Spring 2018

Encoding the Expectations of a Sensory Stimulus

Alex Chen
Washington University in St. Louis

Encoding the Expectation of a Sensory Stimulus

Alex Chen

Mentor: Barani Raman

Most organisms possess an ability to differentiate unexpected or surprising sensory stimuli from those that are repeatedly encountered. How is this sensory computation performed? We examined this issue in the locust olfactory system. We found that odor-evoked responses in the antennal lobe (downstream to sensory neurons) systematically reduced upon repeated encounters of temporally discontinuous stimuli. Rather than confounding information about stimulus identity and intensity, neural representations were optimized to encode equivalent stimulus-specific information but with fewer spikes. Further, spontaneous activities of the antennal lobe network also changed systematically and become negatively correlated with the response elicited by the repetitive stimulus (i.e., 'a negative image'). Notably, while response to the repetitive stimulus reduced, exposure to a novel cue generated undamped and even exaggerated spiking responses in several neurons. In sum, our results reveal how expectations regarding a stimulus is encoded in a neural circuit to allow response optimization and preferential filtering.