



Department of Psychology
The University of Hong Kong
香港大學心理學系

Aug
20
2026

Departmental Seminar

The Neural Dynamics of Flexible Cognitive Control: From Large-Scale Networks to Local Neural Populations



Dr. Runhao Lu

CIHR Postdoctoral Fellow
Montreal Neurological Institute
McGill University

11:00a.m. – 12:00n.n.

Room 715, 7/F
The Jockey Club Tower
Centennial Campus
The University of Hong Kong

Abstract

Flexible cognitive control allows humans to adapt their thoughts and behavior to changing goals and contexts. Although this capacity is thought to rely on the frontoparietal multiple-demand (MD) network, its electrophysiological mechanisms remain unclear. In this talk, I will present a multimodal and multiscale investigation of these neural dynamics. Using MEG and MEG–fMRI fusion, we first identified aperiodic activity as a key bridge between electrophysiological and hemodynamic representations of cognitive demand within the MD network. Next, to unpack how this control selectively filters information, we dissociated the roles of oscillatory and aperiodic activity in selective attention, using concurrent TMS-EEG to test their causal representational and behavioral contributions. As flexible control also requires updating representations based on outcomes, we extended this work to examine local prefrontal populations in macaques, revealing how feedback-dependent dynamics reconfigure goal-relevant representations to support adaptive learning. Finally, I will highlight ongoing work exploring how thalamocortical circuits support cognitive flexibility during naturalistic social processing.

About the Speaker

Runhao Lu is a CIHR (Canadian Institutes of Health Research) Postdoctoral Fellow at the Montreal Neurological Institute, McGill University. He completed his PhD in Cognitive Neuroscience at the MRC Cognition and Brain Sciences Unit, University of Cambridge, as a Gates Cambridge Scholar. His research investigates how cortical and subcortical systems support flexible cognition across attention, cognitive control, memory, and naturalistic cognition, using multimodal approaches that integrate neuroimaging (7T/3T fMRI), human and non-human-primate electrophysiology (EEG/MEG/iEEG/single neuron recordings), and neuromodulation (TMS). He also develops computational and stimulation methods, including reservoir computing for time-resolved neural decoding and TMS protocols for modulating oscillatory and aperiodic neural activity.

Zoom Meeting (For participants who couldn't attend the Seminar in person)

<https://hku.zoom.us/j/91501621934?pwd=eS7uM7ncaeMRNg2lmbtIestat6FaRV.1>

Meeting ID: 915 0162 1934 | Password: 766389

~ All are Welcome ~

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