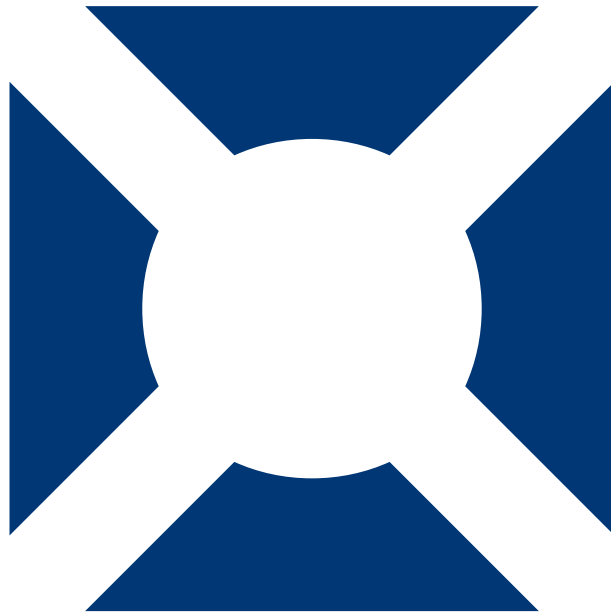




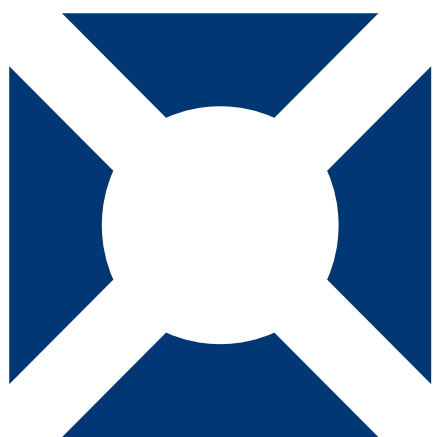
KYOTO UNIVERSITY



KUIAS

2019

Kyoto University Institute for Advanced Study



KUIAS

Wide-Open Window for Intellectual Exchange

- In the spirit of Kyoto University's tradition of academic freedom, KUIAS conducts advanced research utilizing the strengths of the University. Preeminent researchers from Japan and overseas gather at its international research centers.
- As a leading institute of Kyoto University, KUIAS has a system in which researchers with excellent achievements and next-generation researchers can practice high-level research activities, no matter what field they are from.
- Through high-level research activities, KUIAS contributes to nurturing young researchers, returning research benefits to society, and promoting science internationally.

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Message from the President

As one of Japan's leading research and education institutions, Kyoto University is home to a large community of outstanding researchers, and research exchange with other leading institutions throughout the world is part of the university's daily operations. The Kyoto University Institute for Advanced Study (KUIAS) was established in April 2016 to further enhance those endeavors to provide continuous support for the university's unique research, and serve as an international hub for advanced scholarship.



Capitalizing on the strengths of Kyoto University, KUIAS has a number of first-class researchers along with various world-leading research institutes, including two World Premier International Research Center Initiative (WPI) centers: the Institute for the Advanced Study of Human Biology (ASHBi) and the Institute for Integrated Cell-Material Sciences (iCeMS). KUIAS will continue to implement innovative research and administrative initiatives as a global center of knowledge and as an institution at the vanguard of university-wide reform.

I look forward to watching the progress of KUIAS as it leverages the university's unique strengths to advance cutting-edge research endeavors. I anticipate that the institute will make a significant contribution to cultivating the next generation of researchers, and serve as a focal point for domestic and international research-based knowledge generation.

Juichi Yamagiwa President, Kyoto University

Message from the Director-General

KUIAS is an institute that continuously conducts advanced research utilizing the strengths of Kyoto University. It features a team of excellent faculty members, including Distinguished Professors with internationally outstanding achievements in their respective fields, as well as various organizations engaged in world-leading research.



At present, KUIAS operates two World Premier International Research Center Initiative (WPI) centers: the Institute for the Advanced Study of Human Biology (ASHBi) since 2018, and the Institute for Integrated Cell-Material Sciences (iCeMS) since 2017. In addition, two collaborative research centers established in partnership with the National Institute of Advanced Industrial Science and Technology (AIST) and with RIKEN, as well as the Center for Integrative Medicine and Physics, a new endowed research laboratory founded in 2018, are undertaking cutting-edge research in their particular disciplines and combining their respective strengths to help accelerate the activities of KUIAS.

With these researchers and research centers at its core, KUIAS will contribute to academic progress as a global, cutting-edge research hub that draws together the knowledge of domestic and overseas researchers, fosters future scientific leaders, and shares the fruits of Kyoto University's research with society.

Shigefumi Mori Director-General, KUIAS

Tasuku Honjo, Deputy Director-General and Distinguished Professor, receives Nobel Prize in Physiology or Medicine

10 Dec. 2018

In the evening of October 1, 2018 (Japan time), the Nobel Foundation announced that the Nobel Prize in Physiology or Medicine would be awarded to Tasuku Honjo, deputy director-general and distinguished professor at the Kyoto University Institute for Advanced Study (KUIAS). The prize was awarded jointly to Dr. James P. Allison for "their discovery of cancer therapy by inhibition of negative immune regulation." On October 1 and 2 at the International Conference Hall in Clock Tower Centennial Hall, Distinguished Professor Honjo addressed a press conference, gave interviews and appeared live on news programs. During a press conference on October 1, the professor received phone calls from Prime Minister Shinzo Abe and (then) Minister of Education, Culture, Sports, Science and Technology Yoshimasa Hayashi with messages of congratulations. The Nobel Prize award ceremony took place on December 10 at the Stockholm Concert Hall in Sweden. Distinguished Professor Honjo received his medal and diploma from King Carl XVI



Tasuku Honjo receiving his Nobel Prize, December 10, 2018

Gustaf of Sweden. Along with his wife Shigeko and other family members, the award ceremony was also attended by Kyoto University President Juichi Yamagiwa, and by Provost, Executive Vice-President, Nagahiro Minato. At the banquet following the award ceremony, the professor presented a speech on behalf of the two Laureates, voicing his wish for every person on Earth to lead a healthy life through the improvement of cancer immunotherapy, and expressing his deep gratitude. In February and March, Distinguished Professor Honjo was also presented special awards of honor by Kyoto Prefecture and Toyama Prefecture plus awards of honor by Shizuoka Prefecture, Yamaguchi Prefecture and Ube City, and was conferred the title of honorary citizen in Kyoto, Kobe and Toyama cities. At KUIAS, a press conference was held on December 26 following the professor's return to Japan from the Nobel Prize award ceremony. He spoke about his impressions of Nobel Week and about the Tasuku Honjo "Yuh-shi" Fund, which was set up for the long-term assistance of salaries and research budgets for the development of young researchers. Furthermore, on March 27, KUIAS hosted an event to celebrate Distinguished Professor Honjo receiving the Nobel Prize in Physiology or Medicine. It was attended by about 150 guests, including the governor of Kyoto Prefecture and the mayor of Kyoto City.



At the press conference



At the event to celebrate receiving the Nobel Prize

✦ iCeMS opens Smart Materials Research Center in Thailand as an on-site laboratory

22 Aug. 2018

18 Dec. 2018

The Institute for Integrated Cell-Material Sciences (iCeMS), a part of Kyoto University Institute for Advanced Study (KUIAS), opened an on-site laboratory at the Vidyasirimedhi Institute of Science and Technology (VISTEC) in the Kingdom of Thailand. The inauguration of the Smart Materials Research Center, as the laboratory is called, was marked by a ceremony and commemorative symposium. Kyoto University was named a Designated National University (DNU) in 2017 by the Japanese government, and has since been working to implement a series of special initiatives under this program. One of these undertakings is focused on establishing multiple research facilities outside Japan in collaboration with local universities and institutes with the aim of promoting world-leading and creative research. The Smart Materials Research Center was founded on this concept, and includes instructors and researchers from both iCeMS and VISTEC. The laboratory's inauguration on 22 August

was preceded by VISTEC's graduation ceremony, where Her Royal Highness Princess Maha Chakri Sirindhorn administered the degree certificates. HRH then had lunch with members of iCeMS and VISTEC. The opening ceremony took place in the afternoon, followed by a facility tour and commemorative symposium, where researchers from both institutes presented their work in the materials and energy science field. The Smart Materials Research Center was approved as an On-site Laboratory of Kyoto University in December 2018.



Sign at the entrance of the center

✦ KUIAS hosts public symposium "KYOTO Science Session 2018"

17 Sep. 2018

Titled "Let's Talk about the World of Science," the KYOTO Science Session 2018 was held in the Centennial Hall at Kyoto University Clock Tower Centennial Hall. Open to the general public, the symposium attracted an audience of about 500 people, including high school students, university students, researchers, educators



Kyoto Science Session 2018

and members of the public. The first part of the symposium was a forum titled "What is KUIAS?" Representing KUIAS, researchers engaged in world-leading, cutting-edge research in their respective fields, together with a science navigator, outlined the significance and activities of KUIAS, and presented their latest research results. The second part of the symposium was a talk session titled "Let's Talk with KUIAS About Science." Distinguished professors and other researchers responded to questions from the audience, speaking to the appeal of science on the basis of their own experiences. They also offered messages of encouragement to high school students in attendance. It was an opportunity for researchers and audience to band together to consider and discuss science.

✦ Institute for the Advanced Study of Human Biology (ASHBi) established at KUIAS

30 Oct. 2018

The Institute for the Advanced Study of Human Biology (ASHBi) has been established at the Kyoto University Institute for Advanced Study (KUIAS). Based on a proposal submitted by Kyoto University, ASHBi was selected by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as a World Premier International Research Center Initiative (WPI) center. Following on iCeMS, it is the second WPI center at Kyoto University. The purpose of ASHBi is to create a new foundation for life sciences and medical sciences by elucidating the design principles of human traits through interdisciplinary research strategies. The ASHBi Kick-off

Symposium was held in March 2019. For further details about ASHBi, please see pages 7 and 16.



ASHBi Kick-off Symposium

Timeline

- 2016 Apr. 1 ● KUIAS is established at Kyoto University
- 2017 Apr. 1 ● Institute for Integrated Cell-Material Sciences (iCeMS) becomes a research center of KUIAS
 - AIST- Kyoto University Chemical Energy Materials Open Innovation Laboratory (ChEM-OIL) joins KUIAS as a collaborative research center
- 2018 Jan. 1 ● Center for Integrative Medicine and Physics (iCeMS-CiMPhy) joins KUIAS as an endowed research section
- 2018 Mar. 1 ● RIKEN-Kyoto University Science, Technology and Innovation Hub (RIKEN-Kyoto U Hub) joins KUIAS as a collaborative research center
- 2018 Oct. 30 ● Institute for the Advanced Study of Human Biology (ASHBi) joins KUIAS as a research center

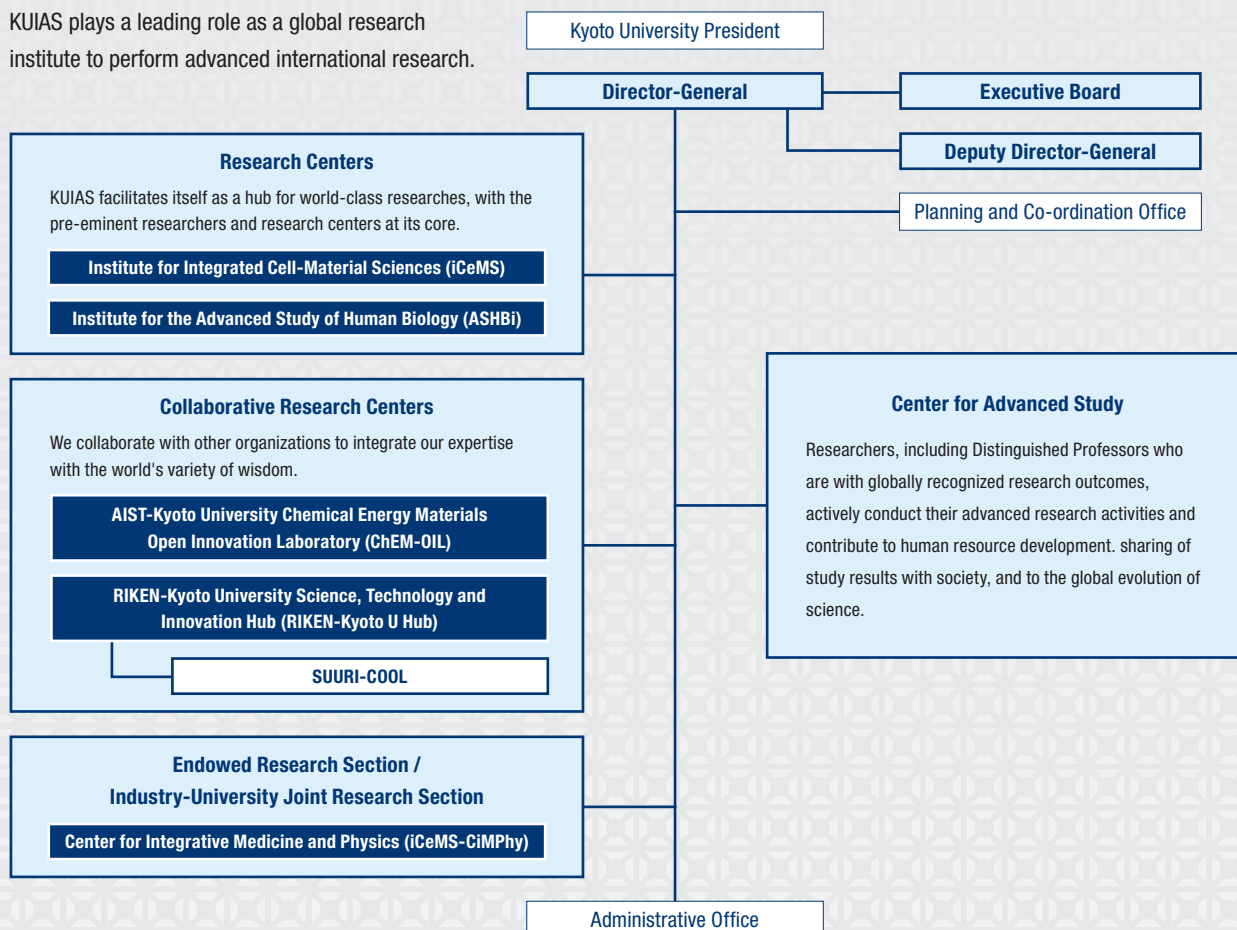
Features

KUIAS has the following features as an institute to grow into a leading center based on a new paradigm:

- Management with superb mobility under the strong leadership of the President
- Application of a pioneering organization system designed for a "special zone" within the university
 - System to allow world-leading excellent researchers to continue their research regardless of the conventional mandatory retirement age

Organizational Structure

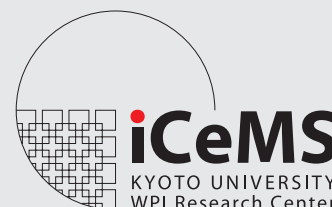
KUIAS plays a leading role as a global research institute to perform advanced international research.



Research Centers

● Institute for Integrated Cell-Material Sciences (iCeMS)

iCeMS is committed to integrating materials science and cell biology to establish novel academic disciplines. At iCeMS, researchers from different fields work together toward the common goals of unlocking the secrets of life by developing compounds to control cells and creating new, life-inspired materials for the practical benefit of society. iCeMS was established in 2007 as a center of the World Premier International Research Center Initiative (WPI) supported by Japan's ministry of science, and has since fostered research excellence and promoted internationalization. In 2017, the institute was certified as a WPI Academy center for its level of research and management was recognized as the World Premier Status.



● Institute for the Advanced Study of Human Biology (ASHBi)

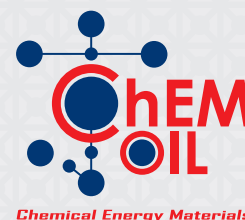
ASHBi aims to establish an advanced study of human biology that sheds light on the origin and unique characteristics of human beings, by elucidating the design principles of human beings and disease states and by synthesizing this knowledge, using an interdisciplinary methodology that integrates multiple fields of study (life sciences, mathematics, humanities). ASHBi was established in 2018 within the Kyoto University Institute for Advanced Study (KUIAS) as a new research center selected by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as a part of the World Premier International Research Center Initiative (WPI). ASHBi creates a highly open and flexible international research environment, and along with iCeMS, will be a world-leading international research center.



Collaborative Research Centers

● AIST-Kyoto University Chemical Energy Materials Open Innovation Laboratory (ChEM-OIL)

ChEM-OIL integrates expertise of Kyoto University and the National Institute of Advanced Industrial Science and Technology (AIST) related to basic materials science and device development/application. It aims to create non-conventional technologies for energy conversion and storage by directly connecting Kyoto University's inventions in advanced materials—such as porous coordination polymers (MOFs/PCPs), electrolytes, and metal-catalyst nanoparticles—with AIST's expertise in functional interface construction and electrochemical device development. Emphasizing objective, basic research and serving as a bridge to promote private business participation in its industry-government-academia network, ChEM-OIL will also conduct basic and applied research on base technologies and materials, electrolyte materials, and technologies for the design and device development of catalyst materials and electrodes, which are necessary to achieve the practical application of innovative technologies for advanced chemical materials related to energy issues.



● RIKEN-Kyoto University Science, Technology and Innovation Hub (RIKEN-Kyoto U Hub)

Under cooperation between Kyoto University and RIKEN, this Hub conducts joint research by using their respective strengths, beyond the borders of their research organizational frameworks and study areas, and strives to promote the world's most advanced research, develop new research horizons, and nurture next-generation personnel to take over its endeavors. "SUURI-COOL," the first collaborative center of the Hub, has recently been established within KUIAS. Its ultimate goal is to unravel the mystery of the universe, matter and life, as well as to solve various key problems in modern society, through its unique interdisciplinary approaches centered on mathematics.

Endowed Research Section / Industry-University Joint Research Section

● Center for Integrative Medicine and Physics (iCeMS-CiMPhy)

This Center, established by the munificence of Nakatani Foundation for Advancement of Measuring Technologies in Biomedical Engineering, "fuses physics and clinical medicine." It aims to develop multiscale measurement/analysis techniques to detect disease progression, and to pioneer new technologies to evaluate cellular kinetics. The Center contributes to society through implementation of its developed measurement hardware and software, as well as through fostering of research personnel with a global mindset.



Shigefumi Mori

Director-General
Distinguished Professor

*Algebraic Geometry
Birational Geometry*

Research Overview

Mori studies three-dimensional (3D) classification problems in a subfield known as birational classification theory of algebraic geometry. Algebraic geometry is a field in science that deals with shapes known as "algebraic varieties." Such an algebraic variety can appear in many slightly different forms if it is of dimension 2 (2D) or higher. The differences between these forms may be understood as partial dents or sharp points similar to those that appear in a physical object when it is struck by another. "Birational classification" refers to an approach where we ignore these minor differences when classifying algebraic varieties. It was known that one could make surfaces into minimal ones and minimize these differences by collapsing certain curves to points. This operation was known as the minimal model program (MMP).

For a long period of time, the generalization of the MMP to dimension three or higher was considered to be difficult; however, the introduction of extremal ray theory and application of general perspectives in [2]* was a major trigger for the development of 3D MMP. Following this, MMP was developed, and it was discovered that in a broad sense, 3D birational classification theory is linked to the conjectural existence of an operation known as "flip." Furthermore, in [3]*, by proving the existence of 3D flips, the problem of 3D MMP was resolved. Hence, the 3D birational classification theory was completed in a rough sense. Subsequently, with the contribution of many researchers, MMPs of dimension four or higher have been established in a practical form.

Biography

1973	B.Sc., Faculty of Science, Kyoto University
1975	M.Sc., Graduate School of Science, Kyoto University
1975-1980	Assistant of Faculty of Science, Kyoto University
1980-1982	Lecturer of Faculty of Science, Nagoya University
1982-1987	Associate Professor of Faculty of Science, Nagoya University
1988-1990	Professor of Faculty of Science, Nagoya University
1990-2016	Professor of Research Institute for Mathematical Sciences, Kyoto University
2011-2014	Director of Research Institute for Mathematical Sciences, Kyoto University
2016-	Director-General and Distinguished Professor of KUIAS

Honors

Inoue Prize for Science (1989), Frank Nelson Cole Prize (1990), Japan Academy Prize (1990), Fields Medal (1990), Person of Cultural Merit (1990), Foreign Honorary Member of the American Academy of Arts and Sciences (1992), Member of the

Japan Academy (1998), Honorary Doctorate of University of Torino (2002), Fujihara Award (2004), University Professor of Nagoya University (2010), Foreign Member of the Russian Academy of Sciences (2016), Foreign Associate of US National Academy of Sciences (2017), Honorary Doctorate of University of Warwick (2017), Kodaira Kunihiko Prize (2019)

Selected Papers

- [1] S. Mori, Projective manifolds with ample tangent bundles, *Ann. Math.* **110**, 593-606 (1979).
- *[2] S. Mori, Threefolds whose canonical bundles are not numerically effective, *Ann. Math.* **116**, 133-176 (1982).
- *[3] S. Mori, Flip theorem and the existence of minimal models for 3-folds, *J. Amer. Math. Soc.* **1**, 117-253 (1988).
- [4] J. Kollar, S. Mori, Classification of three dimensional flips, *J. Amer. Math. Soc.* **5**, 533-703 (1992); *Erratum* **20**, 269-271 (2007).
- [5] S. Mori, Y. Prokhorov, On Q-conic bundles, *Publ. Res. Inst. Math. Sci.* **44**, 315-369 (2008).

Tetsuro Matsuzawa



Tetsuro Matsuzawa

Deputy Director-General
Distinguished Professor

*Primateology
Comparative Cognitive Science*

Research Overview

Matsuzawa has been studying chimpanzee both in the laboratory and in the wild. The laboratory work is known as "Ai-project" in the Primate Research Institute of Kyoto University since 1977: a female chimpanzee named Ai learned to use Arabic numerals to represent the number (Matsuzawa, 1985, *Nature*). The field work has been carried out in Bossou-Nimba, Guinea, since 1986, focusing on the tool use in the wild. Matsuzawa tries to synthesize the field and the lab work to understand the mind of chimpanzees to know the evolutionary origins of human mind. He published the books such as "Primate origins of human cognition and behavior", "Cognitive development in chimpanzees", "The chimpanzees of Bossou and Nimba".

Biography

1974	B.A., Kyoto University
1976	Psy.M., Kyoto University
1976	Ph. D degree in Science, Kyoto University
1976-1987	Assistant of Primate Research Institute, Kyoto University
1987-1993	Associate Professor of Primate Research Institute, Kyoto University
1993-2016	Professor of Primate Research Institute, Kyoto University
2006-2012	Director of Primate Research Institute, Kyoto University
2016-	Deputy Director-General and Distinguished Professor of KUIAS

Honors

Jane Goodall Award (2001), Medal with Purple Ribbon (2004), Person of Cultural Merit (2013), Awards for Distinguished Research/Services from the Japanese Psychological Association (2014)

Selected Papers

- [1] T. Matsuzawa, Use of numbers by a chimpanzee. *Nature* **315**, 57-59 (1985).
- [2] N. Kawai, T. Matsuzawa, Numerical memory span in a chimpanzee. *Nature* **403**, 39-40 (2000).
- [3] T. Matsuzawa, Primate Origins of Human Cognition and Behavior. *Springer-Verlag* (2001).
- [4] T. Matsuzawa, M. Tomonaga, M. Tanaka, Cognitive Development in Chimpanzees. *Springer* (2006).
- [5] T. Matsuzawa, T. Humle, Y. Sugiyama, The Chimpanzees of Bossou and Nimba. *Springer* (2011).



Tasuku Honjo

Deputy Director-General
Distinguished Professor

Molecular Immunology

Research Overview

Honjo is well known for his discovery of activation-induced cytidine deaminase (AID) that is essential for class switch recombination and somatic hypermutation. He has established the basic conceptual framework of class switch recombination starting from discovery of DNA deletion (1978). Dr. Honjo identified a series of key molecules involved in immune regulation, including IL-4, IL-5, SDF-1, and IL-2R α chain. Also appreciated is his seminal contribution to developmental biology by identification of RBP-J as the Notch signaling target. In addition, he discovered PD-1 (program cell death 1), a negative coreceptor at the effector phase of immune response and demonstrated that PD-1 inhibition contributes to cancer treatments. Anti-PD-1 cancer immunotherapy has been approved in US, EU, and Japan. This treatment revolutionized the cancer therapy and is considered to be equivalent to penicillin in infectious diseases.

Biography

1966	M.D., Kyoto University
1975	Ph.D., Kyoto University
1971-1973	Fellow of Carnegie Institution of Washington, Department of Embryology
1973-1974	Visiting Fellow and Associate of National Institute of Child Health and Human Development, NIH
1974-1979	Assistant Professor of Faculty of Medicine, The University of Tokyo
1979-1984	Professor of School of Medicine, Osaka University
1984-2005	Professor of Faculty of Medicine, Kyoto University
1996-2000	Director of Faculty of Medicine/Graduate School of Medicine, Kyoto University
2002-2004	Director of Faculty of Medicine/Graduate School of Medicine, Kyoto University
2005-	Specially-Appointed Professor of Graduate School of Medicine, Kyoto University
2006-2017	Visiting Professor of Kyoto University
2006-2012	Executive Member of the Council for Science and Technology Policy, Cabinet Office
2012-2017	Chairman, Board of Directors, Shizuoka Prefectural University Corporation
2015-	President of Foundation for Biomedical Research and Innovation
2017-	Distinguished Professor of KUIAS
2018-	Deputy Director-General of KUIAS

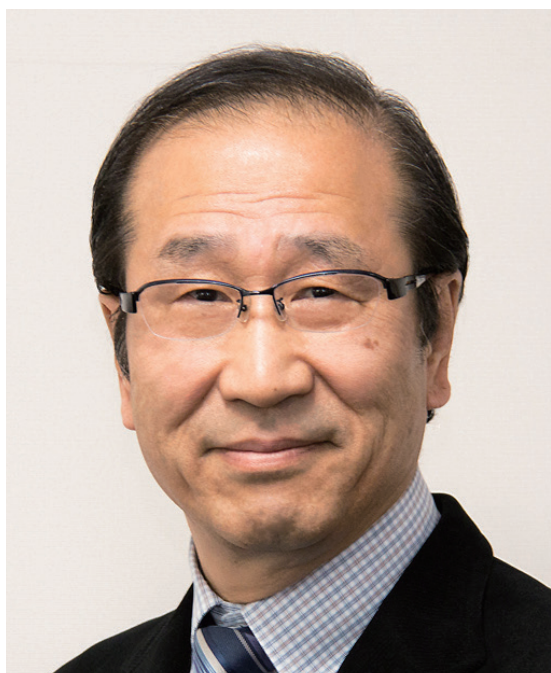
Honors

Noguchi Hideyo-Memorial Award for Medicine (1981), Asahi Prize (1982), The Imperial Prize and the Japan Academy Prize (1996), Person of Cultural Merit (2000), Foreign Associate of U.S. National Academy of Sciences (2001), Thomson Leading Japanese

Scientists in Emerging Research Fronts (2004), Robert Koch Prize (2012), Order of Culture, Japan (2013), Tang Prize, Biopharmaceutical Science Award (2014), William B. Coley Award (2014), JCA-CHAAO Award (2014), Richard V. Smalley, MD Memorial Award (2015), Kyoto Prize (2016), The Keio Medical Science Prize (2016), Fudan-Zhongzhi Science Award in Biomedicine (2016), The Pharmaceutical Society of Japan Award (2016), Warren Alpert Foundation Prize (2017), Nobel Prize in Physiology or Medicine (2018)

Selected Papers

- [1] T. Honjo, T. Kataoka, Organization of immunoglobulin heavy chain genes and allelic deletion model. *Proc. Natl. Acad. Sci. USA* **75**, 2140-2144 (1978).
- [2] Y. Yaoita, T. Honjo, Deletion of immunoglobulin heavy chain genes from expressed allelic chromosome. *Nature* **286**, 850-853 (1980).
- [3] Y. Ishida, Y. Agata, K. Shibahara, T. Honjo, Induced expression of PD-1, a novel member of the immunoglobulin gene superfamily, upon programmed cell death. *EMBO J.* **11**, 3887-3895 (1992).
- [4] M. Muramatsu, K. Kinoshita, S. Fagarasan, S. Yamada, Y. Shinkai, T. Honjo, Class switch recombination and hypermutation require activation-induced cytidine deaminase (AID), a potential RNA editing enzyme. *Cell* **102**, 553-563 (2000).
- [5] Y. Iwai, M. Ishida, Y. Tanaka, T. Okazaki, T. Honjo, N. Minato, Involvement of PD-L1 on tumor cells in the escape from host immune system and tumor immunotherapy by PD-L1 blockade. *Proc. Natl. Acad. Sci. USA* **99**, 12293-12297 (2002).



Susumu Kitagawa

Distinguished Professor
iCeMS Director

*Inorganic and Material Chemistry
Chemistry of Coordination Space*

Research Overview

Kitagawa's main research field is inorganic and material chemistry, in particular, chemistry of coordination space, and his current research interests are centered on synthesis and properties of porous coordination polymers/metal-organic frameworks.

He was the first to discover and to demonstrate "porosity" for metal complexes with gas sorption experiments (1997), whose materials are called porous coordination polymers (PCPs) or metal-organic frameworks (MOFs). To date, MOFs are classified as a new category of porous materials, as opposed to the conventional classifications of inorganic and carbon materials. Kitagawa pioneered the functional chemistry of MOFs, and discovered flexible MOFs, dissimilar to those of conventional porous materials. Today several hundred different MOFs are known, and over 7,000 articles on this class of materials have been published annually worldwide. The research developments built on his discoveries are anticipated to lead to radical innovations in materials science, with wide-ranging implications for both academia and industry. Chemical industry firms are producing MOF materials for use in purification, storage, and transportation of gases, among other applications. Kitagawa's achievement has blazed a trail to a new era for porous materials, vital to addressing energy and environmental issues and contributing to human welfare.

Biography

1974	B.Sc., Kyoto University
1976	M.Sc., Kyoto University
1979	Ph.D., Kyoto University
1979-1983	Assistant, Department of Chemistry, Kindai University
1983-1988	Lecturer, Department of Chemistry, Kindai University
1988-1992	Associate Professor of Department of Chemistry, Kindai University
1992-1998	Professor of Department of Chemistry, Tokyo Metropolitan University
1998-2017	Professor of Department of Synthetic Chemistry and Biological Chemistry, Kyoto University
2007-2012	Deputy Director and Professor of Institute for Integrated Cell-Material Sciences, Kyoto University
2013-2017	Director and Professor of Institute for Integrated Cell-Material Sciences, Kyoto University
2016-2018	Deputy Director-General of KUIAS
2017-	Distinguished Professor of KUIAS
2017-	Director of Institute for Integrated Cell-Material Sciences, KUIAS

Honors

The Chemical Society of Japan Award (2009), Thomson Reuters Citation Laureate (Chemistry) (2010), Medal with Purple Ribbon (2011), Kyoto University Shi-Shi Award (2013), The fellow of the UK Royal Society of Chemistry (2013), Leo Esaki Prize (2013),

Japan Academy Prize (2016), Fred Basolo Medal (2016), Fujihara Award (2017), Solvay Prize (2017), Grand Prix de la Fondation de la Maison de la Chimie (2018), Emanuel Merck Lectureship Award (2019)

Selected Papers

- [1] R. Matsuda, R. Kitaura, S. Kitagawa, Y. Kubota, R. V. Belosludov, T. C. Kobayashi, H. Sakamoto, T. Chiba, M. Takata, Y. Kawazoe, Y. Mita, Highly controlled acetylene accommodation in a metal-organic microporous material. *Nature* **436**, 238-241 (2005).
- [2] Y. Sakata, S. Furukawa, M. Kondo, K. Hirai, N. Horike, Y. Takashima, H. Uehara, N. Louvain, M. Meilikhov, T. Tsuruoka, S. Isoda, W. Kosaka, O. Sakata, S. Kitagawa, Shape-memory nanopores induced in coordination frameworks by crystal downsizing. *Science* **339**, 193-196 (2013).
- [3] H. Sato, W. Kosaka, R. Matsuda, A. Hori, Y. Hijikata, R. V. Belosludov, S. Sakaki, M. Takata, S. Kitagawa, Self-Accelerating CO Sorption in a Soft Nanoporous Crystal. *Science* **343**, 167-170 (2014).
- [4] N. Hosono, A. Terashima, S. Kusaka, R. Matsuda, S. Kitagawa, Highly responsive nature of porous coordination polymer surfaces imaged by in situ atomic force microscopy. *Nature Chemistry* **11**, 109-116 (2018).
- [5] C. Gu, N. Hosono, J. Zheng, Y. Sato, S. Kusaka, S. Sakaki, S. Kitagawa, Design and control of gas diffusion process in a nanoporous soft crystal. *Science* **363**, 387-391 (2019).



Takeo Kanade

Invited Distinguished Professor

*Computer Vision, Robotics,
Artificial Intelligence, Multimedia*

Since early 70's, Kanade has performed a series of pioneering research in computer vision. The feature of his accomplishments is that they are fundamental in nature and have practical impacts. To illustrate a few, his neural network-based face detection technique raised the detection rate to an unprecedented level and thus led to today's

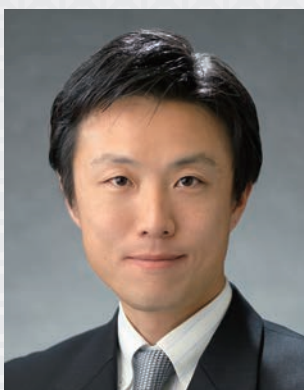
common use of face detection in smart phone cameras; his optical-flow algorithm for estimating the direction and speed of moving patterns is now the basis of almost all the video processing including motion video coding; and his factorization algorithm for the so-called structure-from-motion problem was one of the earliest algorithms that demonstrated a successful reconstruction of three-dimensional shape from image sequence, which now is a powerful and common procedure for scene modeling by video. Kanade launched an autonomous vehicle project in 1985, and formed the early foundation for the recent emergence of autonomous driving technologies. The team developed one of the first artificial intelligence systems capable of sensing freeway lanes, executing accurate lane changes, recognizing and avoiding obstacles, and detecting other vehicles in real time based on data from vehicle-mounted range sensors and cameras. In 1995, he carried out a demonstration called No Hands Across America, in which the NAVLAB 5 vehicle drove from coast to coast, 98.2% under auto driving.

Biography

1974	Ph.D., Kyoto University
1974-1976	Research Assistant, Faculty of Engineering, Kyoto University
1976-1980	Associate Professor, Faculty of Engineering, Kyoto University
1980-1985	Senior Research Scientist, The Robotics Institute and Computer Science Department, Carnegie Mellon University (CMU)
1985-1994	Professor, The Robotics Institute and Computer Science Department, CMU
1992-2001	Director, The Robotics Institute, CMU
1993-1998	U.A. and Helen Whitaker Chaired Professor, CMU
1998-	U.A. and Helen Whitaker University Professor, CMU
2004-2010	Director, Digital Human Research Center, National Institute of Advanced Industrial Science and Technology (AIST), Japan
2006-2012	Director, Quality of Life Technology Engineering Research Center, CMU
2015-	Honorary AIST Fellow
2016-	Senior advisor, Center for Advanced Integrated Intelligence Research, RIKEN
2017-	Invited Distinguished Professor, KUIAS

Honors

Joseph F. Engelberger Award (1995), Foreign Member of US National Academy of Engineering (1997), C&C Prize (2000), Funai Achievement Award (2004), Azriel Rosenfeld Lifetime Achievement Award, IEEE Computer Society (2007), RAS Pioneer Award, IEEE Robotics and Automation Society (2007), Okawa Prize (2007), Bower Award and Prize for Achievement in Science, The Franklin Institute (2008), ACM-AAAI Allen Newell Award (2010), Tateishi Prize, Grand Award (2010), Kyoto Prize (2016), IEEE Founders Medal (2017)



Yasuaki Hiraoka

**Director of Center for Advanced Study /
Deputy Director of ASHBI / Professor**

*Topological Data Analysis,
Applied Mathematics*

Hiraoka is a world leading mathematician in the area of topological data analysis (TDA). He studies mathematical theory and algorithms of TDA, and also works on applying them into scientific and engineering problems. His primary interest

is to develop descriptors for characterizing shape of complex and big data. By combining various mathematical theories such as topology, representation, probability, he succeeded in making TDA powerful and general for practical problems. In applications, he has organized the materials TDA team, and his group achieved several pioneering results on structural analysis in materials science based on TDA. In particular, a series of methods developed by his group using persistent homology, machine learning, and inverse analysis are expected to be a key technology for materials informatics in future. In addition to materials science, he has recently launched TDA projects for other application areas such as life science.

Biography

2005	Doctor of Science, Graduate School of Engineering Science, Osaka University
2005-2006	JSPS PD, Research Institute for Electronic Science, Hokkaido University
2006-2009	Assistant Professor, Graduate School of Science, Hiroshima University
2009-2011	Associate Professor, Graduate School of Science, Hiroshima University
2009-2010	Visiting researcher, Department of Mathematics, University of Pennsylvania
2011-2015	Associate Professor, Institute of Mathematics for Industry (IMI), Kyushu University
2015-2016	Associate Professor, Advanced Institute for Materials Research (AIMR), Tohoku University
2016-2018	Professor, Advanced Institute for Materials Research (AIMR), Tohoku University
2017-	Team Leader, Center for Advanced Intelligence Project, RIKEN
2018-	Director of Center for Advanced Study and Professor, KUIAS, Kyoto University
2018-	Deputy Director of Institute for the Advanced Study of Human Biology, KUIAS

Honors

JSIAM best paper award (2004), The 1st Hiroshi Fujiwara Mathematical Science Award (2012), NISTEP Award (2016)



Shinya Yamamoto

Associate Professor

Animal Behavior, Comparative Cognitive Science

Yamamoto is studying the evolution of sociality and its related intelligence in humans and non-human animals, developing a two-by-two research paradigm: experiments and fieldwork with chimpanzees and bonobos. Recently he has been expanding this to our socially closest animals, dogs and horses, both in captivity and in natural environments. His ultimate theme is to explore what

humanity is. Where did it come from and how can it change in the future? He is especially interested in the evolution of social living characterized by empathy, cooperation, and culture. His previous work has revealed that chimpanzees help others upon request, but not proactively, even when they understand others' goals. This suggests that proactive helping is one of unique characteristics of humans. His main research sites are the Kumamoto Sanctuary (chimpanzees and bonobos), Wamba and Mbali/Malebo in DR Congo (wild bonobos), Bossou in Guinea (wild chimpanzees), horse-riding clubs and dog nurseries in Japan, Serra d'Arga in Portugal (feral horses), and Taiwan (free-ranging dogs).

Biography

- 2009 Ph.D. Science (Comparative Psychology), Graduate School of Science, Kyoto University
- 2009-2010 JSPS Post Doctoral Fellow(PD), Graduate School of Arts and Sciences, University of Tokyo
- 2010-2013 Program-specific Assistant Professor, Primate Research Institute, Kyoto University
- 2013-2017 Associate Professor, Graduate School of Intercultural Studies, Kobe University
- 2013- Specially Appointed Associate Professor, Wildlife Research Center, Kyoto University
- 2017- Associate Professor, Institute for Advanced Study, Kyoto University

Honors

Takashima award, Primate Society of Japan (2011), Outstanding award, Japanese Psychological Association's international award (2015), Young Researcher award, Kobe University President award (2016), MEXT Young Scientists' prize (2019)



Masaki Kashiwara

Program-Specific Professor

Mathematics, Algebraic Analysis, Representation Theory

Dr. Kashiwara's work in Mathematics extends from microlocal analysis, representation theory and combinatorics to homological algebra, symplectic geometry and integrable systems. Most well-known works of him are his contributions to the theory of D-modules and his creation of crystal basis

theory. Introduced by Sato around 1960, algebraic analysis is a framework in which systems of linear differential equations are formulated as modules over the ring D of differential operators and are investigated with algebraic means such as rings, modules, sheaves and categories. Sato's idea of D-modules was greatly developed by Kashiwara, and has become a fundamental tool in many branches of mathematics. In the 1980s with Schapira he further introduced and developed microlocal sheaf theory. One of his early major results was his 1980 construction of the Riemann-Hilbert correspondence, a generalization of Hilbert's 21st problem about the existence of a linear differential equation on the projective line with prescribed monodromy. The Riemann-Hilbert correspondence, found a remarkable application to a problem in representation theory, called the Kazhdan-Lusztig conjecture.

Biography

- 1971 M.Sc., Graduate School of Science, The University of Tokyo
- 1971-1974 Assistant, Research Institute for Mathematical Sciences, Kyoto University
- 1974-1977 Associate Professor, Nagoya University
- 1974 Ph.D., Kyoto University
- 1977-1978 Associate researcher, Massachusetts Institute of Technology
- 1978-1984 Associate Professor, Research Institute for Mathematical Sciences, Kyoto University
- 1984-2010 Professor, Research Institute for Mathematical Sciences, Kyoto University
- 2001-2003 Director of Research Institute for Mathematical Sciences, Kyoto University
- 2007-2009 Director of Research Institute for Mathematical Sciences, Kyoto University
- 2010- Project Professor, Research Institute for Mathematical Sciences, Kyoto University
- 2019- Program-Specific Professor, Institute for Advanced Study, Kyoto University

Honors

Iyanaga prize of Mathematical Society of Japan (1981), Asahi prize (1988), Japan Academy prize (1988), Fujiwara award (2008), Chern Medal (2018), Kyoto Prize (2018)

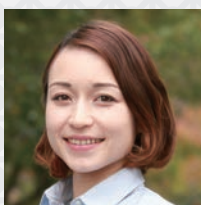


Fumihiro Kano

Program-Specific Associate Professor *Primate Cognition, Animal Behavior*

Kano is a comparative psychologist studying cognition and emotion of nonhuman animals. He works with multiple species including great apes including bonobos, chimpanzees, orangutans, gorillas, and recently some bird species such as pigeons and crows. His unique approach is using cutting-edge sensor technologies to answer traditional questions in this field. Recently, using eye-tracking, he and his colleagues discovered that apes anticipate that other individuals act according to the false-beliefs – an evidence that apes may understand other individuals' goals and intentions like humans – the question which remained unanswered for quite a while in this field. Also, he and his colleagues are one of the few who started thermos-imaging in the study of

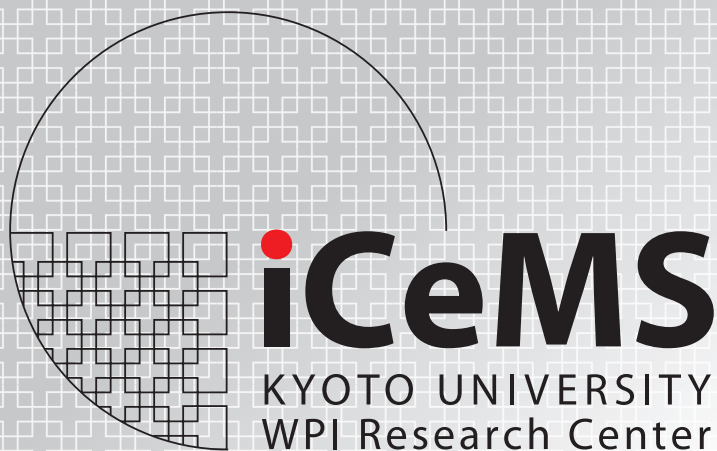
emotion with apes. His recent challenge is using the same methods to study cognition and emotion of bird species which are distantly related to primates but might be as intelligent as primates.



Monamie Ringhofer

Program-Specific Assistant Professor *Ethology, Comparative Cognitive Science*

Ringhofer studies horses, which have had a close relationship with humans since being domesticated approximately 6,000 years ago. Her research is on the question of why horses came to have such close relationships with humans. Combining experiments on domestic horses and field observations of feral horses, She studies the social interaction between horses and between humans and horses. Her main research topic is behavioral coordination between individuals and understanding of others.



Institute for Integrated Cell-Material Sciences

Our mission is to explore the secrets of life by creating compounds to control cells, and further down the road to create life-inspired super materials.

Our approach is radical and new. At iCeMS we are not simply rewriting the rule-book, we are throwing it out of the window. Traditional single discipline-based research is not enough for nurturing flexible and innovative ideas. Thus at iCeMS biologists, chemists, engineers, physicists, and mathematicians share ideas and work together to devise new ways to integrate cells and materials, to keep creating new science.



Timeline

- 2007 Sep. ● iCeMS is selected for the World Premier International Research Center (WPI) Initiative by the Ministry of Education, Culture, Sports, Science and Technology (MEXT).
- Oct. ● iCeMS is established at Kyoto University with Prof. Norio Nakatsuji as founding director.
- 2008 Jan. ● The Center for iPS Cell Research and Application (CiRA) is established under the auspices of iCeMS with Prof. Shinya Yamanaka as founding director.
- 2010 Apr. ● The Center for iPS Cell Research and Application (CiRA) is re-established as a sister institute to iCeMS with Prof. Shinya Yamanaka as founding director.
- 2012 Oct. ● Prof. Shinya Yamanaka wins the Nobel Prize in Physiology or Medicine.
- 2013 Jan. ● Prof. Susumu Kitagawa succeeds Prof. Nakatsuji as director.
- 2017 Apr. ● iCeMS becomes a research center of KUIAS.
- May ● iCeMS was certified as a WPI Academy center by MEXT.

Principal Investigators (PIs) / Adjunct PIs

At iCeMS, researchers from different fields work together to devise groundbreaking ideas. (The red frames are PIs and the blue frames are Adjunct PIs.)

Chemical Biology

Materials Science

Cell Biology

Tissue Engineering

Biophysics

Field	PI (Red Frame)	Adjunct PI (Blue Frame)
Cell Biology	Jun Suzuki	Ryoichiro Kageyama
	Peter Carlton	Mineko Kengaku
	Michiyuki Matsuda	Kouichi Hasegawa
	Dan Ohtan Wang	Motonari Uesugi
	Ganesh Pandian Namasivayam	Itaru Hamachi
	Fuyuhiko Tamanoi	Hiroshi Imahori
	Aiko Fukazawa	Daniel Packwood
	Yasuo Mori	Motomu Tanaka
	Shuhei Furukawa	Daishi Fujita
	Shuhei Furukawa	Daishi Fujita
Materials Science	Easan Sivaniah	Susumu Kitagawa
	Satoshi Horike	Hiroshi Kageyama
	Kunihisa Sugimoto	Hiroshi Kitagawa
	Kaoru Sugimura	
Tissue Engineering	Ken-ichiro Kamei	



Institute for the Advanced Study of Human Biology

ASHBi's mission is to clarify the functional mechanism unique to humans and the pathogenesis of intractable diseases arising from the failure of that mechanism, by elucidating the origin and the evolutionary process of human beings. Research at ASHBi is expected to become the cornerstone for developing innovative medical treatment and unravelling what humans are, and to contribute to the sound development of human society.

Life sciences have so far shown that elemental processes for life have been preserved during evolution. On the other hand, there are clear species differences, and consequently, the knowledge gleaned from model organisms has been difficult to translate to humans. For example, humans have acquired a unique metabolic mechanism, and have achieved remarkable development in brain function through long-period evolution.

ASHBi, therefore, aims to create an advanced study of human biology which promotes systematic investigations into humans and non-human primates, and which seeks to elucidate the mechanistic basis of species differences, that is, diversity driven by evolution.

ASHBi creates a highly open and flexible international research environment in collaboration with organizations such as the European Molecular Biology Laboratory (EMBL), the University of Cambridge and Karolinska Institutet, as well as with the Kyoto University Hospital. Researchers from various fields of study (life sciences, mathematics, humanities) are inspiring and collaborating with one another toward innovation.



Timeline

- 2018 Oct.
 - ASHBi is selected by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as a part of the World Premier International Research Center Initiative (WPI).
 - ASHBi is established within KUIAS.
 - ASHBi Satellite is established at the Shiga University of Medical Science.
- 2019 Mar.
 - ASHBi Kick-off Symposium is held.



Key Investigators

At ASHBi, researchers in life sciences, mathematics and humanities attempt to create new ideas beyond their respective fields. (Red = principal investigator (PI). Blue = senior academic mentor. Green = administrative director)



Yasuaki Hiraoka
[Vice Director]
Professor at KUIAS
Applied Mathematics



Takuya Yamamoto
[Head of the Research Development Core]
Associate Professor at Center for IPS Cell Research and Application, Kyoto University
Molecular Biology, Bioinformatics



Guillaume Bourque
Associate Professor at McGill University
Bioinformatics



Seishi Ogawa
Professor at Graduate School of Medicine, Kyoto University
Molecular Oncology



Hideki Ueno
Professor at Icahn School of Medicine at Mount Sinai
Immunology



Takashi Hiiragi
Group Leader at European Molecular Biology Laboratory (EMBL)
Developmental Biology



Mototsugu Eiraku
Professor at Institute for Frontier Life and Medical Sciences, Kyoto University
Developmental Biology



Motoko Yanagita
Professor at Graduate School of Medicine, Kyoto University
Nephrology



Misao Fujita
Program-Specific Professor at Center for IPS Cell Research and Application, Kyoto University
Bioethics



Masatsugu Ema
Professor at Research Center for Animal Life Science, Shiga University of Medical Science
Developmental Engineering



Anne Ferguson-Smith
[Senior Academic Mentor]
Professor at University of Cambridge
Epigenetic Inheritance, Developmental Genetics



Tadashi Ogawa
[Administrative Director]
Program-Specific Professor at KUIAS

Partner Institutions

KUIAS enriches its research through close contact with the following domestic and international partners.

University-level MoU* Partners * Memorandum of Understanding

- RIKEN, Japan
- National Institute of Advanced Industrial Science and Technology (AIST)
- Seoul National University, South Korea
- Pohang University of Science and Technology (POSTECH), South Korea
- Rice University, USA
- Heidelberg University, Germany
- University of Edinburgh, UK
- University of Oxford, UK
- Royal University of Bhutan, Bhutan

MoU Partners

- Academy of Emerging Sciences, Chubu University (CUAES), Japan
- Center for Highly Advanced Integration of Nano and Life Sciences, Gifu University (G-CHAIN), Japan
- UCLA California NanoSystems Institute (CNSI), USA
- Tata Institute of Fundamental Research National Centre for Biological Sciences (NCBS), India
- The Institute for Stem Cell Biology and Regenerative Medicine (inStem), India
- Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), India
- Peking-Tsinghua Center for Life Sciences (CLS), China
- Vidyasirimedhi Institute of Science and Technology (VISTEC), Thailand
- Research and Development Center for Membrane Technology (CMT), Chung Yuan Christian University, Taiwan
- School of Physical Science and Technology, ShanghaiTech University, China
- Zoological Society of San Diego d/b/a San Diego Zoo Global, USA
- AO Research Institute Davos, AO Foundation, Switzerland
- School of Environmental and Chemical Engineering, Shanghai University, China

International Partners

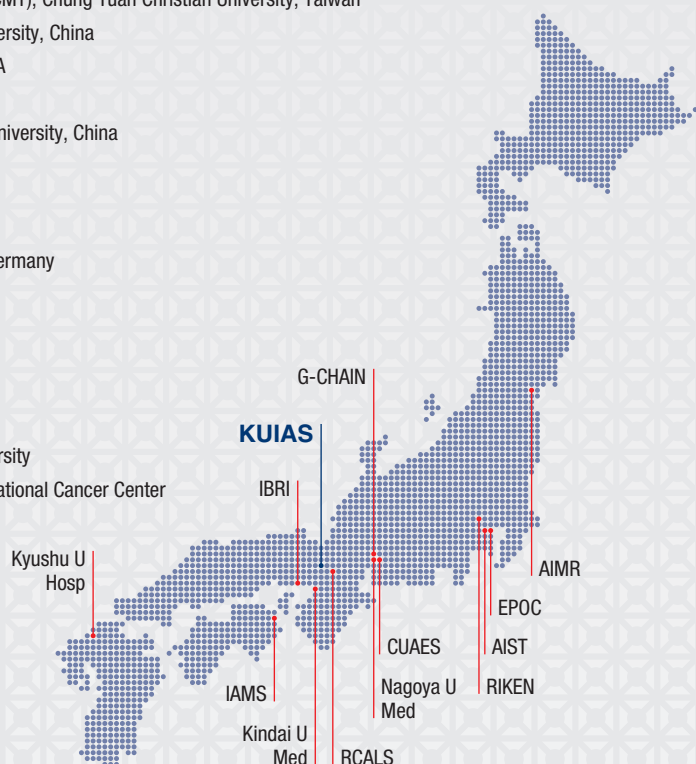
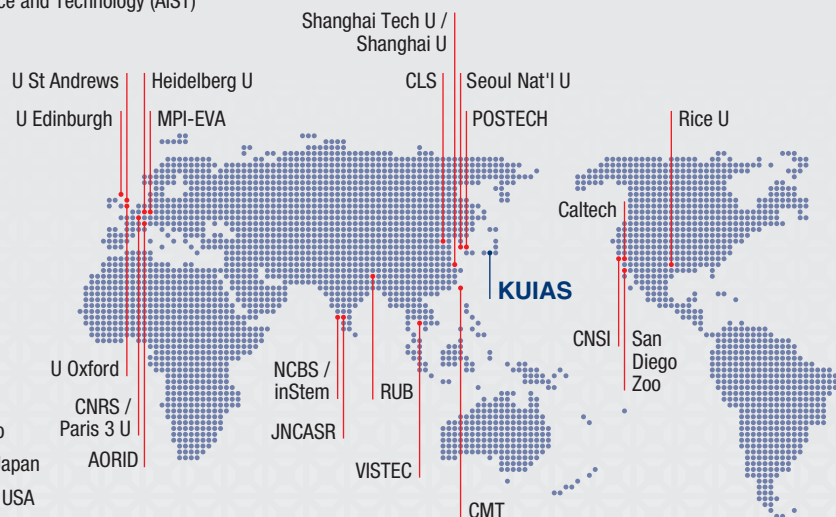
- California Institute of Technology (Caltech), USA
- Max Planck Institute for Evolutionary Anthropology (MPI-EVA), Germany
- University of St Andrews, UK
- National Center for Scientific Research (CNRS), France
- Sorbonne Nouvelle Paris III University, France

Domestic Partners

- Advanced Institute for Materials Research (AIMR), Tohoku University
- Exploratory Oncology Research & Clinical Trial Center (EPOC), National Cancer Center
- Graduate School of Medicine, Nagoya University
- Faculty of Medicine, Kindai University
- Institute of Biomedical Research and Innovation (IBRI), Foundation for Biomedical Research and Innovation
- Institute of Advanced Medical Sciences (IAMS), Tokushima University
- Kyushu University Hospital

Satellite (ASHBi)

- Research Center for Animal Life Science, Shiga University of Medical Science (RCALS)



Facilities

● **KUIAS Main Building** [Approx. 4,000 m² of floor space]

The Main Building bears the headquarter functions of KUIAS. In addition to laboratories and collaborative research spaces, the building has a seminar hall, a lounge for informal gatherings of researchers, and an exhibition room which can also be used for meetings.



KUIAS Main Building

● **KUIAS West Building** [Approx. 550 m² of floor space]

The West Building mainly serves as the laboratory and office of faculty members and researchers of the Center for Advanced Study of KUIAS. To facilitate exchanges among researchers, the building is also equipped with a meeting room and other shared spaces.



KUIAS West Building

● **KUIAS iCeMS Research Building**

● Research Building No.1 / Project Lab

● Research Building No.1 Annex [Approx. 6,000 m² of floor space]

Researchers from different groups collaborate with each other in extensive shared laboratory and office spaces to advance cross-disciplinary research.



KUIAS iCeMS Research Building

● **AIST-Kyoto University Chemical Energy Materials Open Innovation Laboratory (ChEM-OIL)** (in International Science Innovation Building)

[Approx. 165 m² of floor space]

ChEM-OIL is a collaborative research center of Kyoto University and the National Institute of Advanced Industrial Science and Technology (AIST). Focusing on pioneering energy conversion/storage techniques based on novel materials and concepts, ChEM-OIL acts as a bridge between industry and academia to accelerate commercialization of next-generation chemical materials and technologies for energy issues.

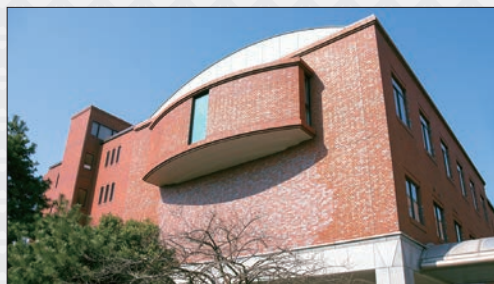


AIST-Kyoto University Chemical Energy Materials Open Innovation Laboratory (ChEM-OIL)

● **Faculty of Medicine Building B** **Institute for the Advanced Study of Human Biology**

[Approx. 1,500 m² of floor space]

In addition to laboratories for young PIs and overseas PIs, the building is equipped with the single-cell genome information analysis core and common laboratories, as well as open office spaces and community spaces to advance cross-disciplinary research.



Faculty of Medicine Building B
Institute for the Advanced Study of Human Biology



- **KUIAS Main Building**
- **KUIAS West Building**

Yoshida Ushinomiya-cho, Sakyo-ku, Kyoto
One-minute walk from "Kyodai Seimon-mae" Stop
(Kyoto City Bus)

- **KUIAS iCeMS Research Building**

- Research Building No.1 / Project Lab
- Research Building No.1 Annex

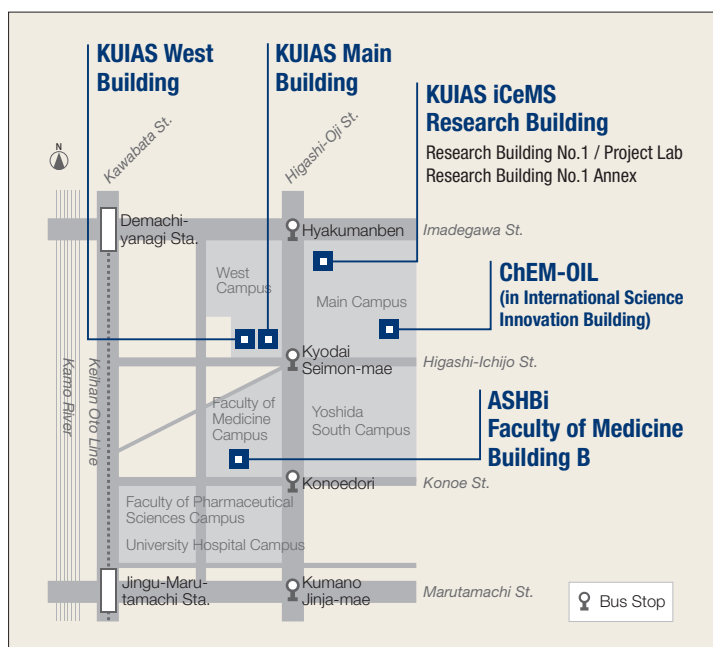
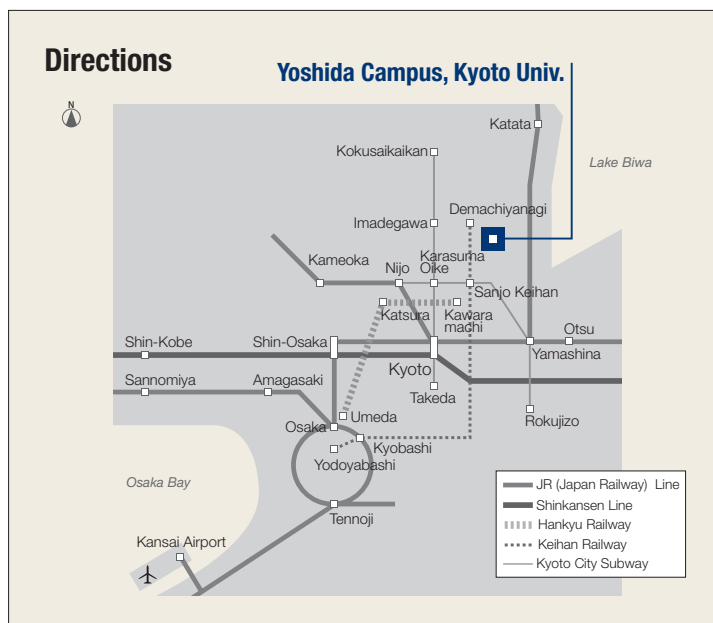
Yoshida Honmachi, Sakyo-ku, Kyoto
One-minute walk from "Hyakumanben" Stop
(Kyoto City Bus)

- **AIST-Kyoto University Chemical Energy Materials Open Innovation Laboratory (ChEM-OIL)**

Yoshida Honmachi, Sakyo-ku, Kyoto
Five-minute walk from "Kyodai Seimon-mae" Stop
(Kyoto City Bus)

- **Faculty of Medicine Building B**
Institute for the Advanced Study of Human Biology (ASHBi)

Yoshida Konoe-cho, Sakyo-ku, Kyoto
Five-minute walk from "Konoedori" Stop
(Kyoto City Bus)



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