（Attachment 1）

World Premier International Research Center Initiative (WPI)
Selected Projects

Host institution	Center name	Prospective center director
University of Tsukuba	International Institute for Integrative Sleep Medicine	Masashi Yanagisawa (Professor and Director, Cnter for Behavioral Molecular Genetics)
Tokyo Institute of Technology	Earth-Life Science Institute	Kei Hirose (Professor, Graduate School of Science and Engineering, Tokyo Institute of Technology)
Nagoya University	Institute of Transformative Bio-Molecules	Kenichiro Itami (Professor, Department of Chemistry, Graduate School of Science, Nagoya University)

Outline of Selected Projects

Host institution	University of Tsukuba
Center name	International Institute for Integrative Sleep Medicine
Head of host institution	Nobuhiro Yamada
Chief center-project officer	Masashi Yanagisawa
Prospective center director	Masashi Yanagisawa

＜Project Summary＞

Sleep is a remarkably universal phenomenon in the higher animal species, and its disturbances reduce mental and physical wellbeing. However, the function of sleep and the mechanism for sleep regulation still remain unknown; these questions are among the most important challenges in modern neuroscience. The proposed research center will gather the world prominent scientists from multiple research fields contributing to the neurobiology of sleep. We will aim at elucidating the fundamental mechanism of sleep/wake regulation by combining the cutting-edge methodologies of neurobiology, molecular genetics and physiology. We will induce the fusion of medicine, chemistry, pharmacology and biology in order to reveal the pathophysiology of sleep disorders and related diseases, and to develop methods for their treatment and prevention. Through these research efforts, we will strive to reduce sleep disorders and associated diseases, and to contribute to an improvement of physical and mental health in today's aging society with a dwindling birthrate.

The mission of this WPI Center is to be a multidisciplinary, international hub for the research to elucidate the fundamental mechanism of sleep/wakefulness, to develop strategies to regulate sleep, and to contribute to enhancement of world health through the combat with sleep disorders and associated diseases.

Target research field

Sleep biomedicine

Sleep biomedicine, as defined here, is an inherently interdisciplinary field in terms of methodology, spanning molecular genetics, cellular biology, neurophysiology, neurochemistry, pharmaceutical sciences, medicinal chemistry, and clinical and social medicine. While focusing on sleep, the field is also interdisciplinary with respect to its integral research targets, e.g., studying mood disorders as well as metabolic diseases that are closely associated with pathological variations in sleep/wake states.

＜Remarks＞

Sleep disorder is a major medical and social problem in today's developed countries. Progress in this area has excellent potential for positive societal impact. It can attract interest from general public as well as specialists.

There is a distinctive approach to an important set of basic research problems. Genetic approach that the center is intending seems to be one of the promising ones. It can be the first sleep research center in Japan.

The prospective center director is well recognized internationally, and able to bring back practices that can be transformative to the host institution.

University of Tsukuba
筑波大学

International Institute for Integrative Sleep Medicine

wpi

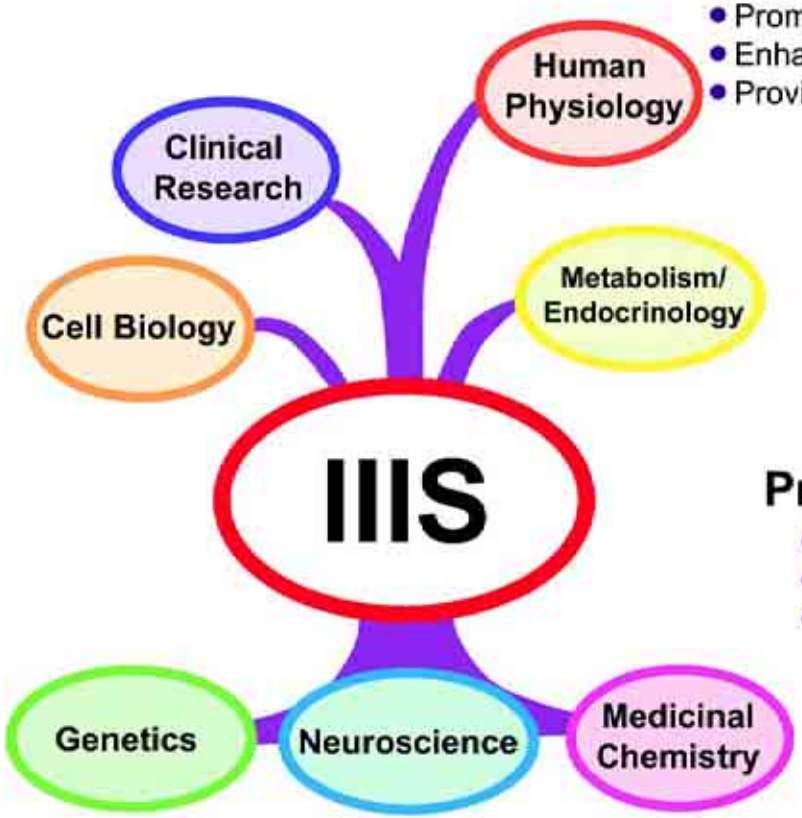
Missions

- Solve the mysteries of sleep
- Develop novel approaches for sleep disorders
- Contribute to global health

Under strong leadership of Center Director

New means of sleep intervention and medication based on discoveries in basic reseach

- Produce natural sleep
- Promote activity during waking hours
- Enhance mood stability
- Provide resistance to obesity

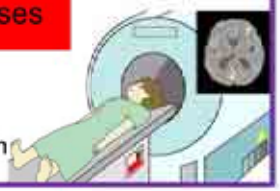


Promote health in aging society

- Support healthy and positive aging
- Reduce medical and nursing cost
- Promote a society that young people can have hope for the future

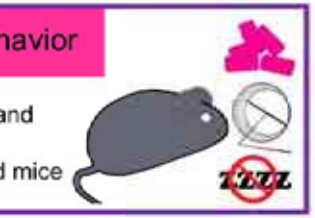
Human health and diseases

Integrative clinical approaches to sleep, mood and metabolic disorders based on basic research



Multiple aspects of behavior

Examine how sleep, exercise and nutrition are interacted and integrated using gene-modified mice

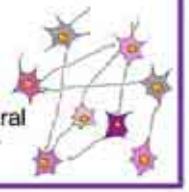


Multiple organ network

Examine how brain interacts with peripheral tissues to regulate the systemic metabolism during sleep-wake cycle

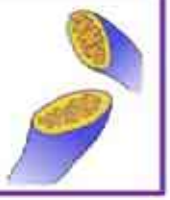
Neural network

Optogenetic approach to visualize and manipulate neural circuits to elucidate neural substrates for sleep-wakefulness behavior



Intracellular systems

Examine the role of adenosine metabolism, signal transduction and mitochondrial activity in sleep-wakefulness behavior



Genes and Proteins

Identify novel genes regulating sleep-wakefulness behaviors using a forward genetic approach

Name: Masashi Yanagisawa, M.D., Ph.D.
Affiliation: University of Tsukuba
Title: Professor
Research field: Molecular pharmacology, Neuroscience

Education:

1985	M.D. (summa cum laude), University of Tsukuba
1988	Ph.D. in Medical Sciences, University of Tsukuba

Professional Appointments:

1989-1991	Assistant Professor of Pharmacology, University of Tsukuba
1991-1991	Assistant Professor of Pharmacology, Kyoto University School of Medicine
1991-1996	Associate Professor of Molecular Genetics, University of Texas Southwestern Medical Center Associate Investigator, Howard Hughes Medical Institute
1996-Present	Professor of Molecular Genetics, University of Texas Southwestern Medical Center Investigator, Howard Hughes Medical Institute
1998-Present	The Patrick E. Haggerty Distinguished Chair in Basic Biomedical Science, UTSWMC
2001-2007	Director, Exploratory Research for Advanced Technology (ERATO)
2010-2014	Professor and Director, University of Tsukuba, Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST Program)
2012-	Center Director, World Premier International Research Center Initiative (WPI)

Honors/Awards:

- Tsukuba Award, The Science and Technology Promotion Foundation of Ibaraki
- The Donald Seldin Award, International Society or Nephrology
- Jokichi Takamine Award, The Soceity of Cardiovasucular Endocrinology and Metabolism
- The J. J. Abel Award, American Society of Pharmacology and Experimental Therapeutics
- Medical Research Award, Robert J. and Claire Pasarow Foundation
- The Novartis Award, American Heart Association
- The Amgen Award, American Society of Biochemistry and Molecular Biology
- Gold Medal Tokyo Techno-Forum Award
- The Tsukahara Memorial Award, The Brain Science Foundation
- Bristol-Myers Squibb Achievement Award in Cardiovascular Research
- Outstanding Scientific Achievement Award, Sleep Research Society

Publications:

Sakurai, T., Amemiya, A., Ishii, M., Matsuzaki, I., Chemelli, R. M., Tanaka, H., Williams, S. C., Richardson, J. A., Kozlowski, G. P., Wilson, S., Arch, J. R. S., Buckingham, R. E., Haynes, A. C., Carr, S. A., Annan, R. S., McNulty, D. E., Liu, W.-S., Terrett, J. A., Elshourbagy, N. A., Bergsma, D. J. & Yanagisawa, M. Orexins and orexin receptors: A family of hypothalamic neuropeptides and G protein-coupled receptors that regulate feeding behavior. Cell 92: 573-585, 1998.

Chemelli, R. M., Willie, J. T., Sinton, C. M., Elmquist, J. K., Scammell, T., Lee, C., Richardson, J. A., Williams, S. C., Xiong, Y., Kisanuki, Y., Fitch, T. E., Nakazato, M., Hammer, R. E., Saper, C. B. & Yanagisawa, M. Narcolepsy in orexin knockout mice: Molecular genetics of sleep regulation. Cell 98: 437-451, 1999.

Sakurai, T., Nagata, R., Yamanaka, A., Kawamura, H., Tsujino, N., Muraki, Y., Kageyama, H., Kunita, S., Takahashi, S., Goto, K., Koyama, Y., Shioda, S. & Yanagisawa, M. Input of orexin/hypocretin neurons revealed by a genetically encoded tracer in mice. Neuron 46: 297-308, 2005.

Funato, H., Tsai, A.L., Willie, J.T., Kisanuki, Y., Williams, S.C., Sakurai, T. & Yanagisawa, M. Enhanced orexin receptor 2 signaling prevents diet-induced obesity and improves leptin sensitivity. Cell Metabolism 9:64-76, 2009.

Outline of Selected Projects

Host institution	Tokyo Institute of Technology
Center name	Earth-Life Science Institute
Head of host institution	Yoshinao Mishima
Chief center-project officer	Kei Hirose
Prospective center director	Kei Hirose

＜Project Summary＞

ELSI aims to answer the fundamental question "when and where did life originate and how did it evolve?" This question, which originated with the Greek philosophers, has been one of the most important topics of natural science. We will focus our research on addressing the formation and early history of the Earth and its unique environments that gave birth to life and their subsequent changes, with the main aim to study the origin and early evolution of life and persistent ecological systems in their geological context. We will also approach the primordial environment of the Earth through explorations of deep-sea microbial ecosystems and extraterrestrial primitive asteroids. In addition, we will critically examine the universality of these processes, to determine the uniqueness of our planet, with implications for the search for extraterrestrial life, both in the solar system and beyond.

So far, discussions about the origin of life on Earth have been mostly limited to the biochemistry of proto-life forms. While the Earth environment has been described as a “cradle of life”, the image of a “cradle” points to a supporting background role, rather than a dynamic interplay. In ELSI, we want to radically broaden these discussions by focusing equally strongly on both sides of Earth and Life. For one thing, life is preserved through a continuous exchange of matter and energy with the surrounding environment. For another, it is a two-way interaction: as soon as life forms are present, they start to influence the environment, just as the environment is influencing life. Our basic outlook is reflected in the name of our proposed center: ELSI stands for Earth-Life Science Institute, in which Earth sciences and Life sciences will be equally represented.

Target research field

Interdisciplinary Research on Solid-Earth Science, Planetary Science, Geology, Environmental Biology, and Microbial Genome Science

＜Remarks＞

A very fundamental research topic addressing “How did life originate?” based on the understanding of the early earth, which can attract interest from the public.

The prospective center director is a young, visionary and strong leader with impressive track record. Excellent researchers outside Tokyo Tech are going to join.

The proposal to bring in the interdisciplinary orientation technique from Princeton is strong. The collaborations at Princeton and Harvard add strength and may help to attract talents.

Tokyo Institute of Technology

Earth-Life Science Institute

Exploring the Origins of Earth and Life

ELSI

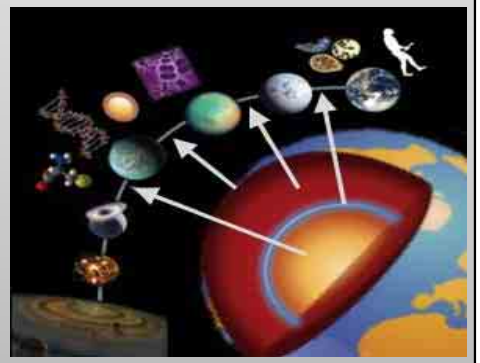
Director:
Kei Hirose

Kei is a discoverer of post-perovskite, a principal mineral in the Earth's lowermost mantle. Also, he and his colleagues first created the conditions at the center of the Earth in the laboratory. His recent research explores the formation and evolution of the Earth's core and its role in modulating the surface environments.

■Research Objectives

The research at ELSI has the grand aims of exploring "the origin of the Earth" and "the origin of life", both of which are fundamental questions to humankind. They are inseparable topics, because nature of the first life should have been strongly controlled by surrounding environments. Similarly we will also examine the evolution of life in the context of the evolution of the Earth.

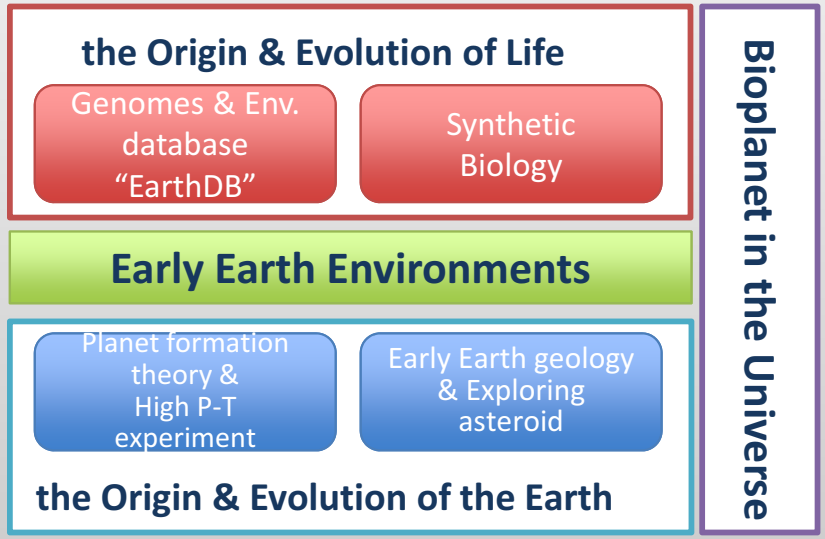
- What were the environments at the beginning of the Earth's history?
- When and where did the primordial ecological system originate?
- How did the Earth and the Universe affect the evolution of life?
- How unique is our planet?



■Research Specialty

- Daily internal communications will follow the model of Institute for Advanced Study, Princeton, US (ELSI Satellite).
- We will promote interdisciplinary research.
- Young researchers will be directly supervised by the Director. We provide maximum opportunities for young scientists.

■Outline of Research



We will focus equally on both sides of Earth and life, because the early Earth environment is the key to better understand "the origin of life on Earth". The evolution of the solid Earth should have changed the surface environments and evolved the life as well.

■Satellites

- Ehime University
- Institute for Advanced Study, Princeton
- Harvard University

Center director

October 30, 2012

Name: Kei Hirose

Date of birth: February 9, 1968 (44 years)

Title: Professor, Ph.D.

Affiliation: Graduate school of Science and Engineering,
Department of Earth and Planetary Sciences,
Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro-ku, Tokyo 152-8551 Japan

Education:

1990	B.Sc., The University of Tokyo
1994	Ph.D., The University of Tokyo

Professional Career:

1994	Post-Doctoral Fellow, The University of Tokyo
1995-2000	Assistant Professor, Faculty of Science, Department of Earth and Planetary Sciences, Tokyo Institute of Technology
1996-1998	Visiting Scientist, Geophysical Laboratory, Carnegie Institution of Washington
2000-2005	Associate Professor, Graduate School of Science and Engineering, Department of Earth and Planetary Sciences, Tokyo Institute of Technology
2006-present	Professor, Graduate School of Science and Engineering, Department of Earth and Planetary Sciences, Tokyo Institute of Technology

Major research fields:

1992-	Experimental petrology on the genesis of basaltic magmas in the upper mantle
1996-	Experiments on ultrahigh-pressure mineral physics and petrology on lower mantle materials
2000-	Synchrotron XRD study on deep mantle phase transitions
2005-	Ultrahigh-pressure and -temperature experiments on core materials

Award:

2006	Inoue Prize for Science
2007	IBM Japan Science Prize
2007	Thomson Scientific Research Front Award
2008	JSPS Prize
2011	Science Innovation Award – Ringwood Medal from the European Association of Geochemistry
2011	Japan Academy Award

Outline of Selected Projects

Host institution	Nagoya University
Center name	Institute of Transformative Bio-Molecules
Head of host institution	Michinari Hamaguchi
Chief center-project officer	Kenichiro Itami
Prospective center director	Kenichiro Itami

＜Project Summary＞

Our goal is to develop innovative functional molecules that make a marked change in the form and nature of biological science and technology by taking full advantage of the cutting-edge molecular synthesis expertise of our chemistry principal investigators (PIs) and intense interactions with our leading plant/animal biology PIs. Through this interaction, which is fundamental to the Center, transformative bio-molecules will be synthesized that can (1) **enhance biotic productivity and quality** and (2) **realize innovative bio-imaging**. To ensure the advancement of these projects, we will (3) **develop catalysts that enable incredibly efficient synthesis and molecule activation on demand**. The ultimate goal is to have a positive impact on global issues such as food production. Our team of PIs is an innovative mix of chemists and biologists from Japan and abroad. A Co-PI system, and an efficient administration with English will ensure that international members will have significant involvement in the project.

The mission of the Center is to develop diverse functional molecules that afford innovative impact on the operating principle of the biological systems. To accomplish this, we will harness our synthetic abilities based on molecule-activation chemistry. We seek to effect a paradigm shift in science by creating a new field of research that aims to implement programmed chemical transformations in vivo for precisely controlling the production of bio-functional molecules of requisite structures and their functional expressions. The identity of this Center resides in the development of brand new bio-molecules that will affect this goal. To accomplish this, we will enlist the best synthetic chemists and plant and animal biologists worldwide.

Target research field

Molecule-Activation Chemistry for Advanced Systems Biology (This is an area in which Nagoya University has significant international competitive advantages: synthetic chemistry, molecular catalysis, systems biology, plant science, peptide science, live-cell imaging.)

＜Remarks＞

A very ambitious mission with high return if successful, to construct a new interdisciplinary field between chemistry and biology. The targets, future food, bio-mass, and others are major interests of society.

A fresh group of young investigators of different disciplines who already performed interesting and high quality researches. The director is a young and visionary leader, talented to lead a new domain of research.

The support of Nagoya University is well designed. The proposed new building is the strength.

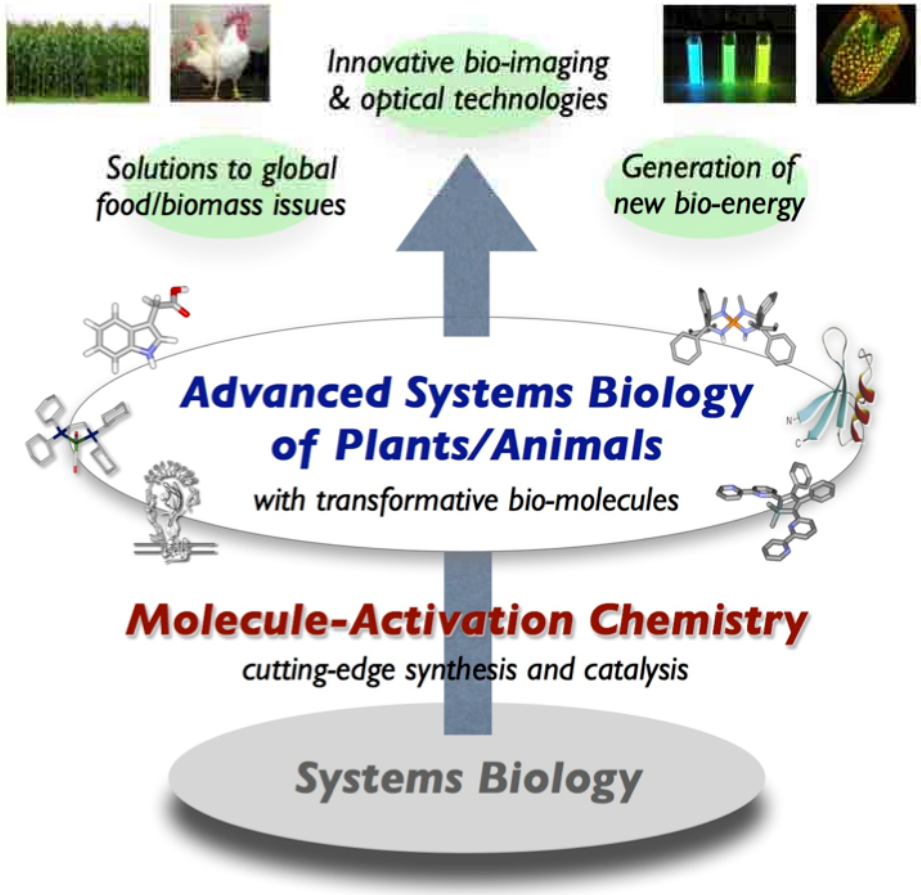
Institute of Transformative Bio-Molecules (Nagoya University)

OUR GOAL is to develop "**transformative bio-molecules**", innovative functional molecules that make a marked change in the form and nature of biological science and technology.

OUR UNIQUE APPROACH is to apply our **cutting-edge synthesis** (molecule-activation chemistry), with the support of computational chemistry, to synthesize key molecules to explore **advanced systems biology in plants and animals**.

THE IDENTITY of the Center is its capability to **synthesize** completely new bio-functional molecules with carefully **designed** functions.

EXPECTED OUTCOME: Our campaign will culminate in a wealth of **synthetic bio-molecules** that will be key to solving urgent problems at the interface of chemistry and biology. The innovation in food/biomass production, optical technologies, and generation of new bio-energy can be imagined as our dream.



Center Director

Kenichiro Itami

Professor
Department of Chemistry, Graduate School of Science,
Nagoya University, Japan
Website: http://synth.chem.nagoya-u.ac.jp

BORN

April 4, 1971 (41)

CAREER

1990~1994	**B.S.**, Kyoto University (with Prof. Hisanobu Ogoshi)
1994~1996	**M.S.**, Kyoto University (with Prof. Yoshihiko Ito)
1996~1998	**Ph.D.**, Kyoto University (with Prof. Yoshihiko Ito)
1996~1998	JSPS Research Fellowship for Young Scientists
1997~1998	Exchange Student, Uppsala University, Sweden (with Prof. Jan-E. Bäckvall)
1998~2005	**Assistant Professor**, Kyoto University (with Prof. Jun-ichi Yoshida)
2005~2008	**Associate Professor**, Nagoya University (with Prof. Ryoji Noyori)
2005~2009	**PRESTO Researcher**, Japan Science and Technology Agency
2008~present	**Full Professor**, Nagoya University

AWARDS & HONORS

2013	Novartis Chemistry Lectureship Award
2013	Mukaiyama Award
2012	Fellow of the Royal Society of Chemistry, UK
2012	German Innovation Award "Gottfried Wagener Prize 2012"
2012	Novartis-MIT Lectureship Award, MIT, USA
2011	ACP Lectureship Award, China
2011	ACP Lectureship Award, Malaysia
2011	Nozoe Memorial Award for Young Organic Chemists
2011	Distinguished Professor of Wuhan University, China
2008	Merck-Banyu Lectureship Award
2007	Banyu Young Chemist Award
2006	Minister Award for Distinguished Young Scientists (MEXT)
2005	Mitsui Chemicals Catalysis Science Award of Encouragement
2005	The Chemical Society of Japan Award for Distinguished Young Chemists
2004	Thieme Journals Award
2000	Nissan Chemical Industries Award in Synthetic Organic Chemistry, Japan

EDITORIAL BOARD

2008~present	*Canadian Journal of Chemistry* (Advisory Board)
2011~present	*Organic & Biomolecular Chemistry*, RSC (Editorial Board)
2012~present	*Beilstein Journal of Organic Chemistry* (Associate Editor)
2012~present	*ChemCatChem* (International Advisory Board)

Specialties: Chemistry, Synthetic Chemistry, Catalysis, Pharmaceutical Science, Nanocarbon Chemistry
Publication Records: 155 papers, h-index 37, m-index 2.1
Plenary and Invited Lectures: 125 lectures during the last 6 years (64 English, 61 Japanese)
Research Highlight in TV, Radio, Newspapers, and Journals: >70 times during the last 5 years