A single inhibitory feedback neuron revealed by genetic labeling and live imaging of a learning centre, the *Drosophila* larval mushroom body

Animal and human behavior are guided by learning of sensory cues. In contrast to the superficial layers of the nervous system, in the higher association cortices of the brain, sensory cues are represented by sparse and selective ensembles of neurons, a configuration that would allow maximal use of the coding capacity of the brain. To understand the neural mechanisms that govern the formation of such selective representations, we used the *Drosophila* larval brain as model. The larva has only 21 olfactory sensory neurons that carry sensory signals to the higher brain. In the mushroom bodies (MBs), the centers for olfactory learning, olfactory signals carried in parallel olfactory receptor channels are transformed into a combinatorial coding by neurons that are highly selective. We found that a single inhibitory neuron, larval APL (Anterior Posterior Lateral), innervates the MBs in a manner that would provide a feedback loop from output to input of MBs. This suggests a model in which the activity of all MB neurons is inhibited after olfactory stimulation providing a mechanism for the high selectivity of MB neurons.

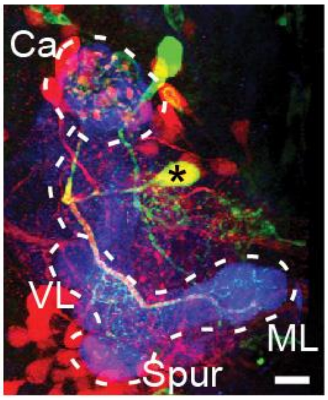

Figure legend:

The larval APL (green). The cell body of the APL (asterisk) is posterior medial to the MBs (blue, marked by dashed lines), sends a process that bifurcates into one process with terminals in the calyx input region (Ca) and one process innervating one output region in the medial lobe (ML). GABA (red), APL neuron (green), MB (blue), vertical lobe (VL). Scale bar 10 µm.

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