RCMS NEWS

18
2017

NAGOYA UNIVERSITY
RESEARCH CENTER FOR MATERIALS SCIENCE

RCMS

Reports and Communications of RCMS Activities

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May 2017
Issue #18

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Integrated Research Consortium on Chemical Sciences Established in 2016

In April 2016, the Research Center for Materials Science at Nagoya University established the Integrated Research Consortium on Chemical Sciences with cooperation from the Institute for Catalysis at Hokkaido University, the Science Institute for Chemical Research at Kyoto University, and the Institute for Materials Chemistry and Engineering at Kyushu University.

On June 22 (Wed.) of 2016, an opening ceremony for the Consortium and commemorative lecture was held at the 2nd-Floor Conference Room of the Noyori Materials Science Laboratory. A kick-off symposium was held on the following day. Without delaying the succession of initiatives from the MEXT Project of Integrated Research on Chemical Synthesis which finished in the 2016 academic year, the Consortium will serve as a core international research organization in materials synthesis.

Opening Ceremony for the Consortium and Commemorative Lecture

(June 22–23, 2016)

Greetings, Director, Prof. Tatsumi

Greetings, President, Prof. Matsuo

Prof. Amano

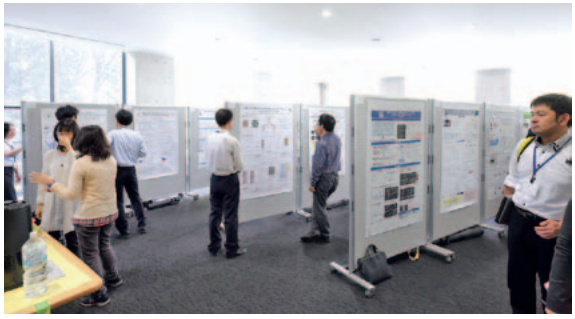
Prof. Noyori

Conglaturate address, MEXT, Mr. Ushio

Prof. Itami

Prof. Erker

Invited, Prof. Takimiya

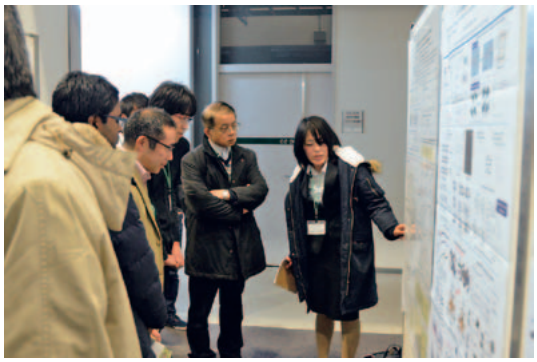


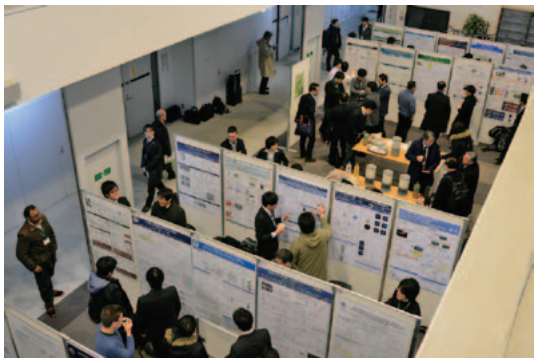
Poster session

IRCCS 2nd Symposium, Hokkaido ＊＊

(January 26–27, 2017)

Prof. Kobayashi, The U. of Tokyo





Core-to-Core Program

The 20th Joint Seminar

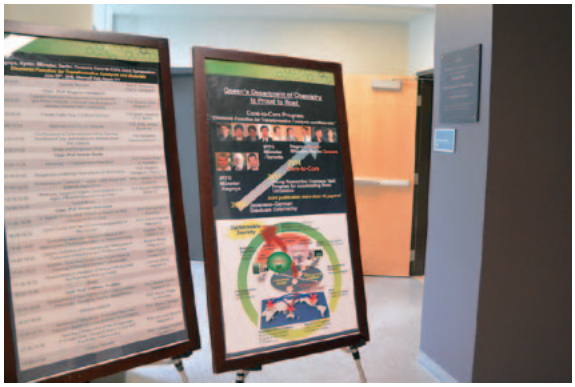
As part of the Core-to-Core Program "Strategic Research Networks (Type A)" operated by the Japan Society for the Promotion of Science (JSPS), the program "Elements Function for Transformative Catalysis and Materials" is promoted by the Research Center for Materials Science and the Department of Chemistry, Graduate School of Science at Nagoya University, with Professor Shigehiro Yamaguchi serving as Project Coordinator. This program was selected for the Core-to-Core Program in the 2014 academic year as a successor to the Japanese-German Graduate Externship and The JSPS Strategic Young Researcher Overseas Visits Program for Accelerating Brain Circulation, two programs which were conducted to provide overseas experience at a young age for outstanding young researchers expected to perform internationally. In this program, joint research and dispatch of researchers is actively performed with the participating institutions at the University of Munster (Germany), the Technical University of Berlin (Germany), Queen's University (Canada), and Kyoto University (Japan).

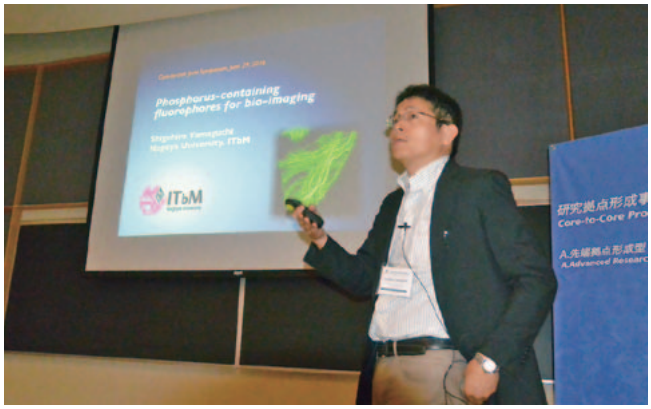
The 2016 academic year featured the 20th Joint Seminar when counting from the Japanese-German Graduate Externship program. The Seminar was held at Queen's University, marking the first time that the event was held in Canada. "Boron in the Americas – Boram 2016" had been held at Queen's University immediately prior to the 20th Joint Seminar, and many researchers who had attended Boram 2016 also attended the symposium. Researchers participating in joint research for the program were asked many questions by researchers who had come to listen to the symposium. The Joint Seminar was a lively and extremely meaningful event.

The 20th Joint Seminar

June 29 (Wed.), 2016; held at Queen's University, Canada

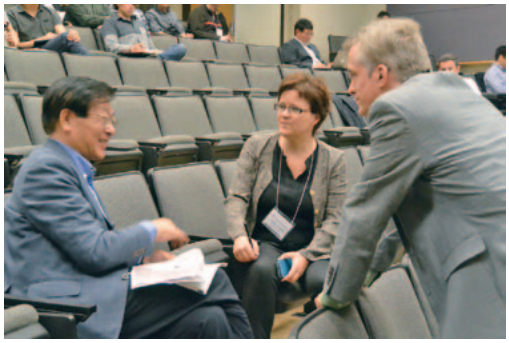
Participants from Japan: 7 professors, 4 students (oral presentation)
Participants from Canada: 20 professors, approx. 70 students
Participants from Germany: 7 professors, 5 students (oral presentation by all participants)





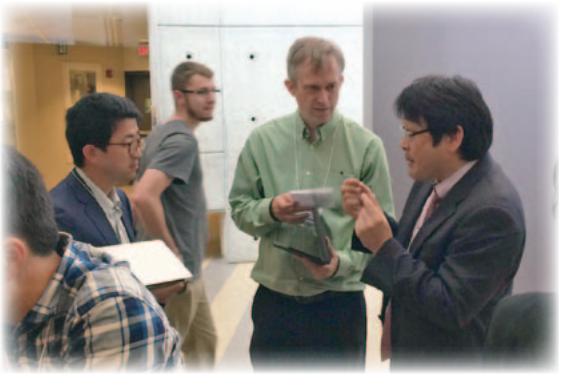
Prof. Yamaguchi

Opening, Prof. Wang



Ms. Mihara, student from Nagoya

Prof. Erker



Prof. Saito

Mr. Wang, student from Nagoya

Group photo

Closing, Prof. Crudden

Research Topic

(Functional Materials)

Visualizing photoexcitation in a molecule by laser tunneling ionization imaging

Electron motion governs bond-breaking and bond-making between molecules. Shooting movies of electrons is thus a long-standing goal of physicists and chemists pursuing a deeper understanding of chemical reactions. Laser tunneling ionization is a promising approach towards this goal that requires a high temporal resolution in the femtosecond range or shorter. In fact, the laser tunneling ionization has been successfully applied to static imaging of ground-state molecules. On the other hand, the applicability to excited states is not trivial. This is because of their small ionization potentials, which may introduce significant contributions from multiphoton process (instead of tunneling) to the ionization. Supported by quantitative comparisons with solid theories, the present study on nitric oxide (NO) demonstrates that the laser tunneling imaging can visualize the electron distribution in a short-lived, excited molecules and the change upon photoabsorption. The present study[1] demonstrates the visualization of photoexcitation in a molecule – a model reaction involving electron rearrangement – by laser tunneling ionization, thus suggesting a route to shoot ultrafast electron movies during chemical reactions.

We adopted NO as the target, which has a low-lying electronic state ($A^2\Sigma^+$) in the deep UV range (226 nm) from the ground state ($X^2\Pi$) (Fig.1). The ion image of N^+ fragment ions produced by dissociative tunneling ionization of NO in the ground state, $NO(X^2\Pi, 2\pi) \rightarrow NO^+ + e^- \rightarrow N^+ + O + e^-$, exhibits a characteristic momentum distribution peaked at 45° to the laser polarization direction. Since the tunneling ionization rate is determined by the shape of HOMO along the laser electric field, the structure of the 2π orbital appears in the ion image. On the other hand, a broad distribution centered at ~0° is seen when the $A^2\Sigma^+$ excited state (with the $3s\sigma$ HOMO of a Rydberg character) is prepared as the initial state by deep-UV photoexcitation. The observed angular distributions are in good agreement with the predictions by weak-field asymptotic theory (WFAT) of tunneling ionization, showing that the laser tunneling ionization can probe changes in the highest-occupied molecular orbital by photoexcitation.

Reference

[1] T. Endo, A. Matsuda, M. Fushitani, T. Yasuike, O. I. Tolstikhin, T. Morishita and A. Hishikawa, Phys. Rev. Lett. 116 (2016) 163002 (5 pages).

(Akiyoshi HISHIKAWA)

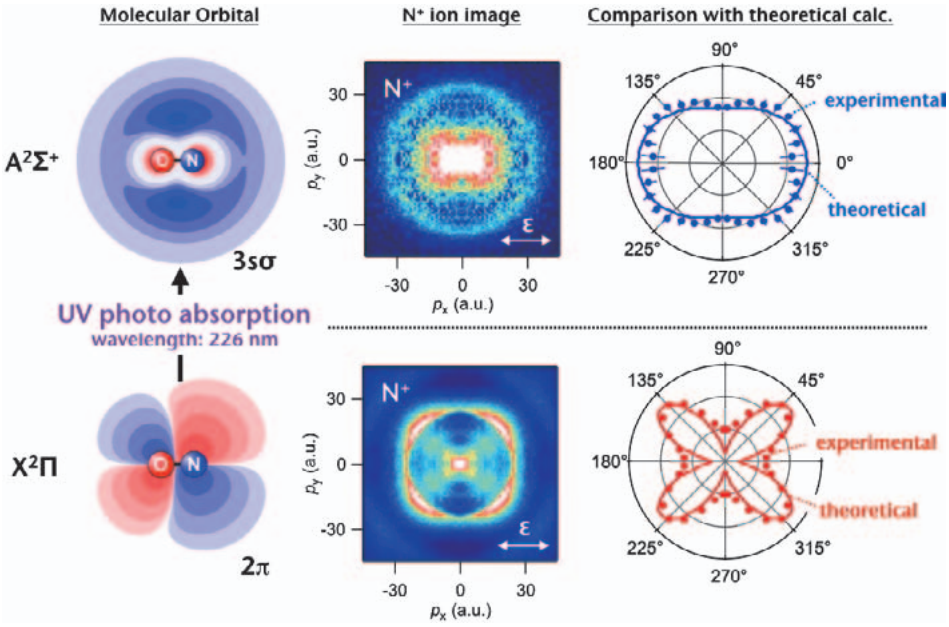


Figure 1. Molecular orbitals before and after UV photoexcitation (226 nm) of NO (left). Experimental results (middle) and comparison with theoretical predictions (right).

Research Topic

(Inorganic Synthesis)

Development of Imaging XAFS Techniques and Visualization of Heterogeneous Catalysts

Heterogeneous solid catalysts act as key materials for various chemical conversions in industry and their high stability and catalytic performances are often unique for solid catalysts. However, it is still difficult to visualize heterogeneous structures of solid catalysts, which obtain their unique reactivity, and the nature and dynamic behaviors of heterogeneous catalysis are not fully understand yet. X-ray absorption fine structure (XAFS) is a powerful tool to characterize local structures of solid catalysts without crystal structures, which cannot be characterized by X-ray diffraction analysis, and it has been applied for the characterization of various heterogeneous catalysts. Conventional XAFS measurements have been performed using mm-size X-ray beams, and average structural information inside mm-size X-ray beam irradiated to a sample is obtained. Spatial information is reduced to 1 dimensional data by the conventional XAFS and the developments of imaging XAFS techniques with two/three-dimensional spatial information are state-of-the-art.

We have developed several imaging XAFS techniques by use of high-flux synchrotron X-ray source and they have been applied to visualize two/three-dimensional structures of functional solid materials such as heterogeneous catalysts and fuel cell electrode membranes[1, 2]. Particularly, two-dimensional scanning nano-XAFS has a simple optical setup and X-ray imaging combining XAFS spectroscopy is developed by using 100 nm-size focused X-ray nanobeam[2]. Recently, we succeeded in imaging of Ce oxidation states inside a single particle of Ce-Zr solid solution, which is a key material of automobile exhausting process, for oxygen storage and release (OSC) processes. Imaging XAFS clearly showed that the mode of oxygen diffusion in the Ce-Zr solid solution particles for the OSC process[3].

Figure 1 shows two-dimensional mapping of Ce oxidation state inside a single $Ce_2Zr_2O_x$ (x = 7–8) particle attached with a Pt catalyst particle imaged by scanning nano-XAFS using focused X-ray nanobeam of 409 × 154 nm. We determined the positions of Pt particles and $Ce_2Zr_2O_x$ particles on a substrate by SEM images and selected a $Ce_2Zr_2O_x$ particle attaching with a Pt particle. After the reduction with H_2 at 573 K, oxygen storage proceeds into the $Ce_2Zr_2O_x$ bulk by a reaction with O_2, changing the Ce oxidation state from 3+ to 4+. The oxygen storage was not completed at 423 K and the 2D mapping of the Ce valence state showed heterogeneous distribution of the Ce oxidation state inside the $Ce_2Zr_2O_x$ particle (Fig. 1 (1)). Similar heterogeneous distribution was observed for other $Ce_2Zr_2O_x$ particles, indicating that heterogeneous reaction modes of the oxygen storage process, independent to the position of the attaching Pt catalyst.

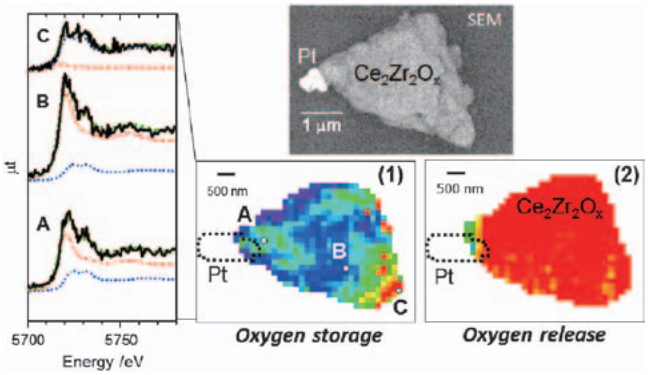


Figure 1. Ce L_{III}-edge scanning nano-XAFS spectra (left), SEM (top), and Ce oxidation-state mappings (1 and 2) of a Pt-attached $Ce_2Zr_2O_x$ particle. (1) Oxygen storage process, (2) oxygen release process.

The reverse oxygen release process proceeds by the reduction with H2, changing in the Ce oxidation state from 4+ to 3+. For the reduction process, significant differences in the reactivity of $Ce_2Zr_2O_x$ particles by the imaging XAFS. The reduction of a $Ce_2Zr_2O_x$ particle without the attaching Pt particle was slow and did not complete. $Ce_2Zr_2O_x$ particles with the attaching Pt particle were smoothly reduced and it was visualized that the reaction spread from the interface of the Pt and $Ce_2Zr_2O_x$ (Fig. 1 (2)). These results suggested that the oxygen release proceeded from the Pt catalyst and oxygen diffusion spread in the $Ce_2Zr_2O_x$ bulk. The supported Pt catalyst would support the heterogenous reactivity of the $Ce_2Zr_2O_x$ particles and improve the overall reactivity.

Imaging XAFS can visualize distribution and chemical states of each elements in solid materials and would provide heterogeneous structures, reactivity, reaction modes, and phenomena of solid heterogeneous materials.

References

[1] T. Saida, O. Sekizawa, N. Ishiguro, K. Uesugi, M. Hoshina, T. Uruga, S. Ohkoshi, T. Yokoyama, and M. Tada, ***Angew. Chem. Int. Ed.* 51**, 9361-9365 (2012) (Hot paper).

[2] N. Ishiguro, T. Uruga, O. Sekizawa, T. Tsuji, M. Suzuki, N. Kawamura, M. Mizumaki, K. Nitta, T. Yokoyama, and M. Tada, ***ChemPhysChem* 15**, 1563-1568 (2014).

[3] H. Matsui, N. Ishiguro, K. Enomoto, O. Sekizawa, T. Uruga, and M. Tada, ***Angew. Chem. Int. Ed.* 55**, 12022-12025 (2016).

(Mizuki TADA)

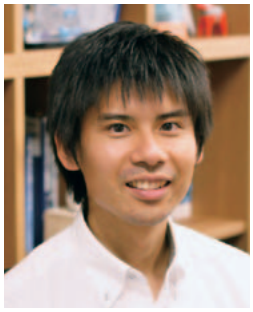
New Faculty Member

(Organic Synthesis)

Material Design based on Living Supramolecular Polymerization

Molecular organization of π-conjugated molecules in a highly ordered manner is an attractive methodology for the development of materials with photo/electronic functions beyond those of molecules. An important class of materials in the field of supramolecular chemistry is supramolecular polymers, which have recently been shown to be synthesized precisely by kinetics, as distinct from thermodynamics. During my postdoctoral career under the guidance of Profs. Masayuki Takeuchi and Kazunori Sugiyasu at National Institute for Materials Science, we have investigated the supramolecular polymerization of porphyrin-based monomers. The assembly phenomenon was found to occur for a delicate interplay of two aggregation pathways based on a kinetic formation of nanoparticles and a formation of thermodynamically stable nanofibres (**Figure 1**). Interestingly, the supramolecular polymerization, which was temporally retarded by the nanoparticle formation, could be initiated by an addition of an aliquot of fragmented nanofibres. Despite the non-covalent polymerization, the kinetics of seed-induced supramolecular polymerization was analogous to those of conventional chain growth polymerization. Thus, we have demonstrated living supramolecular polymerization that enable us to synthesize supramolecular polymers with controlled length and narrow polydispersity.[1]

Furthermore, the thermodynamic and kinetic supramolecular polymerizations have been elucidated for an amide-functionalized perylene bisimide (PBI) organogelator molecule during my postdoctoral career in the Würthner Group at Würzburg University.



This molecule in solvents of low polarity self-assembles by the concerted hydrogen-bonding and π-π stacking interactions into highly defined one-dimensional helical nanofibers.[2] Spectroscopic studies on the polymerization process revealed that the monomers are kinetically trapped in conformationally restricted state through intramolecular hydrogen bonding between the amide and imide groups. The unique kinetics in the nucleation process was confirmed as a thermal hysteresis in a cycle of assembly and disassembly processes. Under the out-of-equilibrium condition within the hysteresis loop, we have succeeded in demonstrating seeded polymerization by addition of a supramolecular initiator (e.g., pre-assembled short nanofibers) to the kinetically trapped monomer solution.[3,4]

The kinetic and mechanistic understanding in the process of molecular organization will open up a new aspect in the design of functional soft matters for applications including the areas of organic electronics and biology. The materials design based on living supramolecular polymerization are currently under investigation in the Yamaguchi Group.

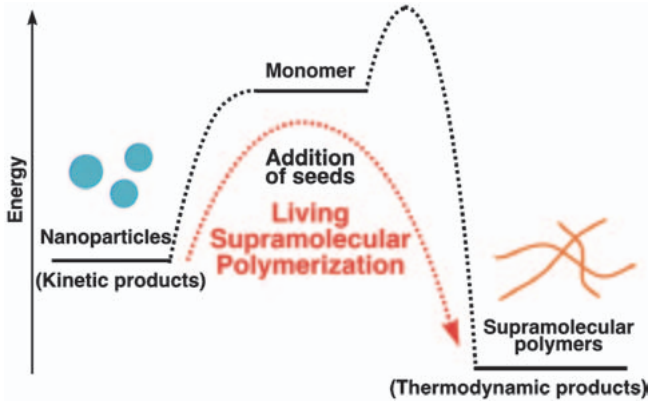


Figure 1. Energy landscape of two competing aggregation pathways of porphyrin-based monomers.

References

[1] Ogi, S.; Sugiyasu, K.; Manna, S.; Samitsu, S.; Takeuchi, M. *Nat. Chem.* **2014**, *6*, 188-195.

[2] Würthner, F.; Saha-Möller, C. R.; Fimmel, B.; Ogi, S.; Leowanawat, P.; Schmidt, D. *Chem. Rev.* **2016**, *116*, 962-1052.

[3] Ogi, S.; Stepanenko, V.; Sugiyasu, K.; Takeuchi, M.; Würthner, F. *J. Am. Chem. Soc.* **2015**, *137*, 3300-3307.

[4] Ogi, S.; Stepanenko, V.; Thein, J.; Würthner, F. *J. Am. Chem. Soc.* **2016**, *138*, 670-678.

(Soichiro OGI)

New Faculty Member

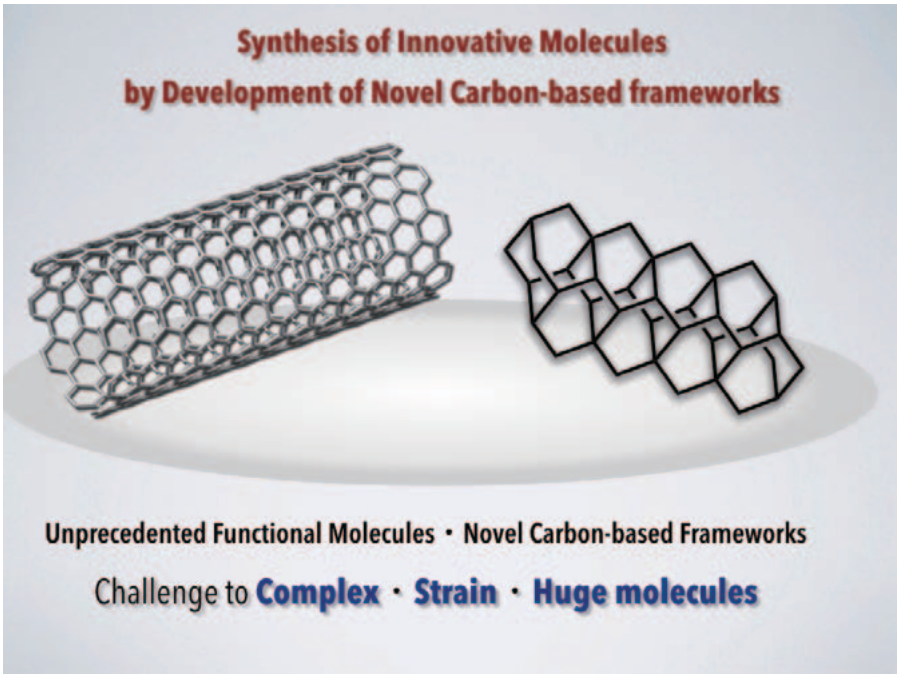
(Organic Synthesis)

Synthesis of Innovative Molecules by Development of Novel Carbon-based frameworks

Due to drastic development of organic synthetic chemistry, easy access to various complicated molecules has been enabled. However, current technology still has a significant hurdle to provide some organic molecules. In most cases of such unprecedented molecules, the construction of carbon-based frameworks is difficult because of their strain, large size and so on. Therefore, new synthetic methods to overcome these problematic properties are strongly demanded.

We started to pursue the development of a methodology to construct novel carbon-based frameworks towards synthesis of innovative molecules. Our ultimate goal is making a huge progress in whole science by advancement of organic synthetic chemistry.

(Akiko YAGI)



Integrative Graduate Education and Research Program in Green Natural Sciences (IGER)

Integrative Graduate Education and Research (IGER) Program in Green Natural Sciences was launched in 2011, and built on three pillars: (I) practicing cutting-edge fundamental natural science research, (II) completion of sufficient coursework to enable that research, and (III) graduate school literacy education (English training, studying abroad, skill seminars, etc.). Based on these, the program aims to nurture the "scientific ability and social skills to view situations from a broad perspective," "developmental ability to extract practical results from fundamental research," and "active international citizenship on a global scale," along with fostering "corporate researchers cultivated as seeds in industry," "academic researchers raised in the scholarly domain," and "environmental coordinators and mentors active throughout global society" that will carry the environmental fields of the next generation.

In 2016, the program provided opportunity for 63 students to participate in international conferences held at outside Japan, and also provided opportunity of mid-term (2–3 months) overseas research exchange for 14 students. Furthermore, the program hosted various international symposium / workshop where lots of students could have opportunities to discuss with foreign researchers.

Eleven students participated in the Leadership Program at North Carolina (NC), US. All students not only attended lectures regarding Leadership, Entrepreneurship and Technology Transfer but also visited many laboratories in universities at NC to build networks with PIs, postdocs and graduate students. In addition, all of them had opportunities to do presentations on their research to these researchers and have discussions. Furthermore, they visited some companies to learn some ideas of working in industry as a researcher and business environment in the USA from entrepreneurs and researchers. In the last day, Prof. Matsuo, the president of Nagoya University, attended the final presentations of the students and the farewell party.

Poster Prize

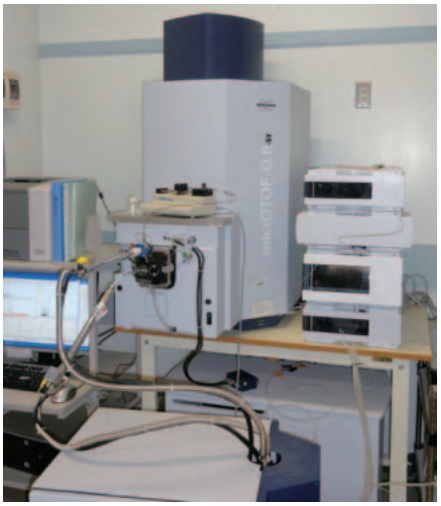
Overseas Research Exchange

IBM WATSON (NC Program)

Final Presentation (NC Program)

Report from the Chemical Instrumentation Facility

The Chemical Instrumentation Facility is a facility shared by the whole university that contains instrumental analysis equipment including a nuclear magnetic resonance (NMR) spectrometer, mass spectrometer, and spectroscopic analysis equipment for analyzing molecular structures. In the Chemical Instrumentation Facility, services are provided to users including teaching faculty, researchers, and students through maintenance of these measurement instruments, lectures on measurement methods, consultations for specific measurements, and entrusted measurement. During the 2016 fiscal year, as shown in "CIF Utilization Status", 71 research groups from the university registered to use the facility, and the number of teaching faculty, students, and researchers who registered to use the facility during the year was 718.



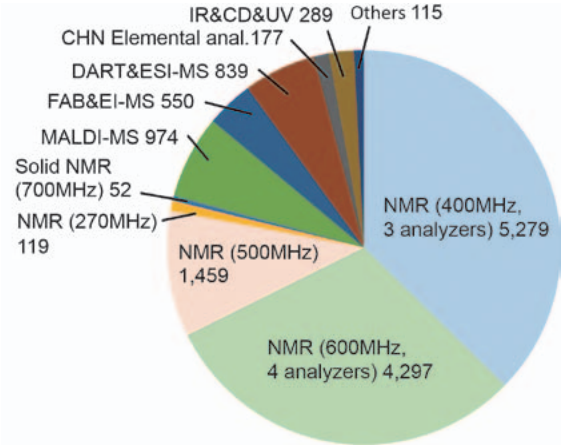
CSI-MS (micrOTOF-QII, Bruker)

NMR (ECA-600, JEOL)

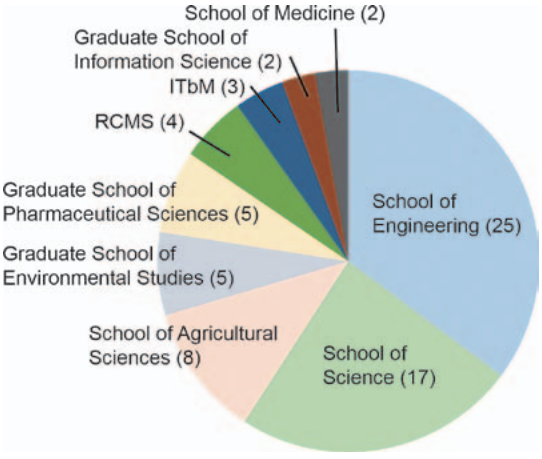
CHN Elemental analyzer, (MT-6, YANACO)

[CIF Utilization Status]

Utilization Status for the Academic Year 2016
(April 2016 – April 2017)



Number of Uses/Measurements by Instrument



Utilization Status by Department
(Total: 71 Groups, 718 People)

Visiting Professor 2016

Prof. Eric Rivard

Associate Professor,
University of Alberta

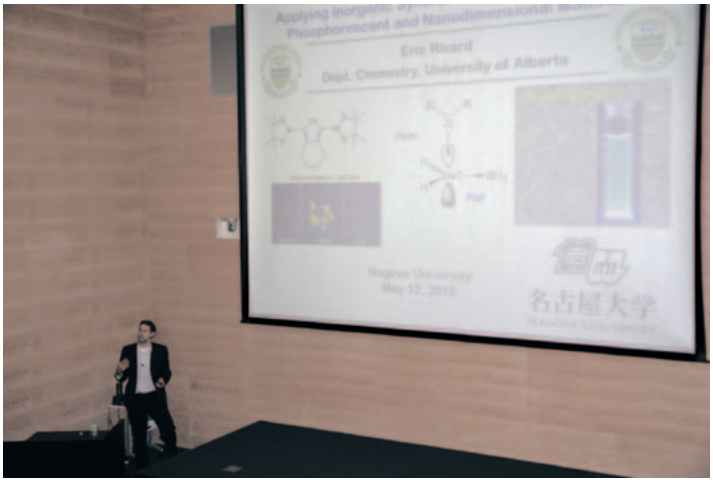
Period of Stay:
April 25, 2016 – June 26, 2016
Research Theme:
Chemistry of Functional Organo-Main Group Compounds

Prof. Eric Rivard from University of Alberta, Canada, stayed as a Visiting Associate Professor in RCMS for two months from April 25th, 2016 to engage in the research about chemistry of functional organo-main group compounds. Prof. Rivard is a highly distinguished young researcher in the field of inorganic chemistry and, particularly, main group chemistry focusing molecular functions.

His chemistry covers broad aspects from the fundamental structural main group chemistry to catalysis as well as electronic functions. For example, his outstanding discovery of room temperature phosphorescence of tellurophene boronic acids gave siginificant impact on the relevant research community. He has also promoted main group chemistry focusing intriguing structures and reactivity, such as reactive element hydride chemistry and oligogermanium synthesis. To promote these researches in depth, he has visited us and stayed in RCMS.

During his stay, he actively participated in the research in RCMS. He delivered a wonderful lecture on May 12, 2016 with the title of "Applying Inorganic Synthesis to Gain Access to New Phosphorescent and Nanodimensional Materials". Moreover, he also kindly joined group meetings in our research group and gave us many insightful suggestions. He always discussed with our students with great enthusiasm. In addition, he also kindly delivered classes in the graduate course about adavanced polymer science. Many students participated were impressed by his elegant lectures with clear explanation. Prof. Eric also enjoyed laboratory parties many times, where he indeed talked with students very frankly and always encouraged them. We all would like to appreciate his significant contributions to the activities in RCMS.

Welcome party



Seminar

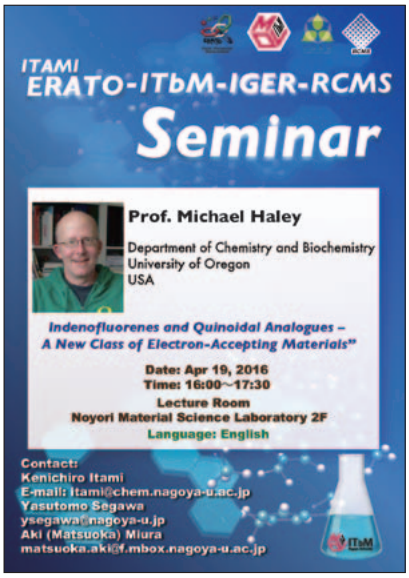
With assist. Prof. Ogi

With Prof. Yamaguchi

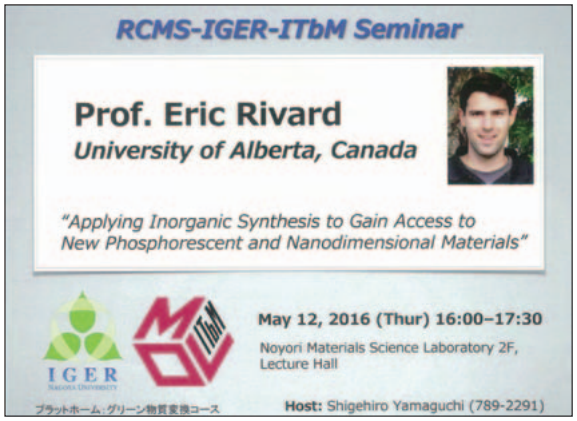
Farewell party

Farewell party

RCMS Seminars



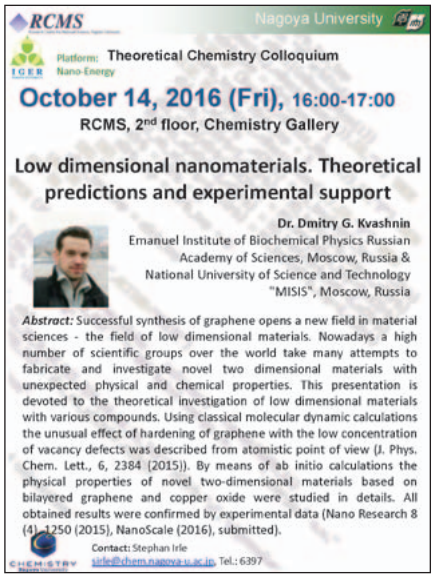
April 19, 2016 Prof. Michael Haley
(Department of Chemistry and Biochemistry , University of Oregon, USA)
"Indenofluorenes and Quinoidal Analogues
– A New Class of Electron-Accepting Materials"



May 12, 2016 Prof. Eric Rivard
(University of Alberta, Canada)
"Applying Inorganic Synthesis to Gain Access to New Phosphorescent and Nanodimensional Materials"

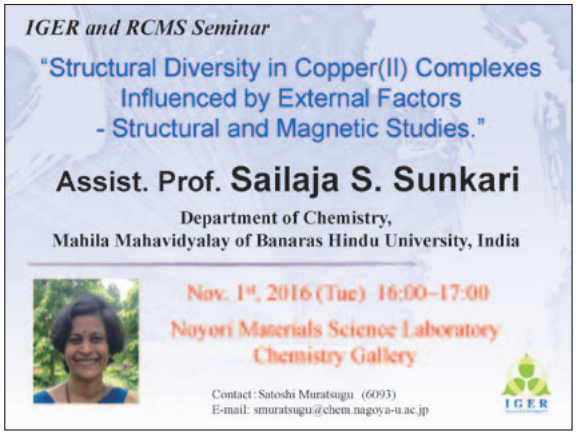
July 19, 2016 Dr. Michael J. Shevlin
(Senior Scientist, Chemistry MSD, USA)
"High-Throughput Experimentation-Enabled Reaction Discovery, Development, and Mechanistic Elucidation: Cobalt- and Nickel- Catalyzed Asymmetric Hydrogenation of Olefins"

August 31, 2016 Prof. J Derek Woollins
(University of St Andrews)
"Synthesis and Structure of Group 16 systems"

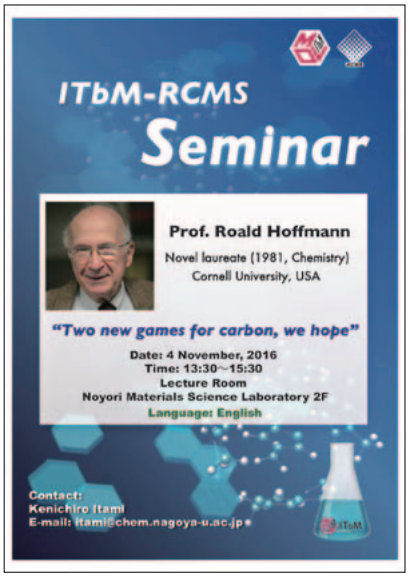


October 14, 2016 Dr. Dmitry G. Kvashnin
(Emanuel Institute of Biochemical Physics Russian Academy of Sciences, Moscow, Russia & National University of Science and Technology "MISIS", Moscow, Russia)
"Low dimensional nanomaterials. Theoretical predictions and experimental support"

October 18, 2016 Prof. Evamarie Hey-Hawkins
(University Leipzig, Germany)
"Carborane Meets Phosphorus"

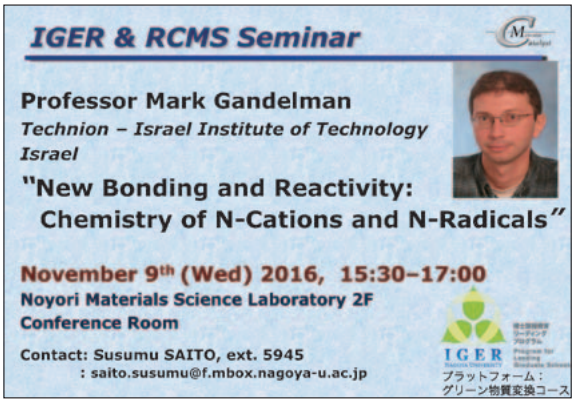


November 1, 2016 Assist. Prof. Sailaja S. Sunkari
(Department of Chemistry, Mahila Mahavidyalay of Banaras Hindu University, India)
"Structural Diversity in Copper(II) Complexes Influenced by External Factors – Structural and Magnetic Studies"

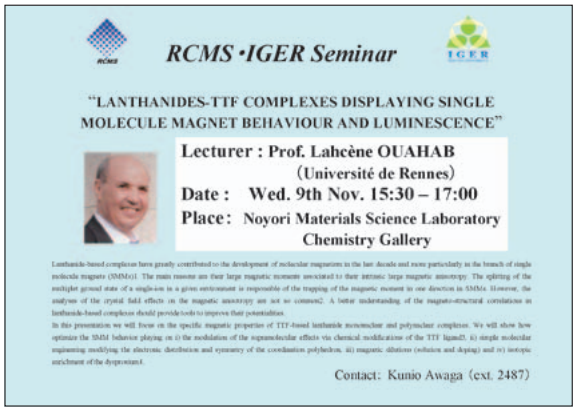


November 4, 2016 Prof. Roald Hoffmann
(Novel Laureate (1981, Chemistry), Cornell University, USA)
"Two new games for carbon, we hope"

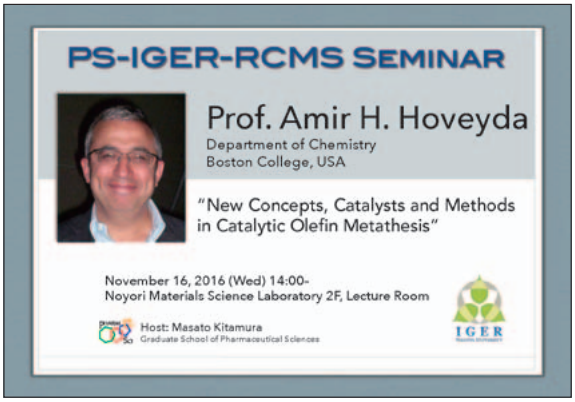
November 8, 2016 Prof. Rudi Fasan
(University of Rochester)
"Engineered metalloenzymes for selective carbene and nitrene transfer reactions"



November 9, 2016 Professor Mark Gandelman
(Technion – Israel Institute of Technology, Israel)
"New Bonding and Reactivity: Chemistry of N-Cations and N-Radicals"

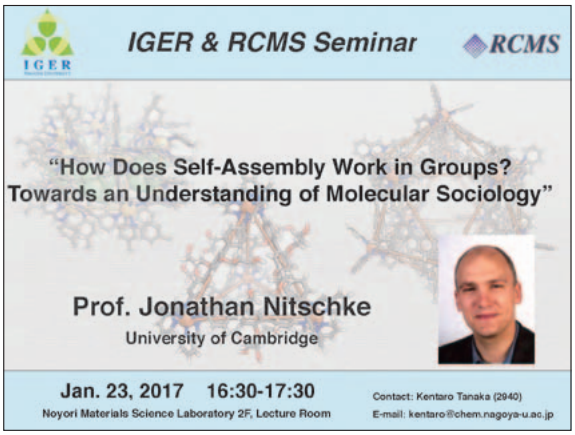


November 9, 2016 Prof. Lahcène OUAHAB
(Université de Rennes)
"LANTHANIDES-TTF COMPLEXES DISPLAYING SINGLE MOLECULE MAGNET BEHAVIOUR AND LUMINESCENCE"

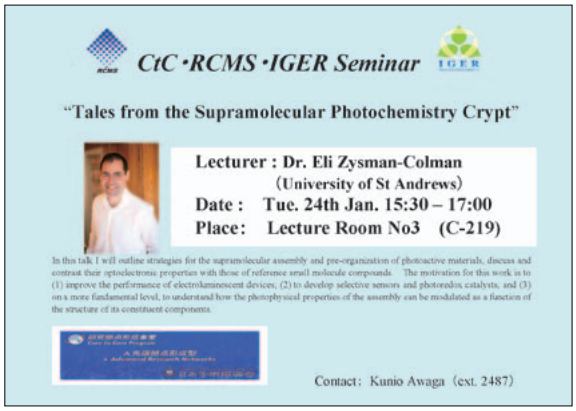


November 16, 2016 Prof. Amir H. Hoveyda
(Department of Chemistry, Boston College, USA)
"New Concepts, Catalysts and Methods in Catalytic Olefin Metathesis"

November 16, 2016 Prof. Yoshio Hisaeda
(Graduate School of Engineering, Kyushu University)



January 23, 2017 Prof. Jonathan Nitschke
(University of Cambridge)
"How Does Self-Assembly Work in Groups?
Towards an Understanding of Molecular Sociology"



January 24, 2017 Dr. Eli Zysman-Colman
(University of St Andrews)
"Tales from the Supramolecular Photochemistry Crypt"

February 22, 2017 Prof. Hiroshi Kitagawa
(Graduate School of Science,
Kyoto University)

Chemistry Gallery

The Chemistry Gallery (2nd Floor of the Noyori Materials Science Laboratory) welcomed many visitors again in the 2016 academic year. Thanks to a Japanese scientist being selected for the Nobel Prize in Physiology or Medicine (Satoshi Omura, Professor Emeritus at Kitasato University), the gallery attracted more than 20,000 visitors throughout the year.

The Chemistry Gallery also features a replica exhibition of the venue for the Nobel Prize Awards Ceremony. In a year in which a Japanese scientist won the Nobel Prize, many visitors took commemorative photographs at this exhibition. 23,206 people visited the gallery as of March 31, 2017 (according to an automatic counter for entry/exit to the gallery).

A particularly large number of visitors were welcomed during the following periods when Nagoya University was open to the public.

Number of visitors during Open Campus (August 8 to 10): 845

Number of visitors on Homecoming Day (October 5): 2,010

Exhibition of Nobel Ceremony venue

Exhibition of RCMS Members

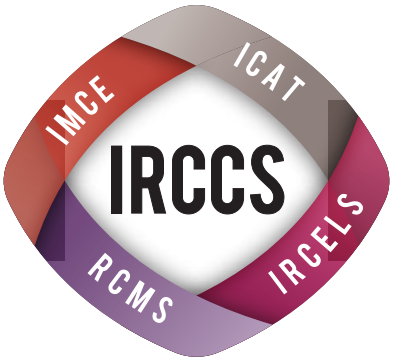
Record of RCMS Directors

Events 2016

[Establishment of the Integrated Research Consortium on Chemical Sciences]

The Research Center for Materials Science at Nagoya University led the establishment of the Integrated Research Consortium on Chemical Sciences

Through the Joint Project of Chemical Synthesis Core Research Institutions (Nagoya University, Kyoto University, Kyushu University) which was held from 2005 to 2009 and the MEXT Project of Integrated Research on Chemical Synthesis (Nagoya University, Kyoto University, Kyushu University, Hokkaido University) which was held from 2010 to 2015, Nagoya University has implemented projects aimed at achieving world-class research standards for fulfilling the role of a core international research institute in materials synthesis. The Consortium will inherit and build upon these projects while working to further strengthen the ability of practical implementation.



Integrated Research Consortium on Chemical Sciences

[Professor Shigehiro Yamaguchi selected as next Director of the Research Center for Materials Science]

Professor Shigehiro Yamaguchi (Institute of Transformative Bio-Molecules, current Director of the Chemical Instrumentation Facility) has been selected to serve as Director of the Research Center for Materials Science from the 2017 academic year.

[Appointment of two new Assistant Professors]

Two new Assistant Professors have been appointed in the field of organic materials synthesis research.

Assistant Professor Soichiro Ogi (appointed on May 1, 2016)

Assistant Professor Akiko Yagi (appointed on March 1, 2017)

Staff List

Director	Professor	Kunio Awaga	(2487)	awaga@mbox.chem.nagoya-u.ac.jp
Special Advisor	University Professor	Ryoji Noyori		
Organic Synthesis	Professor	Shigehiro Yamaguchi	(2291)	yamaguchi@mbox.chem.nagoya-u.ac.jp
	Assistant Professor	Soichiro Ogi	(5750)	ogi.soichiro@chem.nagoya-u.ac.jp
	Assistant Professor	Akiko Yagi	(5873)	yagi.akiko@d.mbox.nagoya-u.ac.jp
Inorganic Synthesis	Professor	Mizuki Tada	(6200)	mtada@chem.nagoya-u.ac.jp
	Associate Professor	Hideo Takagi	(5473)	htakagi@chem.nagoya-u.ac.jp
	Associate Professor	Yasuyuki Yamada	(2471)	yy@chem.nagoya-u.ac.jp
	Designated Professor	Kazuyuki Tatsumi	(2474)	i45100a@nucc.cc.nagoya-u.ac.jp
Functional Materials	Professor	Akiyoshi Hishikawa	(2494)	hishi@chem.nagoya-u.ac.jp
	Assistant Professor	Zhang Zhongyue	(5106)	zhangzhongyue@i.mbox.nagoya-u.ac.jp
	Assistant Professor	Haruka Omachi	(3660)	omachi.haruka@a.mbox.nagoya-u.ac.jp
Biomaterials Research	Professor	Yoshihito Watanabe	(3049)	p47297a@nucc.cc.nagoya-u.ac.jp
	Assistant Professor	Fumiaki Tomoike	(2950)	tomoike@chem.nagoya-u.ac.jp
Molecular Catalysis	University Professor	Ryoji Noyori	(2956)	noyori@chem3.chem.nagoya-u.ac.jp
	Assistant Professor	Hiroshi Naka	(5411)	h_naka@nagoya-u.jp
	Assistant Professor	Shinji Tanaka	(2960)	tanaka@os.rcms.nagoya-u.ac.jp
Collaborative Studies	Guest Professor	Hiroshi Kitagawa (Professor, Kyoto University)		
	Guest Associate Professor	Eric Rivard (Associate Professor, University of Alberta)		
Chemical Instrumentation Facility	Manager / Professor	Shigehiro Yamaguchi	(2291)	yamaguchi@mbox.chem.nagoya-u.ac.jp
	Assistant Professor	Chunguang Han	(3072)	hanc@cic.nagoya-u.ac.jp
	Technical official	Yutaka Maeda	(3069)	maeda@cic.nagoya-u.ac.jp
	Technical official	Kin-ichi Oyama	(3069)	oyama@cic.nagoya-u.ac.jp
International Advisory Board		Michael Grunze (Professor Emeritus, Heidelberg University)		
		Roald Hoffman (Professor Emeritus, Cornell University – Laureate, Nobel Prize in Chemistry)		
		Henri Boris Kagan (Professor Emeritus, Paris-Sud 11 University)		
		Atsuko Tsuji (Designated Professor, Nagoya University)		
Cooperating Faculty	Professor	Hisanori Shinohara (Graduate School of Science)	(2482)	noris@nagoya-u.jp
	Professor	Kenichiro Itami (Institute of Transformative Bio-Molecules)	(6098)	itami.kenichiro@a.mbox.nagoya-u.ac.jp
	Professor	Masato Kitamura (Graduate School of Pharmaceutical Sciences)	(2957)	kitamura@os.rcms.nagoya-u.ac.jp
	Professor	Susumu Saito (Graduate School of Science)	(5945)	saito.susumu@f.mbox.nagoya-u.ac.jp
	Distinguished Invited University Professor	Sumio Iijima	(6460)	iijimas@nagoya-u.jp
RCMS Office	Administrative Staff	Yuko Kihara	(5907)	kihara@os.rcms.nagoya-u.ac.jp
	Administrative Staff	Chiaki Yamamoto	(5902)	yamamoto@os.rcms.nagoya-u.ac.jp
	Administrative Staff	Sonoe Tankiku	(5908)	tankiku@os.rcms.nagoya-u.ac.jp