

Multisensory Mechanisms of Hippocampal Spatio-temporal Selectivity

Mayank R. Mehta

Departments of Physics & Astronomy, Neurology and Neurobiology,

University of California, Los Angeles, US

Email: mayank@physics.ucla.edu

Abstract:

A complex network of neurons, called the hippocampus, is crucial for many forms of learning and memory and for learning spatial maps. This part of the brain is quite plastic, even in adults and is implicated in a range of neurological disorders including ADHD, Alzheimer's disease, Epilepsy and PTSD. To understand hippocampal function, especially in mediating spatial navigation, we have developed a noninvasive, immersive and multisensory virtual reality system where precisely controlled stimuli determine the surrounding virtual space, and nonspecific stimuli are spatially uninformative. We simultaneously measured rats' behavioral performance and the activities of thousands of neurons from the hippocampal circuit while rats performed complex tasks in virtual reality. We also developed computational techniques to decipher the emergent neural dynamics. This integrative, experiment-theory approach provided many surprising results, suggesting that the hippocampus does rapid, multisensory associations that serve diverse behaviors.