Feedback Inhibition in the Mushroom Body and Gain Control

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The giant GABAergic neuron (GGN) is a single, paired, non-spiking neuron that arborizes extensively in the mushroom body (MB) \cite{Leitch1996}, where it overlaps with the dendrites and the axons of Kenyon cells (KCs). KCs are the intrinsic neurons of the MB and are thought to be required for learning and memory \cite{Heisenberg2000}. We are interested in understanding the function of GGN in olfactory processing: in particular, its pattern of arborization makes it an attractive candidate for controlling or modulating KC responses to odors, with potential implications for learning and recall. Physiological recordings of KCs in locust show that these neurons respond sparsely to odors, by contrast with their excitatory input from the antennal lobe (projection neurons or PNs) \cite{Perez-Orive2002}. Inhibition appears to be critical to control KC response threshold, probability and duration during odor stimulation \cite{Perez-Orive2002}. We have shown that there exists a feedback loop whereby KCs provide excitatory input to GGN and this cell -because of its GABAergic output- contributes to the inhibitory control of KC excitability. As such, this neuron could act to control the gain of PN-to-KC information transfer and normalize KC-population output, making it independent of input strength. Using electrophysiological techniques, we are studying the properties and modes of action of GGN in locust.

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References
\cite{Leitch1996, Heisenberg2000, Perez-Orive2002}
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References