

Table of Contents

General Introduction.....	7
Olfaction.....	7
<i>Drosophila melanogaster</i> as model for olfaction research.....	8
References.....	9

Tyramine Modulates Electrical Properties of Sensilla

Introduction.....	14
Biogenic Amines.....	14
Olfactory sensilla of <i>Drosophila melanogaster</i>	21
Aims of this study.....	23
Material and Methods.....	25
Fly rearing and stocks.....	25
Electroantennograms (EAGs).....	26
Feeding of flies with tyramine.....	27
Single sensillum recordings (SSR).....	27
Calcium Imaging.....	29
Odor stimulation in EAG, SSR and Calcium Imaging.....	30
Isolation of total RNA from <i>Drosophila</i> Antennae, Heads and Bodies.....	31
RT-PCR.....	31
Preparation of DIG-labelled riboprobes for in situ-Hybridization.....	34
In situ-Hybridization on <i>Drosophila</i> antennae.....	35
Results.....	37
Several biogenic amine receptors are expressed in the <i>Drosophila</i> antenna	37
Octopamine deficiency has no effect on odor response profiles in EAGs.....	39
Higher dopamine concentrations do not change odor responses.....	40

Higher concentrations of all biogenic amines cause lower odor responses.....	40
Flies lacking the tyramine receptor show an altered odor response profile.....	41
Sensillum potentials of ab2 sensilla are elevated in tyramine receptor mutants but spike frequencies are not changed.....	43
Putative tyraminerpic or octopaminergic neurons project into the antenna.....	47
Ablation of the Tdc2 positive processes does not change odor responses.....	49
Non-neuronal cells are a possible source for tyramine in the antenna.....	51
Accessory cells of a subset of olfactory sensilla are able to synthesize tyramine.....	51
Tdc1 expression in the antenna does not occur during metamorphosis.....	55
Accessory cells expressing Tdc1 respond to odor stimuli.....	58
Localization of biogenic amine receptor expressing cells in the antenna.....	60
Feeding of tyramine does not rescue the hono phenotype.....	64
Discussion.....	62
Biogenic amine receptor expression in the antenna.....	64
Electrophysiological changes due to tyramine receptor mutation.....	66
Thecogen cells are able to synthesize tyramine.....	68
Thecogen cells respond to odors.....	69
Model 1: Plastic modulation of electrical properties of sensilla.....	71
Model 2: An active mechanism of intersensillum insulation.....	72
Tyraminerpic or octopaminergic processes innervate the antenna.....	72
Outlook.....	73
References.....	76

Carbon Dioxide Sensitive Neurons Express a Gustatory Receptor

Summary.....	89
Introduction.....	90
Results.....	95

The gustatory receptor Gr21a is expressed in large basiconic sensilla of type ab1.....	95
Gr21a-driven expression of a calcium sensor shows ab1C neuron responses to CO2.....	96
The ab1C neuron is sensitive around ambient CO2 concentrations.....	99
CO2 is repellent at a range of concentrations.....	101
Specific ablation of ab1C neurons eliminates CO2 responses.....	102
Discussion.....	105
A gustatory gene in an olfactory neuron.....	105
Acknowledgements.....	112
References.....	113
Experimental procedures.....	118
Figure legends.....	124
Figures.....	129
Summary.....	135
Zusammenfassung.....	136
Danksagung.....	137
Lebenslauf.....	138