



NEURO GLOBAL Skill-up Seminar

NGP Exchange Meeting (Closed Seminar)

Date:

December 22 (Mon) 16:00 - 17:00 JST

Special Seminar:

Prof Mayu Takahashi

Dept. of Physiology,
Graduate School of Medicine, Tohoku University



Title:

“Neural Mechanisms of Coordinate Transformation:
From Visual Signals to Eye Movement Control”

Venue:

Medicinal Hub

School of Medicine Building5, 2F, Seiryō campus

(医学部5号館2階 メディシナルハブ 星陵キャンパス)

【MAP】https://www.tohoku.ac.jp/map/ja/?f=SR_B04

Note:

This is a mandatory end-of-the-year event for all NGP students. Students are recommended to attend on site, but could be viewed through zoom, in case of health issues or any other circumstances.



NEURO GLOBAL

Skill-up Seminar

Abstract:

Visual information provides the majority of sensory input in humans, and precise eye movements are essential for bringing visual targets onto the fovea. Among the five types of eye movements, rapid saccades shift gaze to new locations, whereas fixation stabilizes the eyes on a target so that detailed visual information can be acquired. These two states—generation and suppression of movement—must be switched appropriately. Understanding how the brain executes this switch is fundamental to clarifying how sensory signals are transformed into motor commands.

Traditionally, the saccadic system has been described as consisting of separate horizontal and vertical subsystems, but the underlying circuitry has not been fully defined. Using intracellular recordings and anatomical tracing in cats and monkeys, we examined the pathways linking the superior colliculus (SC) to premotor and motor structures. We found that both excitatory and inhibitory SC outputs reach motoneurons through disynaptic pathways, and that the vertical saccade system contains a torsional component. These findings indicate that saccades operate within a three-dimensional coordinate framework aligned with the semicircular canals, similar to the vestibulo-ocular reflex (VOR).

We also investigated the mechanism that enables the brain to switch from fixation to saccade initiation. Although earlier models proposed a dedicated “trigger circuit” for initiating saccades, our studies showed that such a specialized mechanism is unnecessary. Instead, inhibitory burst neurons transiently inhibit omnipause neurons which have suppressed saccade generation, releasing the gate that allows saccade initiation. This mechanism provides a unified account of how saccades are triggered and suggests revisions to long-standing computational models of oculomotor control.