Neural circuits for navigation-based decision-making

Animals learn relationships between sensory cues in their environment and behavioral actions in order to achieve desirable outcomes. For example, as animals move through an environment, they integrate sensory signals over time to inform decision-making and planning about where to navigate to next to find food or avoid predators. My laboratory is interested in identifying the neural circuit mechanisms underlying navigation-based decision-making. I will present the methods we have developed to study this topic using a virtual reality system for mice, cellular resolution two-photon imaging of activity in neuronal populations, and in vivo whole-cell patch-clamp recording techniques. We have recently identified the mouse posterior parietal cortex (PPC) as a region that is essential for memory-guided decision tasks during virtual navigation. Based on our anatomical studies, the PPC is a putative sensorimotor association area that receives synaptic inputs from sensory cortices, sends outputs to motor-related structures, and has recurrent connections with frontal cortices. From two-photon imaging of PPC neuronal populations, we found that the neural circuit activity dynamics in the PPC during navigation-based decision tasks can be characterized as choice-specific sequences of neuronal activation. I will discuss how our recent and on-going work on neural circuit dynamics in the PPC presents models for how circuits may perform the computations necessary for navigation-based decision-making.

Suggested papers: