Presenter: Jiahui Peng, Graduate Student, Lois lab

Poster title: Flexible neuronal recruitment in a stable motor sequence

Abstract: Neural circuits must generate learned behaviors reliably while retaining flexibility for context-dependent modulation, adaptation, and repair. In the zebra finch song system, stereotyped vocalizations are thought to rely on precisely timed sequences in the premotor nucleus HVC, yet song can recover after major circuit perturbation, implying latent degrees of freedom within an apparently stable motor program. Using chronic calcium imaging in freely behaving zebra finches, we found that HVC neurons maintained precise motif-locked timing while participating probabilistically across renditions. This trial-to-trial variability was structured rather than random: local song syntax shaped recruitment probabilities, and social context modulated recruitment in a baseline-dependent manner, engaging infrequently active neurons while amplifying frequent participants. During post-lesion recovery and late juvenile development, recruitment underwent heterogeneous, bidirectional reconfiguration while temporal tuning remained largely preserved. These results show that reliable learned behavior need not depend on invariant participation of the same neurons on every rendition. Instead, separating stable timing from flexible recruitment provides a circuit architecture that preserves temporal precision while maintaining latent degrees of freedom for plasticity and resilience.