Tohoku – UCL Integrative Neuroscience Seminar Series

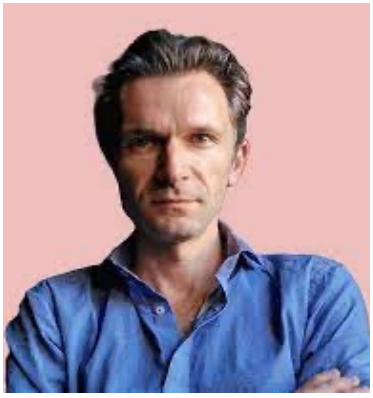
Endorsed by: **Tohoku University** [**Neuro Global** (International Graduate School Program), Brain Science Center, ToMMo (Tohoku Medical Megabank Organization), AI Applied Medicine, United Centers for Advanced Research and Translational Medicine]
University College London [**Institute of Neurology**]

Date

March 6 (Wed.) 19:00 – 21:00

Zoom link

Refer to the NGP Office
(info@neuroglobal.tohoku.ac.jp)



1st Speaker

PARASHKEV Nachev

Professor of Neurology at the UCL
Queen Square Institute of Neurology and Honorary Consultant Neurologist at the National Hospital for Neurology and Neurosurgery

Title

Foundational modelling of the human brain (19:05-)

2nd Speaker

TAKAHASHI Yuta, MD, Ph.D.

国立精神・神経医療研究センター　神経研究所
/National Center of Neurology and Psychiatry
第一研究室長（脳病態データサイエンス研究室長）

Title

The Digital Twin Brain: Prototype Development with Primate ECoG Data and its Potential in Psychiatric Disorder Research (20:00-)

Program

19:00 Opening Remarks
19:05 Lecture by Prof. Parashkev Nachev (40min)
19:45 Q & A (15min)
20:00 Lecture by Dr. Yuta TAKAHASHI (40min)
20:40 *Q &A (15min)*
20:55 *Closing Remarks*

【[先進]脳科学セミナーシリーズEx】【[Advanced] Brain science seminar series Ex】2 points
【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 2 points
【生命科学研究科・単位認定セミナー、イノベーションセミナー】【Credit-granted seminar, Innovation seminar】2 points

Contact: Neuro Global Program Office (info@neuroglobal.tohoku.ac.jp)

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Speaker： Prof. PARASHKEV Nachev

Title： Foundational modelling of the human brain

Summary: As culture is expressed in language shaped by historical practice, so biological facts are expressed in physiology shaped by evolutionary forces. And as interpreting language to extract the facts it conveys requires deep generative models of text, so interpreting physiology to reveal the biological principles that underlay it requires deep generative models of the body. The biological task is harder, for physiology---the grammar of biology---is hidden from view, glimpsed from the narrow, distorting apertures of imperfect medical instruments, and distributed across multiple, interacting scales of organisation. Though the nervous system is the most complex, the structuring pressure on its organisation is arguably highest, and its accessibility to generative models of the right expressivity therefore greatest. Here I examine the challenges and potential rewards of developing multi-modal, >3D deep generative models of the brain, drawing on analyses involving >10^6 individual brain volume images across >10^5 distinct patients powered by >5 petaFLOPS of compute, in the context of an array of representational, predictive, and prescriptive tasks

Speaker： Dr.TAKAHASHI Yuta

Title: The Digital Twin Brain: Prototype Development with Primate ECoG Data and its Potential in Psychiatric Disorder Research

Abstract：The concept of the digital twin brain centers on developing a simulator that reflects the biological brain, producing information comparable to that of the actual brain in real-time. This advancement is promising for the real-time diagnosis of brain pathologies and the facilitation of personalized treatment simulations. At the heart of this project is the advanced integration of data assimilation technology, enabling the dynamic integration and synthesis of new observational data into the simulator. In this presentation, I will outline our efforts to construct a prototype of the digital twin brain. Specifically, I will describe the development of a real-time simulator for electrocorticogram (ECoG) signals, which incorporates a data assimilation technique. Our research has involved training a generative AI, specifically a Variational Bayes Recurrent Neural Network, with ECoG signals from macaques during anesthesia and wakefulness. This training aims to model the process by which ECoG signals are generated from latent brain states. This approach has enabled the accurate simulation of ECoG signal generation for unknown individuals and the real-time inference of their brain states (arousal level). Furthermore, by manipulating this latent brain states, we have successfully conducted virtual drug administration simulations. In addition, at the end of the talk, I would like to discuss the latest efforts to apply the digital twin brain to psychiatric disease research. Specifically, I will present a framework that facilitates the modeling of individual pathophysiology and behavior through analysis of biobank data, which includes large-scale, multiscale biomarkers.

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