].

Deeper than the multiform layer is the perforating and alveolar tracts.

The first layer is practically devoid of neurons and contains transversely oriented nerve fibers.

Layer II mainly contains medium and large stellate neurons. They tend to cluster in clusters (cell islands), caudally they merge to form a continuous layer.

Layer III contains pyramidal neurons.

Layer IV is most pronounced in the caudal entorhinal cortex. In other areas it is fragmentary.

Layer V in the upper part contains sparsely located pyramidal and polymorphic neurons. Then, in its lower sublayer, the neurons lie denser.

Layer VI contains a heterogeneous population of neurons whose perikarya density decreases in the lower regions adjacent to the white matter (Table 2).

**Table 2:** Neuronal and transmitter organization of the entorhinal cortex.

| Name of neuron | Cortical layer | Mediator |
|---|---|---|
| Horizontal neurons | molecular, small cell, multiform | GABA |
| Stellate neurons | stellate, multiform | calretinin |
| pyramidal neurons | pyramidal, large cell, small cell | aspartate, glutamate<br>calretinin, calbindin |
| Basket neurons | stellate, pyramidal | GABA, parvalbumin |
| Candelabra cells | stellate, pyramidal | GABA, parvalbumin |
| Fusiform neurons | –//– | –//– |
| Bipolar neurons | small cell, multiforme | calretinin, calbindin somatostatin, substance P |
| Polymorphic neurons | pyramidal, small cell, multiform | calretinin, calbindin somatostatin substance P |

The entorhinal cortex localized between the association areas of the neocortex [1] and the hippocampus [20].

The entorhinal cortex plays the role of a link in the exchange of information.

Forms connections with the hippocampus, dentate gyrus, subiculum, anterior cingulate cortex, olfactory bulbs, piriform cortex [13] and is involved in the perception of smells.

The data presented in the article can serve as a fundamental basis for further study of the parts of the rat brain in normal and pathological conditions with further extrapolation of the obtained data to humans.

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