NEUROSCIENCE & PHYSIOLOGY SEMINAR SERIES

MARCH 12TH

12:00AM – 1:30PM | LILY 1117

Origin and propagation of visual experience dependent oscillations

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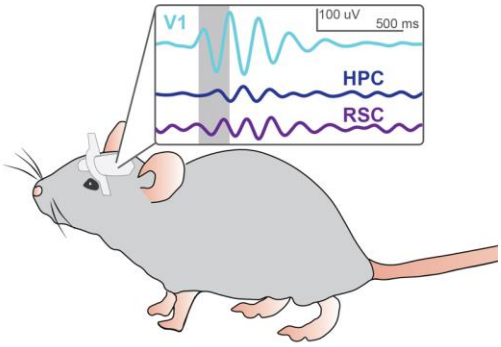

Our brains constantly receive a major influx of sensory information from the environment around us. Whether we're recognizing the faces of individuals in our buildings, remembering items on our to-do lists, or even being startled when a lab mate suddenly appears in the lab room, our brains are constantly working to decipher what sort of action needs to be taken given the situation we are in. One line of thought proposes that prediction errors, when our internal perception of the environment around us differs from the sensory input we receive, drive much of the brain's focus. At the core of this theory is a separation of stimuli into one of two categories; novel or familiar, better termed as experience. In mice, visual experience, which is induced by being passively shown the same visual stimulus multiple times a day for multiple days, is shown to give rise to visually evoked theta (4-8 Hz) oscillations in the primary visual cortex (V1). Recent work from our lab has shown the presence of these oscillations outside of V1 in higher-visual areas (HVAs), which are synchronized with V1 in a context-dependent manner. It remains unclear, however, where these unique oscillatory dynamics originate; whether from the cortex, thalamus, hippocampus, or other-memory related brain regions. To address this, we conducted paired extracellular silicon probe recordings in two visual thalamic nuclei (dorsal lateral geniculate nucleus, dLGN, and lateral posterior thalamus, LP), the retrosplenial cortex (RSC), which is a non-visual cortical area directly connected with V1, and the hippocampus (HPC), which is widely known to be involved in memory encoding and retention. We find that both thalamic nuclei show no oscillatory activity, however, both RSC and the HPC demonstrate a sparce population of neurons with theta oscillations, with the RSC activity temporally delayed. To determine if the activity in the HPC was interacting with V1, we performed hippocampal lesioning and found that it did not modify the activity in V1. These results suggest two things; first, the oscillations are primarily originating in V1 and not initially in thalamic regions, and second, there is little to no interaction between the theta oscillations in V1 and the HPC in response to known, familiar stimuli. Overall, this work sheds light on the purpose of these visually-evoked theta oscillations and determining the role they play in cross-brain relay of information for memory encoding and retention.

Pizza will be served!