

Unit Name

Neural Computation Unit

Research Personnel

Katsuhiko Miyazaki, Senior Staff Scientist
Kayoko Miyazaki, Senior Staff Scientist
Jovan David Rebolledo Mendez, Staff Scientist
Kevin Max, Research Fellow
Yukako Yamane, Staff Scientist
Ekaterina Sangati, Postdoctoral Scholar
Chia Jung (Anna) Chang, Postdoctoral Scholar
Andrei Razvan Gamanut, Research Fellow
Bianca Gamanut, Technician
Anupama Chaudhary, Technician
Yuji Kanagawa, PhD Student
Sergey Zobnin, PhD Student
Terezie Sedlinska, PhD Student
Florian Lalande, PhD Student
Naohiro Yamauchi, PhD Student
Kristine Faith Roque, PhD Student
Jianning Chen, PhD Student
Sutashu Tomonaga, PhD Student
Tojoarisoa Rakotoaritina, PhD Student
Hideyuki Yoshimura, PhD Student
Miles Josef Desforgues, PhD Student
Yi-Shan Cheng, PhD Student
Kota Shirahata, PhD Student
Shuhei Hara, PhD Student
Yusaku Kasai, PhD Student
Yuma Kajihara, PhD Student
Gaganpreet Singh Jhajj, Research Intern
Ami Maeno, Research Intern

Mehak Bhatia, Research Intern

Aman Altabbaa, Research Intern

Yusaku Miyashita, Research Intern

Yui Tateyama, Research Intern

Scholarly Contributions and Creative Productions (by Faculty)

Journal Article

1. Cheng, Yi-Shan, Acer Yu-Chan Chang, and Kenji Doya. 2025. "Information-Theoretical Analysis of Team Dynamics in Football Matches." *Entropy*.
<https://doi.org/10.3390/e27030224>
2. Lalande, Florian, Elizabeth Tasker, and Kenji Doya. 2024. "Estimating Exoplanet Mass Using Machine Learning on Incomplete Datasets." *Open Journal of Astrophysics* 7.
<https://dx.doi.org/10.33232/001c.124538>
3. Kasahara, Kazumi, Keigo Hikishima, Mariko Nakata, Tomokazu Tsurugizawa, Noriyuki Higo, and Kenji Doya. 2024. "A Whole-Brain Analysis of Functional Connectivity and Immediate Early Gene Expression Reveals Functional Network Shifts after Operant Learning." *NeuroImage* 299:120840.
<https://dx.doi.org/10.1016/j.neuroimage.2024.120840>
4. Taira, Masakazu, Katsuhiko Miyazaki, Kayoko Miyazaki, Jianning Chen, Shiho Okitsu-Sakurayama, Anupama Chaudhary, Mika Nishio, et al. 2024. "The Differential Effect of Optogenetic Serotonergic Manipulation on Sustained Motor Actions and Waiting for Future Rewards in Mice." *Frontiers in Neuroscience* 18:1433061.
<https://dx.doi.org/10.3389/fnins.2024.1433061>
5. Keshmiri, Soheil, Sutashu Tomonaga, Haruo Mizutani, and Kenji Doya. 2024. "Respiratory Modulation of the Heart Rate: A Potential Biomarker of Cardiorespiratory Function in Human." *Computers in Biology and Medicine* 173:108335.
<https://dx.doi.org/10.1016/j.compbiomed.2024.108335>
6. Han, D., K. Doya, D. Li, and J. Tani. 2024. "Synergizing Habits and Goals with Variational Bayes." *Nature Communications* 15:4461.
<https://doi.org/10.1038/s41467-024-48577-7>
7. Tinker, TJ, K Doya, and J Tani. 2024. "Intrinsic Rewards for Exploration Without Harm From Observational Noise: A Simulation Study Based on the Free Energy Principle." *Neural Computation* 36:1854–85.
https://doi.org/10.1162/neco_a_01690
8. Hamada, Hiro, Yoshifumi Abe, Norio Takata, Masakazu Taira, Kenji Tanaka, and Kenji Doya. 2024. "Optogenetic Activation of Dorsal Raphe Serotonin Neurons Induces Brain-Wide Activation." *Nature Communications* 15:4152.
<https://dx.doi.org/10.1038/s41467-024-48489-6>
9. Tanaka, SC, K Kasai, Y Okamoto, S Koike, T Hayashi, A Yamashita, O Yamashita, et al. 2024. "The Status of MRI Databases across the World Focused on Psychiatric and Neurological Disorders." *PCN Frontier Review* 78:563–79.
<https://onlinelibrary.wiley.com/doi/10.1111/pcn.13717>

Conference Proceedings

1. Tomonaga, S, H Mizutani, and K Doya. 2025. "Training Recurrent Neural Networks with Inherent Missing Data for Wearable Device Applications." In In Proceedings of the AAAI Conference on Artificial Intelligence, 39:29512–13. <https://doi.org/10.1609/aaai.v39i28.35307>
2. Kanagawa, Yuji, and Kenji Doya. 2024. "Evolution of Rewards for Food and Motor Action by Simulating Birth and Death." In Proceedings of the 2024 Artificial Life Conference, 288–96. <https://doi.org/10.48550/arXiv.2406.15016>
3. Sangati, E, F Sangati, M Slors, and Kenji Doya. 2024. "The Collaborative Abilities of ChatGPT Agents in a Number Guessing Game." In In Proceedings of the Joint Symposium of AROB-ISBC-SWARM, 116–21. <https://repository.ubn.ru.nl/bitstream/handle/2066/314022/314022.pdf>

Presentation at Conference

1. Doya, Kenji. 2025. "Reinforcement Learning, Computational Neuropsychiatry, and the Digital Brain." 6th Japan-UK Neuroscience Symposium.
2. Doya, Kenji. 2025. "脳神経統合プログラムのデジタル脳プロジェクト Digital Brain Project of Brain/MINDS 2.0." 第 26 回日本正常圧水頭症学会 26th Annual Meeting of the Japanese Society of NPH. <http://nph2025.umin.jp/>
3. Doya, Kenji. 2025. "「デジタル脳」による精神神経疾患の予測と制御 Prediction and Control of Neuropsychiatric Disorders by Digital Brains." 産総研人間情報インタラクション研究 部門シンポジウム 2024 脳の変化 AIST Human Information Interaction Research Area Symposium: Changing Brain. <https://unit.aist.go.jp/hiiri/events/HIIRI-sympo2024.html>
4. Doya, Kenji. 2025. "Reinforcement Learning, Bayesian Inference and the Digital Brain." 2025 5th International Conference on Electrical Engineering and Information Technology (CEEIT 2025). <https://www.ceeit.net>
5. Doya, Kenji. 2025. "Bayesian Inference, Reinforcement Learning, and the Canonical Cortical Circuit." Biological, Artificial, and Quantum Intelligence 2025 (BAQ2025), March. <https://groups.oist.jp/qed/event/【international-workshop】biological-artificial-and-quantum-intelligence-2025-baq2025>
6. Doya, Kenji. 2025. "理論駆動とデータ駆動の脳科学 Theory-Driven and Data-Driven Brain Sciences." 脳科学若手の会 春の合宿 Spring Camp of Young Researchers in Brain Science, March. <https://brainsci.jp/blog/2025/03/17/第17回-脳科学若手の会-春の合宿-2/>
7. Doya, Kenji. 2025. "Digital Brain: Computational Theory Meets Brain Big Data." Brain Science × AI Community Event, March. <https://www.softbank.jp/biz/blog/cloud-technology/articles/202412/beyond-ai-brain-science/>
8. Doya, Kenji. 2025. "脳と AI、デジタル脳 Brain, AI and Digital Brain." 数理の翼伊計島セミナー2025 Wings of Mathematics Ikei Island Seminar. <https://seminar.npo-tsubasa.jp/island2025/>
9. Doya, Kenji. 2025. "Reinforcement Learning, Bayesian Inference and the Digital Brain." OIST Machine Learning Workshop. <http://omlw2025.mlds.jp>
10. Doya, Kenji. 2024. "楽しい大学のつくり方:OIST で拓く脳と AI 研究 How to Enjoy Making a University: Developing Brain Science and AI in OIST." トライボロジー学会 2024 秋名護 Fall 2024 Tribology Meeting in Nago. https://www.tribology.jp/conference/tribology_conference/24nago

11. Doya, Kenji. 2024. “デジタル脳プロジェクトのめざすもの The Aims of the Digital Brain Project.” 第 1 回 日本放射線医療技術学術大会 (JCRTM2024).
<https://www.linkage-okinawa.co.jp/jcrtm2024/index.html>
12. Doya, Kenji. 2024. “デジタル脳は脳構造、脳活動、脳機能をつなげるか Can Digital Brains Bring Together Brain Structures, Activities, and Functions?.” Autumn School for Computational Neuroscience (ASCONE 2024).
<http://ascone.brainsci.net>
13. Doya, Kenji. 2024. “Brain/MINDS 2.0 and the Digital Brain Project.” The 17th International Conference on Brain Informatics(BI2024).
<https://wi-consortium.org/conferences/bi2024/>
14. Doya, Kenji. 2024. “Digital Brain Project for Brain/MINDS 2.0.” Digital Brain Workshop.
<https://boatneck-weeder-7b7.notion.site/1st-Digital-Brain-Workshop-131a68936dda4867a88fedd25dfa92>
15. Doya, Kenji. 2024. “Evolution, Reinforcement Learning, and Mental Simulation.” ICRA 2024 Workshop: Cognition across Species: From Nature to Robotic Application.
https://sites.google.com/view/cognitionacrossspecies/cognition_wsicra2024
16. Doya, Kenji. 2024. “Bayesian Inference and Model-Based Reinforcement Learning.” FENS 2024 Symposium on Internal World Models.
<https://forum2024.fensforum.org/>
17. Doya, Kenji. 2024. “Bayesian Inference, Reinforcement Learning, and the Canonical Cortical Circuit.” RIKEN CBS Summer Program, July.
<https://cbs.riken.jp/en/summer/2024/>
18. Doya, Kenji. 2024. “Digital Brain Project of Brain/MINDS 2.0.” The 1st International Whole Brain Architecture Workshop.
<https://wba-initiative.org/en/24158/>
19. Doya, Kenji. 2024. “Endless Questions about Behaviors and Brain.” The EMBO Practical Course - Barcelona Summer School for Advanced Modeling of Behavior (BAMB!).
<https://www.bambschool.org/previous-editions/bamb-2024>
20. Doya, Kenji. 2024. “Bayesian Inference, Reinforcement Learning, and the Cortico-Basal Ganglia Circuits.” CogSci 2024 Hong Kong Meetup: Cognitive Science in the Era of AI.
<https://cogsci2024.hkust.edu.hk>
21. Doya, Kenji. 2024. “Consciousness as Data Assimilation.” CogSci 2024 Invited Symposium: Dynamics Between Minds & The Environment.
<https://underline.io/events/465/sessions?eventSessi>
22. Doya, Kenji. 2024. “脳と AI の強みと弱み Strengths and Weaknesses of the Brain and AI.” 情報処理学会 連続セミナー「次世代 AI モデルに向けた研究開発動向」4th Seminar Series “Research and Developments for Next-Generation AI Models,” Information Processing Society of Japan.
<https://www.ipsj.or.jp/event/seminar/2024/program04.html>
23. Doya, Kenji. 2024. “What Is the Digital Brain of Brain/MINDS 2.0?.” Digital Brain Seminar, April.
<https://digitalbrainproject.github.io/seminar/>
24. Sangati, Ekaterina, Federico Sangati, Marc Slors, and Kenji Doya. 2024. “The Collaborative Abilities of ChatGPT Agents in a Number Guessing Game.” Proceedings of the Joint Symposium of AROB-ISBC-SWARM 2024.
https://isarob.org/symposium/past_symposia/arob29

Seminars

1. Doya, Kenji. 2025. "Reinforcement Learning in Machines and Brains."
2. Doya, Kenji. 2024. "ベイズ推定・強化学習と大脳皮質－基底核の神経回路 Bayesian Inference, Reinforcement Learning, and the Cortico-Basal Ganglia Circuit."
3. Doya, Kenji. 2024. "How Can We Build Digital Brains?." <https://brainprize.org/winners/computational-and-theoretical-neuroscience-2024/the-brain-prize-webinar-series-2024>
4. Doya, Kenji. 2024. "デジタル脳」による精神神経疾患の予測と制御 Prediction and Control of Neuropsychiatric Disorders by Digital Brain."
5. Doya, Kenji. 2024. "デジタル脳とは何か、どう作りどう使うのか What Is the Digital Brain? How Can We Build and Use It?."
6. Doya, Kenji. 2024. "神経の高次機能と報酬系 Higher Functions of the Brain and the Reward System."
7. Doya, Kenji. 2024. "強化学習と脳内シミュレーションの神経機構 Neural Mechanisms of Reinforcement Learning and Mental Simulation." Doya, Kenji. 2024. "How the Cerebellum and the Basal Ganglia Can Work Together."
8. Doya, Kenji. 2024. "強化学習とベイズ推定の脳機構 Brain Mechanisms for Reinforcement Learning and Bayesian Inference."

Scholarly Contributions (by Unit Members)

Journal Article

1. Machida I, Shishikura M, Yamane Y, Sakai K (2024). Representation of Natural Contours by a Neural Population in Monkey V4. eNeuro, 11. <https://doi.org/10.1523/ENEURO.0445-23.2024>
2. Yamane Y (2024). Adaptation of the inferior temporal neurons and efficient visual processing. Frontiers in Behavioral Neuroscience, 18, 1398874. <https://doi.org/10.3389/fnbeh.2024.1398874>
3. Mkrtchian A, Qiu Z, Abir Y, Erdmann T, Dercon Q, Sedlinska T, Browning M, Costello H, Huys QJM (2025). Differential Associations of Dopamine and Serotonin With Reward and Punishment Processes in Humans: A Systematic Review and Meta-Analysis. JAMA Psychiatry. <https://doi.org/10.1001/jamapsychiatry.2025.0839>

Conference Presentations

Name of Unit Member	Type	Title	Outlet
Yukako Yamane	Tutorial	OptiNiSt (Optical Neuroimage Studio) Tutorial	JNNS 2024 satellite symposium
Yuji Kanagawa	Oral Presentation	Evolution of Rewards for Food and Motor Action by Simulating Birth and Death	ALIFE 2024
Razvan Gamanut	Oral Presentation	A computational bottom-up, mesoscale approach for the study of the interaction between claustrum and cortex	SfN 2024
Razvan Gamanut	Oral Presentation	A bottom-up, mesoscale approach for the study of the claustrum function	NEST conference (Online)
Anna Chiajung Chang	Oral Presentation	First-in-class peptide drug for the treatment of Alzheimer's Disease (Pitchers)	BioFIT 2024
Anna Chiajung Chang	Oral Presentation	A new synthesized peptide, PHDP5, as a potential treatment of Alzheimer's Disease	OIST x LINK-J "Bridging basic research to innovative solutions

Name of Unit Member	Type	Title	Outlet
Yukako Yamane	Oral Presentation	OptiNiSt (Optical Neuroimage Studio) Tutorial	NEURO 2024 satellite symposium
Yukako Yamane	Oral Presentation	Young Investigators Seminar on AI and Brain 2024	NEURO 2024 satellite symposium
Naohiro Yamauchi	Oral Presentation	Encoding of action and action values in the primary motor cortex of mice during a lever-pulling task	NEURO2024 (JNNS 2024)
Razvan Gamanut	Oral Presentation	A computational bottom-up, mesoscale approach for the study of the interaction between claustrum and cortex	Society for Claustrum annual meeting
Naohiro Yamauchi	Oral Presentation	Data for Brain Reference Architecture of NY24CanonicalCorticalMicrocircuitsInference and NY24CanonicalCorticalMicrocircuitsDecisionMaking	The Second International Whole Brain Architecture Workshop
Sutashu Tomonaga	Poster Presentation	A Novel Recurrent Neural Network Architecture for Modeling Time Series from Wearable Devices	JNNS2024
Sutashu Tomonaga	Poster Presentation	Training Recurrent Neural Networks with Inherent Missing Data for Wearable Device Applications (Student Abstract)	AAAI25
Anna Chiajung Chang	Poster Presentation	The efficacy of the synthetic peptide PHDP5 in rescuing cognitive deficits in Alzheimer's disease model mice	SfN 2024
Anna Chiajung Chang	Poster Presentation	Evaluating the Therapeutic Potential of Synthetic Peptide PHDP5 in Rescuing Cognitive Deficits in Alzheimer's Disease Model Mice	2nd Dementia Researchers Exchange
Tojoarisoa Rakotoaritina	Poster Presentation	Embodied Evolution of Intrinsically Motivated Reinforcement Learning	OIST Machine Learning Workshop 2025
Razvan Gamanut	Poster Presentation	A computational approach at mesoscopic scale for studying the interaction between claustrum and cortex	JNNS 2024
Shuhei Hara	Poster Presentation	fMRI study reveals enhanced top-down and bottom-up processes in schizophrenia	COSYNE 2025
Naohiro Yamauchi	Poster Presentation	Cortical micro circuits reference architecture for dynamic Bayesian inference	1st Digital Brain Workshop
Razvan Gamanut	Poster Presentation	A computational model of the interaction between claustrum and cortex	The third research area meeting of Transformative Research Area (A): unified theory of prediction and action
Razvan Gamanut	Poster Presentation	A computational bottom-up, mesoscale approach for the study of the interaction between claustrum and cortex	The fourth research area meeting of Transformative Research Area (A): unified theory of prediction and action
Gaganpreet Singh Jhaji	Poster Presentation	Jack and the BeansTALK: Towards Question Answering in Plant Biology	Eighth Widening NLP Workshop EMNLP 2024
Katushiko-Kayoko Miyazaki	Poster Presentation	Dorsal raphe serotonin neurons encode probability not value of future rewards	FENS2024

Name of Unit Member	Type	Title	Outlet
Terezie Sedlinska	Poster Presentation	Reversal learning under 2-week bupropion or escitalopram treatment in mice	SfN 2024

Honors, Awards & Fellowships (by Unit Members)

2025-03-27	Shuhei Hara, COSYNE presenter travel grant, COSYNE, 2024, COSYNE.
2024-07-24	Naohiro Yamauchi, Excellence Award for the Training Session for Early-Career Scientists, 2024, NEURO2024.

Outreach Activities (by Unit Members)

2024-10-09	Yuji Kanagawa, Program Assistant for Yokohama Science Frontier School Visit , OIST
2024-7-27	Yukako Yamane, Young Investigators Seminar on AI and Brain 2024, Satellite Symposium of Japan Neuroscience Society Meeting

Workshops and Seminars (Organized and Hosted by Faculty/Unit)

Speaker Name(s)	Title	Location	Date
	Mechanism of Brain and Mind Winter workshop 2025	Rusutsu Resort Hotel & Convention, Hokkaido, Japan	2025-03-10
	Neural Computation Workshop 2025 (FY2024)	OIST Seminar Room B250	2025-02-22
Dr. Saskia de Vries & Dr. James Berg	Allen Neural Dynamics Workshop at OIST	OIST Seminar Room C209 & C015	2025-01-30
Dr. Atsushi Yokoi	A possible link between autonomic arousal and contextual inference process in human motor learning and control	Meeting room D015, Lab1	2024-12-09
Dr. Jovan Rebolledo	Exponential Data and Better AI for Solving Biological Challenges	Meeting Room D014 - Lab1	2024-08-08
Dr. Mehdi Adibi	Neuronal mechanisms of decision making in rodents and humans	Meeting Room D014 - Lab1	2024-07-31
Dr. Andres Hernandez-Matamoros	Enhancing Biomedical Data Utility and Privacy Through Synthetic Data Generation and Local Differential Privacy	Meeting Room D014 - Lab1	2024-07-31
WCCI 2024 Open Forum on AI Governance	How to harness evolving AI – Dialogue of developers, users, and policy makers –	Pacifico Yokohama, Japan	2024-06-30
Dr. Rieko Osu	Well-Being and Communication: Exploring Social Interaction and Neurodiversity	Meeting Room D015 (Lab1)	2024-06-05

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.