P1-002 Expression of synaptosome-associated protein 25 kDa (SNAP25) in the salmon brain

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Synaptosome-associated protein 25 kDa (SNAP25) constitutes the soluble N-ethylmaleimide-sensitive factor attachment protein receptor (SNARE) complex that mediates pre-synaptic vesicle exocytosis, regulates synaptic transmission and neuronal plasticity. It is generally accepted that anadromous Pacific salmon (*Oncorhynchus* spp.) imprint some odorants of their natal streams at the seaward migration, and use their olfaction for discriminating those streams during spawning migration. Despite the importance of the synaptic plasticity for the olfactory imprinting, the expression of SNARE complex is not well understood in salmon brain. In this study, SNAP25 was detected in the chum salmon (*O. keta*) brain as one of SNARE complex by molecular biological techniques. Expressions of *snap25a* and *snap25b* mRNA were detected in the olfactory center (olfactory bulb and telencephalon) by reverse transcriptase polymerase chain reaction. By quantitative-PCR of each brain region in mature salmon, *snap25a* were mainly detected in rostral regions of brain (i.e., forebrain), and its expression especially in the olfactory bulb was the highest. On the other hand, expressions of *snap25b* were detected in all regions of brain. In juvenile salmon at the imprinting period, expressions of both *snap25s* in the olfactory centers were the highest seawater life stage compared with the freshwater life stage at natal stream during the seaward migration. In comparison of both *snap25s*, the expression level of the *snap25b* was high. Our results provide the first detection of *snap25* gene expressions in the salmon brain, and indicate that *snap25 s* are involved in the synaptic plasticity for the olfactory imprinting and/or olfactory memory retrieval in Pacific salmon.

P1-003 Olfactory network function is modulated by flight motor pattern generating centers: Evidence for the first corollary discharge circuit to an olfactory pathway

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Active odor sampling behaviors shape spatiotemporal olfactory input, processing and perception. These behaviors also drive rhythmic reafferent signals driving olfactory responses in the absence of odor. Other sensory domains receiving reafferent signals also typically receive a corollary discharge signal from motor pathways driving reafference, yet little is known about the presence and function of these circuits in olfactory systems. We characterize a novel corollary discharge circuit the moth *Manduca sexta*. Using anatomical techniques we characterized two histamine (HA) immunoreactive cells projecting from flight motor centers to antennal lobe (AL), where <20 local interneurons express the HA-B receptor and co-express GABA, and one or two also expressing Allatotropin or fmrfamide. We show that these HA cells are the only source of AL HA and the circuit is only complete in adults. Using paired intra- and extracellular techniques we confirm that the HA cells spiking activity is positively correlated to motor neuron output. Multiunit recordings of AL responses to temporally structured stimuli meant to simulate wing beating revealed that populations of AL neurons track and clarify periodic antennal input resulting in enhanced AL representations as measured by power spectral and population analyses. Pharmacological manipulation of the HA pathway reveals that HA modulates the ability of AL neurons to entrain to temporally structured stimuli. These findings are further supported by psychophysical results demonstrating lowered detection and discrimination thresholds to rhythmical stimuli in a HA pathway-dependent manner. Overall these results establish that this simple and elegant motor-to-sensory circuit provides a corollary discharge that modulates AL function, presumably enhancing odor representations during odor-guided flight. This is the first known corollary discharge circuit to an olfactory pathway and the first higher order corollary discharge in arthropods, however preliminary comparative immunolabeling suggests this circuit is present in other moths but not butterflies.

P1-004 A functional atlas of serotonin receptor expression in the Antennal Lobe

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The behavioral relevance of an odor changes from one moment to the next depending on the physiological state of an animal and, as a result, sensory networks often use neuromodulators to optimize how they encode information to meet these ongoing demands. Neuromodulators alter the biophysical properties and synaptic efficacy of individual neurons within a network resulting in changes in both the direct output of a network and the lateral interactions within a network. For instance, within the antennal lobe (AL) of *Drosophila melanogaster* serotonin (5-HT) enhances the odor-evoked responses of projection neurons (PNs), while also enhancing the degree of pre-synaptic inhibition exerted by local interneurons (LNs) on olfactory receptor neurons (ORNs). However, without knowing the functional identity of those neurons that express each neuromodulatory receptor, it is difficult to determine

if specific changes in olfactory processing are due to direct changes in biophysical properties or the synaptic input that a particular neuron receives. To this end, we used *Drosophila* to generate a functional atlas of AL neurons that express each of the five insect 5-HT receptor subtypes using a reporter of endogenous receptor translation and functionally identified each population of neurons based on their transmitter content and morphological characteristics. Each 5-HT receptor was expressed by distinct functional populations of neurons and, overall, subpopulations from each of the 3 major neuron classes (ORNs, LNs and PNs) expressed a 5-HT receptor. For instance, the 5-HT1A receptor was expressed by a specific population of peptidergic LNs and the GABAergic PNs, while the 5-HT2A receptor was expressed only by cholinergic PNs. Our results suggest that the expression of different 5-HT receptors by each neuronal class allows 5-HT to have distinct effects on individual features of olfactory coding.

P1-005 Feedforward excitation entrains oscillatory microcircuits in the mouse accessory olfactory bulb

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The accessory olfactory system is a key component in rodent conspecific chemical communication. In the accessory olfactory bulb (AOB), the first stage of information processing in the mouse vomeronasal pathway, mitral cells (MCs) receive sensory input from peripheral vomeronasal neurons and relay this information to the vomeronasal amygdala and the hypothalamus. Despite its fundamental function, however, sensory coding in the AOB is poorly understood. Recently, we demonstrated that a subpopulation of MCs is intrinsically rhythmogenic and exhibits slow stereotypical oscillatory discharge triggered by cyclic activation of three interdependent ionic conductances: subthreshold persistent Na^+ current, R-type Ca^{2+} current, and Ca^{2+}-activated big conductance K^+ current. Here, we identify an excitatory circuit within the AOB network that entrains oscillatory activity in a second MC subpopulation. Using a battery of physiological techniques in acute AOB tissue slices, we investigate the mechanisms underlying oscillatory entrainment and synchronization. Entrained MCs display periodically increased excitatory synaptic input that correlates with their respective rhythmic discharge patterns. Several such MCs are often organized into synchronized microcircuits. Block of fast glutamatergic synaptic transmission reveals that entrainment depends on an intact glutamatergic network. Ongoing experiments aim to identify the detailed mechanisms of MC entrainment and the role of slow rhythmic activity in AOB information processing.

This work was supported by the Deutsche Forschungsgemeinschaft (SP724/9-1; SPP 1392: "Integrative Analysis of Olfaction").

P1-006 Neural circuits controlling pup-directed behaviors in male mice

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Parental behavior, provided by mother and father, is essential for the survival of pups in mammalian species. Therefore, it is plausible to assume that the basic central neural mechanisms in mammals including humans are highly conserved. Understanding the central mechanisms of parental behavior should significantly benefit our society by promoting ideal parental care and preventing its malfunction such as child neglect and infanticide. In the present study, we investigated both paternal behavior in mice by combining variety of techniques. We demonstrated that the c-Fos expression pattern in the four nuclei of the preoptic-bed nuclei of stria terminalis (BST) region could robustly discriminate five kinds of previous social behavior of male mice. Specifically, neuronal activation in the central part of the medial preoptic area (cMPOA) and rhomboid nucleus of the BST (BSTrh) retroactively detected paternal and infanticidal motivation with more than 95% accuracy. Moreover, cMPOA lesions switched behavior in fathers from paternal to infanticidal, while BSTrh lesions inhibited infanticide in virgin males. Optogenetic or pharmacogenetic activation of cMPOA attenuated infanticide in virgin males. We also found that excitotoxic lesions centered in the central nucleus of the amygdala attenuated infanticide in virgin males. These results identified the preoptic-BST nuclei underlying social motivations in male mice, and amygdala's involvement in this circuit is also suggested. Afferent and efferent connections of mouse cMPOA are also described and discussed.

P1-007 Investigation of morphological differences between mitral cell subpopulations in the accessory olfactory bulb of mice

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The accessory olfactory system is crucial for controlling both inter- and intraspecific communication as well as sexual behavior in rodents. Astonishingly, its sensory coding and morphology is still poorly understood compared to the main olfactory system. The first stages of the vomeronasal pathway comprise the vomeronasal organ and the accessory olfactory