# 6 Summary

Odors elicit specific spatio-temporal combinatorial patterns of activity in the olfactory bulb (OB) of vertebrates and the antennal lobe (AL) of insects. In recent years, there have been several reports of changes in these patterns following olfactory learning. These studies pose a conundrum: How can an animal learn to efficiently respond to a particular odor with an adequate response, if its representation is changing during this process? A plastic odor-code cannot ensure reliable odor recognition. In this study, we offer a possible solution for this problem.

Using the honey bee as an experimental animal, I measured odor evoked calcium responses in a subpopulation of AL output neurons, the uniglomerular projection neurons (PNs). I demonstrate that neural representations of odors in these neurons are remarkably resistant to plasticity following a variety of appetitive olfactory learning paradigms. There was no significant difference in the changes of odor-evoked activity between single and multiple trial forward or backward conditioning, differential conditioning, or unrewarded successive odor stimulation. In a behavioural learning experiment we show that uniglomerular projection neurons are necessary for conditioned odor responses.

As a consequence, I discuss the possibility of parallel odor processing in the antennal lobe: lACT uniglomerular projection neurons are necessary for reliable odor coding and are not modified by learning. Parallel processing of olfactory information might ensures the separate encoding of the neural representations of a variety of aspects of olfactory stimuli, for example their temporal structure, their intensity fluctuations and the sequence, their evaluation and meaning

The role that other neurons (such as multiglomerular projection neurons) play in olfactory memory remains to be investigated.