



ICR

Institute for Chemical Research
Kyoto University

2015

Preface



Director
TOKITOH, Norihiro

The Institute for Chemical Research (ICR), launched in 1926 as the first research institute at Kyoto University, will celebrate its 90th anniversary in 2016, however, its factual roots date back to 1915 (Specialized Center for Chemical Research founded at Kyoto Imperial University, College of Science for the study of special medicinal substance, "Salvarsan," that is, arsphenamine, and so on). Our founding vision was to "Excel in the Investigation of Basic Principles of Chemistry and Their Applications." Since then, the ICR has continuously produced outstanding research achievements. Now, we have reached the current large-scale organization of five research divisions: Synthetic Chemistry, Materials Chemistry, Biochemistry, Environmental Chemistry, and Multidisciplinary Chemistry, and three research centers: Advanced Research Center for Beam Science, International Research Center for Elements Science (IRCELS), and Bioinformatics Center. Currently, about 120 faculty members, 210 graduate students, and 60 researchers are engaged in research activities in 30 laboratories in total supervised by full-time professors. Furthermore, we have 5 laboratories supervised by visiting professors.

The research in the ICR encompasses the fields of chemistry, physics, biology, and informatics. The chemical studies core covers fields including physical chemistry, inorganic chemistry, organic chemistry, materials chemistry, and biochemistry. The graduate schools to which our laboratories belong as cooperative ones accepting graduate students cover diverse fields of science, engineering, agriculture, pharmaceutical sciences, medicine, informatics, and human/environmental studies. These laboratories are spearheading leading-edge research, and yielding outstanding results in their own and correlated research areas. The legacy of our founding philosophy above continues to the present day and describes the essence of our research activities. With this vision in mind, we have entrusted our scientists to choose and pursue research topics at the forefront of advanced chemistry with bottom-up paradigms. Whether or not the human race maintains sustained growth is a key issue of this century.

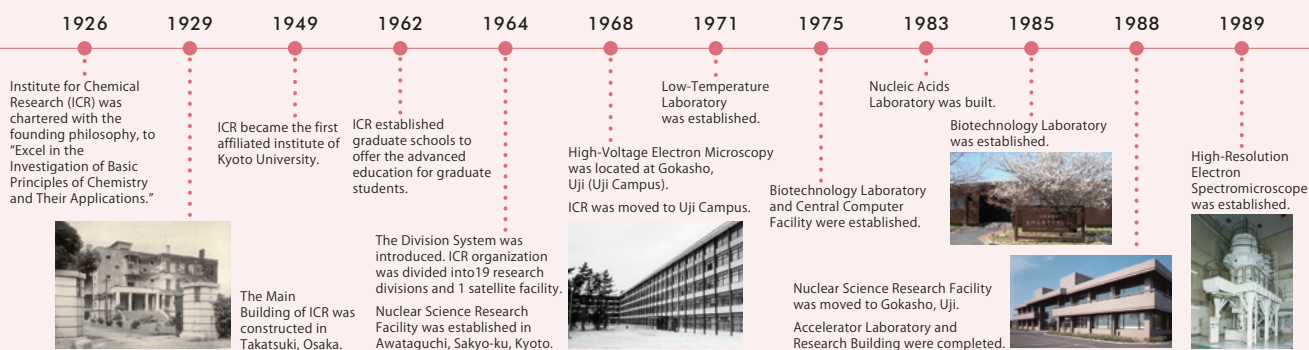
Moreover, we must facilitate the recovery and reconstruction of Japan with bearing in mind the Great East Japan Earthquake in 2011 and a variety of difficult challenges it

faces. Hence, the ICR encourages its members to be actively involved in research projects with bottom-up approach in mind, and to value the development of unique interdisciplinary research projects, in order to create new knowledge as well as to contribute to the future of our society in materials-related fields. Actually, one of our major issues in hand is creation and development of bio-inspired smart materials from the view point of not only academic interests but also a policy aimed at fabricating a sustainable society, as they will fulfill highly efficient respective functions enabling reduction of the effects/loads on the environment and so on. The Institute for Chemical Research collaborates with the Research Institute for Sustainable Humanosphere and the Institute of Advanced Energy to start the MEXT-supported joint research project on the bio-inspired smart materials as of April 1, 2015.

Besides, the ICR is currently collaborating with domestic/oversea universities and research organizations (with about 65 official international collaboration agreements) and is functioning as a Joint Usage/Research Center proclaiming the Frontier/Interdisciplinary Research Core for Deepening Investigation and Promoting Cooperation in Chemistry-Oriented Fields supported by MEXT (2010-2016); its activity received high commendation on the interim assessment last year. In addition, the ICR, IRCELS in particular, is making a significant contribution to the MEXT Project of Integrated Research on Chemical Synthesis (2010-2016) as one of the key members of core research institutions from four Japanese national universities. Further, we also fully strive to foster and secure of young researchers through these activities as well as the graduate education mentioned above. For instance, last year we restarted an in-house annual grant system named "ICR Grant for Promoting Integrated Research." The strong collaboration basis so far constructed in-house and also with of ensures the ICR serves as the core of global research propellers in chemistry-oriented fields. Finally, we would appreciate your continued encouragement and support.

History

For about 90 years of its history, ICR has continued the challenge to uncover the basis of chemistry and answer the frontier quests.

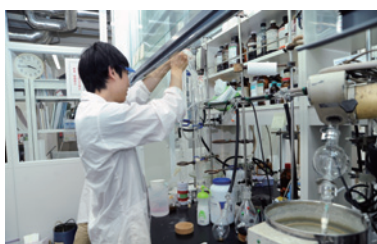


Our Mission

The founding philosophy of the Institute for Chemical Research is to “Excel in the Investigation of Basic Principles of Chemistry and Their Applications.” Research is grounded on the core values of freedom, independence, and harmony. As a key part of Kyoto University, the institute is committed to contributing to the harmonious development of the global community by solving fundamental chemical issues.

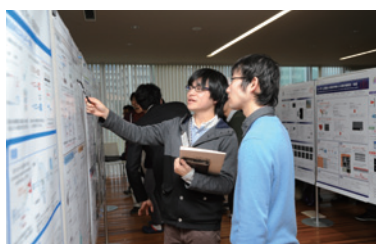
Research

We regard chemistry as a broad area of the natural sciences, and strive for balanced development: the platform of basic research into the true nature of matter serves as a foothold for more applied studies that strive to be flexible and responsive to the challenges of our global society.



Education

Through research in an integrated environment of world-class laboratories, we aim to train and develop talented people with broad experience and a high level of problem solving skills, capable of providing leadership towards the harmonious development of the global community.

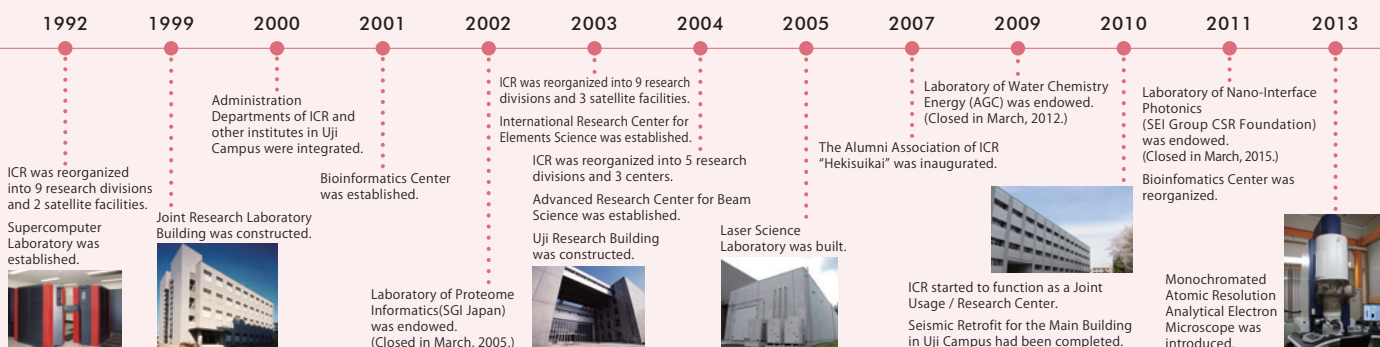
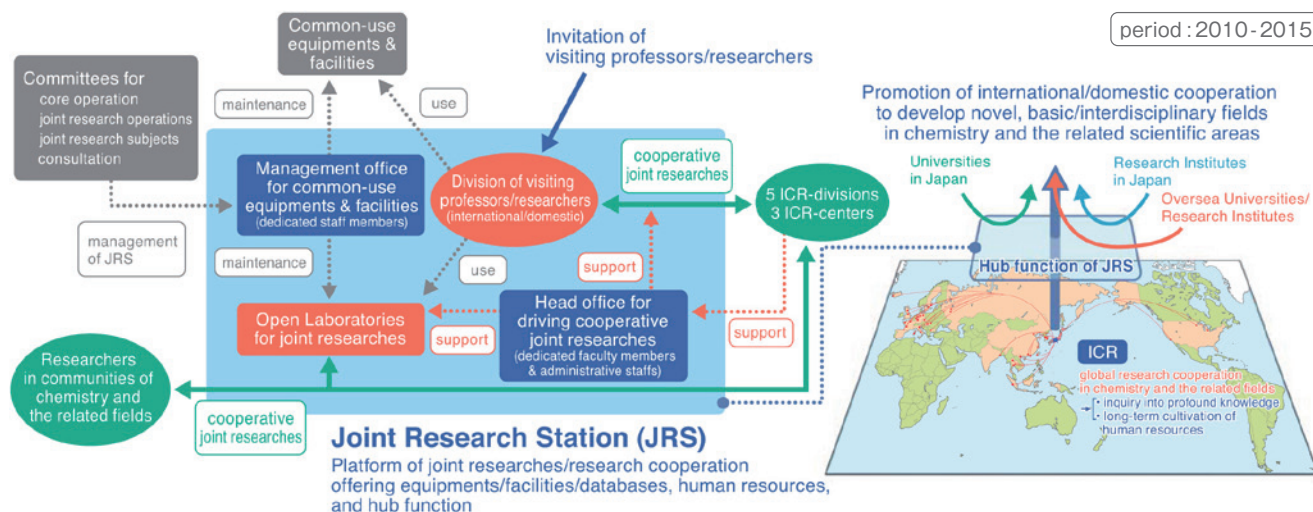


Relationship with Society

As researchers and educators of chemistry, we endeavor to deepen our exchanges with local communities and the Japanese society. We envision contributing to solving global problems through active scientific exchange with international researchers and institutions. Lastly, we commit to our accountability to society through internal review and information disclosure.



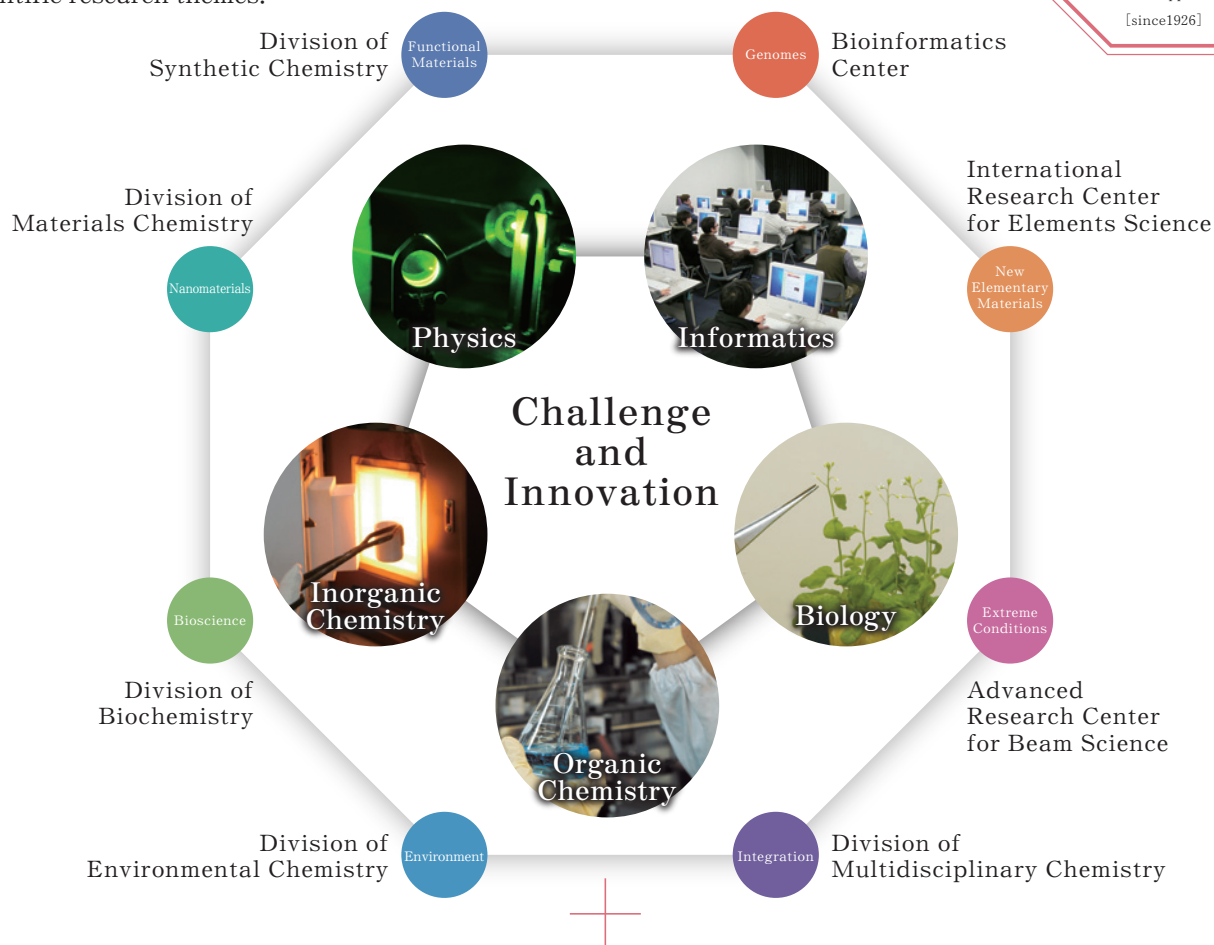
Frontier/Interdisciplinary Research Core in ICR for Deepening Investigation and Promoting Cooperation in Chemistry-Oriented Fields



Research

ICR is located in the Uji Campus of Kyoto University.

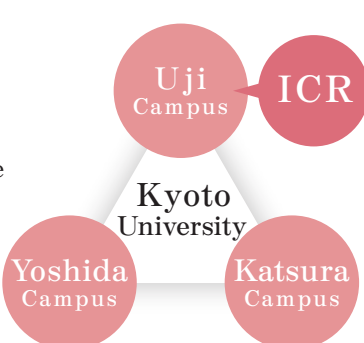
30 Laboratories constitute the system of “5 Research Divisions and 3 Research Centers” and more than 100 faculty and many researchers are engaged in various scientific research themes.



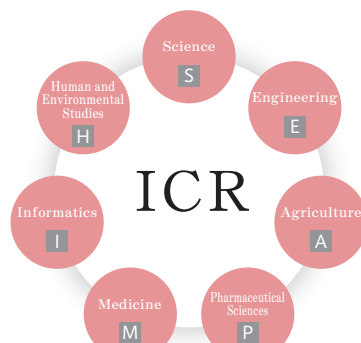
- Group of Competent Researchers
- Developing New Fields Based on Merits
- Pluralistic Contribution to Researchers' Communities
- On-demand Creation and Precise Analysis of Supereminent Functional Materials
- Chemistry-affiliated Multidisciplinary Collaboration
- Cultivation of Research Personnel in Charge of the Next Generation

Education

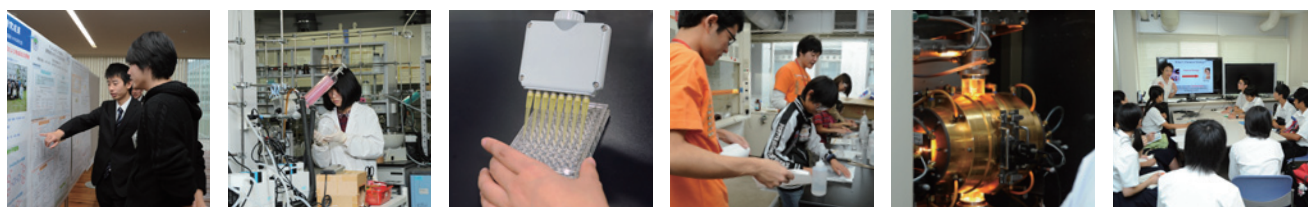
Every laboratory in ICR is affiliated with one of the Graduate Schools and has contributions to education.



3 Campuses of Kyoto University



Education in the Graduate Schools



Functional Materials

Division of Synthetic Chemistry

Research is conducted for the creation of "Novel Materials" for clarification of their structures, functions, and properties irrespective of disciplines of organic and inorganic chemistry.

Original research is conducted in individual laboratories across scientific disciplines toward the creation of novel materials beyond common concepts. Clarification of the structure and intrinsic properties of novel materials have impact in many scientific fields including material science, synthetic organic and inorganic chemistry.

Organoelement Chemistry S

Prof.
TOKITOH, Norihiro (D Sc)
Assoc. Prof.
SASAMORI, Takahiro (D Sc)
Assist. Prof.
MIZUHATA, Yoshiyuki (D Sc)
Assist. Prof.
AGOU, Tomohiro (D Sc)
Techn. Staff
HIRANO, Toshiko



Structural Organic Chemistry E

Prof.
MURATA, Yasujiro (D Eng)
Assoc. Prof.
WAKAMIYA, Atsushi (D Eng)
Assist. Prof.
MURATA, Michihisa (D Eng)



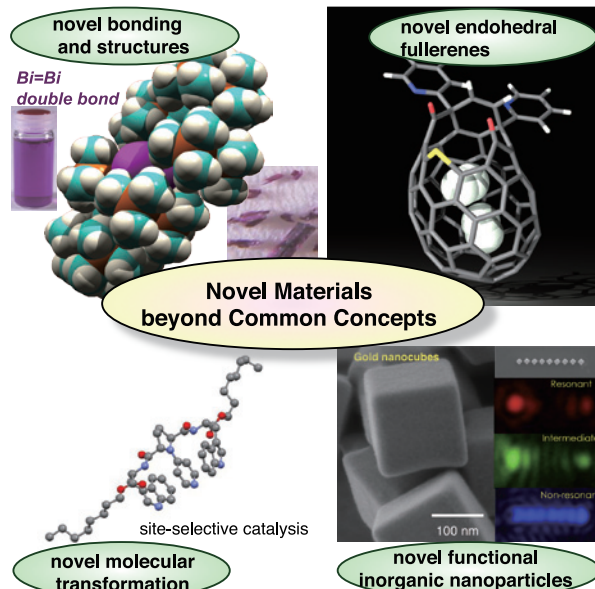
Synthetic Organic Chemistry P

Prof.
KAWABATA, Takeo (D Pharm Sc)
Assoc. Prof.
FURUTA, Takumi (D Pharm Sc)
Assist. Prof.
YOSHIMURA, Tomoyuki (D Pharm Sc)
Program-Specific Assist. Prof.
UEDA, Yoshihiro (D Pharm Sc)
Techn. Staff
FUJIIHASHI, Akiko



Advanced Inorganic Synthesis S

Prof.
TERANISHI, Toshiharu (D Eng)
Assist. Prof.
SAKAMOTO, Masanori (D Eng)
Assist. Prof.
SATO, Ryota (D Sc)
Program-Specific Assist. Prof.
SARUYAMA, Masaki (D Sc)
Program-Specific Assist. Prof.
TRINH, Thang Thuy (D Materials Science)



Nanomaterials

Division of Materials Chemistry

Creation of new functional materials for next generation by hybridization, conjugation, and integration of different materials and by nano-miniaturization.

The aim of this research area is to develop a controlled synthetic method for nano-sized macromolecules. Novel precision fabrication of polymeric materials are also investigated. This area also emphasizes the creation and development of new functional materials by controlling electronic, photonic, and spin states through hybridization of organic-inorganic materials, creation of novel surfaces with high-density polymer brushes, development of nano-fabrication of artificial multi-layers, and the utilization of size- and quantum effects.

Chemistry of Polymer Materials E

Prof.
TSUJII, Yoshinobu (D Eng)
Assoc. Prof.
OHNO, Kohji (D Eng)
Assist. Prof.
SAKAKIBARA, Keita (D Agr)



Polymer Controlled Synthesis E

Prof.
YAMAGO, Shigeru (D Sc)
Assoc. Prof.
TOSAKA, Masatoshi (D Eng)
Assist. Prof.
KAYAHARA, Eiichi (D Eng)
Program-Specific Assoc. Prof.
NAKAMURA, Yasuyuki (D Sc)
Program-Specific Assist. Prof.
HASHIMOTO, Sigma (D Eng)

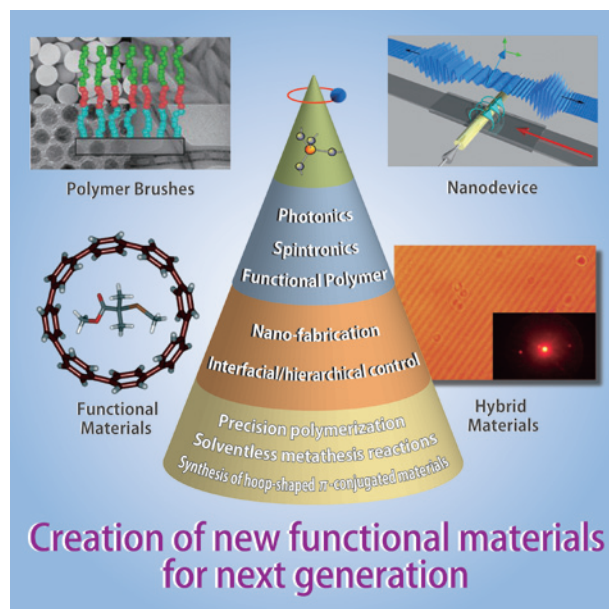


Inorganic Photonics Materials E

Assoc. Prof.
TOKUDA, Yomei (D Eng)
Assist. Prof.
MASAI, Hirokazu (D Eng)

Nanospintronics S

Prof.
ONO, Teruo (D Sc)
Assist. Prof.
MORIYAMA, Takahiro (Ph D)
Assist. Prof.
KIM, Kab-Jin (Ph D)
Techn. Staff
KUSUDA, Toshiyuki



Bioscience

Division of Biochemistry

Biology meets Chemistry; this division elucidates the mechanisms behind intra-/inter-cellular recognition, stimuli response, and biomolecular synthesis in living organisms, leading to the development of pioneering novel materials.

The goals of this division are (i) Design and creation of bioactive peptides/proteins controlling cellular and gene functions, (ii) Chemical understanding of the reaction mechanisms and physiological significance of biocatalysts, (iii) Unveiling the framework of regulatory network between genetic programs and environmental stimulus responses in higher plants, and (iv) Discovery of new bioactive organic molecules and their new use.

Biofunctional Design-Chemistry P

Prof.
FUTAKI, Shiroh (D Pharm Sc)
Assist. Prof.
IMANISHI, Miki (D Pharm Sc)
Assist. Prof.
TAKEUCHI, Toshihide (D Pharm Sc)



Chemistry of Molecular Biocatalysts A

Prof.
HIRATAKE, Jun (D Agr)
Assist. Prof.
WATANABE, Bunta (D Agr)



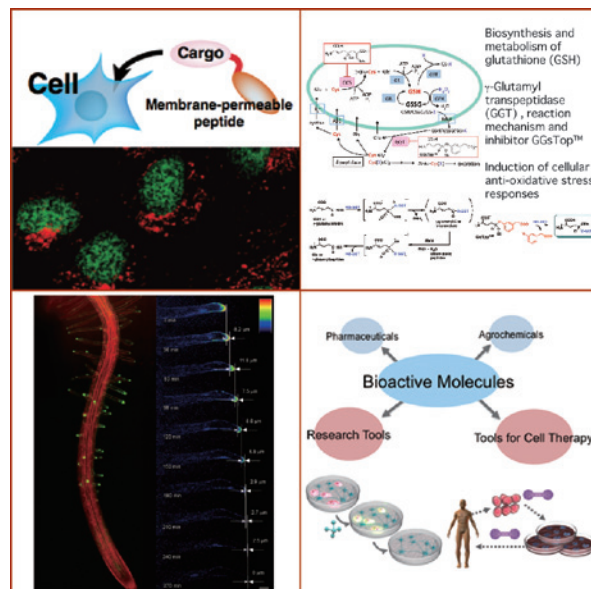
Molecular Biology S

Prof.
AOYAMA, Takashi (D Sc)
Assoc. Prof.
TSUGE, Tomohiko (D Sc)
Assist. Prof.
KATO, Mariko (D Agr)
Techn. Staff
YASUDA, Keiko



Chemical Biology M

Prof.
UESUGI, Motonari (D Pharm Sc)
Assoc. Prof.
OHKANDA, Junko (D Eng)
Senior Lect.
PERRON, Amelie (Ph D)
Assist. Prof.
WATANABE, Mizuki (D Pharm Sc)



Environment

Division of Environmental Chemistry

This research group aims to contribute to the development of a sustainable society through fundamental studies such as fabrication and characterization of environmentally-friendly organic devices, biogeochemistry in the hydrosphere, and biotechnology of enzymes and microorganisms.

The main research subjects are as follows: (1) Design and fabrication of novel organic LEDs and organic solar-cells. Clarification of relationship between structure and performance of the devices by solid-state NMR. (2) Biogeochemistry of trace elements in the hydrosphere, ion recognition. (3) Study of chemical roles of minute water and molecular complex involved in a functionalized polymer and a solution using vibrational spectroscopy. (4) Physiology of extremophilic microorganisms and their applications to production of useful compounds and bioremediations. Biochemistry of trace elements.

Molecular Materials Chemistry E

Prof.
KAJI, Hironori (D Eng)
Assist Prof.
FUKUSHIMA, Tatsuya (D Eng)
Program-Specific Assist Prof.
SHIZU, Katsuyuki (D Eng)
Techn Staff
OHMINE, Kyoko
Techn Staff
MAENO, Ayaka



Hydrospheric Environment Analytical Chemistry S

Prof.
SOHRIN, Yoshiki (D Sc)
Assoc Prof.
UMETANI, Shigeo (D Sc)
Assist Prof.
TAKANO, Shotaro (D Sc)
Techn Staff
MINAMI, Tomoharu (D Eng)



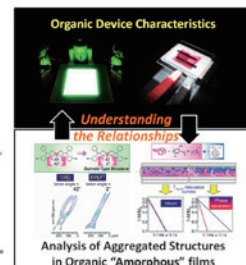
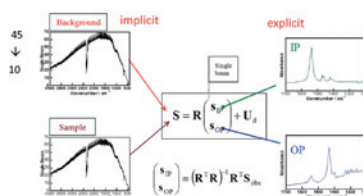
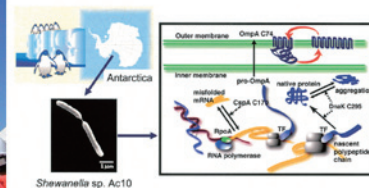
Solution and Interface Chemistry S

Prof.
HASEGAWA, Takeshi (D Sc)
Assist Prof.
WAKAI, Chihiro (D Sc)
Assist Prof.
SHIMOAKA, Takafumi (D Sc)



Molecular Microbial Science A

Prof.
KURIHARA, Tatsuo (D Eng)
Assist Prof.
KAWAMOTO, Jun (D Agr)
Assist Prof.
OGAWA, Takuya (D Agr)



Integration

Division of Multidisciplinary Chemistry

Integrating viewpoints of science and engineering, we aim at developing basis in the interdisciplinary area between chemistry and physics. We carry out fundamental, exploratory research through cooperation with other divisions/centers in ICR to establish a novel aspect of the advanced materials science.

This division performs basic research that aims to achieve molecular understanding of various phenomena of natural/artificial materials, develop an interdisciplinary integration view of natural science based on chemistry, and establish a new aspect of material science. The research is being conducted with a multidisciplinary methodology through collaboration within this division as well as with the other divisions/centers in ICR.

Polymer Materials Science E

Assoc Prof.
NISHIDA, Koji (D Eng)
Assist Prof.
OGAWA, Hiroki (D Eng)

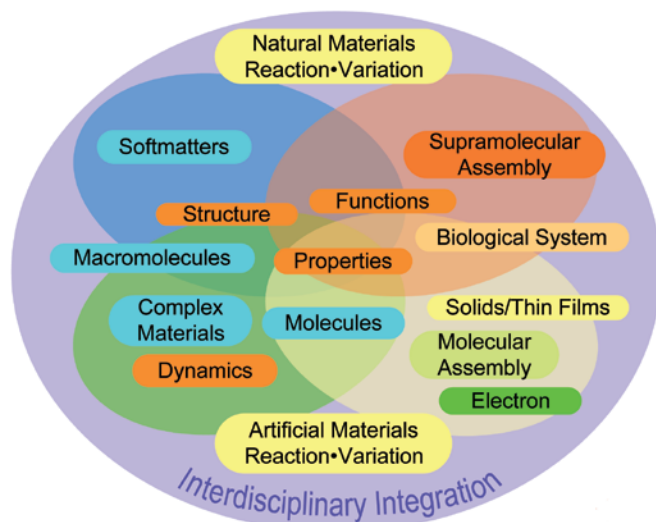
Molecular Rheology E

Prof.
WATANABE, Hiroshi (D Sc)
Assist Prof.
MATSUMIYA, Yumi (D Eng)
Techn Staff
OKADA, Shinichi



Molecular Aggregation Analysis S

Prof.
SATO, Naoki (D Sc)
Assist Prof.
MURDEY, Richard (Ph D)



Extreme Conditions

Advanced Research Center for Beam Science

Our research is performed to develop new capabilities with combination of various beams, to develop new methods for space-time analysis with extreme resolution, to multidimensionally analyze of functional chemical materials oriented for application, and to establish the collaborative research system.

The Advanced Research Center aims to create advanced material science in nanoscale space/time by combining various beams (particle, laser, electron and X-ray beams) to understand and control nanospace/time phenomena from physical, chemical and biological aspects. The current topics include dynamics and handling of particle beams and improvement of their characteristics, physics of intense short pulse laser-matter interactions and its applications, high-resolution dynamical structure visualization of nano-materials, analysis of chemical reaction pathways, and dynamical analysis of vital phenomena based on molecular structures.

Particle Beam Science S

Assoc Prof.
IWASHITA, Yoshihisa (D Sc)
Techn Staff
TONGU, Hiromu

Laser Matter Interaction Science S

Prof.
SAKABE, Shuji (D Eng)
Assoc Prof.
HASHIDA, Masaki (D Eng)
Assist Prof.
INOUE, Shunsuke (D Sc)



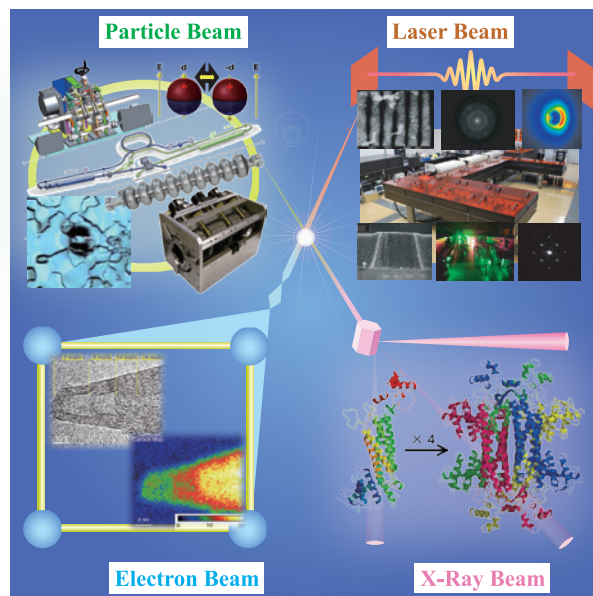
Electron Microscopy and Crystal Chemistry S

Prof.
KURATA, Hiroki (D Sc)
Assist Prof.
NEMOTO, Takashi (D Sc)
Assist Prof.
HARUTA, Mitsutaka (D Sc)



Structural Molecular Biology H

Prof.
HATA, Yasuo (D Sc)
Assoc Prof.
ITO, Yoshiaki (D Sc)
Assist Prof.
FUJII, Tomomi (D Sc)



New Elementary Materials

International Research Center for Elements Science

Our aim is to develop a guideline for the creation of novel elementary materials through uncovering the role of key elements which determine the functions of materials.

Our research interests are centered on the development of Elements Science for creation of new functional materials and innovative chemical transformations. We are trying to design and synthesize new inorganic and organic compounds and to seek for their new functionalities from the viewpoints of fundamental science and industrial applications.

Organic Main Group Chemistry E

Prof
NAKAMURA, Masaharu (D Sc)
Assoc Prof
TAKAYA, Hikaru (D Eng)
Assist Prof
ISOZAKI, Katsuhiko (D Eng)
Program-Specific Assist Prof
IWAMOTO, Takahiro (D Eng)



Advanced Solid State Chemistry S

Prof
SHIMAKAWA, Yuichi (D Sc)
Assoc Prof
KAN, Daisuke (D Sc)
Assist Prof
SAITO, Takashi (D Sc)
Program-Specific Assist Prof
ICHIKAWA, Noriya (D Eng)



Organotransition Metal Chemistry E

Prof
OZAWA, Fumiyuki (D Eng)
Assist Prof
WAKIOKA, Masayuki (D Eng)
Assist Prof
TAKEUCHI, Katsuhiko (D Sc)



Photonic Elements Science S

Prof
KANEMITSU, Yoshihiko (D Eng)
Assist Prof
IHARA, Toshiyuki (D Sc)
Assist Prof
TAHARA, Hirokazu (D Sc)



Organic Main Group Chemistry

New Organic Reactions

Organotransition Metal Chemistry

Well-defined Catalysts

IRCELS

Creation of functional materials based on specific characters of the elements

Advanced Solid State Chemistry

Novel Inorganic Materials

Photonic Elements Science

Nanomaterials Photonics

Genomes

Bioinformatics Center

Our laboratories promote research in bioinformatics and the development of the foundation for an integrated and extensive resource for the bioscience.

In order to understand and utilize the information encoded in the genome, a blueprint of life, it is necessary to develop both state-of-the-art informatics technologies and excellent human resources. The Bioinformatics Center is involved in basic research on the analysis of genomic and molecular information towards understanding design principles of the biological systems, applications of bioinformatics methods to pharmaceutical and medical sciences, development of databases for deciphering the genome, and bioinformatics education and training of young scientists.

Chemical Life Science S P

Prof
OGATA, Hiroyuki (D Sc)
Assoc Prof
GOTO, Susumu (D Eng)



Mathematical Bioinformatics I

Prof
AKUTSU, Tatsuya (D Eng)
Assist Prof
HAYASHIDA, Morihiro (D Inf)
Assist Prof
TAMURA, Takeyuki (D Inf)



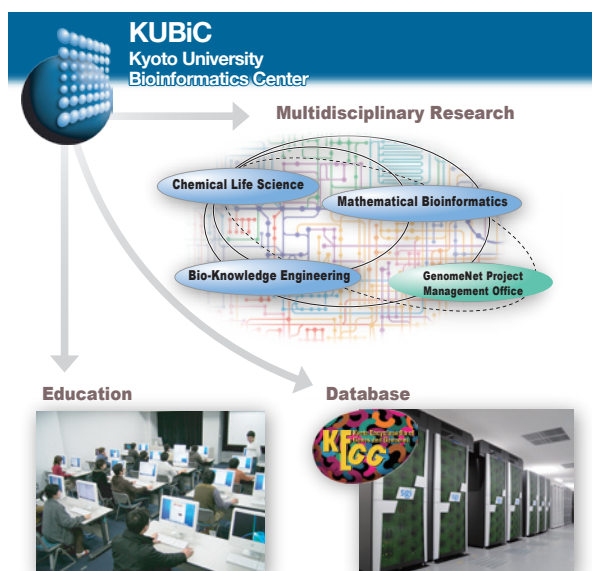
Bio-knowledge Engineering P

Prof
MAMITSUKA, Hiroshi (D Sc)
Assist Prof
NGUYEN, Hao Canh (D Knowledge Science)



GenomeNet Project Management Office

Prof
OGATA, Hiroyuki (D Sc)



Visiting Professors

Division of Synthetic Chemistry

Prof MATANO, Yoshihiro Professor, Faculty of Science, Niigata University

Division of Biochemistry

Prof HAYASHI, Ken-ichiro Professor, Faculty of Science, Okayama University of Science

Division of Multidisciplinary Chemistry

Prof TAKAHARA, Atsushi Professor, Institute for Materials Chemistry and Engineering, Kyushu University

International Research Center for Elements Science

Prof UOZUMI, Yasuhiro Professor, Department of Life and Coordination-Complex Molecular Science, Institute for Molecular Science (Joint appointment:RIKEN)

Division of Materials Chemistry

Assoc Prof NAKAMURA, Kohji Associate Professor, Graduate School of Engineering, Mie University

Division of Environmental Chemistry

Assoc Prof YOSHIMURA, Ken Senior Research Scientist, Tsukuba Research Laboratory, Sumitomo Chemical Co., Ltd.

Advanced Research Center for Beam Science

Assoc Prof AGO, Hideo Senior Research Scientist, RIKEN Spring-8 Center, RIKEN

Bioinformatics Center

Assoc Prof IWASAKI, Wataru Associate Professor, Graduate School of Science, The University of Tokyo

International Visiting Professor

Bioinformatics Center

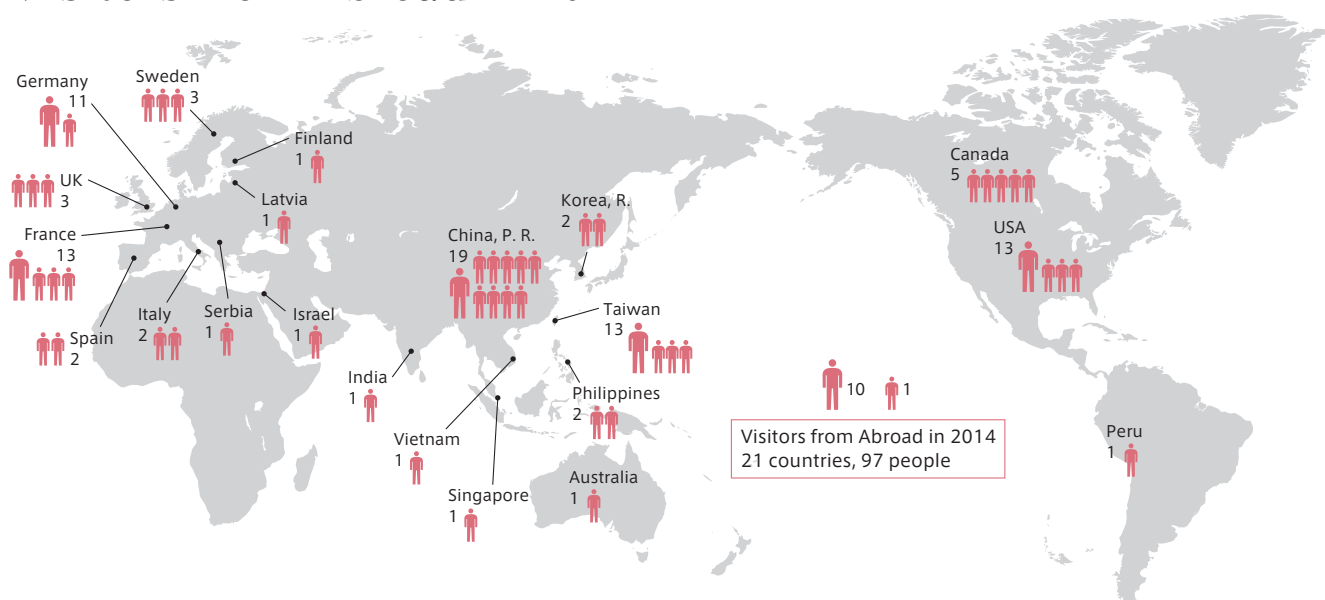
Assoc Prof HINGAMP, Pascal Michel Associate Professor, Aix-Marseille University, France [May -July, 2015]

Hakubi Project to Foster and Support Young Researchers, Kyoto University

Algorithmic Graph Theory with Applications to Bioinformatics

Program-Specific Assoc Prof JANSSON, Jesper

Visitors from Abroad in 2014



Major Research Projects

As of May 2015

Research and Education Funding

Joint Usage / Research Center: Frontier/Interdisciplinary Research Core in ICR for Deepening Investigation and Promoting Cooperation in Chemistry-Oriented Fields

Representative from ICR TOKITOH, Norihiro / **Term** 2010-2015

MEXT Project of Integrated Research on Chemical Synthesis

Joint Project with CRC (Hokkaido Univ),
RCMS (Nagoya Univ), IMCE (Kyushu Univ)



Representative from ICR OZAWA, Fumiya / **Term** 2010-2015

MEXT Project of Creative Research on Highly Efficient Smart Materials for Green Innovation

Joint Project with Institute of Advanced Energy (Kyoto Univ),
Research Institute for Sustainable Humanosphere (Kyoto Univ)

Representative from ICR TOKITOH, Norihiro / **Term** 2015-2020

Human Resource in ICR

Faculty

Numbers in () Represent Visiting Professors.

| Professor | Associate Professor | Senior Lecturer | Assistant Professor | Technical Staff | PS* Associate Professor | PS* Assistant Professor | PS* Researcher | Sub-total | Researcher** | Other Staff | Sub-total | Total |
|-----------|---------------------|-----------------|---------------------|-----------------|-------------------------|-------------------------|----------------|-----------|--------------|-------------|-----------|-------|
| 27 | 16 | 1 | 38 | 9 | 1 | 7 | 10 | 109 | 32 | 30 | 62 | 171 |
| (4) | (5) | | | | | | | (9) | | | | (9) |

* PS: Program Specific ** Including Researchers from Abroad As of July 1, 2015

Researchers(PD) from Abroad

| | | | | | | | |
|---------|---|--------------|---|---------|---|-----------|----|
| Austria | 1 | China, P. R. | 4 | India | 5 | Korea, R. | 2 |
| Taiwan | 2 | Thailand | 1 | Vietnam | 1 | Total | 16 |

As of May 1, 2015

Research Students, Fellows and Associates

| Research Student | Research Fellow | Postdoctoral Fellow of JSPS | Research Associate | Total |
|------------------|-----------------|-----------------------------|--------------------|-------|
| 0 | 1 | 3 | 9 | 13 |

As of May 1, 2015

Graduate Students

Numbers in () Represent Students from Abroad.

| | Science | Engineering | Agriculture | Pharmaceutical Sc. | Medicine | Informatics | Human & Environmental Studies | Total |
|-----------------|---------|-------------|-------------|--------------------|----------|-------------|-------------------------------|----------|
| Master's Course | 40 | 44 (4) | 14 (2) | 16 | 2 (2) | 4 (2) | | 120 (10) |
| Doctoral Course | 33 (6) | 18 (4) | 5 (1) | 20 (2) | 5 (2) | 3 (2) | | 84 (17) |
| Total | 73 (6) | 62 (8) | 19 (3) | 36 (2) | 7 (4) | 7 (4) | 0 | 204 (27) |

As of May 1, 2015

Graduate Students from Abroad

| | | | | | | | | | |
|-----------|---|--------------|----|--------------|---|----------|---|-------|----|
| Cambodia | 1 | China, P. R. | 20 | Congo, D. R. | 1 | Egypt | 1 | Total | 27 |
| Korea, R. | 1 | Malaysia | 1 | Philippines | 1 | Thailand | 1 | | |

As of May 1, 2015

Life Science Database Integration Projects

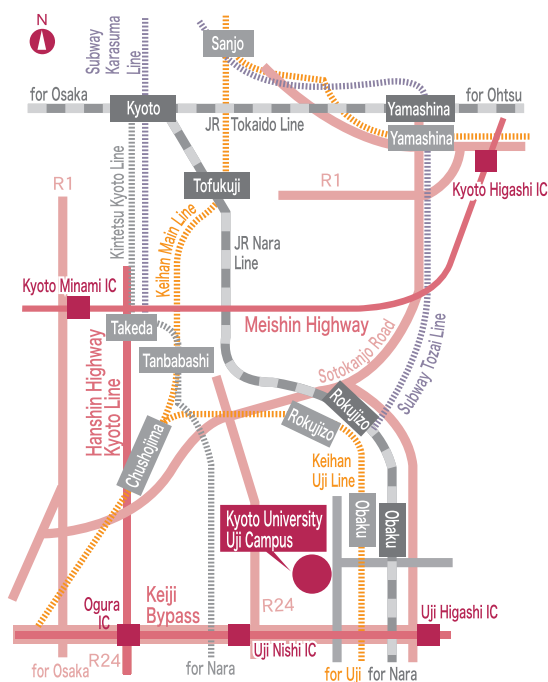
Database Integration Coordination Program

Development of Integrated Proteome Database jPOST

Research Leader GOTO, Susumu / **Term** 2015-2017

Integrated Database Linking Genomes to Phenotypes, Diseases and Drugs

Research Leader KANEHISA, Minoru (Specially Appointed Professor) / **Term** 2014-2016



Access

From Obaku Station on the JR Nara Line: 7 min by walk
(from Kyoto Station to Obaku Station: 20 min)

From Obaku Station on the Keihan Uji Line: 10 min by walk
(from Sanjo Station to Obaku Station: 35 min)

From Kyoto-Minami IC: 20 min by car

From Uji-Higashi IC: 10 min by car / From Uji-Nishi IC: 10 min by car



Institute for Chemical Research,
Kyoto University

Gokasho, Uji, Kyoto, Japan 611-0011
Tel: +81-774-38-3344 Fax: +81-774-38-3014
E-mail: koho@scl.kyoto-u.ac.jp



The latest information of ICR is on the web
www.kuicr.kyoto-u.ac.jp