

NYCU-Tohoku Online Seminar for Neuroscience



Organized by :

National Yang Ming Chiao Tung University, College of Medicine
Tohoku University, Graduate School of Medicine,

Endorsed by :

Tohoku University [Neuro Global International Joint Graduate program,
Tohoku University Brain Science Center



Date

Wednesday, June 17, 2026, 16:00 – 17:35 TST
(17:00 – 18:35 JST)

1st Speaker

Bei-Jung Lin (林貝容), Ph.D.

Associate Professor, Institute of Neuroscience, National Yang
Ming Chiao Tung University



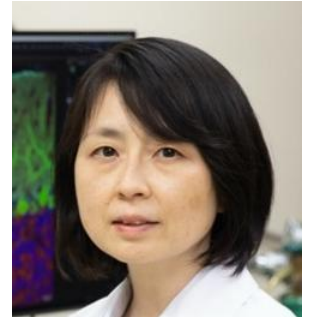
Title

**Subthreshold dynamics and the coordination of
hippocampal ensembles**

2nd Speaker

Nariko Arimura, Ph.D.

Associate Professor, Department of Pharmacology,
Graduate School of Pharmaceutical Sciences,
Tohoku University.



Title

**From Molecular Mechanisms to Brain Recovery: Understanding
Dynamic Changes in the Nervous System**

Program

- 17:00 JST (16:00 TST)** Opening Remarks (10min)
- 17:10 (16:10)** Lecture by **Bei-Jung Lin, Ph.D.** (35min)
- 17:45 (16:45)** Q&A (5min)
- 17:50 (16:50)** Lecture by **Nariko Arimura, 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 : Bei-Jung Lin, PhD

Title: Subthreshold dynamics and the coordination of hippocampal ensembles

Abstract:

Most neuronal communication occurs through synaptic potentials that are invisible to conventional spike-based recordings. In vivo voltage imaging enables simultaneous measurement of subthreshold and spiking activities across neurons during behavior, revealing how subthreshold dynamics organize population spiking. Using this approach, my lab studies how hippocampal networks coordinate neuronal activity during learning and memory. We showed that parvalbumin-positive (PV) neurons synchronized within individual 7-10 ms ripple cycles during ripple oscillations. PV ensembles were highly dynamic, with neuronal participation varying across cycles. These dynamics were mirrored by coordinated subthreshold depolarizations, suggesting that membrane dynamics shape ripple ensembles. We also identified synchronous ensembles among pyramidal neurons during novel environment exploration. These ensembles synchronized over tens of milliseconds and were coupled to theta oscillations in both extracellular and intracellular recordings. Moreover, place cell pairs with distinct place fields showed stronger co-activation than pairs with overlapping fields, linking synchronous activity to spatial representation during memory acquisition. Together, these findings support a model in which subthreshold membrane dynamics coordinate hippocampal ensembles across distinct behavioral and oscillatory states.

Reference:

1. Chen, T.-W.*, Huang X.-B., Plutkis S. E., Holland K., Lavis L. D., Lin B.-J.* (2025) Imaging neuronal voltage beyond the scattering limit. *Nature Methods* 22, 1366-1375 (*corresponding author)
2. Chen, E.-L., Chen, T.-W., Schreiter, E. R., Lin, B.-J.* (2025). Synchronous ensembles of hippocampal CA1 pyramidal neurons during novel exploration. *eLife* 13:RP96718. (*corresponding author)
3. Huang, Y.-C., Chen, H.-C., Lin, Y.-T., Lin, S.-T., Zheng, Q., Abdelfattah, A., Lavis, L., Schreiter, E.R., Lin, B.-J.*, Chen, T.-W.*, (2024). Dynamic assemblies of parvalbumin interneurons in brain oscillations. *Neuron* 112, 1-14. (*corresponding author)

Profile:

Dr. Bei-Jung Lin is an Associate Professor at the Institute of Neuroscience, National Yang Ming Chiao Tung University. Her research focuses on the neuronal and network mechanisms underlying learning and memory, with particular interest in hippocampal population dynamics during memory formation. Her lab develops and applies in vivo voltage imaging approaches to study how subthreshold membrane potentials and neuronal ensembles coordinate activity across neural circuits. She previously conducted research at the Janelia Research Campus of the Howard Hughes Medical Institute and received her Ph.D. in Neuroscience from the Max Planck Research School in Goettingen, Germany.

Speaker : Nariko Arimura, Ph.D.

Title: From Molecular Mechanisms to Brain Recovery: Understanding Dynamic Changes in the Nervous System

Abstract:

The formation and function of the nervous system are supported by highly coordinated molecular and cellular mechanisms. During brain development, neural circuits are established through dynamic structural changes, whereas in the mature brain, function is primarily maintained through subtle electrical activity and synaptic communication. However, under pathological conditions such as neurodegenerative diseases or stroke, the brain undergoes rapid and profound alterations and simultaneously activates intrinsic mechanisms aimed at functional recovery and adaptation. Emerging evidence further suggests that systemic factors, including blood-derived signals, play important roles in regulating these processes. My research has focused on understanding how the brain changes its functional state and reorganizes its underlying mechanisms across development, disease, and recovery. Early studies investigated how the membrane-associated molecule DSCAM contributes to neural circuit formation and functional maturation during brain development. Building on this molecular perspective, my recent work has expanded toward understanding broader mechanisms of brain plasticity, including plasma-mediated pathways involved in cognitive decline and dementia, as well as neural circuit reorganization during recovery from brain injury. In this lecture, I will discuss how these studies are beginning to provide new insights into the molecular and circuit-level mechanisms that support brain adaptation and recovery. Ultimately, this research aims to contribute to a more integrated understanding of brain function in the context of whole-body physiology, with the long-term goal of promoting functional recovery and preventing cognitive decline.

Reference:

1. Dewa KI, Arimura N, Kakegawa W, Itoh M, Adachi T, Miyashita S, Inoue YU, Hizawa K, Hori K, Honjaya N, Yagishita H, Taya S, Miyazaki T, Usui C, Tatsumoto S, Tsuzuki A, Uetake H, Sakai K, Yamakawa K, Sasaki T, Nagai J, Kawaguchi Y, Sone M, Inoue T, Go Y, Ichinohe N, Kaibuchi K, Watanabe M, Koizumi S, Yuzaki M, Hoshino M. Neuronal DSCAM regulates the peri-synaptic localization of GLAST in Bergmann glia for functional synapse formation. *Nature Communication* 2024;15(1):458.
2. Arimura N, Okada M, Taya S, Dewa KI, Tsuzuki A, Uetake H, Miyashita S, Hashizume K, Shimaoka K, Egusa S, Nishioka T, Yanagawa Y, Yamakawa K, Inoue YU, Inoue T, Kaibuchi K, Hoshino M. DSCAM regulates delamination of neurons in the developing midbrain. *Science Advances* 2020;6(36):eaba1693.

Profile:

Nariko Arimura is an Associate Professor in the Department of Pharmacology, Graduate School of Pharmaceutical Sciences, Tohoku University. Her research focuses on the molecular and circuit-level mechanisms underlying brain development, plasticity, and functional recovery. She has investigated the role of the membrane-associated molecule DSCAM in neural circuit formation during brain development and has more recently expanded her work toward understanding systemic and neural mechanisms involved in cognitive decline, dementia, and recovery from brain injury. Her current research integrates molecular neuroscience, systems neuroscience, and plasma proteomics to explore how the brain dynamically reorganizes itself in response to aging and disease, with the long-term goal of promoting functional recovery and preventing cognitive decline.