NEURO GLOBAL Seminar

Date & Time

June 4, 2025 (Wed) 15:00~16:30
(Including Q&A)

Speaker

Chih-Yang Chen

Assistant Professor,
Division of Neurobiology and Physiology,
Department of Neuroscience,
Graduate School of Medicine, Kyoto University

Title

Subcortical and cortical mechanisms in primate during active vision

Venue

Main Conference Room, 2 F Seiryo Hall, Seiryo Campus, Tohoku University

【MAP】https://www.tohoku.ac.jp/map/en/?f=SR_B10

Format Hybrid (On-site & Online)

Registration Please contact NGP Office (neuroglobal@grp.tohoku.ac.jp)

Related Website https://nscinbiol.med.kyoto-u.ac.jp/member/chen/

●**Neuro Globalプログラム生 (Neuro Global Program Students)**
【脳科学セミナーシリーズEx】【先進脳科学セミナーシリーズEx】 1 point
●医学系研究科(Graduate School of Medicine)
【医学履修課程】国際交流セミナー(アドバンスド講義科目)」 出席1回分
【Medical Science Doctoral Course】 International Interchange Seminar (Advanced Lecture course) 1 attendance
●生命科学研究科(Graduate School of Life Sciences)
【単位認定セミナー】【イノベーションセミナー（留学生対象）】 2ポイント
【Credit-granted seminar】【Innovation seminar (For international students)】 2 points

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Seminar

Title

Subcortical and cortical mechanisms in primate during active vision

Abstract

Organisms acquire visual information actively by shifting their eyes. Thus, studying active vision needs to understand not only how the eye movements are generated, but also how the visual signals are processed along different brain areas, and to understand the interaction between them.

I started my journey with Ziad, my PhD supervisor, in active vision since 2012. We selected superior colliculus (SC), a subcortical brain area that are involved in both vision and saccade generation pathway, as the first stop. For 5 years, using macaque monkey as the animal model, we characterized the visual responsive area of neurons with single unit recordings and quantified their visual sensitivity without eye movement using various visual stimulus. During mapping the response field, we found surprisingly an asymmetry between upper and lower visual field that is correlated with the asymmetry in saccade reaction time (SRT). Further, when we analyzed their sensitivity around saccades, we found SC neurons became more sensitive to visual stimulus before eye movement onset and less sensitive after. The decrease of sensitivity is dependent on the spatial frequency content of the stimulus and is also correlated with the change in SRT.

After graduation, I continued this journey in Tadashi's lab since 2017. With a rather novel animal model, the marmosets (*Callithrix jacchus*), in this field, we looked at the cortical mechanism during active vision. I first characterized a cortical brain area, frontal eye field (FEF) as my starting point. We located saccade related areas in the dorsal frontal cortex by electrical microstinulation. Combining with anterograde virus tracing in similar cortical areas, we revealed a retinotopic saccade map in the saccade evoking areas. We further used muscimol or optogenetically to manipulated the saccade evoking areas and showed causal relationship of these areas to saccade generation. On the other hand, we injected retrograde virus in the SC to map saccade related cortical areas and found that beside the the dorsal frontal cortex, several parietal, temporal, and occipital areas also send direct project to the SC. We implanted a large ECoG covering a whole hemisphere of the cortical surface to record the brain activities and found large traveling brain waves after saccade offset covering almost half of the cortical surface which is dependent on both visual signal and motor command. We have also showed how the eye movement response time changes with the progression of a neurodegenerative model we developed using α-synuclein fibrils injected marmosets.

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