OIST OKINAWA INSTITUTE OF SCIENCE AND TECHNOLOGY
沖縄科学技術大学院大学

THEORETICAL SCIENCES VISITING PROGRAM

TSVP TALK

What They Didn't Tell Us in Computational Neuroscience 101

Studying Nonlinear Dendritic Integration and Network Entrainment in Pacemaking Neurons

2024 THU. **July 11**

15:00–16:00

HYBRID B250, ZOOM

For zoom and other details scan QR code or visit groups.oist.jp/tsvp

To simplify the description of neurons, neuroscience students are taught that neurons have a resting membrane potential (RMP), and require excitatory synaptic input to drive them to action potential threshold. Then, to simplify how neurons function in networks, neurons are treated as iso-potential (point-like) entities connected by synaptic weights. The first simplification is a prejudiced view that disregards diverse and ubiquitous classes of autonomously pacemaking neurons (that do not possess a stable RMP) in the brain. The second simplification disregards the complexity that dendrites add to the functions and calculations carried out by neurons. In my talk, I will describe my research that is aimed at making the contribution of dendrites to the response properties of pacemakers amenable to experimental investigation with currently available electrophysiological and optogenetic techniques. I will begin by introducing how the phase reduction formalism, provides a general framework for studying pacemakers, and present a recent study on how the framework explains spike correlations that appear in parkinsonism. I will then present how we used this formalism to study the role of dendrites in pacemaking neurons in the basal ganglia. We show that dendrites have a direct impact on how neurons encode their inputs and are entrained by them, and that we can use our formalism to probe the dendritic distribution of membrane non-linearities.

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Joshua Goldberg

Dr. Joshua A. Goldberg is an associate professor of medical neurobiology at the Hebrew University of Jerusalem, Israel. His research focuses on the pathophysiology of movement disorders, most prominently Parkinson's disease (PD). He combines advanced electrophysiology and imaging techniques both in vivo and in vitro with computational approaches to study how the physiology of neurons leads to their vulnerability in early statges of PD and how brain networks dynamics adapt to PD. He is a past recepient of a European Research Council (ERC) Consolidator grant and a Human Frontier Science Program (HFSP) grant with Dr. Jeff Wickens, OIST.

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