

Cytoarchitecture of the Locust Olfactory System

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Abstract

The insect mushroom body (MB) receives and processes olfactory information. The MB is a highly conserved structure found in all but a few insect species, and has been shown to be a relevant area in learning and memory of olfactory information. The functional properties of the intrinsic cells of the MB — the Kenyon cells (KCs) — have been extensively studied, and their integrative properties are starting to be understood, particularly in locust. To help decipher its role in odor processing, this thesis presents an in-depth study of the architecture of the locust MB, using a variety of anatomical techniques and original software. Four divisions in the MB's input area, the calyx, are defined and described, as well as a division in one of its output regions, the β lobe. KCs are characterized based on their morphologies and extents within the calyx divisions and the β lobe. MB input cells — the projection neurons — are described in relation to their own input area, the antennal lobe, as well as their output to MB calyx divisions. Two classes of cells downstream from the KCs are also defined anatomically and related to immunochemistry on neurotransmitters. A specific area within the brain — the lateral horn lobe — to which projection neurons and extrinsic cells project, is also defined. Similarities of these structures to other insect orders are also discussed.

Abbreviations

PN Projection Neuron

LN Local Neuron

AL Antennal Lobe

MB Mushroom Body

ORN Olfactory Receptor Neuron

OB Olfactory Bulb

KC Kenyon Cell

GABA Gamma-aminobutyric Acid

LH Lateral Horn

LHI Lateral Horn Interneuron

LFP Local Field Potential

EPSP Excitatory Post-synaptic Potential

IPSP Inhibitory Post-synaptic Potential

LY Lucifer Yellow

AF Alexa Fluor

OC Outer-Calyx

MC Mid-Calyx

IC Inner-Calyx

CI Class I Extrinsic Cell

CII Class II Extrinsic Cell

PI Pars Intercerebralis

MOB Main Olfactory Bulb

AOB Accessory Olfactory Bulb

VNO Vomeronasal Organ

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