NYU-ECNU
Institute of Brain and Cognitive Science
at NYU Shanghai

Online Neuroscience Seminar Series

Spring 2021

A Cortico-Basal Ganglia-Thalamo-Cortical Circuit for Short-Term Memory

Date & Time: 4:00 - 5:00 pm, Wednesday, March 10, 2021

Speaker: Zengcai Guo, Tsinghua University

Location: Hosted via Zoom

Host: Jeffrey Erlich, NYU Shanghai

Abstract:

Short-term memory (STM), which links past events and future actions, is central to virtually all cognitive abilities. During STM, ensemble of neurons in various brain areas, including prefrontal cortex, parietal cortex, motor cortex and subcortical areas, sustains elevated or suppressed discharge of action potentials. How this persistent activity generated and maintained in the brain remains unclear.

We study this problem by combining multichannel recording, optogenetic perturbations, and quantitative behavior. Mice were trained to perform a whisker stimuli discrimination task with a delay. We previously recorded from a premotor cortex (the anterior lateral motor cortex, ALM) and found persistent activity that predicts future actions. This persistent activity was maintained by the reciprocal connections between ALM and motor thalamus (the ventral medial and ventral anterior-lateral nuclei). We further systematically mapped functional connectivity from the cortex to thalamus and found that inhibition of cortex profoundly reduced thalamic activity. Since thalamus is strongly modulated by SNr, we studied the role of basal ganglia-thalamic projections in formation of trial type selective persistent activity. SNr activity is modulated by the striatum and we find that the direct and indirect pathways play differential roles in formation of persistent activity. Together, these results illustrate a multi-regional network for short-term memory.

Biography

Dr. Guo is an assistant professor in the School of Medicine and a principal investigator in Tsinghua-PKU center for life science and IDG/McGovern Institute for Brain Science at Tsinghua University. His research focuses on understanding the role of the multiregional brain network in cognitive functions such as working memory. Dr. Guo obtained his Ph.D. degree in Applied Mathematics at Harvard University in 2010. After postdoctoral training under Karel Svoboda at HHMI's Janelia Research Campus, Dr. Guo joined Tsinghua University in 2015.

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