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NEUROSCIENCE AND PHYSIOLOGY SEMINAR SERIES

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"Evidence of Multiplexing in Cortical Circuits: A Mechanism for Visual Memory Encoding in Mouse V1"

Neurons in the primary visual cortex (V1) are selective to basic features of the visual stimuli. Our recent work has demonstrated that V1 may also encode visual familiarity by means of persistent theta oscillations. These oscillations are specific to the familiar stimulus, and are crucial for performance in visual working memory tasks, suggesting that they may represent a cellular mechanism of memory. In a visual learning paradigm, we observed distinct differences in the frequencies of these familiarity-evoked oscillations for Go and No-Go stimuli. In this study, we used TRAP2/Ai32 mice to identify engrams in V1, the neuronal ensembles representing stimulus-specific memory. We discovered that the same neurons encoded information about two different familiar visual stimuli by switching their persistent theta oscillations to the distinct frequencies for the Go and No-Go stimuli. Optogenetic reactivation of the identified engram at the observed frequency in V1 alone was sufficient to induce Go-stimulus-associated behavior. We propose that visual memory may be encoded in V1 via frequency-division multiplexing (FDM).

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