FY 2024 Annual Report

Unit Name

Neural Coding and Brain Computing Unit

Research Personnel

Tomas Barta, Postdoctoral Scholar

Daniel Müller-Komorowska, Postdoctoral Scholar

Milena Menezes Carvalho, Postdoctoral Scholar

Gaston Sivori, PhD Student

Balashwethan S Chockalingam, PhD Student

Roman Koshkin, PhD Student

Munenori Takaku, PhD Student

Hugo Paul Musset, PhD Student

Scholarly Contributions and Creative Productions (by Faculty)

Journal Article

1. Haga, T.; Oseki, Y.; Fukai, T.
   A Unified Neural Representation Model for Spatial and Conceptual Computations. The Proceedings of National Academy of Science, USA 2025, 122, e2413449122.
2. Handa, T.; Fukai, T.; Kurikawa, T.
   Single-Trial Representations of Decision-Related Variables by Decomposed Frontal Corticostriatal Ensemble Activity. eNeuro 2024, 11.
3. Fukai, T.; Asabuki, T.
   Predictive Learning Rules Generate a Cortical-like Replay of Probabilistic Sensory Experiences. eLife 2024, 13, RP92712.
4. Fukai, T.
   Inherent Trade-off in Noisy Neural Communication with Rank-Order Coding. Physical review research 2024.
5. Takahashi, K.; Fukai, T.; Sakai, Y.; Takekawa, T.
   Goal-Oriented Inference of Environment from Redundant Observations. Neural networks : the official journal of the International Neural Network Society 2024, 174, 106246.

Presentation at Conference

1. Fukai, T.
   Hippocampal Mechanisms Linking Spatially, Temporally, and Semantically Related Memories. The 9th International Conference on Cognitive Neurodynamics (ICCN2024).
2. Fukai, T.
   Cognitive Computations with Self-Supervised Predictive Learning. Workshop "Building on Models: Experiences from a Decade with the Potjans-Diesmann Microcircuit Model" 2024.

Seminars

1. Fukai, T.
   Self-Supervised Learning of Sequence Patterns in Single Neurons and Networks 2024.
2. Fukai, T.
   Lectures at 2024 CSH Asia Computational and Cognitive Neuroscience Summer School 2024.
3. Fukai, T.
   Theoretical Perspectives of Dendritic Computation in Cortical Neurons 2024.

Scholarly Contributions (For Unit Members Only)

Name of Unit Member (Author-Presenter)	Type	Title	Outlet	Publisher	Year Pub
Koshkin R*, Sudoh K, Nakamura S	Conference Proceedings	TransLLaMa: LLM-based Simultaneous Translation System	Proceedings of the 2024 Conference on Empirical Methods in Natural Language Processing	Association for Computational Linguistics	2024
Koshkin R*, Sudoh K, Nakamura S	Conference Proceedings	LLMs Are Zero-Shot Context-Aware Simultaneous Translators	Proceedings of the 2024 Conference on Empirical Methods in Natural Language Processingural Language Processing	Association for Computational Linguistics	2024
Milena Menezes Carvalho*, Ruxandra Cojocaru, Tomoki Fukai	Conference Proceedings	Neuron participation in temporal patterns forms cross-layer, non-random networks in rat motor cortex	CNS2024	Springer Nature	2024
Roman Koshkin* and Tomoki Fukai	Conference Proceedings	convSeq: fast and scalable method for detecting patterns in spike data	Proceedings of the 41st International Conference on Machine Learning (ICML)	MLResearchPress	2024
Hugo Musset*	Poster Presentation at Conference	A microcircuit model for chunking reward-driven replay in the hippocampus	SfN2024		2024
Tomas Barta*, Tomoki Fukai	Poster Presentation at Conference	Homeostatic inhibitory plasticity enhances memory capacity and replay in spiking networks	COSYNE2025		2025
Daniel Müller-Komorowska*, Temma Fujishige & Tomoki Fukai	Poster Presentation at Conference	Biologically Plausible Interneuron Recurrence Does not Support Synchrony in a Dentate Gyrus Model	FENS Forum 2024		2024
Milena Menezes Carvalho*, Ruxandra Cojocaru, Tomoki Fukai	Poster Presentation at Conference	Neuron participation in temporal patterns forms cross-layer, non-	COSYNE2025		2025

Name of Unit Member (Author-Presenter)	Type	Title	Outlet	Publisher	Year Pub
		random networks in rat motor cortex			
Daniel Müller-Komorowska*, Temma Fujishige & Tomoki Fukai	Poster Presentation at Conference	Recurrent interneuron connectivity does not support synchrony in a biophysical dentate gyrus model	NEURO2024		2024