Summary

We studied two aspects of *Drosophila* olfactory sensilla. In the first part we investigated the modulatory role of biogenic amines in sensilla. We detected expression of receptors for the biogenic amines serotonin, dopamine, octopamine and tyramine in the antenna, and showed that loss of the tyramine receptor in the mutants $TyrR^{hono}$ and $TyrR^{hono}/TyrR^{neo30}$ results in altered odor responses. Specifically, the sensillum potentials are elevated in one physiological class of sensilla, while the spike frequencies and temporal patterns are unaltered. We found two putatively tyraminergic or octopaminergic cells or cell groups. Firstly we visualized a neuron or neurons projecting into the 3rd antennal segment and into the arista. Ablation of this neuron or these neurons did not change odor responses under the tested conditions. Secondly we revealed that one of the glia like accessory cells, the thecogen cell, is able to synthesize tyramine. Preliminary calcium imaging data suggest that the thecogen cell actually responds to odor stimuli. Our hypothesis is that the thecogen cell detects the depolarization of the ORN during odor stimulation and secretes tyramine into the sensillum lymph in response. Thereupon tyramine activates two other accessory cells that possess ion pumps and influence the composition of the sensillum lymph. This could be a mechanism to electrically isolate the sensilla from each other or to deal with changes in the odor environment.

In the second part we studied a gustatory receptor in the antenna. It is expressed in an ORN that senses CO_2. CO_2 is different from other odors in some aspects and coded via a labelled line, whereas usually olfactory coding is considered as combinatorial. Electrophysiological measurements and calcium imaging in the brain revealed the ORN are able to dectect very small changes in CO_2 concentration and T-Maze experiments showed a strong avoidance behaviour for all concentrations. We also investigated the effects of ablating the CO_2 sensing ORNs on electrophysiology and behaviour.