University of Rochester School of Medicine and Dentistry

The Neuroscience Graduate Program

Presents:

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In a PhD Thesis Defense

Advisor: Adam Snyder, PhD

When Oscillations Reflect Key Information Needed for Goals: Maintenance Engages Mnemonic Oscillations in Rhesus Monkey

Working memory (WM) enables temporary maintenance and manipulation of task-relevant information. One important role of WM is preventing information loss during distraction. While neural oscillations are known to support WM maintenance and distractor resistance, less is understood about how anticipation influences these processes. This thesis investigated neural oscillations in WM during distractor anticipation. To test this, we recorded local field potentials (LFP) in the lateral prefrontal cortex (LPFC), a key brain area for WM, and scalp electroencephalograms (EEG) from monkeys performing modified memory-guided saccade (MGS) tasks, with varying in distractor timing and item load. The first experiment tested how distractor anticipation influences brain oscillatory dynamics with fixed distractor timing during memory maintenance. We found widespread thetaband (4-8 Hz) EEG activity better encoded the memory item after, rather than before, the anticipated distractor time, regardless of whether the distractor appeared. However, theta-band LFP activity in the LPFC only encoded the item when the distractor was presented. These results suggest large-scale theta oscillations reflect WM dynamics associated with both maintenance and distractor anticipation, while small-scale theta oscillations in the LPFC specifically encode the stored item, ensuring stability. The second experiment varied distractor timing. We found greater behavioral impairment when the distractor appeared towards the end of the task. EEG theta activity continued encoding item—greater towards the end of maintenance, regardless of the presence of the distractor. Similar encoding was observed for the LFP theta activity only when the distractor was shown. These results suggest WM becomes more vulnerable to distraction over prolonged maintenance, but greater encoding of items may reduce deteriorating distractor effects. The third experiment explored effects of increased item load and internal selective attention on distractor anticipation. Selection increased encoding of an attended item in EEG and LFP theta-band activities. Post-cue distractors tended to increase behavioral errors compared to a single-item conditions in the previous experiments, suggesting increased task complexity and variability impairs distractor anticipation. Together, the results of these experiments demonstrate that the distractor anticipation influences the WM dynamics as reflected in both small- and large-scale oscillatory signals.

January 29, 2025, 1-2pm

1-7619 Adolph (Lower) Auditorium

https://urmc.zoom.us/j/97634538779