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ABSTRACTS

In this ongoing project we explore the morphological and physiological characteristics of projection neurons carrying information from the primary olfactory center of the moth brain, the antennal lobe, to higher integration centers including the mushroom bodies and the lateral protocerebrum. Experimental results from previous studies show that antennal-lobe projection neurons send their axons via three main tracts: the medial, the medio-lateral, and the lateral antenno-protocerebral tract. However, it is to a large extent unknown how the projection neurons passing in the various tracts differ physiologically and morphologically, and also which functional purpose the parallel pathways fills.

By performing intracellular recordings and stainings from central neurons in the antennal lobe and the lateral protocerebrum during stimulation with pheromones and biologically relevant plant odorants, we achieve information about antennal-lobe output neurons projecting in the various antenno-protocerebral tracts. Thus, morphologically diverse neurons are described according to their physiological characteristics such as selectivity to stimuli, excitation vs. inhibition, synergism, temporal response pattern, and response delay.

Elisa Badeke[1], Pablo Pregitzer[2], Bill S. Hansson[1], Jürgen Krieger[2] and Silke Sachse[1]

[1]Max Planck Institute for Chemical Ecology, Department of Evolutionary Neuroethology, Jena; [2]University Hohenheim, Institute of Physiology, Stuttgart

In their environment insects have to deal with a wide range of different odors. The information content of a certain odor bouquet, which is perceived by an insect, is essential for its survival and reproduction. To this end pheromone detection and processing is crucial for an insect to find its conspecific sexual partner. Because of their extremely specialized pheromone detection appendages, the antennae, moths are the most used model organisms to investigate the function of the pheromone system. In the noctuid moth, Heliothis virescens (Hv), we could demonstrate that plant volatiles interfere with pheromone responses at the level of the olfactory sensory neurons (OSN). By in vitro and in vivo calcium imaging we stimulated simultaneously with plant-related odorants and the major sex pheromone component of Hv, Z11-16:Ald. The results show that certain plant odorants reduce Z11-16:Ald-evoked activity in cells expressing the appropriate pheromone receptor HR13. Moreover, this suppression effect could be investigated in the magroglomerular complex of Hv, where Z11-16:Ald-tuned OSNs terminate. These findings indicate that the effect of an odor background is important for the complex mechanism of pheromone detection and coding. Furthermore, we aim to decipher how a plant odor background influences pheromone-guided flight behavior. We are in the process of performing wind tunnel experiments to analyze the interaction of pheromone components and plant volatiles at the behavioral level in order to mimic the natural situation.

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Elisa Rigosi, Haase A, Anfora G, Vallortigara G, Szyszka P

University of Trento, Italy

Asymmetric odour coding in the honeybee antennal lobe

Left-right asymmetric processing is a common property of nervous systems. It is thought that lateralization serves to avoid functional incompatibilities between sensory representations and to increase coding capacity by parallel processing. Lateralized sensory processing has mainly been described at behavioral or anatomical level while asymmetric neuronal coding is less studied. We identified a left-right asymmetry in the honeybeeâ€™s antennal lobes during odour processing.

When odours were symmetrically puffed to the antennae, the neurophysiological distances between odours in the right antennal lobe were higher than in the left one. Moreover, mixture processing differed between sides: inhibitory interactions occurred mainly in the left antennal lobe, while additive processing occurred mainly in the right antennal lobe. We propose a functional specialization between the antennal lobes with the right being tuned for fine odour discrimination. Behavioural data support this hypothesis: bees with amputated right antenna failed in an olfactory discrimination task, while bees with amputated left antenna succeeded.

Ene Leppik, Rachid Hamidi, Brigitte Frerot

INRA Versailles, UMR 1272, PISC, Route de Saint Cyr, Versailles Cedex 78000

The chemical communication between Bruchus rufimanus and its host-plant Vicia faba

The Broad Bean Weevil (BBW) (Bruchus rufimanus, Boheman) is a serious pest of the broad bean (Vicia faba, Linnaeus) in Europe damaging the beans and decreasing the commercial value. Little is known on the biology and ecology of the pest. The BBW host-plant selection and colonisation was studied in France under field and laboratory conditions. In the field we observed that the BBW males arrived first during the flowering stage closely followed by the females. The colonizers were sexually mature and active BBW. Under laboratory condition, in a wind tunnel, the flowering stage of the bean revealed to significantly more attractive to females than the leave stage. The volatiles from bean plants headspace were collected at leaf, flowering stage of the bean plants to characterize the chemical signal emitted and perceived by the colonising BBW.

Erwan Poivet[1], Aurore Gallot[1-2], Nicolas Montagné[3], Pavel Senin[2], Fabrice Legeai[2], Emmanuelle Jacquin-Joly[1]

[1]INRA, UMR 1272 INRA-UPMC Physiologie de l'Insecte : Signalisation et Communication, route de Saint-Cyr, Versailles, France; [2]IRISA, équipe Symbiose, Campus universitaire de Beaulieu, Rennes, France; [3]UPMC – Université Paris 6, UMR-A 1272 Physiologie de l'Insecte : Signalisation et Communication, Paris, France

Molecular bases of chemosensory plasticity upon starvation: RNAseq expression profiling in the cotton leafworm *Spodoptera littoralis*

Starvation is a common experience for animal under fluctuating food conditions in nature, and response to it is vital for life span. Many studies have investigated the behavioral and the physiological responses to starvation. In particular, starvation is known to induce changes in olfactory behaviors and, as revealed by some studies, in the olfactory peripheral sensitivity, but the studies of the induced transcriptional changes in insects are still limited and were essentially conducted on Drosophila.

Here, we investigated the transcriptional changes induced by starvation in the chemosensory tissues of caterpillars of the noctuid Spodoptera littoralis, using RNAseq expression profiling. ~4 million short reads obtained from antennae and maxillary palps dissected from fed and 24 h starved larvae were mapped on a reference transcriptome we established in this species and counted. Gene's expression profiling revealed genes up- and down-regulated upon starvation. Quantitative PCR was used to confirm these results on a selection of transcripts. Transcripts regulated are associated to several biological processes such as glucose metabolism, immune response and olfaction. These observations suggest that the transcriptional response of the chemosensory peripheral organs to starvation may participate in the regulation of olfactory sensitivity.