PROGRESS IN NEUROSCIENCE PINS

Seminar Series of the
Brain & Mind Research Institute
Weill Cornell Medical College (WCMC)
&
The Graduate Program in Neuroscience of
WCMC and Sloan Kettering Institute

Thursday, 12/11/14, 4 PM, coffee at 3:45 PM
Weill Auditorium

"Circuit Principles of Multimodal Integration and Action Selection in Drosophila"

Marta Zlatic, Ph.D.
Howard Hughes Medical Institute Group Leader

Abstract:

Combining information from multiple modalities is essential for the selection of appropriate actions. Key to understanding multimodal computations is determining the structural patterns of multimodal convergence and how these patterns contribute to behavior. Modalities could converge early, late or at multiple levels in the sensory processing hierarchy. These issues have not been systematically determined with synaptic resolution in any large nervous system. We describe a comprehensive electron microscopy dataset spanning the entire 10,000-neuron nervous system of Drosophila larva. Larvae can select multiple modes of escape locomotion depending on degree of threat. We showed that mechanosensory and nociceptive cues synergistically trigger the fastest mode of larval escape locomotion and reconstructed the multisensory circuit supporting the synergy that spans multiple levels of the sensory processing hierarchy in nerve cord and brain. The wiring diagram revealed a complex multilevel multimodal convergence architecture. Using behavioral and physiological studies we identified functionally connected circuit nodes that trigger the fastest locomotor mode, and others that facilitate it. We provide evidence that multiple levels of synergistic multimodal integration contribute to escape mode selection. We propose that the multilevel multimodal convergence architecture may be a general feature of multisensory circuits, enhancing sensitivity to weak multimodal cues and enabling complex input-output functions.

Recent relevant publications:

Vogelstein, J. T.f , Park, Y.f , Ohyama T.f , Kerr, R. A., Truman, J. W., Priebe, C. E.c and Zlatic M.c (2014): Discovery of brain-wide neural-behavior maps via multiscale unsupervised structure learning. Science 344(6182): 386-92.

Ohyama T., Jovanic T., Denisov G., Dang T. C., Hoffmann D., Kerr R. A., Zlatic M. (2013): High-throughput analysis of stimulus-evoked behaviors in Drosophila larva reveals multiple modality-specific escape strategies. PLoS One 8(8):e71706

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