LABORATORY OF COMPUTATIONAL NEUROSCIENCE (LCN)

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Friday, November 29th, 2013
11h00, Room SV 1717a

Computational Neuroscience Seminar
Life Science Seminar

Dmitri "Mitya" CHKLOVSKII,

Janelia Farm, HHMI

Understanding the building blocks of neural computation: Insights from connectomics and theory

Animal behavior arises from computations in neuronal circuits, but our understanding of these computations has been frustrated by the lack of detailed synaptic connection maps, or connectomes. For example, despite intensive investigations over half a century, the neuronal implementation of local motion detection in the insect visual system remains elusive. We developed a semi-automated pipeline using electron microscopy to reconstruct a connectome, containing 379 neurons and 8,637 chemical synaptic contacts, within the Drosophila optic medulla. By matching reconstructed neurons to examples from light microscopy, we assigned neurons to cell types and assembled a connectome of the repeating module of the medulla. Within this module, we identified cell types constituting a motion detection circuit, and showed that the connections onto individual motion-sensitive neurons in this circuit were consistent with their direction selectivity. Our identification of cell types involved in motion detection allowed targeting of extremely demanding electrophysiological recordings by other labs. Preliminary results from such recordings are consistent with a correlation-based motion detector. This demonstrates that connectomes can provide key insights into neuronal computations.