



Graduate School Event

Thesis Defense: Calibrating the Teacher Synapse: Mechanisms and Functional Significance of Presynaptic Inhibition at Hippocampal Mossy Fiber Synapses

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Host: Charles Roques-Carmes

The hippocampal mossy fiber (MF) to CA3 pyramidal neuron synapse plays a key role in hippocampal information processing, acting as a teacher synapse that can conditionally drive postsynaptic firing and instruct information storage in the downstream CA3 network. How the detonation properties of this synapse are kept in check remains unclear. Our study demonstrates that CA3 stratum lucidum interneurons inhibit MF synaptic transmission via presynaptic GABAB receptors. Pharmacological activation of these receptors by baclofen markedly reduced MF synaptic transmission, switching the synapse from a reliable conditional detonator into a coincidence-detecting subdetonator. We identified a dual mechanism underlying this presynaptic inhibition: a reduction in Ca^{2+} influx and, more substantially, a decrease in the readily releasable pool of synaptic vesicles. Synaptically released GABA, evoked by optogenetic stimulation of stratum lucidum interneurons at in vivo-like frequencies, produced comparable effects and further interfered with the stability of the short-term plasticity-associated vesicle pool engram, pointing to a physiological role for presynaptic inhibition. Expansion microscopy showed that interneuron terminals are positioned in close proximity to MF boutons, providing a structural basis for GABA spillover onto presynaptic receptors. Together, our findings reveal how interneuron activity calibrates synaptic efficacy and plasticity at MF synapses through presynaptic inhibition, with implications for memory encoding in the hippocampal trisynaptic circuit.

Thursday, August 6, 2026 03:00pm - 04:00pm

Central Bldg / O1 / Lecture Hall (I02.O1.014) and Zoom



This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.
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