Bio Phys TO

Lunchtime Seminar Series

WHEN?
November 7, 2024
12:00-1:00PM

WHERE?
McLennan Physical Laboratories
255 Huron Street
Rm. 606

WHY?
Join us for pizza and an opportunity to learn and engage with members of the UofT Biophysics community!

SPEAKER

Qian Lin

University of Toronto, Department of Cell and Systems Biology

Cerebellar orthogonal encoding in decision making

Motor planning, one form of decision making, enables animals to prepare and take desirable actions to maximize survival. While executing this mental process requires coordination from a distributed, brain-wide network, our recent study, using whole brain neural imaging and computational tools, has highlighted the cerebellum as a core modulating region. However, it remains unclear how the cerebellum integrates sensory stimuli and internal brain states for motor planning. To investigate this, we have combined calcium imaging using light-field and two-photon microscopies, optogenetic manipulation, and an operant-conditioning task in larval zebrafish. We find the strongly correlated, directed pre-motor signals in the cerebellum and habenula. These pre-motor signals are evoked by sensory stimuli and gained through learning. Disrupting the pre-motor signal in the habenula affects both decision behaviors and signals in the cerebellum. In particular, optogenetic stimulation leads to rotation in the neural manifold in the channelrhodopsin (CoChR) animals, while in control siblings the same light stimuli are encoded orthogonally to the motor planning signals. This result shows that the cerebellum-dependent motor planning relies on the input from the habenula, suggesting a habenula-cerebellum interplay as a conserved motivation-decision circuit. Moreover, the cerebellum can encode 'irrelevant' information orthogonally, highlighting a cognitive cerebellum.

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