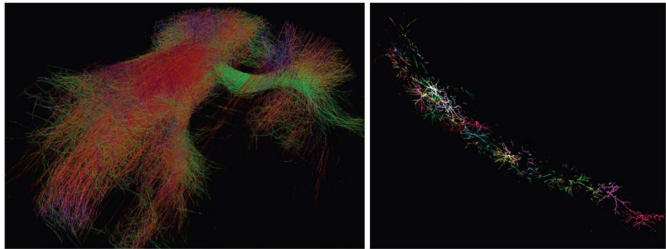
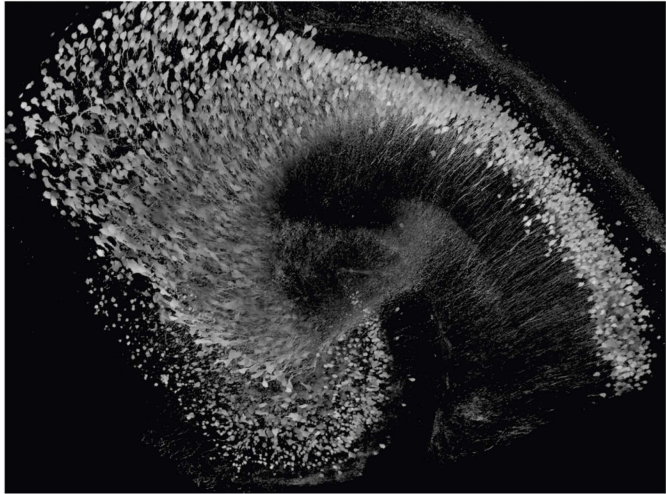
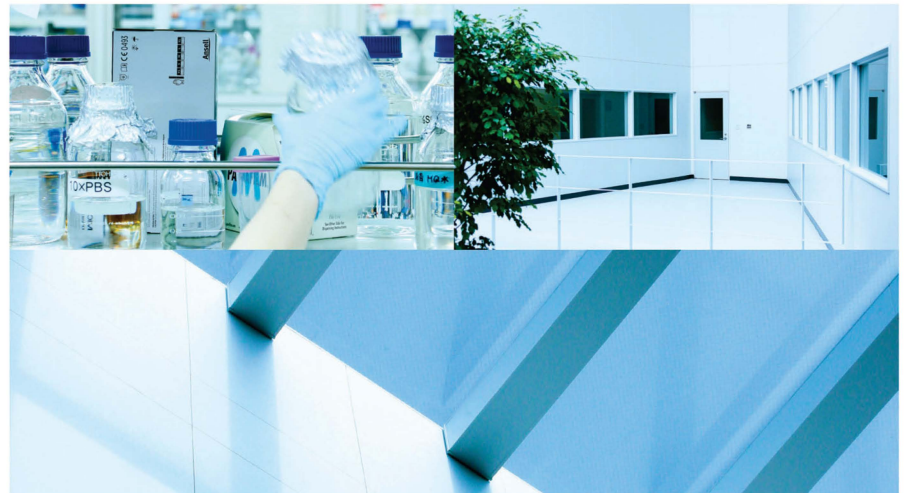


RIKEN CBS



RIKEN CBS

RIKEN Center for Brain Science





RIKEN Center for Brain Science (CBS) is a core research center that investigates the human brain as the foundation of the human mind.

The brain is the last frontier in natural science. The mission of CBS is to probe this frontier with thoughtful and diverse methods at the cellular, individual, and social levels, to produce results with societal impact.

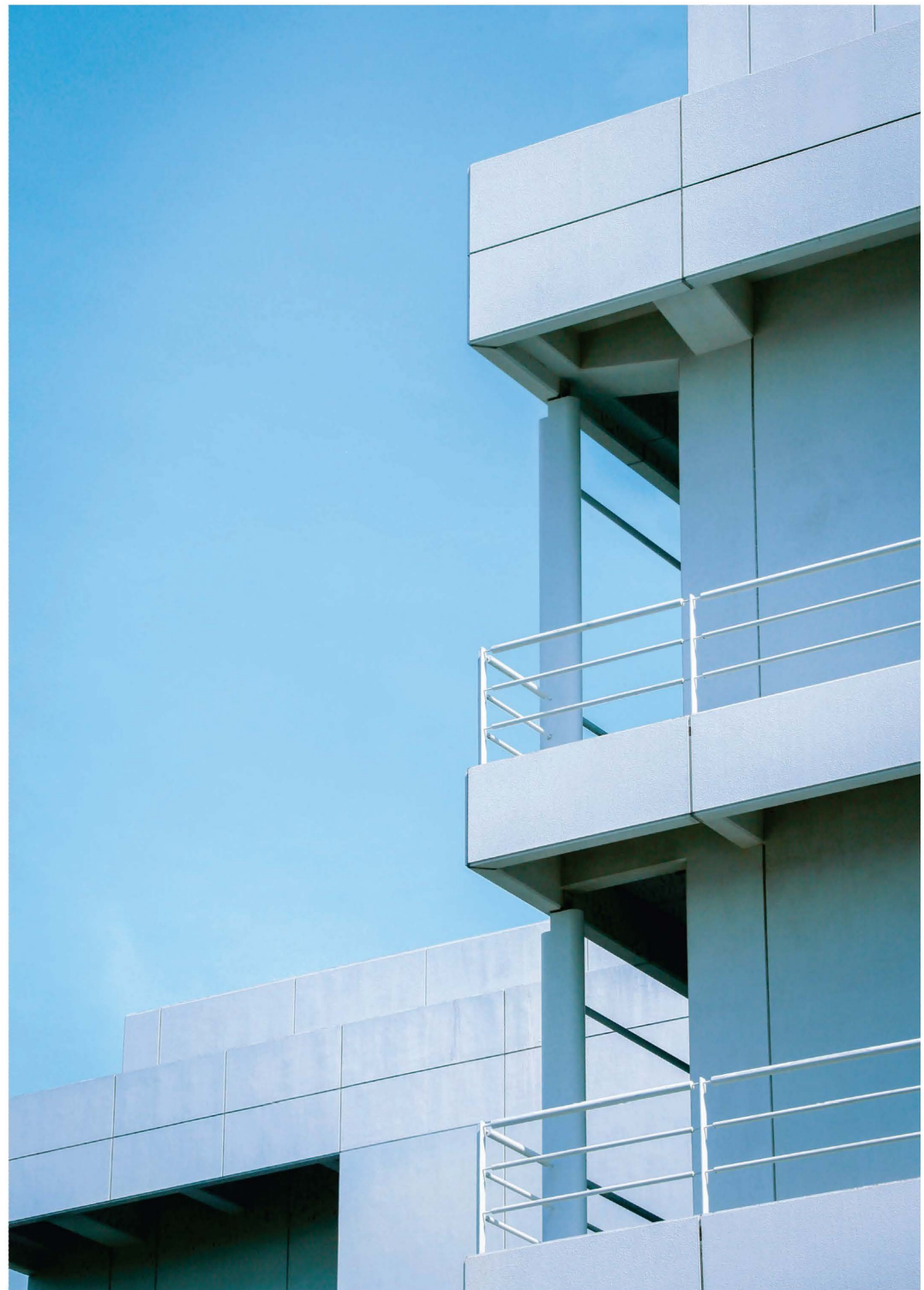


Rapidly aging populations in Japan and elsewhere are facing unprecedented challenges, in particular from dementia and other neuropsychiatric diseases that are already disrupting the foundations of society. In addition, overcoming mental health issues is a pressing matter for our modern society. The brain is the foundation of the mind and enables us to live as human beings, and mental health instability is caused by dysfunction in the brain. The human brain is capable of learning and memory, as well as decision-making and creative activities based on experience. Discovering the principles of these brain activities is essential to understanding the basis of the mind and overcoming mental health challenges.

RIKEN CBS was established in 2018 as a core center for brain science research in Japan. We have been conducting basic research and developing innovative technologies for the brain and mind across multiple levels, including genes, cells, individuals, and social systems, based on interdisciplinary and integrated academic fields such as medical science, biology, chemistry, engineering, information and mathematical sciences, and psychology.

In addition, by working hand-in-hand with domestic and international research institutes, universities, and inter-university research institutions, we are realizing our role as a core center for the Japanese national project Brain/MINDS (Brain Mapping by Integrated Neurotechnologies for Disease Studies). By fostering collaboration with industry, we are furthering our goal of serving as a hub for industry-academia-government networks in brain science. Through such research and development, we aim to meet the expectations of society, contribute to discovering the full range of brain functions and overcome neuropsychiatric disorders. We invite you to join the research journey, and thank you for supporting RIKEN CBS.

Ryoichiro Kageyama
Director, RIKEN Center for Brain Science



Four Keys to Unravelling the Brain



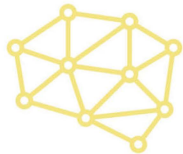
Understand what is unique about the human brain

The brain and mind remain shrouded in mystery. How do people understand themselves and others and how do they form relationships? We will elucidate the brain's highly-developed cognitive functions such as language and emotion.



Learn from the brains of other species

Looking at the brains of other species offers multiple comparative insights at the molecular, cellular or neural network levels. We will work out universal principles that link the brain and body across species.



Analyze the brain with big data

Information science and new technologies are crucial to advancing brain science. Analyzing already-collected data and examining the brain from new angles will allow researchers to reveal the internal computational principles, which can lead to a new generation of artificial intelligence.



Improve quality of life by studying the brain

People face an array of social problems and physical disorders. Many are caused by the deep involvement of the brain. Brain science can clarify the causes of mental and neurological disorders, leading to possible solutions for social problems.

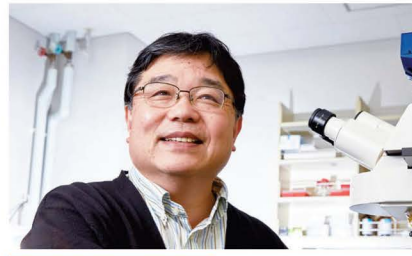


Principal Investigators



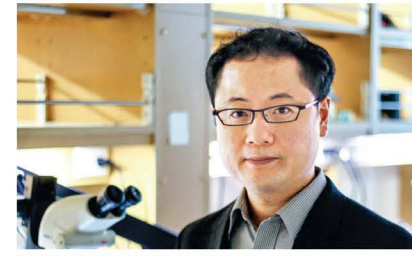
Joshua Johansen
Laboratory for Neural Circuitry
of Learning and Memory

We study how aversive experiences trigger alterations in brain circuits and neural coding resulting in emotional memory formation.



Hitoshi Okamoto
Laboratory for Neural Circuit
Dynamics of Decision Making

We study how the neural circuits for decision making under given circumstances work.



Shigeyoshi Fujisawa
Laboratory for Systems
Neurophysiology

Our goal is to elucidate the neuronal and network mechanisms underlying cognitive functions such as episodic memory and decision making.



Hiroyuki Kamiguchi
Laboratory for Neural
Cell Dynamics

Understanding cellular mechanisms that control nervous system formation and repair.



Kazuhisa Shibata
Laboratory for Human
Cognition and Learning

We clarify brain mechanisms of human cognition by psychophysics, neuroimaging, and machine learning.



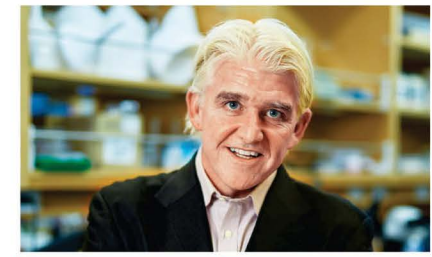
Lukas Ian Schmitt
Laboratory for Distributed
Cognitive Processing

We investigate how selective, short-term maintenance of information allows brain networks to produce continuous, connected perception based on noisy, disconnected inputs.



Hokto Kazama
Laboratory for Circuit
Mechanisms of Sensory
Perception

Our goal is to understand the computations and neural circuit mechanisms underlying sensory-guided behavior.



Thomas McHugh
Laboratory for Circuit and
Behavioral Physiology

Our goal is to understand the neural circuits that allow the brain to encode, consolidate and recall memories.



Hakwan Lau
Laboratory for Consciousness

We study how the brain generates visual experiences in the absence of external input.



Kentaro Miyamoto
Laboratory for Imagination
and Executive Functions

Our goal is to reveal how our brain enables imaginations for future and others.



Adrian Moore
Laboratory for Neurodiversity

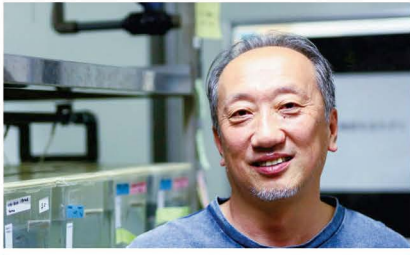
Our lab asks: how does a neuron grow up to be different; how are differentiation pathways initiated and directed to create diversity in neuron form and function?



Tomomi Shimogori
Laboratory for Molecular
Mechanisms of Brain
Development

Revealing molecular mechanisms that control experience-dependent plasticity.

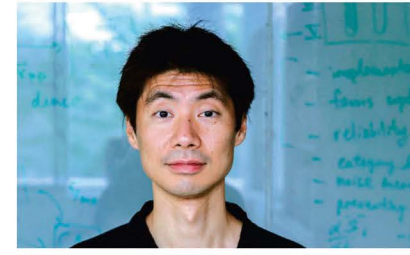
Principal Investigators



Yoshihiro Yoshihara
Laboratory for Systems
Molecular Ethology
We aim to elucidate molecular, cellular and neural circuit mechanisms underlying various olfactory behaviors.



Ryoichiro Kageyama
Laboratory for Neural Stem Cell
Research
We aim to enhance adult neurogenesis, thereby improving cognitive function.



Taro Toyoizumi
Laboratory for Neural
Computation and Adaptation
Exploring the principles behind learning in the brain by computational approaches.



Takuya Isomura
Brain Intelligence Theory Unit
We aim to mathematically express universal characterization of the brain intelligence.



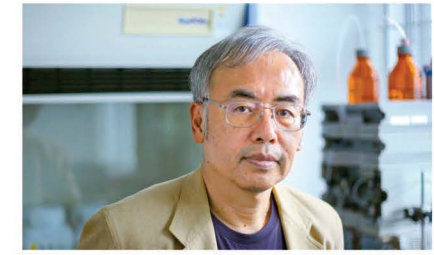
Andrea Benucci
Laboratory for Neural Circuits
and Behavior
We study the neural basis of decision making from the viewpoint of visual perception.



Atsushi Miyawaki
Laboratory for Cell
Function Dynamics
Our primary goal is to better understand how biological molecules behave in space and time.



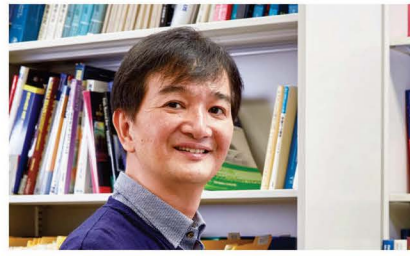
Louis Kang
Neural Circuits and
Computations Unit
We study how computations in neural circuits produce memory and other mental capabilities.



Takaomi Saïdo
Laboratory for Proteolytic
Neuroscience
We aim to elucidate and to regulate the mechanism of brain aging that leads to the onset of Alzheimer's Disease.



Masanori Murayama
Laboratory for Haptic
Perception and Cognitive
Physiology
We observe the living brain and clarify the relationship between perceptual behavior and neural activity at the single-cell and network level.



Hiroyuki Nakahara
Laboratory for Integrated
Theoretical Neuroscience
Uncovering brain functions and computations for learning, decision making and social intelligence.

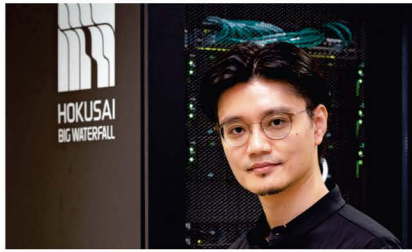


Motomasa Tanaka
Laboratory for Protein
Conformation Diseases
Our goal is to elucidate molecular mechanisms of protein aggregation and its physiological consequences in neuropsychiatric diseases.



Akiko Hayashi-Takagi
Laboratory for Multi-scale
Biological Psychiatry
We aim to causally identify the contributory factors for psychiatric disorders, which could provide the knowledge necessary to establish circuit-centric therapeutics as well as molecular-based drug designs.

Principal Investigators



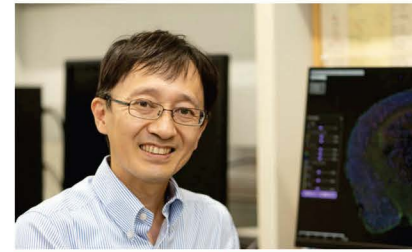
Atsushi Takata
 Laboratory for Molecular Pathology of Psychiatric Disorders

Deciphering the biological basis of psychiatric disorders in order to transform clinical psychiatry.



Jun Nagai
 Laboratory for Glia-Neuron Circuit Dynamics

Exploring contributions of glial cells to brain circuits and adaptive/maladaptive behavior.



Hiroki Sasaguri
 Dementia Pathophysiology Collaboration Unit

Elucidating the pathophysiology of dementia through generation and analyses of disease animal models.



Dai Yanagihara
 Cognition and Behavior Joint Research Laboratory



Aya Ito-Ishida
 Laboratory for Brain Development and Disorders

We aim to clarify the mechanism for brain development and find a solution for developmental disorders.



Asuka Takeishi
 Neural Circuit of Multisensory Integration RIKEN Hakubi Research Team

Exploring the neural and molecular mechanisms of behavior choice in *C. elegans*.



Masako Tamaki
 Cognitive Somnology RIKEN Hakubi Research Team

Elucidating the roles of the sleeping brain in cognition and behavior in humans.



Terufumi Fujiwara
 Adaptive Motor Control RIKEN Hakubi Research Team

We aim to reveal neural mechanisms of how animals adaptively control movements upon environmental and body state changes.

Brain Mapping by Integrated Neurotechnologies for Disease Studies (Brain/MINDS)



Brain/MINDS is a national project to fully understand the structure and networks of the brain. Similar projects are underway in the USA, EU and China, but Brain/MINDS is characterized by an emphasis on the study of the marmoset (a small, non-human primate). To understand our human brains, it is essential to learn from other primates. Marmoset brains can be genetically modified and comprehensively analyzed and have significant advantages as research targets, allowing an understanding of the neural circuit mechanisms developed in primates. These studies can lead to overcoming mental and neurological diseases in humans. CBS is the core partner in the Brain/MINDS project and promotes research in collaboration with domestic and overseas universities and other scientific institutions.



Hideyuki Okano
 Laboratory for Marmoset Neural Architecture

Our laboratory aims to understand higher brain functions and pathophysiology of human psychiatric and neurological diseases, by mapping the marmoset brain precisely.

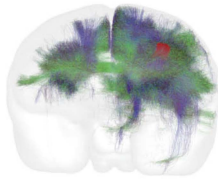
Collaborations with Universities and Research Institutes

CBS has established two collaborative divisions promoting inter-organizational communication with universities and research institutes.



Integrative Computational Brain Science Collaboration Division

The Integrative Computational Brain Science Collaboration Division develops technologies to analyze big data and works together with the Graduate School of Information Science and Technology at the University of Tokyo. A unit specializing in data science promotes data-driven explorations of the field.



Taro Toyoizumi
Integrative Computational Brain Science Collaboration Division



Tomomi Shimogori
Neuroinformatics Unit



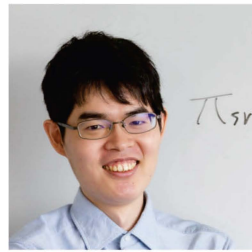
Fumiyasu Komaki
Mathematical Informatics Collaboration Unit



Alexander Woodward
Connectome Analysis Unit
Brain Mapping by Integrated Neurotechnologies for Disease Studies (Brain/MINDS)



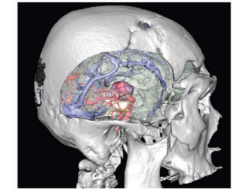
Henrik Skibbe
Brain Image Analysis Unit
Brain Mapping by Integrated Neurotechnologies for Disease Studies (Brain/MINDS)



Takeru Matsuda
Statistical Mathematics Collaboration Unit

Brain Medical Science Collaboration Division

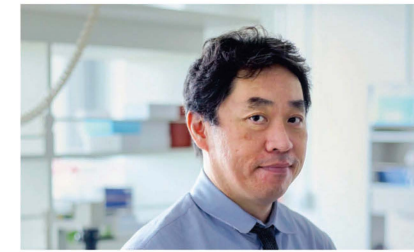
The Brain Medical Science Collaboration Division promotes academic exchange with university medical schools and research institutes. Professors from the University of Tokyo, Juntendo University and Kyorin University head collaboration laboratories at CBS and conduct medical research.



Shigeo Okabe
Brain Medical Science Collaboration Division



Masanori Matsuzaki
Brain Functional Dynamics Collaboration Laboratory
The goal of our laboratory is to elucidate the prefrontal neural dynamics relevant to cognition and behavior by studying the common marmoset.



Hirofumi Nakatomi
Biomedical Neural Dynamics Collaboration Laboratory
Analyzing the genomics from brain tissue, and investigating the pathophysiology of cerebrovascular diseases and epilepsy.



Nobutaka Hattori
Neurodegenerative Disorders Collaboration Laboratory
Deciphering the underlying mechanism of neurodegenerative diseases for the development of theranostics.

Industrial Collaborations

CBS has established three industrial collaboration centers with the aim of ensuring our research outcomes have social benefit.

RIKEN CBS – EVIDENT Open Collaboration Center (BOCC)

Established in June 2007

Linking more than 20 years of brain science expertise of CBS with the optical know-how of Evident, this center develops and harnesses fundamental bio-imaging technologies and instruments. The center also disseminates bio-imaging technology and knowledge through the technical support of researchers. Operational logs of microscopes at BOCC are used to improve bio-imaging products.

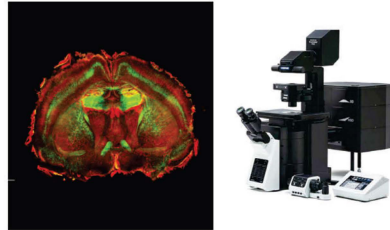


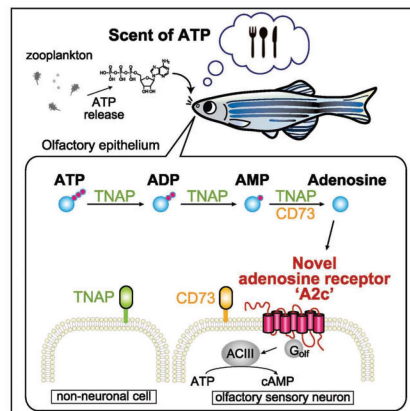
Image taken with FV3000 microscope Confocal Laser Microscope FV3000

EVIDENT

RIKEN CBS – KAO Collaboration Center (BKCC)

Established in April 2016

This center fuses cutting-edge neuroscience research from CBS with the chemical, molecular biological, biochemical and cell biological technologies of KAO Corp. By studying how the brain combines external sensory information and internal states to produce higher brain functions such as cognition, emotion and decision-making, the RIKEN CBS-KAO Collaboration Center contributes to KAO's mission of "As one, we create a Kirei life for all - providing care and enrichment for the life of all people and the planet".



An example of research achievement supported by KAO:
Wakisaka N, Miyasaka N, Koide T, Masuda M, Hiraki-Kajiyama T, Yoshihara Y.
"An adenosine receptor for olfaction in fish", *Current Biology*

KAO

RIKEN CBS – TOYOTA Collaboration Center (BTCC)

Established in November 2007

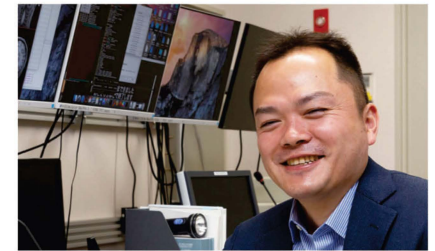
This research organization was set up under a comprehensive agreement with Toyota Motor Corporation to pursue socially-relevant innovation and explore the potential of merging brain science and technology. The center puts up a theme called "Well-being Dynamics of Individuals and Groups", addressed by an integrated endeavor by the three

research units focusing on Inter-Individual Brain Dynamics, Computational Group Dynamics, and Social Value Decision Making. The center also seeks open collaboration with society.

TOYOTA



Yasuo Kuniyoshi
RIKEN CBS-TOYOTA Collaboration Center
Strategic Collaboration Unit



Rei Akaishi
Social Value Decision Making Collaboration Unit



Wataru Toyokawa
Computational Group Dynamics Collaboration Unit



Takahiko Koike
Inter-Individual Brain Dynamics Collaboration Unit

Research Resources Division (RRD)

Research resources and research technologies are crucial for conducting brain science. Our Research Resources Division provides technological support, such as bio-material analysis, and maintains shared research equipment facilities for animal experimentation and

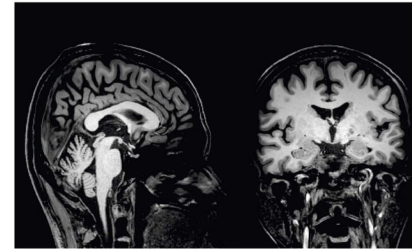
human MRI, for example. RRD also provides support for researchers to use these resources. The division has specialized technical staff who offer guidance on experimental technologies to research teams.

Support Unit for Animal Resources Development



Brain science has accelerated through the use of laboratory animals. This unit maintains large-scale animal experimentation facilities, supplying high-quality laboratory animals. It provides relevant technological support, such as the production of mutant mice by genome editing and mouse embryo manipulation. It also offers administrative support, for example animal health certificates.

Support Unit for Functional Magnetic Resonance Imaging



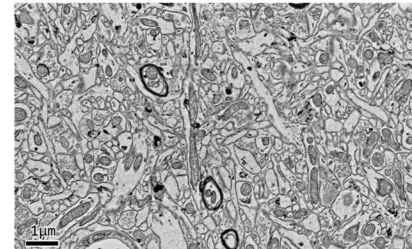
One of the ultimate goals of brain science is to understand human brain functions. This unit provides technical support for experiments that use non-invasive measurements, though magnetic resonance imaging (MRI), of the structure and activities of brains in humans and other species. The unit has been equipped with a 3 Tesla human MRI scanner for a while, and a 7 Tesla human MRI scanner has been in operation since FY2022. Experiments with DTI, MRA, MRS and fMRI can be supported. The unit also develops its own technologies for imaging and data analysis.

Support Unit for Bio-Material Analysis



Researchers in bioscience including brain science require a variety of scientific technologies. This unit provides essential technical support and experimental environments to RIKEN members. The skillful staff carry out commissioned analyses on nucleic acids, proteins, amino acids, peptide synthesis, and more. The unit maintains research equipment in shared experimental areas and also gives technological advice. Educational seminars and exhibitions of research instruments are held as required.

Support Unit for Electron Microscopy Techniques



Our brain is composed of neural circuits. Analysis of synaptic connections is important to understand the neural circuit architecture. Electron microscopy is an excellent tool to study synaptic connection. The Unit for Electron Microscopy Techniques provides a research environment to support research on synaptic connections, fine structures of intracellular organelles and so on. Our staff supports processing of brain tissue for EM, imaging with FIB-SEM (Focus Ion Beam - Scanning Electron Microscope) or FE-SEM (Field Emission Scanning Electron Microscope), and developing technologies of related tools.

Human Resource Development

Human Resource Development Program



CBS Summer Program

This program began in 1999 with the aim of training junior brain scientists, mainly those currently in graduate school. About 50 students from around the world are selected each year through a rigorous application. The program offers a two-month laboratory internship and a one-week intensive lecture course with domestic and overseas experts in cutting-edge research areas. The entire program, including exchange meetings, is delivered in English.



Brain Science Training Program

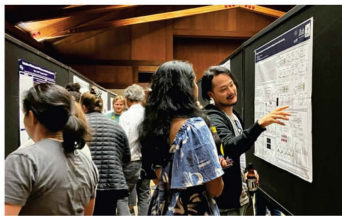
BSTP is a one-year program for fostering young researchers, directed mainly at first-year Master's students. Systematic exposure is given to acquire comprehensive as well as specialized knowledge of brain science. Instruction is in English. Many alumni have gone on to become successful researchers at overseas institutions.

CBS Young Talent Training Program



Young Investigators' Seminar

This event allows young researchers to present their work to the CBS community. Participants are given feedback from team leaders and the audience. Seminars provide an opportunity to initiate future joint research and social gatherings are held to allow informal discussion and exchange.



UCSF-CBS Young Investigator Exchange Travel Award Program

This collaborative program between the University of California, San Francisco (UCSF) and CBS provides an opportunity for CBS trainees to meet new colleagues, set up international collaborations, and bolster international scientific exchange. CBS trainees attend the UCSF retreat and present a poster or talk followed by a visit to the UCSF campus. Reciprocally, participants host UCSF trainees at the CBS retreat.

CBS Internal Members' Exchange Program



Retreat

The annual off-site retreat is an opportunity for exchange of ideas among researchers in different branches of brain science. Free discussion is encouraged across specialized fields. The retreat program has lectures, workshops, poster presentations and roundtables for researchers who might not normally interact to meet and exchange ideas. A lecturer from UCSF is invited every year.



PDFA (Postdoctoral Fellow Association)

PDFA is a self-governing organization within CBS. It was formed by young researchers who organize workshops and forums for career development, scientific discussion and advancement of diversity. Members volunteer at the CBS Summer Program to interact with and assist invited junior researchers from across the globe.



Collaboration with Domestic and Overseas Universities

Collaborations have been established to promote developments in the field of brain science. CBS team leaders may be appointed as visiting professors, while Ph.D. students from collaborating universities are able to visit and undertake research.

Public Relations and Outreach

CBS places great importance on outreach activities. We use social media to deliver press releases and research news to wide audiences. CBS welcomes some 1,000 visitors every year and holds an annual RIKEN Open Day with lectures and demonstrations for adults and children.

As part of World Brain Awareness Week (an international awareness campaign for brain science), CBS holds a popular summer science class for high school students that is known for its clear lectures and hands-on research experience opportunities.



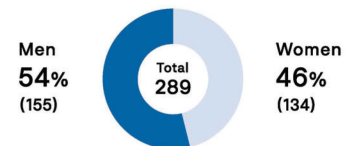


Staff

CBS welcomes diverse personnel and promotes gender equality and internationalization.

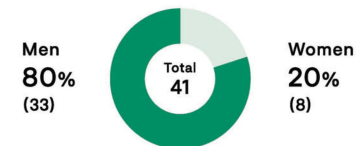
Researchers / Technical staff

Full time only



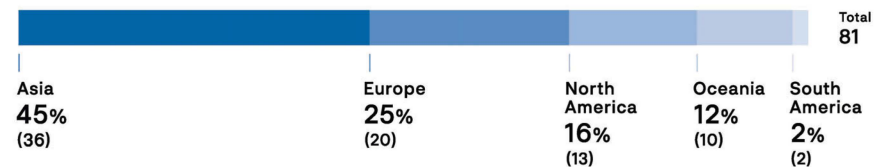
Researchers in Management

Full time only



Foreign Staff by Region

Including researchers in management



As of April 1, 2023

Bio-resources

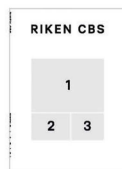
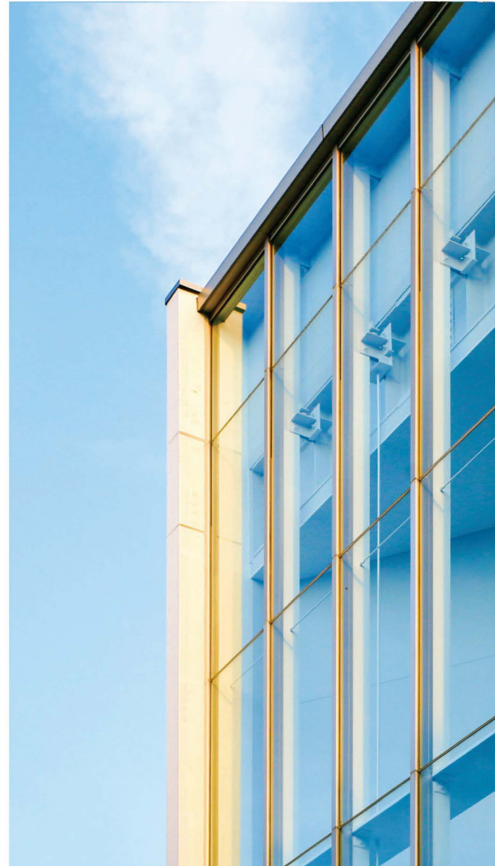
280 model mice with Alzheimer's disease, developed by Laboratory for Proteolytic Neuroscience and 139 DNA clones from the Laboratory for Cell Function Dynamics have been supplied to domestic and overseas research institutions (FY2022). Other CBS research teams accept inquiries concerning bio-resources from all over the world. Genetically modified zebrafish, for example, have been provided by CBS.



RIKEN Center for Brain Science

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351-0198, JAPAN

cbs.riken.jp/en



Cover Images provided by:

- 1 Laboratory for Cell Function Dynamics
- 2 Brain Image Analysis Unit
- 3 Laboratory for Systems Molecular Ethology

