Dissecting retinal circuits encoding light intensity and visual motion.

You are cordially invited to the lecture given by:

Dr. Shai Sabbah
Department of Neuroscience, Brown University

On the topic of:

Dissecting retinal circuits encoding light intensity and visual motion.

The lecture will be held on Tuesday January 24, at 16:00
at ELSC, Silberman Bldg., 3rd Wing, 6th Floor,
Edmond J. Safra Campus

Light refreshments at 15:45

Abstract:
The retina is a favorable part of the CNS for delineating neural circuits linking specific sensory stimuli to
adaptive behaviors. I will review how my postdoctoral work has significantly reshaped our understanding of two key groups of retinal output neurons (ganglion cells), one of which is sensitive to retinal motion, and the other to light intensity. First, I will reveal that retinal direction selectivity adheres to a surprising spherical geometry that permits the animal to detect its own motion through space based on visual feedback (optic flow). By intensive global mapping using two-photon calcium imaging, electrophysiology, and anatomical methods, I will show that each direction-selective ganglion cell type aligns its directional preferences everywhere with optic flow produced by the animal's own motion along a specific axis. Two such axes are represented: the body and the gravitational axes; so that single cell types maximize their output when the animal advances, retreats, rises, or falls. I will also discuss a second project, exploring how the retina encodes light intensity, and drive circadian, pupillary and neuroendocrine responses to daylight. Light intensity is reported to the brain by a subset of retinal output cells: intrinsically photosensitive retinal ganglion cells (ipRGCs). I asked which types of bipolar cells transmit light-intensity signals from rods and cones to ipRGCs, and how they do so. Using serial electron microscopy, I generated a comprehensive description of these synaptic circuits, including bizarre bipolar-to-ipRGC synapses that violate several key dogmas of retinal organization. Surprisingly, using optical recordings of the glutamate release onto RGCs, and patch recordings of their postsynaptic responses, I found that intensity-encoding input is not unique to ipRGCs. This suggest that all RGCs may receive such signals, but that conventional RGCs filter out these intensity signals so that they encode temporal contrast rather than intensity though mechanisms I am now actively probing.

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