NEUROSCIENCE & PHYSIOLOGY SEMINAR SERIES

APRIL 9TH

12:00AM – 1:30PM | LILY 1117

Traveling waves enable reliable volitional motor movement

Om Kolhe
Dr. Krishna Jayant's Lab

Traveling waves (TWs) are an emergent phenomenon observed in complex dynamical systems throughout nature. Recent advances in neural recording technologies have allowed scientists to record traveling waves throughout the mammalian brain. These TWs mediate various aspects of animal cognition such as stimuli perception, volitional movement, and working memory. Theoretical studies have suggested that these TWs play an important role in preserving time during information transfer between two brain regions as well as for plasticity across long-range neural circuits. Yet their potential functional and behavioral relevance remains unknown. In this work, by implementing custom-designed flexible neuro-electronics and high-density electrophysiology in mice performing a motor task, we demonstrate that traveling waves distinctly reflect task-relevant information. Specifically, propagating traveling wave phase-directionality reflected impending movement after an external stimulus while the propensity of precise wave generation relied on the presence of external context. This was reflected by changes in the reliability of local spiking populations of cortical neurons across task conditions, which tightly coupled with ongoing wave dynamics within a lower dimensional state-space. Using focal cooling and optogenetic inhibition, we show that the structured generation of traveling waves and correct motor execution is modulated by M2 via distinct pathways: cortically and subcortically through the motor thalamus. Thus, our results suggest that traveling waves reflect task-specific computations required for the generation of reliable volitional movement and can dynamically coordinate activity between distinct brain regions.

Pizza will be served!