



BCL5

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Abhilasha Joshi

Assistant Professor
National Centre for Biological Sciences,
Bangalore

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Fast timescale synchronization between internal cognitive representations and locomotor stepping

Abstract: The hippocampus is a mammalian brain structure that expresses spatial representations and is crucial for navigation. Navigation, in turn, intricately depends on locomotion; however, hippocampal spatial representations and the details of locomotor processes are typically investigated separately. In our prior work, we simultaneously monitored hippocampal spatial representations and ongoing limb movements underlying locomotion at fast timescales (Joshi et al., 2023). We found that the forelimb stepping cycle in freely behaving rats is rhythmic and peaks at around 8 Hz during movement, matching the approximately 8 Hz modulation of hippocampal activity and spatial representations during locomotion. We discovered a precisely timed coordination between the time at which the forelimbs touch the ground ('plant' times of the stepping cycle) and the hippocampal representation of space that was specifically detectable when rats approached spatial decisions. In this talk, I will discuss those results and share some ongoing efforts to use closed-loop optogenetics to disrupt hippocampal neural activity patterns, explicitly during locomotion, and monitor their effects on learning.