OR322

The role of the mushroom body in honeybee learning and memory

Randolf Menzel, Ina Filla, Paul Szyszka

The memory trace at the input side of the mushroom body (MB) is characterized by high order combinatorial integration across multiple sensory inputs. Presynaptic boutons of olfactory projection neurons are modulated in their responses to the rewarded olfactory stimuli in a behavioral learning related fashion. Intrinsic neurons of the MB code sensory stimuli in a sparse way both in the temporal domain and on the population level. Learning leads to enhancement, reduction and recruitment of intrinsic neurons changing the sensory code at the individual neuron and population level. MB extrinsic neurons lose their sensory coding properties and appear to represent the acquired values of the learned stimuli. Specifically, extrinsic neurons of the MB may encode learned cues and contexts differently. Memory processing is exemplified by rate changes in an inhibitory recurrent pathway that peak at discrete time windows over three days. Thus MB extrinsic neurons provide neural commands for goal directed behavior and decision making. Furthermore, information stored in the MB and/or extrinsic neurons depends on consolidation processes over the range of days. A model will be presented that aims to capture the multi-faceted and distributed nature of the engram and may help to guide our future search of the engram at a neural systems level.