Institute for Chemical Research
Kyoto University
2004

Division of Synthetic Chemistry
Division of Materials Chemistry
Division of Biochemistry
Division of Environmental Chemistry
Division of Multidisciplinary Chemistry
Advanced Research Center for Beam Science
International Research Center for Elements Science
Bioinformatics Center

Index

History

1926.10 The organization of the Institute for Chemical Research (ICR) was published.
It was composed of a director, professors, instructors (full-time), and the secretariat (full-time).
The object was conducting fundamental studies in special fields of chemistry and exploring their application.

1929 The main building of ICR was constructed in Takatsuki, near Osaka.

1962 Association with graduate schools for the education of students was institutionalized.

1964 The Division System was established (19 divisions and 1 satellite facility).
Nuclear Science Research Facility was located at Awataguchi, Sakyo-ku, Kyoto.

1968 Laboratory of High-pressure Electron Microscopy was located at Gokasho, Uji (Uji Campus).
ICR was moved to the Uji Campus.

1971 Low-Temperature Laboratory was established.

1975 Biotechnology Laboratory was established.
Central Computer Facility was located.

1981 Research Facility of Nucleic Acids was established.

1988 Nuclear Science Research Facility was moved to the Uji Campus.

1989 High-Resolution Electron Spectromicroscope was located.

1992 ICR was reorganized into 9 research divisions and 2 satellite facilities.
Supercomputer Laboratory was established.

1999 Joint Research Laboratory was established.

2000 Administration Department was integrated into that of the Uji Campus.

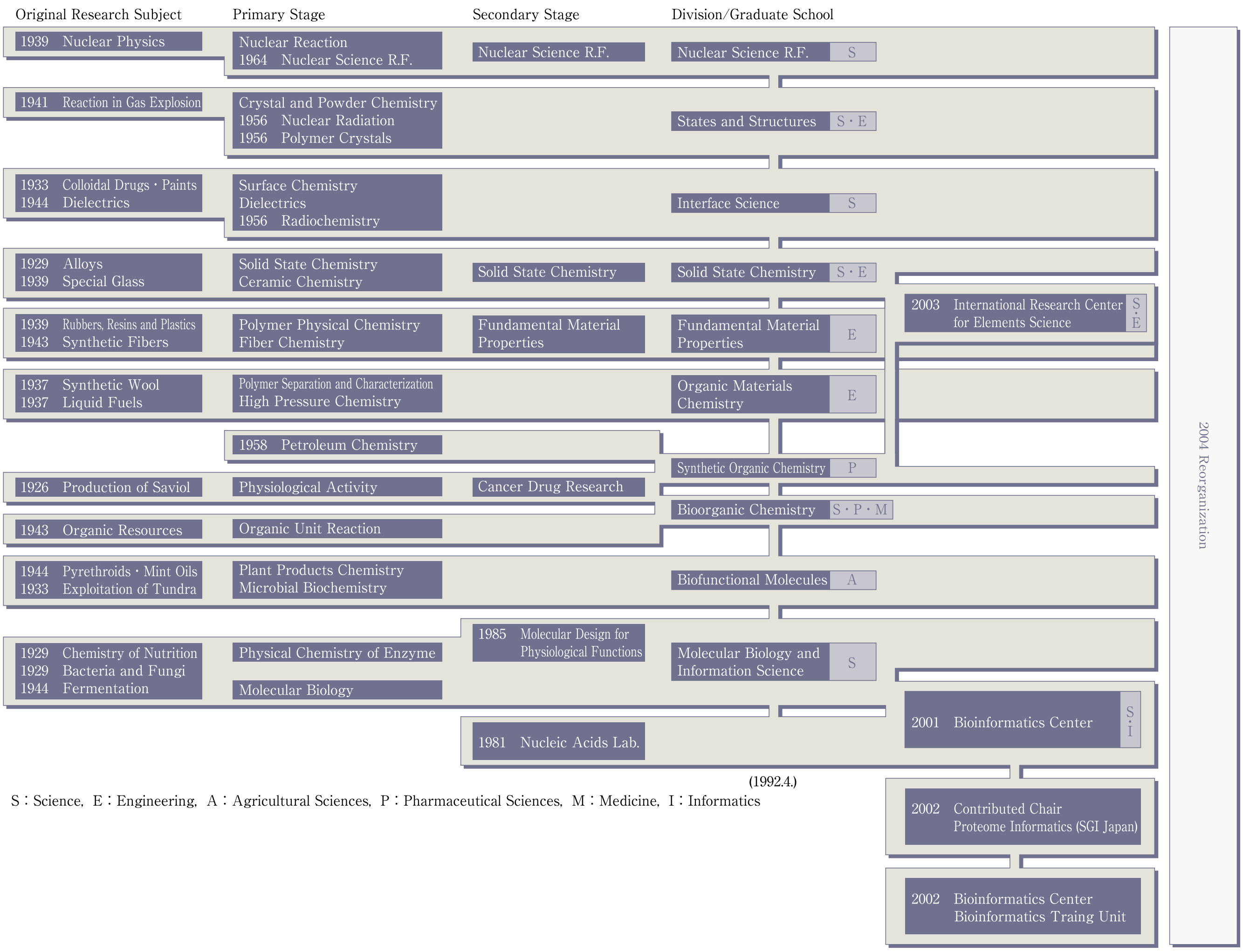
2001 Bioinformatics Center was established.

2002 Proteome Informatics Laboratory was donated by SGI Japan.
Bioinformatics Center, Bioinformatics Training Unit was established.

2003 International Research Center for Elements Science was established.

2004 ICR was reorganized into 5 divisions and 3 centers.
Advanced Research Center for Beam Science was established.

Divisions and Their Historical Backgrounds



S : Science, E : Engineering, A : Agricultural Sciences, P : Pharmaceutical Sciences, M : Medicine, I : Informatics

Preface

Director
TAKANO, Mikio

The history of the Institute for Chemical Research (ICR) dates back to 1915, when a specialized Center was established within Kyoto University. This Center conducted research and production of Salvarsan and other pharmaceutical products and became the foundation for ICR. The ICR was formally established in 1926 with the founding philosophy of “Conducting Fundamental Studies and Exploring Their Application to Special Fields of Chemistry”. The present ICR consists of five major Research Divisions and three affiliated centers in which a total of 31 laboratories and five invited-laboratories with 106 full-time instructors and 230 graduate students are included.

The ICR is extremely active in a wide range of research fields covering chemistry, physics, biology, and informatics. Many members of our staff have participated in major national projects such as the 21st Century COE (Center of Excellence) Program and also in commissioned researches, that have generated outstanding results in advanced research fields. At ICR we have also made extensive contributions to education. Each laboratory is affiliated with one of the Graduate Schools including Science, Engineering, Agriculture, Pharmaceutical Sciences, Medicine, Informatics, and Human and Environmental Studies of Kyoto University. At the same time, we provide the public with opportunities to visit the ICR by holding lectures and tours on a regular basis.

April 1, 2004, saw the birth of the “National University Corporation Kyoto University”. ICR has taken this change one step further to create an environment with even more active research motivation. We reorganized the ICR to the present system and improved the mobility of our staff by implementing a tenure system. We will invest our energy to strengthen our “social contributions” based on the concept of “Science in society and science for society” (the declaration made at the 1999 World Conference on Science and the Use of Scientific Knowledge). Of course, this should go hand in hand with the idea of “science for science.” We encourage young researchers to incubate their interdisciplinary and creative ideas at the ICR, the great melting pot, where the two motivating and inspiring concepts, “science for society” and “science for science” melt together.

We invite you to look into our recent achievements and the scope of our future.

August, 2004

Organization

Institute for Chemical Research

5 Divisions and 3 Centers — Laboratories

- Research Divisions
  - **Division of Synthetic Chemistry**
    - Organoelement Chemistry
    - Structural Organic Chemistry
    - Synthetic Organic Chemistry
    - Advanced Inorganic Synthesis
  - **Division of Materials Chemistry**
    - Chemistry of Polymer Materials
    - Chemistry of Polymeric Functionality Materials
    - Inorganic Photonics Materials
    - Magnetic Materials
  - **Division of Biochemistry**
    - Biofunctional Design-Chemistry
    - Chemistry of Molecular Biocatalysts
    - Molecular Biology
    - Molecular Clinical Chemistry
  - **Division of Environmental Chemistry**
    - Molecular Materials Chemistry
    - Hydrospheric Environment Analytical Chemistry
    - Solution and Interface Chemistry
    - Molecular Microbial Science
  - **Division of Multidisciplinary Chemistry**
    - Polymer Materials Science
    - Molecular Rheology
    - Molecular Aggregation Analysis
    - Supramolecular Biology
- Affiliated Centers
  - **Advanced Research Center for Beam Science**
    - Particle Beam Science
    - Laser Matter Interaction Science
    - Electron Microscopy and Crystal Chemistry
    - Structural Molecular Biology
  - **International Research Center for Elements Science**
    - Organic Main Group Chemistry
    - Advanced Solid State Chemistry
    - Organotransition Metal Chemistry
    - Photonic Elements Science
  - **Bioinformatics Center**
    - Bioknowledge Systems
    - Biological Information Network
    - Pathway Engineering
- Contributed Chair
  - Proteome Informatics (SGI Japan)
- Bioinformatics Training Unit
  - Genome Informatics
- Visiting Divisions
- Supercomputer Laboratory
- Low Temperature Laboratory
- Central Workshop

(2004.4. Reorganized)

DIVISION OF SYNTHETIC CHEMISTRY S

Organoelement Chemistry

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Assist Prof TAKEDA, Nobuhiro (D Sc)
SASAMORI, Takahiro (D Sc)
Technician HIRANO, Toshiko

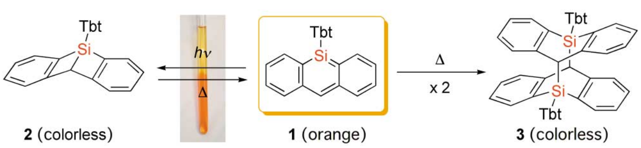
While organic chemistry has been developed as that of second-row elements such as carbon, oxygen, and nitrogen so far, the synthesis and isolation of the heavier congeners of typical organic molecules as stable compounds have been one of the "dreams" for organic chemists. In recent years, however, remarkable progress in main group chemistry has made it possible to synthesize and isolate a variety of novel compounds containing heavier main group elements. Our main research interest is the elucidation of the resemblance and difference in structures and reactivities between organic compounds and the corresponding heavier congeners. These studies are interesting from the standpoints of not only fundamental chemistry but also opening the way to more extensive application of main group chemistry.

(1) Synthesis of Compounds Having Novel Bonding Containing Main Group Elements

We have developed novel steric protection groups, which are very useful for the kinetic stabilization of various highly reactive species of main group elements. Recently, we have succeeded in the synthesis and isolation of “novel metallaaromatic compounds containing a silicon or germanium atom [silabenzene, germabenzene, etc.]”, “novel, strained ring systems containing sila- or germacyclopropane rings fused to a benzene ring [metallacyclopropabenzene, bis(metallacyclopropa)benzene, etc.]” and “novel doubly bonded compounds between heavier group 15 elements [dibismuthene, distibene, phospha-bismuthene, etc.]” and elucidated their unique molecular structures and properties. We are now making further application of our concept to the synthesis of not only the heavier main group element compounds but also the transition metal complexes having novel structures from the viewpoints of new organoelement chemistry.

(2) Development of New Transformation Methods Using a Biocatalyst

New synthetic applications mediated by biocatalysts (microorganisms, cells of plants, and enzymes) are studied. Further extension of biocatalysts to the detoxication of environmental pollution substances is also under way.



Photochemical and Thermal Reactions of 9-Silaanthracene **1**.
Irradiation of an orange solution of **1** with light (λ= 300-500 nm) resulted in the disappearance of the orange color in the irradiated part, indicating the isomerization of **1** to 9,10-Dewar-9-silaanthracene **2**.

DIVISION OF SYNTHETIC CHEMISTRY E

Structural Organic Chemistry

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Assist Prof NISHINAGA, Tohru (D Eng)
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Synthetic, structural, and theoretical studies are being conducted on π-conjugated molecules, with particular attention being paid for the redox activity. Thus, structural features are pursued to create stable cationic and radical species in order to furnish redox-active systems as fundamental models for functional materials. The main subjects of studies are as follows.

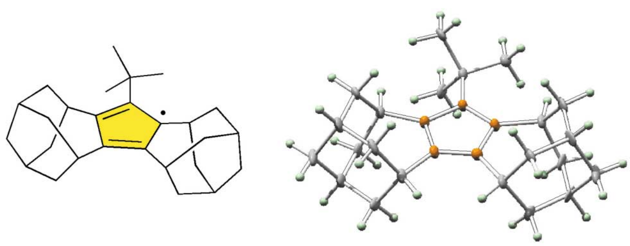
(1) A series of cyclic π-conjugated systems surrounded by rigid bicyclic σ-frameworks are synthesized. These systems are characterized by raised HOMO levels due to the effective σ-π conjugation, and afford highly stabilized cationic species.

(2) A tripod structure made of adamantanetrithiol is constructed, and is transformed into a self-assembed monolayer rigidly fixed on a Au(111) surface. Redox-active functional units are placed at the top of the molecule.

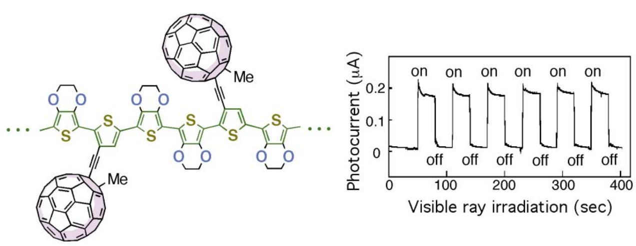
(3) The organic synthesis of endohedral fullerene is attempted by a series of reactions, that is, opening a hole on the fullerene's cage, insertion of a small molecule, and closing the hole.

(4) New methods for generation and isolation of monofunctionalized fullerenyl cations, which have been considered as highly inaccessible materials, are explored and are applied for creation of fullerene-based functional materials.

(5) The terthiophene derivative having C_{60} side-arms is polymerized to the corresponding polythiophene, and is applied to a photovoltaic device.



The first Cp radical with a *localized* unpaired electron (X-ray structure).



Polythiophene having C_{60} as side-arms and its device's photocurrent generation.

DIVISION OF SYNTHETIC CHEMISTRY P

Synthetic Organic Chemistry

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Technician TERADA, Tomoko

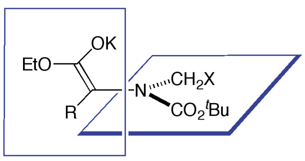
Research in this laboratory focuses on molecular chirality. Programs are active in the areas of asymmetric synthesis, organocatalysis, supramolecular chemistry, and structural and functional investigation of chiral oligomers.

(1) Asymmetric Synthesis Based on Dynamic Chirality: The structure of enolates was long believed to be achiral, however, we have proposed that enolates are intrinsically chiral in a limited time scale (*i.e.,* dynamic chirality). Based on dynamic chirality of enolates, direct asymmetric synthesis of a new family of amino acids and nitrogen heterocycles has been achieved without the aid of external chiral sources (*i.e.,* memory of chirality). The control of lifetime of chiral enolate intermediates and the mechanistic investigation for the novel asymmetric induction are in progress.

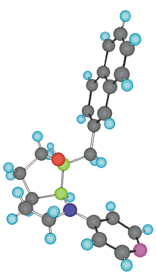
(2) Organocatalysis: Organocatalysis is promising toward the development of environmentally benign synthetic processes. Research focuses on the development of chiral organocatalysts based on remote asymmetric induction. Highly active and selective catalysts have been developed for the kinetic resolution of racemic alcohols and asymmetric desymmetrization of *meso*-diols. Application of these catalysts to asymmetric carbon-carbon bond forming reactions and substrate-specific reactions are under investigation.

(3) Supramolecular Chemistry: Visualization of molecular information by functional phenolphthaleins and supramolecular chemistry with homooxaxcalixarenes.

(4) Chiral Oligomers: Studies directed toward structural and functional investigation of chiral oligomers. The effects of accumulated chiral units are investigated with D,L-oligolactates, D,L-oligopeptides, and homochiral oligonaphthalenes.



A chiral nonracemic enolate with dynamic axial chirality: Asymmetric synthesis of a new family of amino acids is performed via this intermediate in the absence of external chiral sources.



Crystal structure of a chiral organocatalyst: Effective chirality transfer is operative from remote chiral centers (● carbon) to an active site (● nitrogen).

DIVISION OF SYNTHETIC CHEMISTRY S

Advanced Inorganic Synthesis

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Assist Prof IKEDA, Yasunori

We are focusing on the fundamental physics and chemistry of "functional oxides" and seeking new materials with new functions.

Inorganic transition-metal oxides show lots of interesting and useful properties, which include ferroelectricity, ferromagnetism, conductivity, and so on. The wide variety of their crystal structures gives rise to various electronic structures, which lead to interesting and useful physical and chemical properties. In transition-metal oxides, the cation-*d*-orbital and anion-*p*-orbital are strongly hybridized. Competitive and/or cooperative energies of Coulomb interaction, band-width, and exchange interaction also play an important role in giving rise to a wide variety of physical and chemical properties. Such exotic properties could be useful for the functions of electronic devices.

We recently pay much attention to researches on multiferroics, which show both ferroelectricity and ferromagnetism. New materials with strong correlation of both properties are expected to be used for new memory devices.

We are conducting systematic studies of various forms of material synthesis. Polycrystalline samples, for example, are obtained based on phase equilibrium information. Single crystals and thin film samples are also synthesized. Precise crystal structures of theses materials are analyzed by x-ray and neutron diffraction. Electronic and magnetic structures are discussed based on the results of electronic structure calculations and physical property measurements.

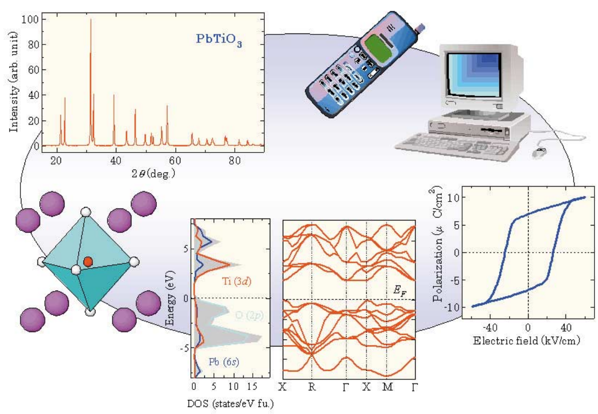

Illustration of our research processes.

DIVISION OF MATERIALS CHEMISTRY E

Chemistry of Polymer Materials

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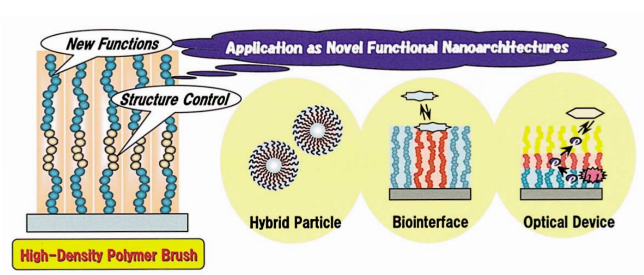
Assist Prof OHNO, Kohji (D Eng)
GOTO, Atsushi (D Eng)

Kinetic and mechanistic analyses are made for better understandings and systematization of the chemical and physicochemical reactions occurring in polymerization systems and for the development of better routes to the synthesis of well-defined polymers. By the application of various polymerization techniques, in particular, living radical polymerization (LRP), new well-defined polymers or polymer assemblies are prepared, and their structure/properties relationships are precisely analyzed for the development of new polymer-based materials of practical importance. Projects in progress include:

(1) Mechanisms and Kinetics of LRP
- Establishment of the theories on LRP kinetics
- Development of the methodologies for determining various rate constants
- Development of a new LRP system with higher performance
- Search for functional monomers applicable to LRP

(2) Synthesis of New Polymeric Materials
- Precision synthesis of polyhedral oligomeric silsesquioxane-carrying polymers
- Functionalization of natural polysaccharides and oligosaccharides
- Precision synthesis of organic/inorganic hybrid nanocapsules

(3) Synthesis, Properties, and Applications of High-Density Polymer Brushes (HDPB)
- Mechanism and kinetics of surface-initiated LRP
- Novel structure, properties and functions of HDPB
- Synthesis of functional HDPB towards the construction of new molecular devices
- Synthesis of fine particles coated with HDPB and fabrication of their ordered arrays



Fabrication and Application of High-Density Polymer Brush

DIVISION OF MATERIALS CHEMISTRY E

Chemistry of Polymeric Functionality Materials

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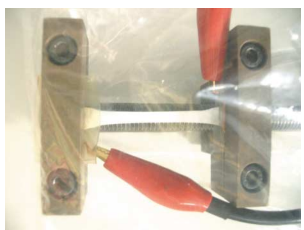
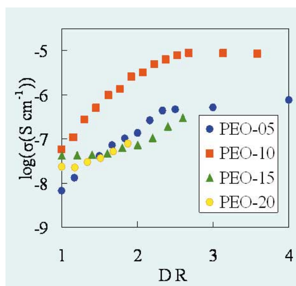
Assist Prof TOSAKA, Masatoshi (D Eng)
SENOO, Kazunobu (D Eng)

Our main research interests involve the investigation on correlation of structure and properties in polymeric functionality materials through the evaluation of the design, analysis and functionality of the higher-order structure.
Function of amorphous, liquid crystal, and crystalline polymer materials is influenced not only by the chemical structure and the conformation of amorphous and crystal chains but also according to how it is organized into the higher-order structure. It is, therefore, very important to understand the relationship between the structure and function in order to get the polymeric materials with desired properties.
From this kind of viewpoint, the following studies are now in progress using a high resolution electron microscope and a wide or small angle X-ray diffractometer;
- The crystallization behavior due to the uniaxial elongation of three dimensionally cross-linked natural rubber and synthetic rubbers.
- Ionic conductivity of uniaxially stretched elastomers containing high molar mass poly(ethylene oxide) as shown in the figures below.
- Direct observation of the molecular chains of the epitaxically grown polymer lamellae crystal structure.
- Synthesis and characterization of the polymer gel consisting of the stereoregular polystyrene.

These researches focus on the role of the crystal chain and region in the polymeric functionality materials, which have been expected to elucidate a deep understanding on resulting higher-order structure and its functional development.



Ionic conductivity measurement with uniaxially stretched PEO.



The relationships between ionic conductivity and draw ratio of PEO doped with 5~20 mol% of Li.

DIVISION OF MATERIALS CHEMISTRY E

Inorganic Photonics Materials

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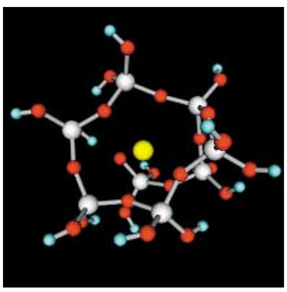
In our laboratory, we are studying on the preparation and characterization of new functional, especially photonics-related inorganic materials. Glasses and ceramics are the most important photonics materials, in which we are very interested. Our major research subjects are as follows:

(1) Synthesis of novel organic-inorganic hybrid low-melting glasses: Based on our own new concept, we are synthesizing novel organic-inorganic hybrid low-melting glasses (melting-temperature: r. t. ~200℃), in which the inorganic network is partly modified by organic groups, via gel-melting method or nonaqueous acid-base reaction method. In addition, we also aim at developing new optical low-melting glasses doped with organic substances as new type photonics materials.

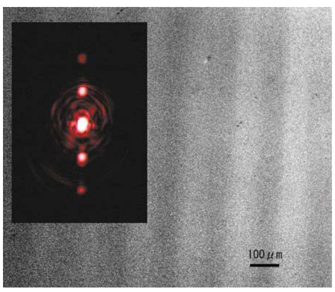
(2) Structural studies of glasses: For a better understanding of the functionality, analyses of the local structure and electronic states of glassy materials are of essence. In our laboratory, they are conducted by means of X-ray and neutron diffraction methods, Raman and IR spectroscopy, MQMAS NMR spectroscopy, ab initio molecular orbital calculation and so on.

(3) Development of optical micro devices utilizing photo-refractive effect: With the use of the refractive index change caused by photochemical reaction or fictive temperature difference, we aim at developing high performance optical micro devices such as passive and active optical wave guides.

(4) Nanoporous TiO_2 thin films: We are trying to synthesize new functional thin films with controlled nanostructure or sub-microstructure by making use of spinodal decomposition in the system consisting of titania sol and photosensitive polymer. Our attention is focused on optical and electrical properties of such nanoporous TiO_2 thin films. Application of this film to solar cells is one of the most exciting subjects.



A model cluster of sodium silicate glass after the structural optimization by ab initio molecular orbital calculation.



"Phase grating" written by inducing refractive index change, when the hybrid low-melting glass prepared by non-aqueous acid-base reaction method was illuminated by a middle-power cw laser. The inset shows the light spots diffracted by the phase grating. Note that the second order diffracted light spots are also clearly observed.

DIVISION OF MATERIALS CHEMISTRY S

Magnetic Materials

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Technician KUSUDA, Toshiyuki

The conventional electronics utilizes only the 'electric charge' of electrons. On the other hand, the conventional magnetic devices utilize only the 'spin' of electrons. Contrary to them, a new field of electronics called spintronics, in which both 'charge' and 'spin' of electrons are utilized in solid-state devices, emerged and has been rapidly developing. We are searching for new functional materials which lead to developments of novel spintronic devices by using fabrication techniques such as film growth in units of atom and electron-beam lithography with a resolution of several tenth nano-meters.

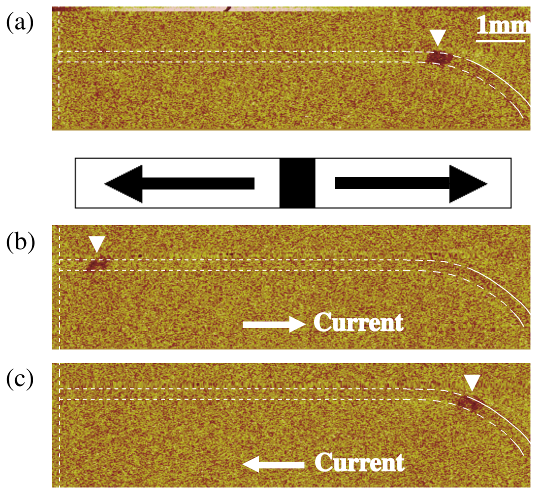
Major research subjects are as follows:

(1) Magnetization reversal process in micro-fabricated magnets. It is inevitable to control the magnetization reversal process in future magnetic nano-devices.

(2) Control of magnetic and transport properties by spin-injection from ferromagnets into non-magnetic materials (para-magnets, superconductor). We have succeeded in resistance control of a magnetoresistive manganite by spin-injection.

(3) Synthesis and characterization of magnetic nano-particles which are candidates as magnetic recording media.

(4) Control of magnetic configuration by spin-current instead of applying a magnetic field. Figures show that spin-polarized current in ferromagnetic wire can move a domain wall.



Observation of current-driven magnetic domain wall motion by magnetic force microscopy. (a) Magnetic force microscopy (MFM) image after the introduction of a magnetic domain wall (DW). DW is imaged as dark contrast, which corresponds to the stray field from negative magnetic charge. (b) MFM image after an application of a pulsed-current from left to right. The DW moved from right to left by the pulsed-current. (c) The DW moved opposite direction when the current direction was reversed. These observations indicate that position of a DW can be controlled by an electric current instead of applying a magnetic field.

DIVISION OF BIOCHEMISTRY P

Biofunctional Design-Chemistry

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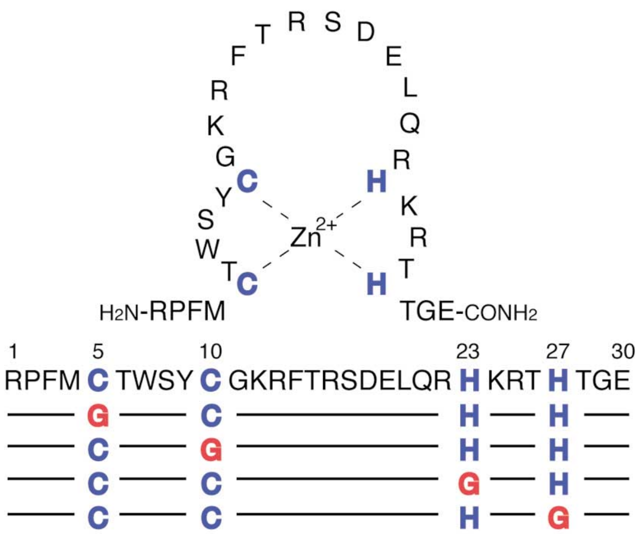
Assoc Prof FUTAKI, Shiroh (D Pharm Sc)
Assist Prof IMANISHI, Miki (D Pharm Sc)

As an interface of chemistry and biology, this division investigates the molecular mechanism of specific interaction between biologically active molecules and macromolecular receptors. We also aim at the design of novel functional molecules such as artificial DNA binding peptides or membrane-permeable peptides. Current research subjects are as follows:

(1) Elucidation of the DNA recognition mode of DNA binding proteins with zinc finger structures such as a human transcription factor Sp1 and design of molecules for specific gene regulation. Studies on the structure and function of a zinc finger motif by coordination of a metal.

(2) Design and synthesis of artificial functional peptides/proteins having protein/DNA recognition abilities and development of novel intracellular delivery systems aiming at elucidation and control of cellular functions.



Ligand substitution of a zinc finger motif

DIVISION OF BIOCHEMISTRY A

Chemistry of Molecular Biocatalysts

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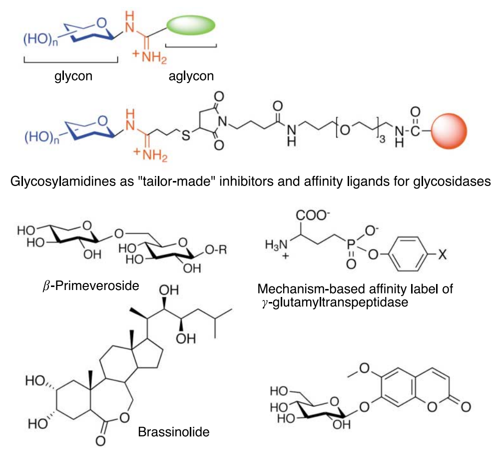
Assoc Prof HIRATAKE, Jun (D Agr)
Assist Prof MIZUTANI, Masaharu (D Agr)
SHIMIZU, Bun-ichi (D Agr)

Our research interest is to clarify, on molecular basis, various biological events during life cycles where many kinds of biocatalysts (enzymes) are concerned. For this purpose, we have combined and made full use of various disciplines and techniques such as natural product chemistry, organic synthetic chemistry, biochemistry, and molecular and structural biology. Our research theme covers the understanding on molecular basis of the physiological roles of plant enzymes such as glycosidases and cytochrome P450s, probing the reaction mechanisms and specificities of each enzymatic reaction, and the design and synthesis of new enzyme inhibitors and their applications as useful chemical tools for enzyme study. For example, we have focused on diglycoside-specific glycosidases such as β-primeverosidase, which is deeply concerned with aroma formation of oolong tea and black tea, and have studied the biocatalytic properties and the real physiological roles of this enzyme in tea plants. We have successfully developed novel glycosidase inhibitors, β-glycosylamidines, which serve as “tailor-made” inhibitors of glycosidase according to their glycon- and aglycon-specificities. Design and syntheses of transition-state analogue inhibitors of other enzymes such as ATP-dependent ligases and transpeptidases are also being pursued to understand the molecular mechanisms of the enzymes. We pursue the identification and understanding of the cytochrome P450 enzymes involved in the biosynthesis and catabolism of plant hormones such as brassinosteroids and cytokinins to study the activation and inactivation mechanisms of plant hormones. We also study the directed evolution of lipase to create a novel biocatalyst with unprecedented reaction specificities. The factors responsible for inducing resistance of sweet potato against pathogenic fungi are also under investigation with an emphasis on the biosynthesis of glucosides of coumarin derivatives.



DIVISION OF BIOCHEMISTRY S

Molecular Biology

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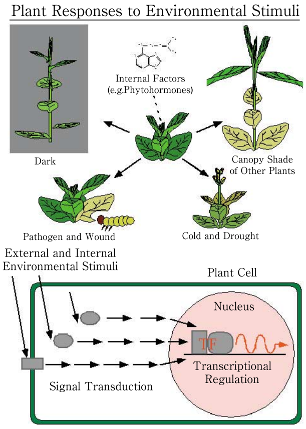
Assist Prof TSUGE, Tomohiko (D Sc)
Technician YASUDA, Keiko

This laboratory aims at clarifying the framework of regulatory network between genetic programs and environmental stress responses through the study on structure-function relationships of genetic materials and cellular proteins in higher plants and plant pathogens. Study is now being concentrated on elucidation of molecular mechanisms for plant signal transduction contributing environmental stress responses and also of developmental and morphogenesis processes of plant epidermal cells contacting directly with the environment. Our recent principal results are as follows: (1) The two-component regulatory system (CRE1 and ARR1) that was previously thought to be specific to the prokaryotic world participates in the perception of cytokinins, a class of phytohormones promoting cell division, and in the subsequent intracellular signal transduction giving immediate responses towards cytokinins in ***Arabidopsis thaliana***; (2) An ***Arabidopsis*** HD-Zip-type transcription factor GLABRA2 modulates lipid metabolism via transcriptional control of the phospholipase D gene, through which root epidermal cells are destined to form root hairs (the first demonstration of contribution of phospholipid signaling to plant cell development); (3) A technique (glucocorticoid-inducible system) by which a particular gene expression can be conditionally induced in plant cells has been established, and revealed that other HD-Zip proteins, ATHB-1 and ATHB-2, concern morphogenesis during leaf development and shade avoidance, respectively; (4) Applying this technique for various ***Arabidopsis*** proteins including protein phosphatases, we have analyzed their roles in signal transduction of plant cells; and (5) The entire genome structure of the hairy-root-inducing plasmid carried by ***Agrobacterium rhizogenes*** A4 has been determined.

Plant Responses to Environmental Stimuli



Plants are exposed to a variety of environmental stimuli and respond appropriately through the recognition of stimuli and the subsequent signal transduction, a considerable portion of which includes transcriptional modulation of particular genes by transcription factors (TF).

DIVISION OF BIOCHEMISTRY M

Molecular Clinical Chemistry

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Prof UEDA, Kunihiro
retired on March, 2004

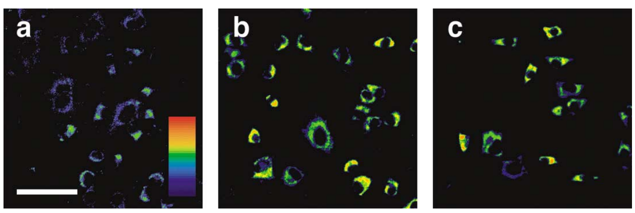
Assoc Prof TANAKA, Seigo (D Med Sc)

Objectives of our research are elucidation of the structure, function and pathophysiological significance of various biomolecules and bioreactions in relation to human diseases, and development of new diagnostic methods leading to prophylactic or therapeutic measures. Our current interest is focused on the role of poly (ADP-ribosyl) ation in protection of genome from apoptosis-inducing stresses, and the molecular etiology of neurodegenerative disorders including Alzheimer's disease (AD) and Parkinson's disease (PD).

(1) Analysis of role of poly (ADP-ribose) synthetase (PARS) in neuronal cell death: PARS is a nuclear enzyme that, upon activation by DNA single-strand breaks, forms (ADP-ribose)$_n$ chains from NAD^+ on acceptor proteins. Poly (ADP-ribose) is known to be involved in various physiological and pathological events such as DNA repair, cell differentiation, cell cycle, and cell death.

(2) Elucidation of physiological function of septin 3 and its pathological role in AD: Septin 3 is a novel member of the septin subfamily with GTPase domain. Our study on microsatellite polymorphisms in exon 11 indicated a significant difference in long/short allelic distribution between AD and control.

(3) Analysis of cytochrome P450 2D6 (CYP2D6, debrisoquine hydroxylase) gene polymorphism and its pathological role in PD: Our study has demonstrated an association between the phenotypic expression of CYP2D6, and polymorphism or mutation within the ***CYP2D6*** gene and PD. Since CYP2D6 detoxifies neurotoxicants, the lowered enzyme activity of CYP2D6 in individuals, termed “poor metabolizers”, represents a risk factor for PD.



Mitochondrial generation of ROS after exposure to MPP^+ or MPTP (differentiated PC12 cells). (a) Control (b) MPP^+ (c) MPTP

DIVISION OF ENVIRONMENTAL CHEMISTRY E

Molecular Materials Chemistry

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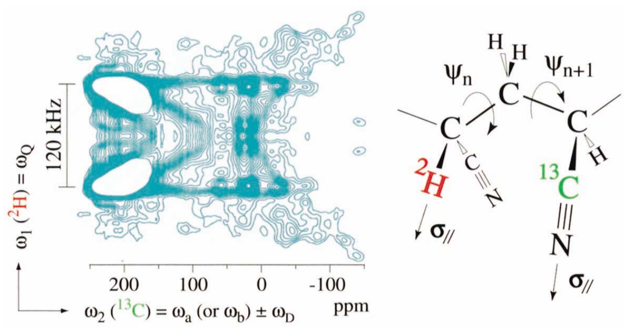
Assoc Prof KAJI, Hironori (D Eng)
Assist Prof HIRAI, Asako (D Eng)
Technician OHMINE, Kyoko

Molecular motion, hydrogen bonding, and structure of polymers in the different states including the liquid crystalline and molecular assembly states are studied mainly by high-resolution solid-state NMR spectroscopy and electron microscopy to design high-performance and high-functionality polymer materials. The major subjects are: (1) the precise characterization of slow motions ranging from 10^{-1} Hz to 10^{5} Hz for polymers by multi-dimensional solid-state NMR spectroscopy to evaluate the correlations with crystal growth, super-drawing, impact strength and so on; (2) developments of new solid-state NMR techniques to characterize the chain conformation, hydrogen bonding, and hydrophobic interactions for organic materials, and the clarification of the structure formation process in the liquid crystalline and molecular assembly states in relation to the functionality; (3) the characterization of biosynthesis, structure and assembly formation, and gelation processes for bacterial cellulose and poly(amino acid) as a model system for the structure formation and functionality realization in nature; (4) reduction of intrinsic dynamical characteristics of single chains in solution and analyses of chain dynamics and structure formations mediated between the chain architecture and the environment.



Precise analysis of the conformation of solid polyacrylonitrile by 2D solid-state heteronuclear multiple quantum coherence NMR.

DIVISION OF ENVIRONMENTAL CHEMISTRY S

Hydrospheric Environment Analytical Chemistry

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Assoc Prof UMETANI, Shigeo (D Sc)
Assist Prof SASAKI, Yoshihiro (D Sc)
OKAMURA, Kei (D Sc)
Res Associate NORISUYE, Kazuhiro
Technician MINAMI, Tomoharu

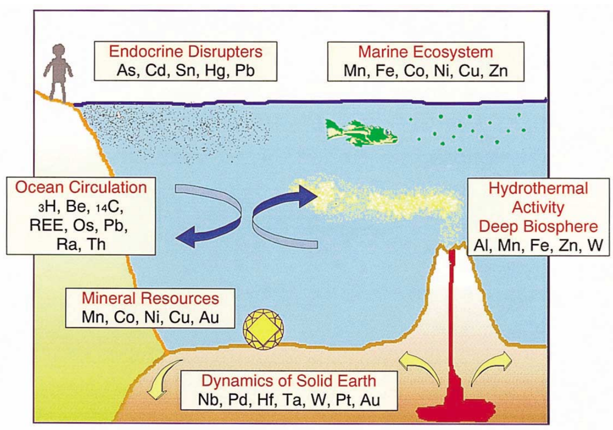
Research activities are concerned with geochemistry, oceanography, limnology, and analytical chemistry, which are important basic sciences in order to realize the sustainable society. Major research subjects are as follows:

(1) Biogeochemistry of trace elements in the hydrosphere. Novel analytical methods are developed for multi-elemental determination, isotope ratio determination, speciation, and in situ measurements. Distribution of trace elements and its effects on ecosystem are investigated. The study also covers hydrothermal activity and deep biosphere. Major parts of these studies are based on field works.

(2) Iron uptake mechanism of phytoplankton. The ultimate aim of this study is to control photosynthesis of phytoplankton and sequester atmospheric CO_2 in the ocean. As a basic science for this aim, iron uptake mechanism of phytoplankton is investigated. We are pursuing iron transport molecules (siderophores) produced by phytoplankton.

(3) Ion recognition. Ligands that have novel functions in ion recognition are designed, synthesized, and characterized. The ion recognition systems are applied to the development of separation technology and sensors.

(4) Simulation of chemical reactions. Instructor Sasaki is studying non-linear chemical reaction in order to understand synchronization and excitation.



DIVISION OF ENVIRONMENTAL CHEMISTRY S

Solution and Interface Chemistry

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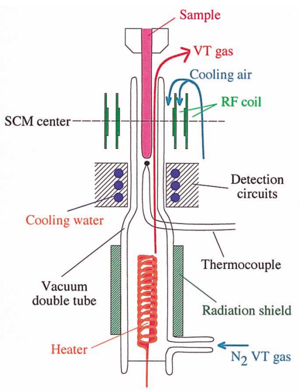
Prof
NAKAHARA, Masaru (D Sc) -L-
UMEMURA, Junzo (D Sc) -R-
Assoc Prof
MATUBAYASI, Nobuyuki (Ph D)
Assist Prof
OKAMURA, Emiko (D Pharm Sc)
WAKAI, Chihiro (D Sc)

Structure and reactions of a variety of ionic and nonionic solutions of physical, chemical, and biological interests are studied by means of NMR, Raman, and computer simulation under extreme conditions including supercritical and super-cooled. A systematic exploration of a wide range of thermodynamic conditions is performed for supercritical fruids to elucidate and control the solute-solvent interaction. Especially, the density of the solvent is varied from the gas-like to liquid-like regimes and a drastic change in the solvation properties is achieved. The dynamics of supercritical fluids, especially of aqueous solutions, is also probed and the effect of the high kinetic energy resulting from the high temperatures involved at supercritical states is characterized. Organic chemical reactions of water and aqueous solutions at super- and subcritical conditions are investigated from the physico-chemical and environmental-science points of view. From the physico-chemical viewpoint, the role of water in organic chemical reactions is specified at the fundamental and molecular level. From the environmental-science viewpoint, non-catalytic reactions are pursued in high-temperature water by exploiting the water molecule itself as both the medium and reactant. Especially, the role of high-temperature water as an effective acid or base is revealed and quantified. The structure, dynamics, and reaction in supercritical fluid, especially in supercritical water, are observed by developing the in-situ NMR spectroscopy. The frontier of the NMR spectroscopy is explored in the high-temperature and/or high-pressure conditions. The connection to the intermolecular interaction is established by developing the theoretical-computational methodology with emphasis on the solvation free energy. Vibrational spectroscopic studies are carried out to elucidate structure and orientations of organic and water molecules in ultra-thin films.



High-temperature probe used for in-situ observation of chemical reactions in supercritical water

DIVISION OF ENVIRONMENTAL CHEMISTRY A

Molecular Microbial Science

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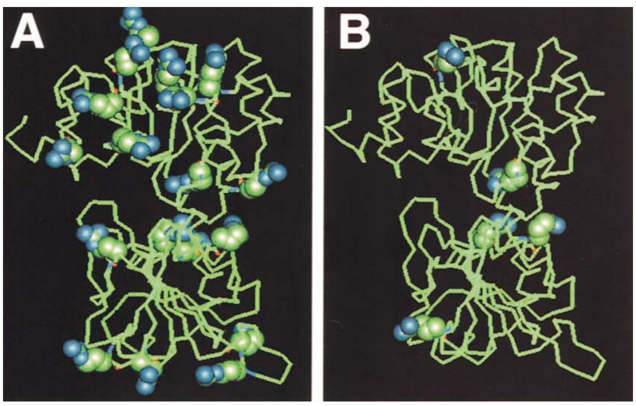
Assoc Prof KURIHARA, Tatsuo (D Eng)
Assist Prof MIHARA, Hisaaki (D Agr)
Res Associate KAZUOKA, Takayuki (D Eng)

Structure and function of biocatalysts are studied to elucidate the dynamic aspects of fine mechanism for their catalysis in the light of recent advances in gene technology, protein engineering and crystallography. In addition, metabolism and biofunction of trace elements are also investigated. Development and application of new biomolecular functions of microorganisms are also studied to open the door to new fields of biotechnology. For example, molecular structures and functions of thermostable and cold-active enzymes and their application are studied. Efficient systems for the enantio-selective production of various optically-active compounds have been developed with the combination of microbial enzymes. The structure and function of various hydrolases oxygenases, and oxidases are studied in order to improve their properties by protein engineering and to apply them to solving pollution problems.



Three-dimensional structures of alanine dehydrogenases from thermophilic (A) and psychrophilic (B) bacteria. The ion pairs on the molecular surface are shown as space-filling models.

DIVISION OF MULTIDISCIPLINARY CHEMISTRY E

Polymer Materials Science

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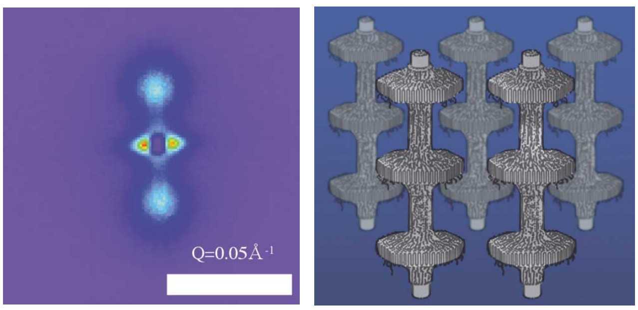
Assoc Prof NISHIDA, Koji (D Eng)
Assist Prof MATSUBA, Go (D Eng)

Fundamentally important unsolved problems in polymer physics are studied using mainly scattering techniques such as neutron, X-ray and light as well as optical microscopies such as normal, polarized and confocal laser. Main subjects are (1) polymer crystallization, (2) glass transition of polymers, (3) polymer gels and (4) polyelectrolyte solutions. These studies are directed to clarify the formation processes of higher order structures of polymers and the guiding principles to control their structures. Further details are as follows:

(1) Structure formation process during the induction period of polymer crystallization is studied. Recently, polymer crystallization process under shear flow is also investigated (see Figure). (2) Frozing processes of amorphous polymers including the glass transition mechanism are studied using neutron scattering techniques. (3) Gelation processes are studied when the system involves phase separation, aiming at controlling the gel structure for applications. (4) A strongly expected phase diagram (molecular weight - concentration diagram) for polyelectrolyte solutions has been completed, particularly revealing that there exists a crystal region in the dilute regime due to strong interpolyion electrostatic repulsive forces. These forces decrease with increasing concentration and are finally screened completely to produce the swollen state just before the system becomes bulk or solid.



Small-angle neutron scattering pattern from elongated polyethylene fiber including ultra-high molecular weight component (left).
Right figure shows a schematic sketch of expected shish-kebab structure.

DIVISION OF MULTIDISCIPLINARY CHEMISTRY E

Molecular Rheology

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Assoc Prof INOUE, Tadashi (D Eng)
Assist Prof MATSUMIYA, Yumi (D Eng)
Technician OKADA, Shinichi

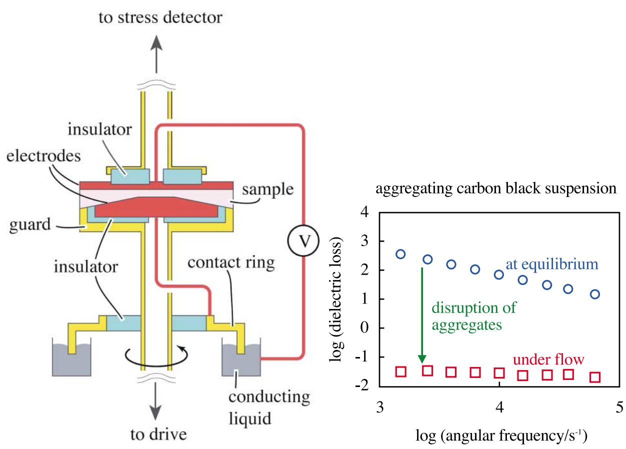
Rheology is a research field of investigating a relationship between the strain and stress of materials. How do the molecules/structures in a given material deform to raise the stress and how do they move to induce the stress relaxation ? From a molecular view summarized in these questions, this research lab combines viscoelastic, optical, scattering, and dielectric methods (see Figure) to investigate rheological properties of materials. Current research is focused on complex systems 1-4 (listed below) having various origins of the stress.

(1) Entangled homopolymer: The stress in this material is determined by axial orientation and stretching of polymer chains. The global chain motion leading to the stress relaxation was analyzed with the above methods to demonstrate the importance of entanglement lifetime (affected by branching and length distribution of the chains) in the rheological behavior.

(2) Block copolymer: The stress in this material was found to reflect orientation/stretching of the blocks and distortions in the concentration fluctuation pattern and microdomain defects. A mechanism of flow-induced disruption of the domain alignment was related to those stress-generating mechanisms.

(3) Organic glass: The stress in this material was found to reflect the axial/planar orientation of the molecules therein as well as distortion of the molecular packing. This result was formulated as the modified stress-optical rule, thereby contributing to molecular design of low birefringence materials.

(4) Suspension of solid particles: The stress in this material results from distortion of the spatial distribution of the particles. Shear thinning of hard-core particles was attributed to saturation of this distortion while the thinning of aggregating particles was related to disruption of aggregates.



Schematic illustration of a rheo-dielectric cell and an example of measured data. Dielectric and rheological responses are simultaneously measured with this cell.

DIVISION OF MULTIDISCIPLINARY CHEMISTRY S

Molecular Aggregation Analysis

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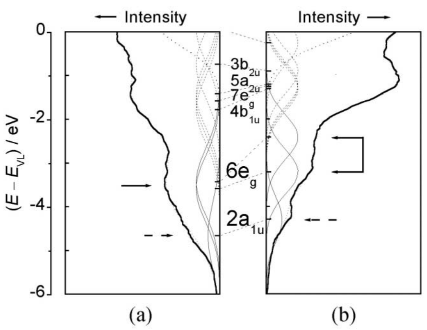
Prof SATO, Naoki (D Sc)
Assoc Prof ASAMI, Koji (D Sc)
Assist Prof KITA, Yasuo (D Sc)
YOSHIDA, Hiroyuki (D Sc)

Studies to elucidate correlation between structures and properties of molecular aggregates are carried out from two aspects: solid-state chemistry of organic thin films based on analyses of their electronic and geometrical structures and physico-chemistry of polymers, membranes and biomaterials by means of electrical measurements.

The former research aims in principle at creating novel molecular systems with notable electronic functions. Both occupied and unoccupied electronic structures in organic semiconductors are directly observed with photoemission and inverse photoemission spectroscopies, respectively. Correlations of such electronic structures in the films and/or at their interface with molecular orientations in them are of particular interest. With bearing in mind such analytical results, synthetic investigations are also made to build up novel molecular systems by assembling molecules newly selected or designed, e.g., highly amphoteric and polar molecules. Further, organic solid-state reactions attract our attention as promising phenomena inducing dynamic electronic properties, so reaction mechanisms are studied for several systems, e.g., a methyl-cation transfer system.



Inverse photoemission spectra of LiPc thin films in (a) the α-form and (b) the x-form. The ordinate is the energy with reference to the vacuum level of LiPc, and as for the abscissae spectral intensities increase toward both sides. The spectral deconvolution using Gaussian functions with assignments is shown for each spectrum. The arrows point significant differences (for SOMO and NLUMO) between the two spectra.

The latter research aims to analyze heterogeneous structures particularly in biological membranes and cells, in relation to their functions. Lipid-bilayer and biological membranes with ion-channels are examined in aqueous solution using several electrical methods. Biological cells under specific conditions such as high pressures are also observed in situ with making full use of these methods, e.g., scanning dielectric microscopy. Further, dielectric properties of polymers and/or liquid crystals are studied in relation to molecular motions.

DIVISION OF MULTIDISCIPLINARY CHEMISTRY S

Supramolecular Biology

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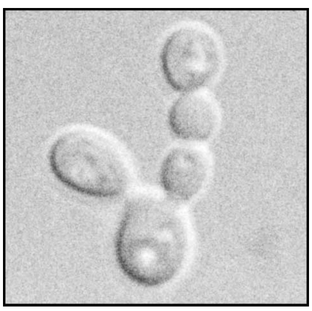
Assist Prof TAKEUCHI, Ken-ichi (D Pharm Sc)
KATO, Utako (D Sc)
Res Associate INADOME, Hironori (D Agr)

We have undertaken the molecular biology, cell biology and behavioral genetics approaches to study the role of biological membrane systems, especially the principal structural element of all membranes, lipid molecules, in controlling animal morphogenesis and behavior. The membrane is a complex supramolecular complex formed by a noncovalent self-assembly of proteins, lipids and carbohydrates. Although the chemical nature and structure of the membrane are extremely diverse, the basic structure of the membrane, the lipid bilayer formed by a vast variety of lipid molecules, is shared by all forms of life.

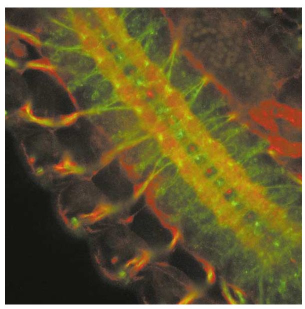
Our long term objective is to elucidate the basic parameters that govern the molecular organization and dynamic movements of membrane lipids during cellular functions, which will provide a new insight into our understanding of the fundamental principles underlying the dynamism of complex membrane systems and a clue to reconstruct an artificial supramolecular membrane complex. Current research topics are as follows:

(1) Identification of a series of proteins that regulate molecular motion of lipid molecules and elucidation of their role in cellular and animal morphogenesis.

(2) Establishment of a series of *Drosophila* mutants with aberrant temperature preference (*atsugari*, *samugari*, etc) and elucidation of the molecular relationship between the temperature-responding membrane systems and animal behaviors.



Over production of a lipid-organizing protein causes multibud formation of yeast.



Distribution of ***Drosophila*** dystroglycan homologue, a causative molecule of ***atsugari*** mutation, in ventral nerve cord.

Particle Beam Science

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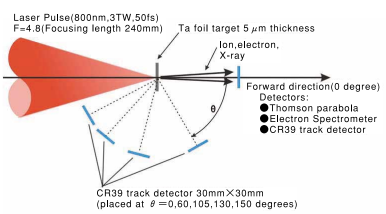
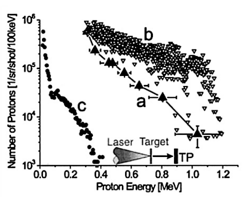
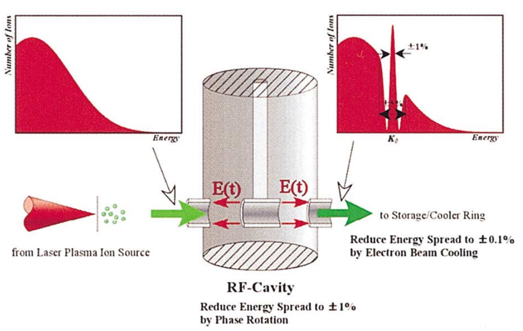
Assoc Prof IWASHITA, Yoshihisa (D Sc)
Assist Prof SHIRAI, Toshiyuki
Technician TONGU, Hiromu

Improvement of the characteristics of the beam, which is an ensemble of many identical charged particles such as proton, heavy ions and electron, is the research scope of our laboratory. (1) Beam emittance in the longitudinal phase space described by energy and time spreads and that in the transverse phase space described by beam position and the declining angle of the beam orbit to the reference one are to be reduced with use of beam cooling. (2) Efficient particle beam acceleration utilizing the extremely high field created by a high power laser, especially the production of high energy ion beam from the plasma created by the high power-density laser and control of its characteristics are under development. (3) Creation of very fine beam by focusing with very high field permanent magnets oriented for linear collider is also being studied. At present, development program combining the items (1) and (2) are proceeding to realize a compact accelerator dedicated for cancer therapy. Ion beam produced by focusing the high power laser on a thin foil target are to be accelerated or decelerated with use of an RF electric field phase synchronized to the pulse laser and its energy spread is reduced by factor of ~5. Its energy spread is further reduced by an electron beam cooling in the downstream ring and the energy spread reduction close to two orders of magnitude is expected by combined use of the above two methods and thus we want to create the sharp peak in the energy spectrum, which originally decays exponentially according to the increase of the energy.







Laser Matter Interaction Science

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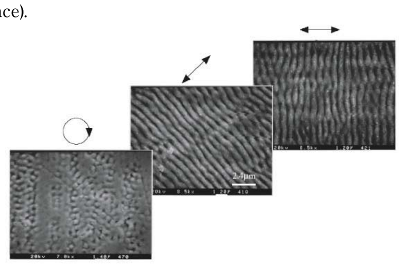
Prof SAKABE, Shuji (D Eng)
Assist Prof HASHIDA, Masaki (D Eng)
SHIMIZU, Seiji (D Sc)

Laser-matter interaction and its applications, and ultra-intense ultra-short pulse lasers are studied. The main subjects are ultra-intense and ultra-short laser-matter interactions and their applications. The physics of nano-ablation and nano-structure formation on the surface of solid with short-pulse lasers are investigated, inquiring the new material science such as laser nano-processing and material creation. The process of ionization of large molecules and tissue with short pulse lasers is also studied to develop new mass spectrometers. With ultra-intense lasers, the physics of high energy radiation generation and its applications are done research into. Ion generations by Coulomb explosion of molecules, clusters, and micro-particles, and sheath acceleration in thin foils and their applications to nuclear science are studied to open a new field of laser nuclear science. In the cooperation with the Laboratory of Electron Microscopy and Crystal Chemistry and the Laboratory of Structural Molecular Biology, the applications of laser produced electrons and x-rays to electron microscopy and x-ray analysis, respectively, will be studied. With the Laboratory of Particle Beam Science, new accelerator physics with laser-produced ions will be developed. For the applications of short pulse lasers to chemistry, biology, material physics, and medical science we will collaborate with laboratories of this institute to challenge to develop a new field of interdisciplinary science. Main facility is the T^6-laser (10TW, 100fs).

Ultra-intense femtosecond laser system for research of laser matter interaction science and collaboration in the Institute for Chemical Research (available from 2004 Autumn in the laser-building in the Advanced Research Center for Beam Science).



Nano-scale structure created on metal surfaces by femtosecond lasers.

ADVANCED RESEARCH CENTER FOR BEAM SCIENCE S

Electron Microscopy and Crystal Chemistry

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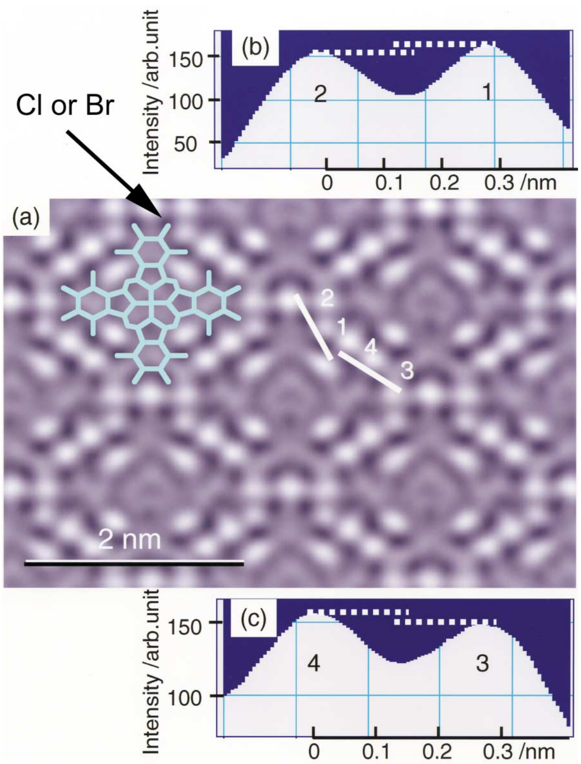
Assoc Prof KURATA, Hiroki (D Sc)
Assist Prof OGAWA, Tetsuya (D Sc)
NEMOTO, Takashi (D Sc)
Res Associate MORIGUCHI, Sakumi (D Sc)

Due to the strong interaction between fast incident electrons and materials, electron microscopic methods are powerful tools to extract information on structural and electronic states of ultra-fine specimens. So as to realize atomic resolution, a 1000 kV electron spectro-microscope has been developed. This electron microscope can resolve atoms or molecules in specimens by using elastically scattered electrons, and crystal structures in thin films can be analyzed directly by electron crystallography method as well. In addition to these, inelastically scattered electrons are utilized to investigate the collective motions of electrons in specimens, quantitative elemental distributions, chemical states of bonding, interactions between neighboring atoms and so on. In cooperation with these methods, scanning probe microscopes are also employed to study low dimensional crystallization processes, surface chemical reactions, functionalities of fine particles and thin films.



HRTEM image of polyhalogenated CuPc. The contrast differences between positions 1 and 2, positions 3 and 4 show the differences of atomic occupancy of cloride and bromide at these positions.

ADVANCED RESEARCH CENTER FOR BEAM SCIENCE H

Structural Molecular Biology

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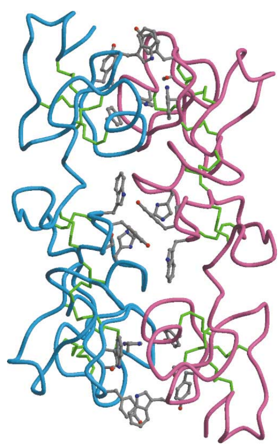
Prof HATA, Yasuo (D Sc)
Assoc Prof ITO, Yoshiaki (D Sc)
Assist Prof FUJII, Tomomi (D Sc)

Detailed information on a structure of a substance can be obtained from analyses of diffraction spots or spectra observed by irradiating X-rays, which strongly interact with electrons distributed around atomic nucleus, into the substance in a crystal or solid state. This laboratory mainly aims at elucidating the relationships between the structure and the function or physical properties of bio-functional substances by investigating the electron-density distributions of biological materials, especially those of proteins, in detail using X-rays from ordinary generators and synchrotron radiations. Furthermore, investigation of the electronic states of atoms and molecules in inorganic materials is performed by X-ray spectroscopy or molecular orbital theory in this laboratory. The main research subjects are as follows:

(1) X-ray crystallographic structure determination of biological substances, especially proteins, and structure-based analysis of their functions. Stereo structures of proteins, their complexes and supra-molecular complexes in crystalline states, especially novel structures of biological substances with structure undetermined, are precisely determined by high-resolution X-ray analysis. Moreover, the structure-based analyses of expression mechanisms of their functions and physical properties are performed using X-ray crystallographic methods. Research themes are structure determination of novel enzyme molecules and their reaction intermediates and products, and crystallographic analyses of enzymatic reaction mechanism, interaction between enzymes and their inhibitors, thermostabilization mechanism of thermo-stable proteins, and formation mechanism of molecular assemblies.

(2) Investigation of the electronic states of atoms and molecules of inorganic materials. The experimental and theoretical investigation of the natural line width in *K* and *L* emission lines by high-resolution X-ray spectroscopy and the theoretical analysis of the electronic states from the X-ray absorption and emission spectra are performed with inorganic materials. Moreover, the development of the detector for soft X-rays are underway.



Intramolecular protein-protein interaction

INTERNATIONAL RESEARCH CENTER FOR ELEMENTS SCIENCE E

Organic Main Group Chemistry

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Prof TAMAO, Kohei (D Eng)
Assist Prof TSUJI, Hayato (D Eng)
SAEKI, Tomoyuki (D Eng)

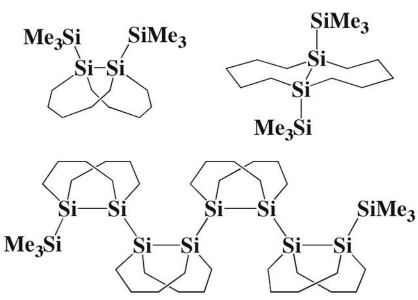
Our research interests encompass the elements science, molecular science, and materials science. Current research projects are concerned with the development and application of new functional organic compounds of the main group elements such as silicon, boron, phosphorus and others, and of new synthetic methodologies based on transition metal catalyzed reactions. The main subjects are as follows.

(1) Conformation-controlled oligosilanes and polysilanes for full-understanding of the sigma-conjugation.

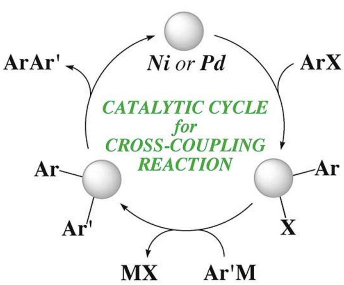
(2) Construction of some donor-oligosilane-acceptor frameworks and their charge-transporting ability.

(3) Development of novel carbon-carbon bond forming reactions catalyzed by transition metal complexes.

(4) Construction of pi-conjugated monomers and polymers containing main group elements via directed ortho-metallation as a key step.



Silicon-Containing sigma-Conjugated Systems
Conformation-Controlled Oligosilanes and Their Photophysics



Transition Metal Catalyzed Cross-Coupling Reaction
Construction of Novel Catalytic Carbon-Carbon Bond Forming Reaction

INTERNATIONAL RESEARCH CENTER FOR ELEMENTS SCIENCE S

Advanced Solid State Chemistry

Tel:0774-38-3120 Fax:0774-38-3125
e-mail:takano@scl.kyoto-u.ac.jp

Prof TAKANO, Mikio (D Sc)
Assoc Prof TERASHIMA, Takahito (D Sc)
Assist Prof SAITO, Takashi (D Sc)
Res Associate YAMAMOTO, Shinpei (D Eng)

We are searching for new 3d transition metal oxides which exhibit exceptional properties. The synthetic techniques we use include application of high pressure of ≤10GPa at 1500℃, film growth using laser ablation and microscopic fabrication of the films, and precipitation of fine particles from solutions. Areas of interest to us include transport and magnetic properties characterized by ligand holes in oxides containing late transition metal ions in high valence states like Fe^{4+}, Co^{4+}, Ni^{3+}, coupling of ferromagnetism and ferroelectricity ($BiMnO_3$), high-T_C superconductivity ($(Ca,Na)_2CuO_2Cl_2$ from which sophisticated experimental data useful to clarifying the superconducting mechanism have been derived by different groups), low-deimensional quantum systems (spin ladders), giant magnetoresistance effect (Mn-oxides), and optical properties (nonlinear optics of $(VO)_2P_2O_7$, blue light emission of $SrTiO_3$).

Concerning the high-pressure synthesis, we have recently succeeded in growing single crystals like those shown in Photo 1. A new Co-oxide discovered in the course of this study shows a hitherto-unknown type of magnetoresistive effect resulting from its unique 2D/1D-mixed structural feature.

Concerning the film growth and microscopic fabrication, we are focusing on effects of the application of high electric field, field-effective transistor effects, *p-n* junction effects for superconductors, and luminescence. Shown in the second picture is the blue-light emitted from a single crystal of $SrTiO_3$ irradiated with argon beam.

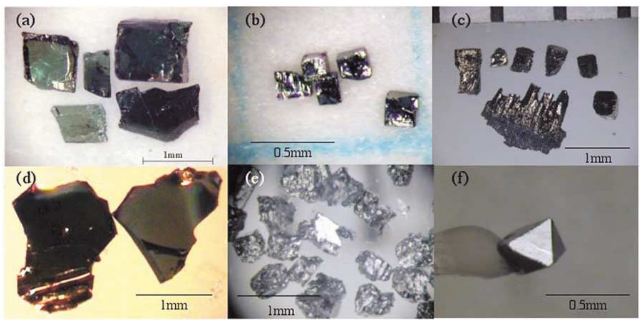


Photo 1: Single crystals of (a) $(VO)_2P_2O_7$, (b) $BiMnO_3$, (c) $PrNiO_3$, (d) $Ca_{1.9}Na_{0.1}CuO_2Cl_2$, (e) $CaFeO_3$, (f) $Tl_2Ru_2O_7$ grown at 3～4.5 GPa at 1300℃.

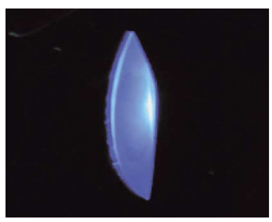


Photo 2: Blue-light emitted from a single crystal of $SrTiO_3$ irradiated with argon beam.

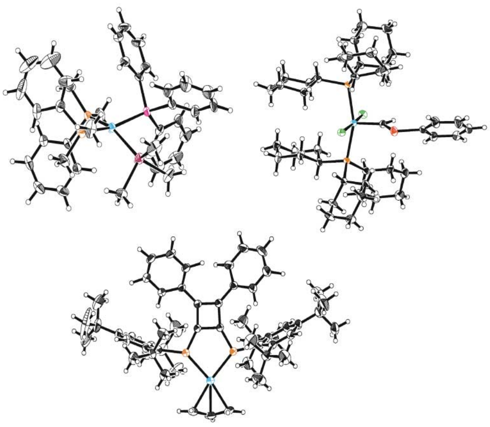
INTERNATIONAL RESEARCH CENTER FOR ELEMENTS SCIENCE E

Organotransition Metal Chemistry

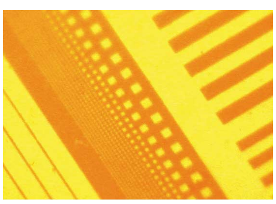
Tel:0774-38-3035　Fax:0774-38-3039
e-mail:ozawa@scl.kyoto-u.ac.jp

Prof OZAWA, Fumiyuki (D Eng)
Assoc Prof OKAZAKI, Masaaki (D Sc)
Assist Prof KATAYAMA, Hiroyuki (D Eng)

Our research aims at establishment of new methodologies for designing well-defined transition metal catalysts. New concepts and ideas of molecular-based catalysts are accumulated by mechanistic investigations using kinetic techniques on the reaction intermediates and elementary processes. A particular interest is focused on transition metal complexes with sp^2-hybridized phosphorus ligands. Thus, sp^2-hybridized phosphorus compounds bear extremely low-lying π^* orbitals mainly located around the phosphorus atoms, and have a marked tendency to engage in metal-to-phosphorus π-back-bonding. We have found that this property is useful for catalysts, leading to highly efficient organic transformations with hitherto unknown reactivities and selectivities.
These studies allow us to develop highly efficient ways of constructing functional organic molecules. We are currently interested in the synthesis of pi-conjugated polymers with well-defined structures, which exhibit novel optical properties.
Recent topics include:
(1) Novel complexes based on the combination of transition metals and heavy main-group elements.
(2) Reactive organometallic complexes bearing sp^2-hybridized phosphorus ligands.
(3) Stereo-controlled synthesis of functional macromolecules using transition metal catalysts.



X-Ray structures of transition metal catalysts



Optical image of micropatterned light-emitting material

INTERNATIONAL RESEARCH CENTER FOR ELEMENTS SCIENCE S

Photonic Elements Science

Tel:0774-38-4510　Fax:0774-38-4511
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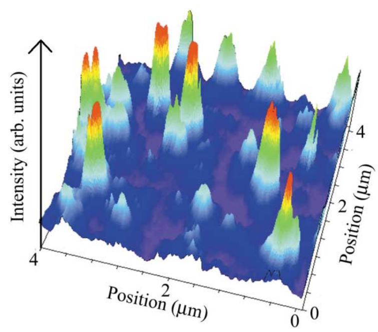
Prof KANEMITSU, Yoshihiko (D Eng)
Assoc Prof MATSUDA, Kazunari (D Eng)
Assist Prof INOUYE, Hideyuki (D Eng)

Today, the study of nanometer-scale structures and materials is one of the major interests in the fields of physics, chemistry, and materials science. Our research interest is to understand optical and quantum properties of nanometer-scale materials and to develop optonanoscience for creation of innovative functional materials. Optical responses of semiconductor quantum nanostructures and low-dimensional strongly correlated electron systems are studied by means of space- and time-resolved laser spectroscopy. In particular, we study optical properties of single nanoparticles and arranged nanoparticle superlattice solids. The main subjects are as follows:
(1) Development of high-resolution scanning near-field optical microscope and optical properties of single nanostructures.
(2) Ultrafast optical spectroscopy of excited states of semiconductor nanostructures.
(3) Nonlinear optical responses of low-dimensional strongly correlated electron systems.
(4) Many body effects of excitons in highly excited solids.
(5) Development of nanoparticles with new optical functions.



Photoluminescence from single semiconductor nanoparticles.

BIOINFORMATICS CENTER S

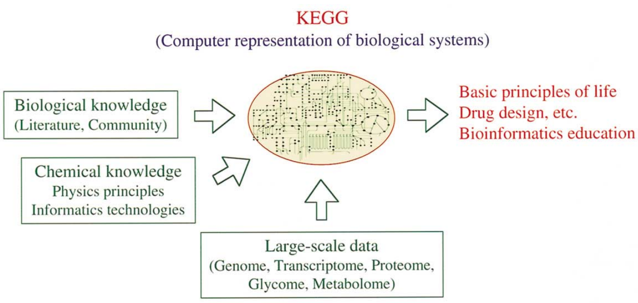
Bioknowledge Systems

Tel:0774-38-3270 Fax:0774-38-3269
e-mail:bic1@kuicr.kyoto-u.ac.jp

Prof KANEHISA, Minoru (D Sc)
Assoc Prof GOTO, Susumu (D Eng)
Assist Prof KAWASHIMA, Shuichi
HATTORI, Masahiro (D Sc)

Owing to continuous developments of high throughput experimental technologies, projects are going on not only to determine complete genome sequence of an increasing number of organisms, but also to analyze gene expression profiles both at the mRNA and protein levels and to catalog protein 3D structure families. However complete, such experimentally determined catalogs of genes, RNAs, and proteins only tell us about the building blocks of life. They do not tell us much about how life operates as a system, such as systemic functional behaviors of the cell or the organism.

Bioinformatics provides basic concepts as well as practical methods to go up from the molecular level to the cellular level, and eventually to still higher levels, of the biological systems by analyzing complex interactions among building blocks and with dynamic environments. We have been developing such bioinformatics technologies and the KEGG system, which is our attempt to uncover and utilize cellular functions through reconstruction of protein interaction networks from the genome information. We are also responsible for the development and operation of the GenomeNet database service (http://www.genome.jp).



BIOINFORMATICS CENTER I

Biological Information Network

Tel:0774-38-3015 Fax:0774-38-3022
e-mail:akutsulab@kuicr.kyoto-u.ac.jp

Prof AKUTSU, Tatsuya (D Eng)
Assist Prof UEDA, Nobuhisa (D Eng)

This laboratory aims at revealing how genetic information of human beings is stored in genome sequences from the viewpoint of informatics. For that purpose, we study computational and mathematical aspects of Bioinformatics and Systems Biology. We are focusing on development of novel algorithms for bioinformatics and mathematical understanding of biological systems. Our main research topics are as follows.

(1) Mathematical analysis of biological information networks.

Recent studies revealed that many of biological networks have special and common structural features such as scale-free topology. We study such structural properties, evolution and dynamics of biological networks using graph-theoretic methods.

(2) Prediction of functions of chemical compounds and proteins.

We develop algorithms for inferring functions and interactions of chemical compounds and proteins. We also develop structure prediction algorithms for RNA and protein sequences.

(3) Algorithms for analyzing biological sequences.

Homology search and motif discovery (extraction of common sequence patterns) are classical but still important problems. We develop flexible and efficient algorithms for these problems.

Software system for protein structure prediction using support vector machines

BIOINFORMATICS CENTER

Pathway Engineering

Tel:Pending　Fax:Pending
e-mail:Pending

to be filled

This laboratory aims at developing a theory on the stability of a system against perturbations and applying the theory to practice such as the drug discovery. The perturbations in this context are, for example, mutations in genes and environmental changes in the system of life that cause genetic and environmental diseases. It is important to consider what kind of (counter) perturbation, e.g. a combination of drugs, is necessary to stabilize the system when we find a relationship between a disease and mutations in several genes, the original perturbations that destabilize the system. We should treat an organism or a cell as a system and construct a knowledge base of biological and medical information about regulation of genes, cells and metabolisms to simulate the stability in the system. We consider the system as a collection of metabolic and other pathways in the pathway engineering and mainly study on the following three topics.

(1) Design of metabolic pathway based on genomic and chemical information.

(2) Theoretical approach to stability of pathways against perturbation such as mutations in a genome and environmental changes.

(3) Practical application of the theories on pathway stabilities.

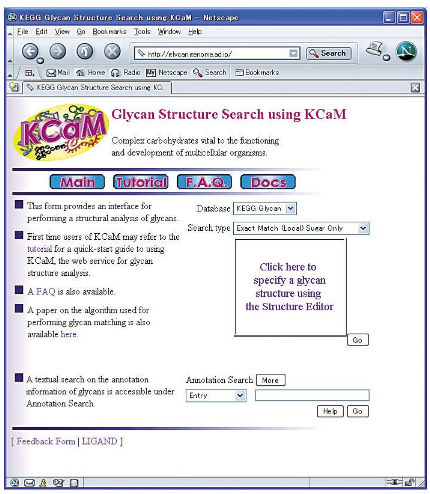
CONTRIBUTED CHAIR

Proteome Informatics (SGI Japan)

Tel:0774-31-4901　Fax:0774-31-4904
e-mail:bic4@kuicr.kyoto-u.ac.jp

Visiting Assoc Prof　MAMITSUKA, Hiroshi (D Sc)
Visiting Assist Prof　YAMAGUCHI, Atsuko
AOKI, Kiyoko F. (Ph D)

The “proteome” is typically defined as the identification and characterization of all proteins produced from all the genes in a genome and of their functions in a living cell or, more generally, an organ. The proteome has become recognized as an essential concept in current biology, and research on the proteome, which is clearly much more complex than that for a protein, has also become recognized as an important field. “Proteome informatics” deals with research involved in analyzing the proteome as a part of bioinformatics, which is a marriage of molecular biology and computer science. The biological data to be dealt with by proteome informatics drastically increases due to recently developed experimental technologies. The mission of proteome informatics is to develop information technologies to draw a picture of the complicated relationships among biological components, mainly proteins, from a vast amount of accumulated biological data. The objective of the Proteome Informatics Laboratory is to undergo research to develop new technologies based on computer science that tackle a variety of issues in proteome informatics, and consequently, to acquire new biological knowledge that contributes to molecular biology as well as pharmacology and the medical sciences. Our particular emphasis has been placed on the following three topics: (1) new probabilistic models and methods for estimating parameters for learning/mining, (2) new efficient algorithms for searching similar chemical compounds, and (3) new methods and models for matching and aligning glycans based on statistical techniques.



KCaM: A web server for structure-based glycan search (http://glycan.genome.jp)

BIOINFORMATICS CENTER

Bioinformatics Training Unit

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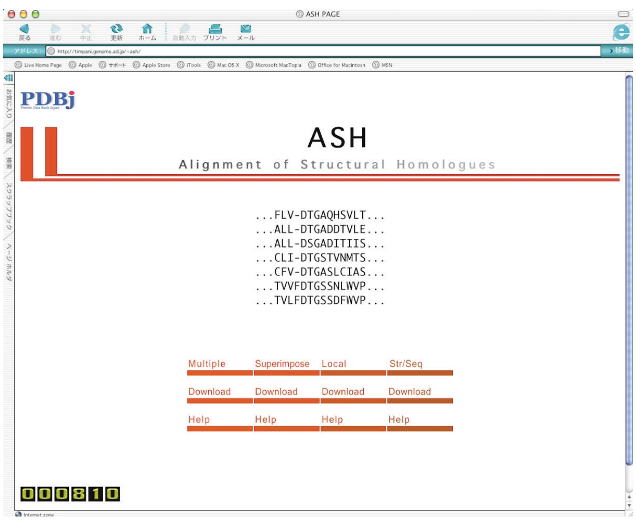
Visiting Prof TOH, Hiroyuki (D Sc)
Visiting Assoc Prof KUMA, Keiichi (D Sc)
Visiting Assist Prof DAIYASU, Hiromi (D Sc)
ICHIHARA, Hisako

Evolutionary studies based on molecular biology are called "molecular evolutionary biology". Living organisms have acquired wide variety of functions during the course of the evolution by changing the information encoded by the genomes. Inversely, reconstruction of the evolutionary history related to the functions would bring us a great insight into the acquired functions and the life. In addition, such evolutionary information is useful for practical fields such as drug design and proteins engineering. We develop new methodologies with evolutionary information, to extract biological knowledge from molecular biological data including sequence and structure data of genes and proteins, genome data, and expression profile data. We also analyze such data from the evolutionary viewpoint, to obtain novel biological knowledge. We are now investigating genome comparison, molecular evolution of archaebacteria, functional analysis of GPCR, protein structure comparison, improvement of evolutionary trace method, glycobiology, and inference of gene expression network from expression profile data. Our protein structure comparison programs are available at a web site, ASH (http://timpani.genome.ad.jp/~ ash/).



Visiting Professors

Prof TAKAHASHI, Hideroh (D Eng)
(Laboratory of Molecular Rheology)

Toyota Central R&D Laboratories, Inc.
Standing Corporate Auditor

Prof. Takahashi has studied rheology in polymer processing. Thus, simulation for processing to obtain products in high-qualities efficiently and application of ultrafast shear flow to processing have been investigated. He will discuss how the fruits of researches of rheology are used and applied in industry.

Prof KYOTO, Michihisa (D Eng)
(Laboratory of Advanced Solid State Chemistry)

Sumitomo Electric Industries, Ltd.
R&D planning Dept., General Manager

Prof. Kyoto has investigated manufacturing processes of VAD, an important method for mass production of optical fiber. He also has took part in court procedure for patents problems of optical fiber against a company in U.S.A., thus he has experienced from basic research to industrialization. Now, he manages research division of the company.

Prof KITAZAWA, Koichi (Ph D)
(Laboratory of Advanced Solid State Chemistry)

Japan Science and Technology Agency
Executive Director

Prof. Kitazawa has developed the sicence of high-temperature superconductoivity from view points of synthesis and property meawsurements. His interest extends magneto-science, including Moses effect, magneto-Archimedes effect of water and formation of magneto-Wigner crystls. Now he is involved in the governmental funding for scientific research,technology transfer and promotion of public relationship with sicence.

Prof NAGASAWA, Koichi (D Sc)
(Laboratory of Advanced Solid State Chemistry)

Renesas Technology Corp.
Chairman & CEO

Dr. Nagasawa is the Chief Executive Officer of Renesas Technology Corp., which is the world's third-largest semiconductor manufacturer and ranks number one in Japan. He is basically amaterial scientist who got a doctorate for his very successful work on the crystal growth of vanadium oxides using a chemical transporttechnique. He will contribute to the ICR by stimulating the studies on new functional materials.

Prof YAN, Chun-Hua (Ph D)
(Laboratory of Advanced Solid State Chemistry)

Peking University
Professor

Prof. Chun-Hua Yan will take the post of the visiting professor of the IRCELS for three months since October, 2004. In his country he is now serving as a young (43 years old) and active director of the State Key Laboratory of Rare Earth Materials Chemistry and Applications, Peking University. He has specialized in inorganic chemistry, bioinorganic chemistry, and nano-science. His wide-ranged activities just match those of the IRCELS. We will work together to develop interdisciplinary researches in the future also.

Assoc Prof SAITO, Susumu (D Eng)
(Laboratory of Structural Organic Chemistry)

Graduate School of Science, Nagoya University
Associate Professor

Acid-base interactions form coordination or hydrogen bonding and are used for molecular recognition and catalysis. Assoc. Prof. Saito has synthesized sterically and electronically well-designed catalysts based on acid-base interactions and evaluate the interactions at molecular level. He has applied these systems to chemical transformations and created reactions of high reactivities with high selectivities. He intends to apply the interactions to innovation of new catalysis and synthesis of new compounds.

Assoc Prof TSUKAGOSHI, Kazuhito (D Sc)
(Laboratory of Advanced Inorganic Synthesis)

RIKEN
Senior Research Scientist

Assoc.Prof Tsukagoshi has developed nanostructure fabrication techniques to produce nanoscale electrodes that will allow the development of technology for the direct analysis of electrical conduction, to aid in the search for heretofore unknown nano-electronic properties.

Assoc Prof EMOTO, Kazuo (D Pharm Sc)
(Laboratory of Supramolecular Biology)

University of California, San Francisco
Postdoctoral Fellow

A neuron has two neuritis: axon and dendrite for formation of neural circuits and interesting in neuroscience is the study how a neuron generates cell porality at cell differentiation. Now Assoc. Prof. Emoto investigates molecular biology of this area using Drosophila peripheral sensory nervous system.

Assoc Prof MATSUMOTO, Yonetatsu (D Eng)
(Laboratory of Organotransition Metal Chemistry)

Rolic Technologies Ltd.
Asia Liaison

Assoc. Prof. Matsumoto has been involved in R&D and industrialization of photo-alignment of liquid crystals. Organic chemistry plays important role in liquid crystals and many other fields, Assoc. Prof. Matsumoto has been making endeavors to apply inventions in organic chemistry to industrial technologies as well as to commercial products.

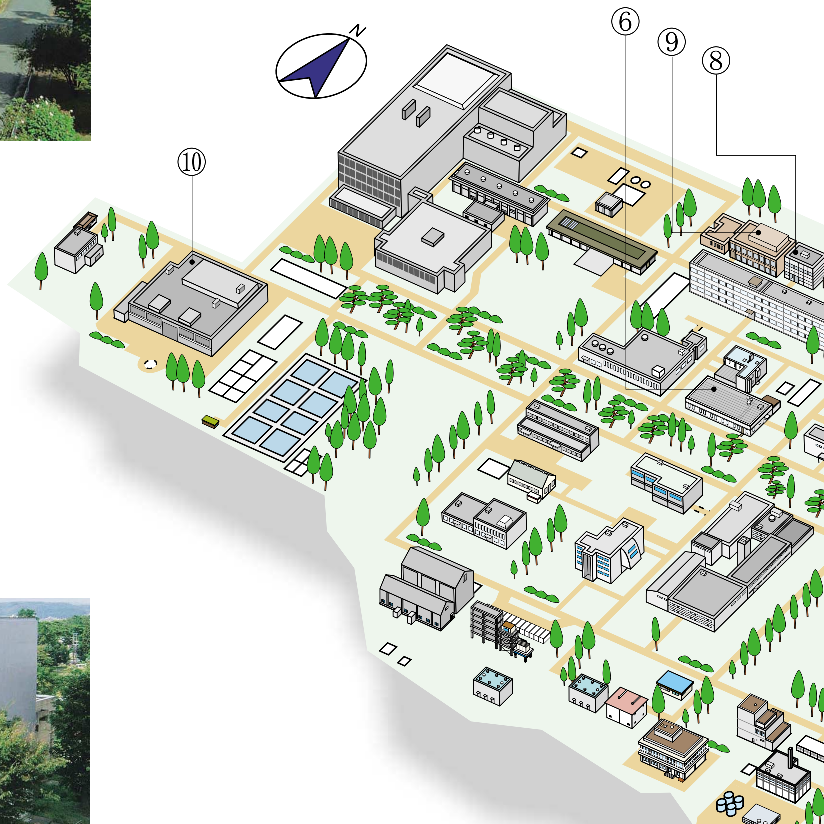
Research Buildings

①Main Building

⑩Accelerator Laboratory

④High– Resolution Electron
Spectromicroscope Laboratory

Drainage Monitor Center of Uji Campus



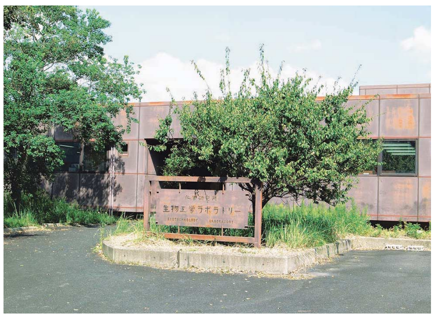
Institute for Chemical Research

Campus Area	215,642 ㎡	
Buildings (Total area)	22,903 ㎡	
①Main Building & Annex		11,714 ㎡
②Administration Office (3rd.Fl.)		
③Joint Research Laboratory		3,777 ㎡
④High-Resolution Electron Spectromicroscope Laboratory		913 ㎡
⑤Low-Temperature High-Resolution Electron Microscope Laboratory		586 ㎡
⑥Low-Temperature Laboratory		760 ㎡
⑦Biotechnology Laboratory		540 ㎡
⑧Bioinformatics Center		496 ㎡
⑨Nucleic Acids Laboratory		1,207 ㎡
⑩Accelerator Laboratory		2,910 ㎡
⑪International Research Center for Elements Science		
⑫Uji Library, Kyoto University (3rd. Fl.)		

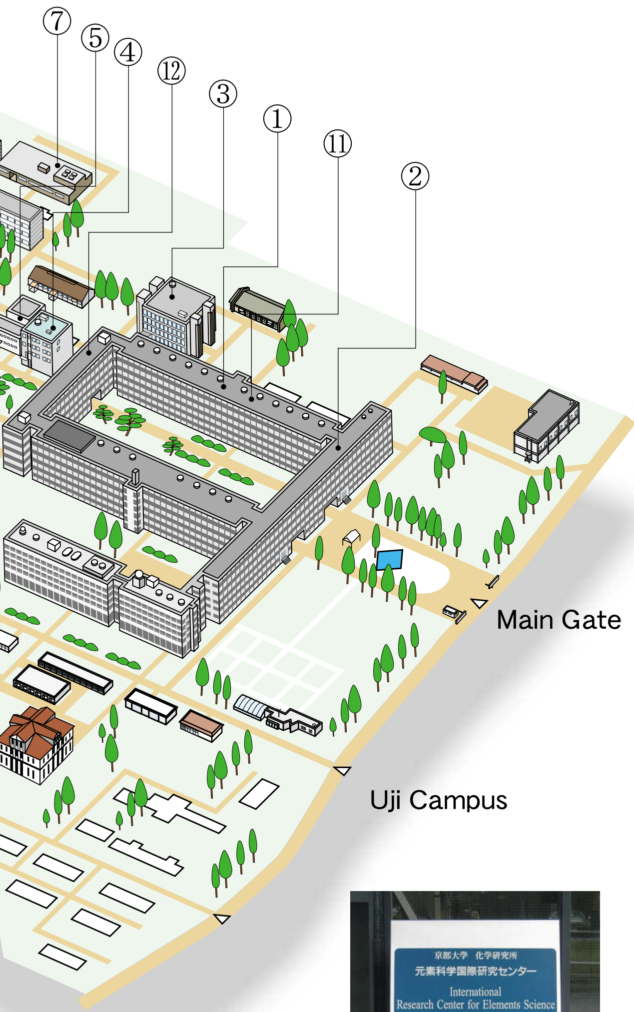
⑧Bioinformatics Center

Uji Campus is located at the verdurous riverfront of the Uji River. Here has been a strategic point between Kyoto and Nara, the old capitals of Japan, and there are many historical heritages such as the Obaku-san Manpukuji Temple that was a center of the advanced culture and arts introduced from Ming. We endeavor to enrich the buildings and facilities those are suitable to the center for the most advanced studies and harmonious with nature and the local community.

⑨Nucleic Acids Laboratory



⑦Biotechnology Laboratory



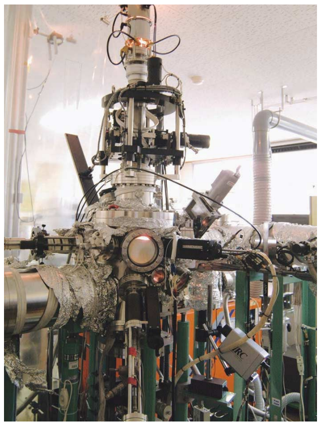
⑪International Research Center for Elements Science

③Joint Research Laboratory

Major Research Instruments

Electron Spin Resonance Spectrometer

Electron Storage Ring KSR



Pulsed Laser Deposition System

Solid-State NMR Spectrometer

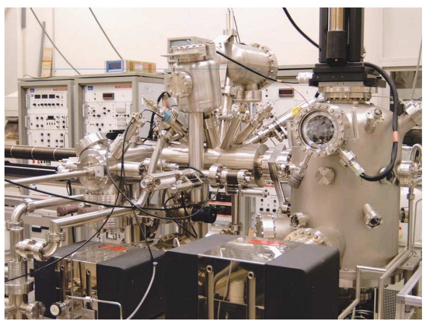
Computational Chemistry and Bioinformatics Servers (SGI Origin 3800 supercomputer systems)

The Institute's Supercomputer Laboratory houses SGI Origin 3800 supercomputer systems (left) and SUN Fire 15K server systems (below), which are used for research in computational chemistry and bioinformatics as well as for the GenomeNet Service.

GenomeNet Server(SUN Fire 15K server systems)

High-Pressure Synthesis Apparatus

Multi-Purpose Automatic Bioreactor



Photoemission Spectrometer

P3-Level Recombinant DNA Technology Laboratory

Low-Temperature Laboratory (Helium Liquifier)

High Resolution Electron Spectro-Microscope

This is one of the highest performance microscopes in the world with accelerating voltage of 1,000 kV, maximum magnification of 6,000,000 and spatial resolution of 0.12 nm. Imaging plate is employed as a high quality detector in addition to photo-films and CCD camera. By using an electron energy spectrometer, inelastically scattered electrons can be analyzed and re-imaged so as to reveal elemental distribution in a specimen. The detectable mass reaches to less than 10^{-20}g. A phthalocyanine molecule was directly imaged in atomic resolution.

New Materials Development Laboratory

MALDI-TOF Mass Spectrometer

This matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectrometer can be used not only for biopolymers, including proteins, nucleic acids, sugars, and lipids, but also for synthetic polymers and organic molecules. This apparatus is particularly useful for the structural characterization of the large and complex molecules which cannot be attained by any other means such as the NMR spectroscopy.

600 MHz NMR Spectrometer

One- and two-dimensional solution spectra and relaxation properties including diffusion can be measured with high resolution for such nuclei as ^{1}H, ^{13}C, ^{14}N, ^{15}N, ^{17}O, ^{19}F, ^{31}P, and metallic elements. Most of these elements are relevant to today's issues in biochemistry, chemistry, and physics. The NMR machine is useful and powerful for a variety of measurements, because it is equipped with computer-controlled field-gradient probes and because it is connected to other NMR machines in our institute by a network system. The equipment is applied for the physico-chemical study of water and aqueous solutions under ambient supercritical conditions.

X-ray Crystallographic Diffration System with 2-Dimensional Detector

Staffs and Students

University Staffs

(As of August 1, 2004)

Professor	Associate Professor	Assistant Professor	Research Associate	Technician	Sub-total	Researcher	Other Staff	Sub-total	Grand Total
30 (3)	25 (4)	42	5	9	111 (7)	46	59	105	216 (7)

Numbers in parentheses represent visiting Professors

Other Research Students, Fellows and Associates

(As of May 1, 2004)

Research Student	Research Fellow	Postdoctoral Fellow of JSPS	Other Research Associate	Total
9	2	4	6	21

Graduate Students and their Origins

(As of May 1, 2004)

Classification	Course	Domestic		Foreign						
		Kyoto University	Other Universities	Brazil	China, P. R.	Korea, R.	Morocco	Nepal	Thailand	Sub-total
Science	Master's Course	19	30		1					50
	Doctoral Course	16	30				1			47
Engineering	Master's Course	39	4							43
	Doctoral Course	11	8		1	4			1	25
Agriculture	Master's Course	1	22							23
	Doctoral Course	1	13		1					15
Pharmaceutical Sciences	Master's Course	6	8		1					15
	Doctoral Course	4	5			1				10
Medicine	Master's Course									0
	Doctoral Course	1								1
Informatics	Master's Course			1						1
	Doctoral Course	1	3					1		5
Sub-total	Master's Course	65	64	1	2					132
	Doctoral Course	34	59		2	5	1	1	1	103
Total		99	123	1	4	5	1	1	1	235

Research Activities

Publications

1998	1999	2000	2001	2002	2003
430	465	390	407	497	448

Visitors from foreign countries in 2003

Australia	1	Mexico	1
Canada	2	Netherlands	1
China, P. R.	12	Poland	3
Croatia	1	Russia	7
Egypt	1	Singapore	1
France	16	Sweden	2
Germany	10	Switzerland	1
Iceland	2	Thailand	1
India	3	UK	5
Israel	3	USA	25
Korea, R.	4		

102 people from 21 countries

Major Research Projects

- Kyoto University, COE Formation Basic Research, "Elements Science" — Research Leader, TAMAO, Kohei
- Research for the Future Program, "Biological Systems Database (KEGG)" — Project Leader, KANEHISA, Minoru
- Creative Scientific Research, "Collaboratory on Electron Correlations" — Representative from ICR, NAKAHARA, Masaru
- JST Bioinformatics Research and Development, "Binary Relations Database (BRITE)" — R&D Leader, KANEHISA, Minoru
- 21st Century COE Program, "Kyoto University Alliance for Chemistry" — Representative from ICR, TOKITOH, Norihiro
- MEXT, "Nanotechnology Support Project of MEXT, Japan" — Representative from ICR, ISODA, Seiji
- Bioinformatics Education Program, "Education and Research Organization for Genome Information Science" — KANEHISA, Minoru
- Partnership between Universities and Industry, "National Research Grid Initiative (NAREGI)" — Representative from ICR, NAKAHARA, Masaru
- 21st Century COE Program, "Knowledge Information Infrastructure for Genome Science" — Project Leader, KANEHISA, Minoru
- 21st Century COE Program, "Center for Diversity and Universality in Physics" — Representative from ICR, NODA, Akira

Finances

(thousands yen)

	Personnel	Non-Personnel	21st Century COE Program	Grants-in-Aid for Scientific Research	Partnership between Universities and Industry	Other*5 Funds	Donation for Research	Total
1999	1,310,127	1,284,260	——	488,921	134,470	——	73,860	3,291,638
2000	1,407,951	1,549,215	——	954,280	418,314*1	——	78,062	4,407,822
2001	1,397,585	1,725,272	——	795,105	356,231*2	98,673	106,478	4,479,344
2002	1,471,582	1,680,788	65,000	652,900	130,578*3	514,748	109,766	4,625,362
2003	1,246,811	1,590,885	307,350	581,000	188,351*4	442,525	110,422	4,467,344

*1 For 2000, including other competitive research funds of the Japanese Government (308,796)
*2 For 2001, including other competitive research funds of the Japanese Government (315,230)
*3 For 2002, including other competitive research funds of the Japanese Government (17,998)
*4 For 2003, including other competitive research funds of the Japanese Government (16,286)
*5 Until 2000, "Other Funds" were included in the funds of Partnership between Universities and Industry

Major Grants and Funds in 2003

Grants-in-Aid for Scientific Research (over ten million yen)

- Specially Promoted Research (COE) (2)/
  Elements Science: Construction of Organic and Inorganic Frameworks Focusing on Quality of Elements — TAMAO, Kohei
- Priority Areas Research (2)/
  Role of Polymers for Constructing all Solid-state Ionic Devices — KOHJIYA, Shinzo
  Construction and Retrieval of Highly Integrated Biological Databases — GOTO, Susumu
  Construction and Characterization of Composite Biocatalysts — ESAKI, Nobuyoshi
  Integrated Database of Genomes and Cellular Functions for Bacterial Species — KANEHISA, Minoru
- Scientific Research (A) (1)/
  Super Strong Permanent Magnet for Final Focus Quadrupole in Linear Collider — IWASHITA, Yoshihisa
- Scientific Research (A) (2)/
  The Science and Functions of Solid Surfaces with High-Density Polymer Brush — FUKUDA, Takeshi
  Searches for New 3d Transition Metal Oxides Dominated by Oxygen p-Hole Character — TAKANO, Mikio
  Study on the Dynamics of Supercritical Aqueous Solutions by Newly Developing a High-Temperature Multinuclear NMR Probe for Diffusion — NAKAHARA, Masaru
  Functional Differentiation and Morphogenesis of Cellular Membranes Based on the Topological Information of Membrane Lipids — UMEDA, Masato
- Scientific Research (B) (2)/
  Polymer Crystallization under Shear Flow - Aming to Reveal the Formation Mechanism of Fiber Structure — KANAYA, Toshiji

Partnership between Universities and Industry (over ten million yen)

- MEXT Research Revolution 2002 (RR2002)
  Nanotechnology Support Project of MEXT, Japan/Precise Analysis Support of Nanosize Materials — ISODA, Seiji
  Protein3000/
  Structural Genomics Consortium for Research on Protein Higher-Order Structure Formation System; Principal Investigator: Prof. MIKI Kunio, Graduate School of Science, Kyoto University — HATA, Yasuo
  Large Scale Preparation of Proteins from Extremophiles; Principal Investigator: Prof. KURAMITSU Seiki, Graduate School of Science, Osaka University — ESAKI, Nobuyoshi
  Structural Genome for Intracellular Signal Transduction; Principal Investigator: Prof. INAGAKI Fuyuhiko, Graduate School of Pharmaceutical Science, Hokkaido University — TOH, Hiroyuki
- Joint Research
  Deductive Database of the Genome and the Biological System Based on Binary Relations (JST) — KANEHISA, Minoru
  Higher Order Structure Formation in Induction Period of PLA Crystallization and in External Fields (Collaboration Research with TOYOTA MOTOR CORPORATION and TOYOTA CRDL., INC.) — KANAYA, Toshiji

Other Funds (over ten million yen)

- Special Coordination Fund of the Ministry of Education, Culture, Sports, Science, and Technology of Japan/
  Bioinformatics Training Unit — KANEHISA, Minoru
- JSPS Research for the Future Program/
  Biological Systems Database (KEGG) and Genome Information Science — KANEHISA, Minoru
- Industrial Technology Research Grant Program by New Energy and Industrial Technology Development Organization (NEDO) of Japan/
  Production of Useful Compounds and Environmental Purification by Cryobiotechnology with Cold-adapted Microorganisms — KURIHARA, Tatsuo

Honors

Nobel Prize

(period of one's tenure of ICR)

YUKAWA, Hideki	1949	Physics	(1943～1968)

Order of Culture

YUKAWA, Hideki	1943	Atomic Physics	(1943～1968)
HAYAISHI, Osamu	1972	Biochemistry	(1959～1976)
SAKURADA, Ichiro	1977	Polymer	(1936～1967)
MITSUDA, Hisateru	1994	Food Science	(1955)

Persons of Cultural Merits

YUKAWA, Hideki	1951	Atomic Physics	(1943～1968)
HORIBA, Shinkichi	1966	Physical Chemistry	(1927～1947)
HAYAISHI, Osamu	1972	Biochemistry	(1959～1976)
SAKURADA, Ichiro	1977	Polymer	(1936～1967)
MITSUDA, Hisateru	1989	Nutrition, Food Science	(1955)
HORIO, Masao	1993	Polymer, Materials	(1955～1970)

The Japan Academy Prize

SASAKI, Nobuji	1944	(1942～1959)
SAKURADA, Ichiro	1955	(1936～1967)
INOUE, Yoshiyuki	1959	(1943～1959)
KIMURA, Ren	1959	(1939～1956)
KATAGIRI, Hideo	1960	(1942～1960)
HAYAISHI, Osamu	1967	(1959～1976)
SUZUKI, Tomoji	1979	(1957～1965)
MITSUDA, Hisateru	1980	(1955)

Medal of Honor with Purple Ribbon

SAKURADA, Ichiro	1956	(1936～1967)
TAKEI, Sankichi	1961	(1937～1959)
ODA, Ryohei	1972	(1955～1970)
SUITO, Eiji	1977	(1951～1975)
TAKADA, Toshio	1987	(1963～1986)
SAKKA, Sumio	1996	(1953～72/1983～94)
SODA, Kenji	1997	(1965～1996)
SHINJO, Teruya	2000	(1966～2002)
TAMAO, Kohei	2004	(1993～present)

Awards

(the last 5 years)

2000	URAYAMA, Kenji	Award for Encouragement of Research in Polymer Science, The Society of Polymer Science, Japan
	INOUE, Tadashi	The Society of Rheology, Japan, Research Award
	KAWACHI, Atsushi	The Society of Silicon Chemistry, Japan Award for Young Chemists
	SUGIURA, Yukio	The Pharmaceutical Society of Japan Award
2001	MURAKAMI, Syozo	The Chemical Society of Japan Award for Technical Achievements
	MATUBAYASI, Nobuyuki	Helmholtz Award, International Association for the Properties of Water and Steam
	UCHINO, Takashi	Vittorio Gottardi Prize, International Commission on Glass
	TAKAHASHI, Masahide	The Ceramic Society of Japan, Young Scientists Award
	OSAKI, Kunihiro	The Society of Rheology, Japan, Award
	KAWACHI, Atsushi	The Chemical Society of Japan Award for Distinguished Young Chemists
2002	AZUMA, Masaki	Japan Sociey of Powder and Powder Metallurgy Award for Innovatory Research
	KANAYA, Toshiji	The Society of Fiber Science and Technology, Japan Prize for Excellence in Fiber Research
	KOMATSU, Koichi	Alexander von Humboldt Research Award
	TAMAO, Kohei	The 42nd Toray Science & Technology Prize (2002) (Toray Science Foundation)
	TAMAO, Kohei	Frederic Stanley Kipping Award 2002, The American Chemical Society
	YAMAGUCHI, Shigehiro	The Chemical Society of Japan Award for Distinguished Young Chemists
2003	KURATA, Hiroki	The Japanese Society of Microscopy Award (Setou Award)
	SOHRIN, Yoshiki	The 18th Oceanochemistry Award (Research Institute of Oceanochemistry)
	TAKAHASHI, Masahide	Ceramic Society of Japan/The Australian Ceramic Society (CJS/ACS) Joint Ceramic Award for 2003
	TSUJII, Yoshinobu	SPSJ Wiley Award
	NISHINAGA, Tohru	Konica Minolta Technology Center Award in Synthetic Organic Chemistry, Japan
	TOKITOH, Norihiro	The Division Award of The Chemical Society of Japan
	TOKITOH, Norihiro	Alexander von Humboldt Research Award
	TAKEDA, Nobuhiro	The Society of Silicon Chemistry, Japan Award for Young Chemists
	TAMAO, Kohei	The Asahi Prize 2002 (Asahi Culture Foundation)
	TAMAO, Kohei	The 14th Mukai Prize (Tokyo Ohka Foundation for the Promotion of Science and Technology)
	TAKANO, Mikio	2002 JSPM Award for Distinguished Achievements in Research
2004	MURATA, Yasujiro	The Chemical Society of Japan Award for Distinguished Young Chemists
	MATUBAYASI, Nobuyuki	Morino Award for Promotion of Molecular Sciences
	KURIHARA, Tatsuo	The Japan Bioscience, Biotechnology and Agrochemistry Society Award for the Encouragement of Young Scientists
	TAMAO, Kohei	Herbert C. Brown Lecturer

Educational and Social Activities

Theses

	Science	Engineering	Agricultural Sc	Pharmaceutical Sc	Medical Sc	Total
2003	8	5	2	3	0	18

Lectures

(April 1, 2003-March 31, 2004)

2003	August 23	The 6th Chemistry for High School Students-Lectures and Open Laboratories "Hear, See and Enjoy the Frontiers of Chemistry"
	October 4	The 10th Public Lectures / The 7th Open Campus Uji 2003 (collaboration)
	December 5	The 103rd Annual Symposium of Institute for Chemical Research The 8th ICR Awards
2004	March 5	Symposium of Graduate Students

Publications

(April 1, 2003-March 31, 2004)

ICR Annual Report 2003, vol.10
Profiles of Institute for Chemical Research, 2003 (in Japanese/in English)
Obaku (News Letter of Institute for Chemical Research, in Japanese), No.19, 20

Web Pages

http://www.kuicr.kyoto-u.ac.jp/index.html
e-mail : koho@scl.kyoto-u.ac.jp

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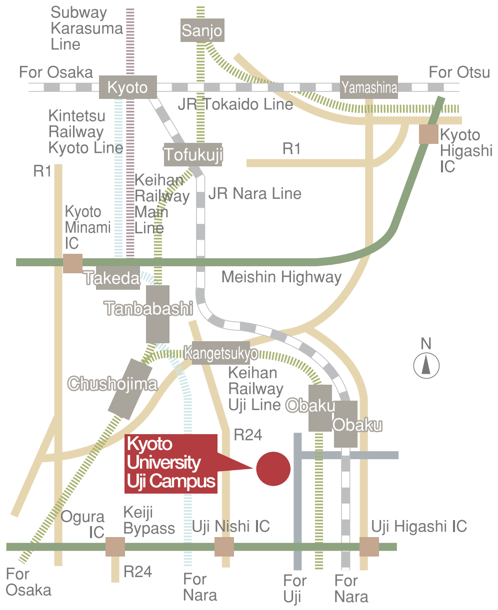

Location and Transportation

From Obaku Station on the Keihan Uji Line: 10 min by walk
(from Keihan-Sanjo Station to Obaku Station: 35 min)
From Obaku Station on the JR Nara Line: 7 min by walk
(from Kyoto Station to Obaku Station: 20 min)
From Kyoto-Minami Interchange: 20 min by car
From Uji-Higashi Interchange: 10 min by car
From Uji-Nishi Interchange: 10 min by car