

Unit Name

Neural Computation Unit
Professor Kenji Doya

Research Personnel

Katsuhiko Miyazaki, Senior Staff Scientist
Kayoko Miyazaki, Senior Staff Scientist
Jovan David Rebolledo Mendez, Staff Scientist
Andres Hernandez-Matamoros, Staff Scientist
Yukako Yamane, Staff Scientist
Bogna Ignatowska Jankowska, Staff Scientist
Andrei Razvan Gamanut, Research Fellow, Staff Scientist
Kevin Max, Research Fellow
Chia Jung (Anna) Chang, Postdoctoral Scholar
Ayan Chakraborty, Postdoctoral Scholar
Jeanne Barthelemy, Postdoctoral Scholar
Kirill Mitrofanov, Technician
Bianca Gamanut, Technician
Xiujun Huang, Technician
Tojoarisoa Rakotoaritina, PhD Student
Shuhei Hara, PhD Student
Naohiro Yamauchi, PhD Student
Yusaku Kasai, PhD Student
Jianning Chen, PhD Student
Kristine Faith Roque, PhD Student
Hideyuki Yoshimura, PhD Student
Yuji Kanagawa, PhD Student
Yuma Kajihara, PhD Student
Yi-Shan Cheng, PhD Student
Sutashu Tomonaga, PhD Student
Terezie Sedlinska, PhD Student
Kota Shirahata, PhD Student
Daniel Rafael Torres Ruiz, Visiting Research Student
Inaya Rahmanisa, Research Intern
Jo Fujimori, Research Intern

Tatsuru Watanabe, Research Intern

Ami Maeno, Research Intern

Kikuko Matsuo, Research Unit Administrator

Misuzu Saito, Research Unit Administrator

Collaborations

Hiroaki Gomi, NTT), JAPAN: Collaboratory mechanisms of multiple learning modules in the brain

Haruo Mizutani, Suntory Global Innovation Center, JAPAN: Health related computational theory utilizing biometric information

Benoit Girard, Sorbonne University, France: Action selection and reinforcement learning in the cortico-basal ganglia circuit.

Scholarly Contributions and Creative Productions (by Faculty)

Book Chapter

1. Doya, K.
Reinforcement Learning. In Learning and Memory: A Comprehensive Reference, Third Edition; Elsevier, 2025; pp 119–139.

Books and Edited Books

1. Taniguchi, T.; Leung, C. s. a.; Kozuno, T.; Yoshimoto, J.; Mahmud, M.; Doborjeh, M.; Doya, K.
Lecture Notes in Computer Science 16309-16313: Neural Information Processing: 32nd International Conference, ICONIP 2025 Proceedings, Part I – V. 2025.
2. Taniguchi, T.; Leung, C. s. a.; Kozuno, T.; Yoshimoto, J.; Mahmud, M.; Doborjeh, M.; Doya, K.
Communications in Computer and Information Science 2753-2758: Neural Information Processing: 32nd International Conference, ICONIP 2025 Proceedings, Part I – VI. 2025.

Conference Proceedings

1. Jianning Chen, Masakazu Taira, Kenji Doya.
Fictive Learning in Model-Based Reinforcement Learning by Generalized Reward Prediction Errors. In In Proceedings of ICONIP 2025; 2025; pp 510–524.

Journal Article

1. Mimura, K.; Nakae, K.; Doya, K.
Possible contribution to data-driven primate research: Comment on “Kinematic Coding: Measuring Information in Naturalistic Behaviour” by Becchio, Pullar, Scaliti, and Panzeri. Physics of Life Reviews 2025, 54, 80–82. <https://doi.org/10.1016/j.plrev.2025.05.012>
2. Yamane, Y.; Li, Y.; Matsumoto, K.; Kanai, R.; Desforges, M.; Gutierrez, C. E.; Doya, K.
Optical Neuroimage Studio (OptiNiSt): Intuitive, scalable, extendable framework for optical neuroimage data analysis. PLOS Computational Biology 2025, 21, 1–15.
<https://doi.org/10.1371/journal.pcbi.1013087>
3. Naohiro Yamauchi, Yoshimasa Tawatsuji, Yudai Suzuki, Hiroshi Yamakawa, Kenji Doya
A computational model of canonical cortical microcircuits for dynamic Bayesian inference and control as inference. Neuroscience Research 2025, 222, 105002.
<https://doi.org/10.1016/j.neures.2025.105002>

Presentation at Conference

1. Doya, Kenji. 2025. “Digital Brains: How to build and how to use.” Bio Korea 2025. 2025.5.7, Korea
https://www.biokorea.org/biokorea/about_01.asp

2. Doya, Kenji. 2025. "Digital Brains: What are They and How Can We Build and Use Them?" Japan Neuroscience Society Meeting Symposium: The Digital Brain: Frameworks for Current and Future Innovation. 2025.7.25, Niigata
3. Doya, Kenji. 2025. "How can we create and utilize Digital Brains?" 8th Annual Meeting of Korean Society of Brain and Neuroscience (KSBNS) and 3rd China-Japan-Korea (CJK) Neuroscience Meeting. 2025.8.26, Korea <https://ksbns2025.org/>
4. Doya, Kenji. 2025. "Evolution of reward functions in reinforcement learning agents." 72nd SICE Autonomous Distributed Systems Research Group. 2025.9.12, Tokyo
5. Doya, Kenji. 2025. "What it takes for behavioral learning in the physical world." 23rd Construction Robot Symposium. 2025.10.15, Ishigaki <https://www.ccr.jp/event/symposium/2025/2025.html>
6. Doya, Kenji. 2025. "Digital brains for understanding brain functions and applications to neuropsychiatric disorders." 55th Clinical Neurophysiology Society Meeting. 2025.11.14, Okinawa
7. Doya, Kenji. 2025. "Evolution of Rewards, Mating Strategies and Diversity." JAIST-OIST Joint Symposium "Advanced Science and Technology × Gendered Innovation" 2025.11.26, Online <https://www.oist.jp/events/jaist-oist-joint-symposium-advanced-science-and-technology-gendered-innovation>
8. Doya, Kenji. 2026. "Reinforcement Learning in Animals and Robots." Gordon Research Conference. 2026.1.12, United States <https://www.grc.org/robotics-conference/2026/default.aspx>
9. Doya, Kenji. 2026. "Brain-inspired AI and AI-empowered Brain Science." International Conference on Cognition, Human and AI. 2026.1.23, Online <https://nmu.ac.in/en-us/CHAI-2026>
10. Doya, Kenji. 2026. "Digital Brain, Artificial Intelligence and Computational Psychiatry." 6th Parkinson's Disease Conference. 2026.1.30, Okinawa
11. Doya, Kenji. 2026. "Canonical cortical circuits and the duality of inference and control." ASHBI Retreat 2026. 2026.2.13, Nara <https://ashbi.kyoto-u.ac.jp/event/event-retreat/21541/>
12. Doya, Kenji. 2026. "Neural Circuits for Sensory Inference and Motor Control." International Symposium on the Unified Theory of Prediction and Action 2026. 2026.3.13-14, Tokyo <https://unifiedtheory.jp/symposium/2026/index.html#top>

Seminars

1. Doya, Kenji. 2025. "Neural higher functions and reward system." Neuroscience Special Lecture. 2025.6.2, University of the Ryukyus.
2. Doya, Kenji. 2025. "Digital brain and medicine." Tohoku University Radiology Skill-up Seminar. 2025.11.15, Online.
3. Doya, Kenji. 2025. "Reinforcement Learning, Bayesian Inference and Digital Brains." Brain-like Learning Systems Intensive Course. 2025.12.23, Tamagawa University.
4. Doya, Kenji. 2026. "Three Levels of NeuroAI." UCSD Course on NeuroAI and Beyond. 2026.1.16, Salk Institute.
5. Doya, Kenji. 2026. "Strengths and weaknesses of the brain and AI: Toward symbiotic society of Humans and AI agents." 6th SENSPIRE Forum. 2026.2.19, Online.

Conference Organization

1. Kenji Doya: General Chair, International Conference on Neural Information Processing (ICONIP 2025). 2025.11.20-24, OIST.

Scholarly Contributions (by Unit Members)

Name of Unit Member	Type	Title	Outlet	Publisher	Year Pub
Terezie Sedlinska	Journal Article	Differential effects of dopamine and serotonin on reward and punishment processes in humans: A systematic review and meta-analysis	JAMA Psychiatry		2025
Kevin Max	Journal Article	Backpropagation through space, time and the brain	Nature Communications		2025
Kevin Max	Journal Article	Synthetic Biology meets Neuromorphic Computing: Towards a bio-inspired Olfactory Perception System	Neuromorphic Computing and Engineering		2026
Bogna Ignatowska Jankowska	Journal Article	Repeated administration of cannabidiol decreases splenic lymphocyte subset numbers in rats	International Journal of Immunopathology and Pharmacology		2026
Razvan Gamanut	Poster Presentation at Conference	Increased claustrum activity coincides with the deactivation of the retrosplenial cortex during waiting for reward in mice	SfN2025		
Yusaku Kasai	Poster Presentation at Conference	Toward a Unified Cortical Model Based on Predictive Coding: Integrating Action Intention, Context, Sensory Inputs, and Motor Control	International Symposium on Unified Theory of Prediction and Action 2026		
Naohiro Yamauch	Poster Presentation at Conference	Neural implementation of Bayesian inference and control as inference in the somatosensory and primary motor cortices addressed by a variable-resistance lever push-pull task	International Symposium on Unified Theory of Prediction and Action 2026		
Jeanne Barthelemy	Poster Presentation at Conference	BETA RHYTHM MODULATION BY EXPLORATION AND EXPLOITATION IN A MODEL OF THE MONKEY CORTICOBASO-THALAMO-CORTICAL LOOP	International Symposium on Unified Theory of Prediction and Action 2026		
Ayan Chakraborty	Poster Presentation at Conference	Probabilistic Inference in Spiking Neural Networks	International Symposium on Unified Theory of Prediction and Action 2026		
Jianning Chen	Poster Presentation at Conference	Continuous Strategy Drift and Discrete Switching Driven by Environment and Internal State in Meta-Learning	International Symposium on Unified Theory of Prediction and Action 2026		
Razvan Gamanut	Poster Presentation at Conference	A computational bottom-up, mesoscale approach for the study of the claustrum dynamics	International Symposium on Unified Theory of Prediction and Action 2026		
Kevin Max	Poster Presentation at Conference	»Backpropagation and the Brain« realized in Cortical Error Neuron Microcircuits	International Symposium on Unified Theory of Prediction and Action 2026		
Kevin Max	Poster Presentation at Conference	»Backpropagation and the Brain« realized in Dendritic Cortical Error Microcircuits	Neuro 2025		

Name of Unit Member	Type	Title	Outlet	Publisher	Year Pub
Kevin Max	Poster Presentation at Conference	»Backpropagation and the Brain« realized in Dendritic Cortical Error Microcircuits	Bernstein Conference 2025		
Yukako Yamane	Poster Presentation at Conference	Identification of Multiple Cortical Activity Patterns Related to Voluntary Movements in Freely Behaving Marmosets Using Electrocorticogram	SFN2025		
Carlos Gutierrez	Poster Presentation at Conference	A Graph-Based, In-Memory Workflow Library for Brain-MINDS 2.0 – The Japan Digital Brain Project	CNS2025		
Jianning Chen	Poster Presentation at Conference	Fictive Learning in Model-based Reinforcement Learning via Generalized Reward Prediction Error	IRCN and Chen Institute Joint Course on Neuro-inspired Computation		
Razvan Gamanut	Poster Presentation at Conference	Waiting for reward deactivates the retrosplenial cortex in mice	The fifth research area meeting of Transformative Research Area (A) : unified theory of prediction and action		
Razvan Gamanut	Poster Presentation at Conference	Automatic optimization of conductance-based models to reproduce the dynamics of the claustrum neurons	CNS2025		
Razvan Gamanut	Poster Presentation at Conference	Waiting for reward deactivates the retrosplenial cortex in mice	Neuro2025		
Razvan Gamanut	Poster Presentation at Conference	Increased claustrum activity coincides with the deactivation of the retrosplenial cortex during waiting for reward in mice	The sixth research area meeting of Transformative Research Area (A) : unified theory of prediction and action		
Jianning Chen	Poster Presentation at Conference	Fictive Learning in Model-Based Reinforcement Learning by Generalized Reward Prediction Errors.	ICONIP 2025		
Andres Hernandez-Matamoros	Poster Presentation at Conference	Transfer Learning from Clinical PSG to Real-World Wearables for Sleep Staging.	HEALTHINF 2026		
Jianning Chen	Poster Presentation at Conference	Meta-parameter Dynamics in Reinforcement Learning Reveal the Regulation of Behavioral Strategies	CPSY Tokyo 2026		
Jianning Chen	Poster Presentation at Conference	Beyond Experience: Fictive Learning as an Inherent Advantage of World Models	Embodied World Models for Decision Making, NeurIPS2025 Workshop		
Jianning Chen	Poster Presentation at Conference	Fictive Learning Augments Model-based Reinforcement Learning in the Two-step Task	Aligning Reinforcement Learning Experimentalists and Theorists, NeurIPS 2025 Workshop		

Name of Unit Member	Type	Title	Outlet	Publisher	Year Pub
Kayoko Miyazaki	Poster Presentation at Conference	Dorsal raphe serotonin neurons encode probability but not amount of future rewards during operant waiting for delayed rewards.	SFN2025		
Sutashu Tomonaga	Poster Presentation at Conference	Opportunistic Teacher Forcing: Training RNNs on Wearable Signals with Inherent Missing Data	BIOSIGNALS2026		
Sutashu Tomonaga	Poster Presentation at Conference	CEBRA-Enabled Latent Embeddings of Wearable Biosignals for Personalized Biorhythm Modeling	PERSUASIVE2026		
Tojoarisoa Rakotoaritina	Poster Presentation at Conference	Information-Theoretic Formulation and Combination of Intrinsic Rewards: Novelty, Surprise and Empowerment	IMOL2025		
Yukako Yamane	Presentation at Conference	Neural representation of figure-ground and their ambiguity	Neuro2025		
Naohiro Yamauchi	Presentation at Conference	Neural Correlates of Prediction Error and Action Value in Mice Primary Somatosensory and Primary Motor Cortex	CSHA Optical Interrogation of Neural Structure and Dynamics Underlying Behavior		
Yuji Kanagawa	Presentation at Conference	Evolution of Fear and Social Rewards in Prey-Predator Relationship	JSAI2025		
Yuji Kanagawa	Seminars	Evolution of Rewards by Simulating Birth and Death	Online (Emerging Researchers in ALife)		
Kevin Max	Seminars	Learning, forward and backward: Error backpropagation in cortical circuits	Bernstein Center at the University of Freiburg		

Honors, Awards & Fellowships [By Unit Members Only]

2025 - 2026 Chia-Jung Chang: OIST Proof of Concept (POC) Program Phase II (R13_85) "A novel synthesized peptide, PHDP5, as a potential treatment for Alzheimer's Disease"

2025 - 2027 Naohiro Yamauchi: JSPS Research Fellowship for Young Scientists DC2

Workshops and Seminars [Organized and Hosted by Faculty/Units]

Speaker Name(s)	Title	Location	Date
Asaki Kataoka	Towards understanding the learning rules for human-like neural representations	Seminar room C210, Ctr Bldg	2025-04-02
Prof. Markus Ullsperger	Multiplexed cortical representations of performance monitoring and reinforcement learning variables in humans	Meeting room C015, Lab1	2025-08-06
Ko Yamamoto	Movement Computing & Learning: From Individual Motion to Crowd Dynamics	Meeting Room C016, Lab1	2025-08-08
Ayan Chakraborty	Probabilistic Inference in Spiking Neural Networks with Population based Stochastic Temporal Encoding	Meeting Room D014, Lab1 + Zoom	2025-08-20
Prof. Flavio Vinicio Changoluisa Panchi	Understanding and replicating human working memory: a computational and neurophysiological approach	Meeting Room C016, Lab1	2025-09-10
Dr. Shohei Furutachi	Sensory prediction error signals: nature and mechanism	Meeting room D015, Lab1	2025-09-18

Speaker Name(s)	Title	Location	Date
Dr. Takuhiro Moromizato	Decision Science in Modern Healthcare: Opportunities and Implications	Meeting Room D014, Lab1	2025-09-19
Alexandru Vasilache	Efficient Learning Systems: From Spiking Neural Networks to Reinforcement Learning	Meeting Room D015, Lab1+Zoom	2025-11-28
France Rose	Animal behavior analysis enabled by unsupervised deep learning	Meeting Room C016, Lab1	2025-12-18