Summary

Three chapters describe experiments which are dedicated to shed more light on the involvement of the mushroom bodies (MB) in olfactory learning of the honeybee (*Apis mellifera*). In order to do this the proboscis extension reflex paradigm was used within a classical conditioning.

Chapter I shows the ability of bees to learn faster, if a certain kind of conditioning problem occurs several times. Bees do not seem to learn an abstract rule but underlie changes in their conditions or within their nervous system, which could be described by the term attention. Available data can not explain what exactly happens within the animal leading to an increased speed in reversal learning.

Chapter II shows that honeybees can fulfill simple learning processes by using only one antenna, which they can not do in a complex learning paradigm including the same stimuli. Since the main amount of connections between hemispheres is found between the MBs, it is concluded that both MBs including their connections work as a functional unit within the olfactory learning of the honeybee. This unit adds possibilities for processing olfactory signals to the abilities of a single MB.

Lesion experiments described in chapter III are evidence for the same conclusion. In these experiments the transfer between hemispheres appears to be a critical factor with respect to olfactory learning. Different olfactory stimuli given to both antennae, in this case two distinct differential conditionings, lead to both brain sides impeding each other. Thus, bees only learn on one side. Ablated bees treated by Hydroxyurea are not able to learn on any side in this experimental design, although animals show only single side ablations. If olfactory information between sides has to be separated to fulfill the task, ablated bees solve the task on their intact brain side but not on their ablated hemisphere. Single side ablations do not seem to have any influence on bilateral olfactory learning.