Tohoku-NYCU Online Seminar for Neuroscience

Organized by :
Tohoku University, Graduate School of Medicine,
National Yang Ming Chiao Tung University, College of Medicine
Endorsed by :
Tohoku University [Neuro Global International Joint Graduate program,
Tohoku University Brain Science Center

Date

Tuesday, February 10, 2026 17:00 – 18:35 JST
(16:00 – 17:35 TST)

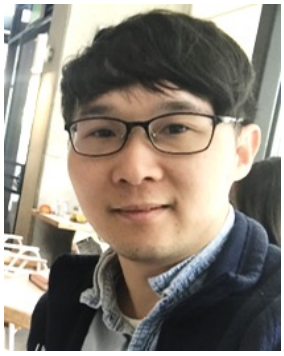
1st Speaker

Shinya Ohara, Ph.D.
Associate Professor, Graduate School of Life Sciences, Tohoku University

Title

Exploring memory mechanisms through multiscale connectivity of the entorhinal cortex

2nd Speaker



Chia-Hsiang Chang, M.D/ Ph.D.
Assistant Professor, The Institute of Brain Science of National Yang Ming Chiao Tung University

Title

In situ Proteomics Unveils Specialized Domains for Extrasynaptic Signaling on Neuronal Cilia

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

Program

17:00 JST (16:00 TST) Opening Remarks (10mim)
17:10 (16:10) Lecture by**, Shinya Ohara, Ph. D.** (35min)
17:45 (16:45) Q&A (5min)
17:50 (16:50) Lecture by **Chia-Hsiang Chang, Ph.D.** (35min)
18:25 (17:25) Q &A (5min)
18:30 (17:30) Closing Remarks (5min)

【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】【[Advanced] brain science seminar series Ex】1 point
【医学系研究科・医学履修課程】国際交流セミナー【Medical Science Doctoral Course】 International Interchange Seminar 1 attendance
【生命科学研究科・単位認定セミナー】【Credit-granted seminar】2 points

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Speaker ：Shinya Ohara, PhD

Title: Exploring memory mechanisms through multiscale connectivity of the entorhinal cortex

Abstract:
Everyday memories gradually mature from an initially labile state to a more stable and long-lasting form. Hippocampal-cortical output circuits via the entorhinal cortex (EC), which transfer information from the hippocampus (HPC) to neocortical structures, are thought to play a pivotal role in this memory consolidation process. Although the anatomical organization of the hippocampal output circuits has been extensively studied, most previous work has focused primarily on inter-regional connectivity. Thus, while hippocampal inputs to the EC and EC outputs to the neocortex have been well characterized, the local EC circuits that connect these two pathways remain poorly understood.

To address this gap, we examined the wiring of the hippocampal output circuit at multiscale level spanning both macroscopic inter-regional circuits and mesoscale local circuits formed by EC neurons. Using viral vector–based circuit tracing together with optogenetic circuit mapping in ex vivo slice preparation, we uncovered previously unrecognized organizational principle of HPC-EC circuits. Contrary to the prevailing anatomical view held for more than three decades, we found that the connectivity patterns of the hippocampal output circuit differ markedly along the longitudinal axis of the HPC. In medial EC (MEC), dorsal HPC preferentially targets layer Vb neurons, which in turn relay signals locally to superficial layers, forming a recurrent entorhinal-hippocampal loop. In contrast, ventral HPC predominantly innervate layer Va neurons, which directly project to the neocortical regions. Our results indicate that the ventral HPC may play a key role in controlling signal transmission through the hippocampal-MEC-neocortical circuit, thereby contributing critically to memory consolidation.

Reference:
1. 1. Ohara S., Rannap M., Tsutsui KI., Draguhn A., Egorov AV., Witter MP. Hippocampal-medial entorhinal circuit is differently organized along the dorsoventral axis in rodents. Cell Reports, 42(1):112001, 2023.
2. 2. Ohara S., Blankvoort S., Nair RR., Nigro MJ., Nilssen ES., Kentros C., Witter MP. Local projections of layer Vb-to-Va are more prominent in lateral than in medial entorhinal cortex. eLife, 10:e67262, 2021.
3. 3. Ohara S., Onodera M., Simonsen ØW., Yoshino R., Hioki H., Iijima T., Tsutsui KI., Witter MP. Intrinsic Projections of Layer Vb Neurons to Layers Va, III, and II in the Lateral and Medial Entorhinal Cortex of the Rat. Cell Reports, 24(1), 107–116, 2018.

Profile: Field of interest: systems neuroscience
– Functional neuroanatomy of the memory circuits
– Development of experimental methods to analyze the organization and function of neural circuits

Dr. Shinya Ohara is an Associate Professor at Tohoku University Graduate School of Life Sciences. He received his B.S. from the Faculty of Science, Tohoku University in 2004, and earned his Ph.D. in 2009 from the Graduate School of Life Sciences at the same institute. Following his doctoral training, he worked as a research associate at Tohoku University from 2009 to 2017. He then spent a year as a researcher at the Norwegian University of Science and Technology (NTNU), before returning to Tohoku University as an Assistant Professor from 2018 to 2024. Since 2024, he has been serving as an Associate Professor at the Graduate School of Life Sciences, Tohoku University.

During his master's and doctoral studies, Dr. Ohara worked on developing novel viral vector–based approaches to investigate the organization and function of the complicated central nervous system. After completing his Ph.D., he used these methods to elucidate the detailed wiring of hippocampus and parahippocampal circuits in rodents and primates. His work aims to uncover the multiscale organization of memory-related neural circuits and the neural mechanism of memory.

Speaker：**Chia-Hsiang Chang, M.D/ Ph.D.**

Title: In situ Proteomics Unveils Specialized Domains for Extrasynaptic Signaling on Neuronal Cilia

Abstract:
Neuronal cilia have emerged as crucial signaling hubs, yet their molecular composition and integration with synaptic communication remain poorly understood. Using a newly developed Arl13b-TurboID mouse model, we achieved robust cilia-specific biotinylation and proteomic profiling across diverse tissues and cell types. Comparative proteomics revealed striking tissue-specific specialization, with neuronal cilia uniquely enriched in synaptic proteins, adhesion molecules, and neurotransmitter receptors. Surprisingly, several signaling and adhesion molecules localize to neuronal cilia in discrete nanodomains maintained by active retrieval mechanisms. In the mouse cortex, expansion microscopy revealed that the NMDA receptor subunit GluN1 is organized in nanodomains on neuronal ciliary membranes, which are precisely positioned to sample neurotransmitter efflux from neighboring glutamatergic synapses. These findings establish neuronal cilia as specialized extrasynaptic signaling platforms, with a nanoscale organization that enables them to integrate local synaptic cues and modulate neuronal connectivity.

Reference:

1. Using in vivo cerebellar electroporation to study neuronal cell proliferation and differentiation in a joubert syndrome mouse model. CH Chang, TY Chen, TK Tang. Methods Cell Biol. 2023;175:235-249.
2. CEP120-mediated KIAA0753 recruitment onto centrioles is required for timely neuronal differentiation and germinal zone exit in the developing cerebellum. Chang CH, Chen TY, Lu IL, Li RB, Tsai JJ, Lin PY, Tang TK. Genes Dev. 2021 Nov 1;35(21-22):1445-1460.
3. Atoh1 Controls Primary Cilia Formation to Allow for SHH-Triggered Granule Neuron Progenitor Proliferation. Chang CH, Zanini M, Shirvani H, Cheng JS, Yu H, Feng CH, Mercier AL, Hung SY, Forget A, Wang CH, Cigna SM, Lu IL, Chen WY, Leboucher S, Wang WJ, Ruat M, Spassky N, Tsai JW, Ayrault O.Dev Cell. 2019 Jan 28;48(2):184-199.e5.

Profile:

Field of interest: neuroscience

- Rare Diseases, neuropsychiatric disorders, The role of cilia in neuronal cilia and synaptic function

Dr. Chang's scientific career centers on understanding a unique cellular organelle—the primary cilium. During the early phase of her career, He focused on elucidating the regulation of ciliogenesis in granule neuron progenitors (GNPs) and its implications in SHH-type medulloblastoma. He developed a mosaic genetic manipulation system through in vivo cerebellar electroporation and refined the purification of GNPs in vitro, establishing a solid foundation for her subsequent research. His postdoctoral training at Academia Sinica provided the opportunity to investigate the pathogenesis of Joubert syndrome (JS), a hereditary disorder marked by ciliary defects in the central nervous system. Building on the experimental tools and approaches developed earlier, he explored the complex interactions among centriolar–ciliary proteins implicated in JS and their roles in postnatal cerebellar development. Later, at the University of California, San Francisco (UCSF), he advanced her research by integrating state-of-the-art cilia proteomics. This experience enabled her to initiate a new line of investigation into the molecular components of neuronal cilia using in vivo biochemical approaches. Through the creation and application of the innovative "cilia-TurboID" transgenic mouse model, he successfully profiled the neuronal ciliary proteome and identified novel ciliary proteins. His discoveries have not only deepened the understanding of the link between neuronal cilia and synaptic function but also shed light on the emerging roles of cilia in neuropsychiatric disorders. Dr. Chang is currently establishing her independent laboratory and welcomes enthusiastic researchers who share a passion for scientific discovery to join her team.