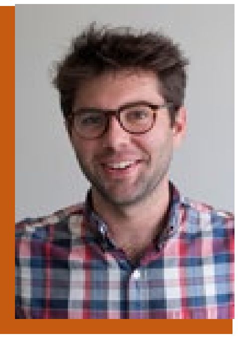
University of Rochester School of Medicine and Dentistry

The Neuroscience Graduate Program

Presents:

Luke Shaw



In a PhD Thesis Defense

Advisors: Kuan Hong Wang, PhD and

Jude Mitchell, PhD

Tools to Explore the Neural Control of Vision-Guided Reaching Behavior for Dynamic Targets in the Common Marmoset

Primates manipulate features of their environment using their forelimbs and dexterous hands, which are commonly guided by visual perception. It is known that in manual interception of moving targets, humans can make rapid adjustments to rapidly compensate for changes in motion. To date, we lack a complete understanding of the neural control of dynamic reaching. This research first characterizes reaching in a new world primate model, the common marmoset (*Callithrix jacchus*), and further demonstrates methods to inhibit specific components of the reaching neural control circuit during reaching.

To study dynamic reaching in marmosets, we use an ecologically relevant approach with reaching for live moving crickets. Using this paradigm, we estimate visuomotor delay and the time constant to which marmosets predict future target position, confirming that marmosets share several aspects of predictive reaching found in human interception. We further extend this paradigm to include mechanically controlled targets capable of mimicking the motion of a live cricket. Using this apparatus, we validate findings from live cricket reaching experiments with higher trial yields and novel target motion behavior.

In primates, control of vision-guided reaching involves tight coordination of motor planning centers in premotor cortex and vision processing centers in parietal cortex. It is thought that premotor cortex relays motor information back to parietal cortex enabling prediction and also short visuomotor delays. Here, we test and optimize optogenetic tools for the marmoset to manipulate feedback projections from premotor cortex to parietal cortex and their role in prediction. To accomplish this, we utilize an intersectional approach to express light activated ion channels, or opsins, in feedback projections and validate their efficacy in histology and with electrophysiological recordings using optical stimulation. We also test opsins expressed specifically in inhibitory interneurons to enable rapid suppression of premotor or parietal areas. These optogenetic manipulations when coordinated with reaching behavior will enable us to distinguish the contributions of feedback to predictive reaching.

August 22, 2024

1:30 – 2:30 pm

1-9525/35 Northeastern Rm