Abstract

A key goal of neuroscience is to understand how neural circuits extract relevant information from the environment and respond with appropriate behaviors. Hunting behavior, a natural complex behavior involving neural functions including sensory processing, sensory-motor transformation, decision making, and selective attention, provides an ideal model for studying this link. One particularly interesting challenge faced by animals during hunting is how to select amongst competing prey items for successful capture, which is a form of competitive selection. However, previous studies of competitive selection have mostly focused on escape responses to aversive stimuli, and little is known about the computations underlying the selection between attractive stimuli during hunting. Furthermore, competitive selection involves integration of information across many brain areas, which is thus difficult to study by neural recordings of only individual brain regions. Larval zebrafish exhibit stereotypical complex hunting behaviors, and are amenable for large-scale whole brain imaging, making them an ideal system for studying the sensory-motor transformation underlying competitive selection. In the proposal, I will combine detailed analysis of free swimming hunting behavior with simultaneous recording of both neural activities and tail responses to competing prey-like visual stimuli to reveal the behavioral and neural characteristics of competitive selection during hunting. Preliminary data suggest a novel and critical role for the habenula in facilitating competitive selection. This project will reveal the circuit mechanisms underlying competitive selection during hunting, and provide deeper insight into the neural computations underlying decision making and selective attention more generally.