INTRODUCTORY COLUMNS OF LABORATORIES

Division of Synthetic Chemistry
– Organoelement Chemistry –

https://www.scl.kyoto-u.ac.jp/~oec/en/index.html

Prof.
YAMADA, Hiroko
(D. Sc.)

Assoc. Prof.
MIZUHATA, Yoshiyuki
(D. Sc.)

Assist. Prof. *1
MATSUO, Kyohei
(D. Sc.)

Assist. Prof.
YAMAUCHI, Mitsuaki
(D. Eng.)

Assist. Prof. *1
YAMAMOTO, Keitaro
(D. Eng.)

P. D.
MOUROT, Benjamin
(Ph. D.)

Techn. Staff *2
HIRANO, Toshiko

Techn. Staff
INUTSUKA, Mayumi

*1 New Research Field Development Project
*2 Re-employed Staff
*3 National Institute for Materials Science

Assist. Admin. Staff

TOTANI, Fuyuko

Lecturer (pt.)

HAYASHI, Hironobu*3 (D. Eng.)

Students

YANG, Yi (D3)
KASAHARA, Shoma (D2)
UCHIDA, Daichi (D2)
UENO, So (D2)
MIYAZAKI, Kazuya (D1)
MURAKAMI, Hideyuki (D1)
REN, Zhe (D1)
SUZUKI, Shinjiro (M2)
TERANISHI, Kento (M2)
WANG, Yutang (M2)
NISHIKAWA, Takeru (M1)
TAKAHASHI, Keita (M1)

Guest Res. Assoc.

SIMÓN MARQUÉS, Pablo Center for Materials Elaboration and Structural Studies, France, 9 October 2024–5 November 2024

Scope of Research

π-Extended aromatic compounds such as higher acenes and porphyrins are attractive as organic functional materials. In particular, we focus on the control of thin-film structure by self-assembly of the materials to investigate the correlation between packing structure and charge carrier mobility. We are also interested in the compounds including heavy main group elements to elucidate the similarities and differences in structures and reactivities between organic compounds and the corresponding heavier congeners.

KEYWORDS

Organic Semiconductor Aromatic Compound Self-Assembly Main Group Element Reactive Intermediate

Recent Selected Publications

Tsuji, S.; Tokitoh, N.; Yamada, H.; Mizuhata, Y., Potassium 2-Germanaphthalenide: An Isolable Polycyclic System of Germanium-Incorporated Anionic Benzenoid, *Inorg. Chem. Front.*, **11,** 400-408 (2024).
Tsuji, S.; Tokitoh, N.; Yamada, H.; Mizuhata, Y., The Reduction of Metallabenzenes: Different Scenarios Highly Dependent on the Central Group 14 Elements, Si vs. Ge, *Chem. Asian J.*, **19,** e202300945 (2024).
Okba, A.; Simón-Marqués, P.; Matsuo, K.; Aratani, N.; Yamada, H.; Rapenne, G.; Kammerer, C., Synthesis of π-Conjugated Polycyclic Compounds by Late-Stage Extrusion of Chalcogen Fragments, *Beilstein J. Org. Chem.*, **20,** 287-305 (2024).
Yamauchi, M.; Nakatsukasa, K.; Kubo, N.; Yamada, H.; Masuo S., One-Dimensionally Arranged Quantum-Dot Superstructures Guided by a Supramolecular Polymer Template, *Angew. Chem. Int. Ed.*, **63,** e202314329 (2024).
Miyazaki, K.; Matsuo, K.; Hayashi, H.; Yamauchi, M.; Aratani, N.; Yamada H., An Unsymmetrical 5,15-Disubstituted Tetrabenzoporphyrin: Effect of Molecular Symmetry on the Packing Structure and Charge Transporting Property, *Org. Lett.*, **25,** 7354-7358 (2023).

Division of Synthetic Chemistry
– Structural Organic Chemistry –

https://www.scl.kyoto-u.ac.jp/~kouzou/en/index.html

Prof.
MURATA, Yasujiro
(D. Eng.)

Assoc. Prof.
HIROSE, Takashi
(D. Eng.)

Assist. Prof.
HASHIKAWA, Yoshifumi
(D. Eng.)

Students

HU, Weizhe (D4)
ZHANG, Zheng (D4)
GU, Jiajian (D3)
LIU, Zhibo (D2)
MIOMO, Sota (U. G.)
YASUDA, Yutaka (U. G.)

Guest Res. Assoc.

ZHANG, Sheng (Ph. D.) Henan University, China, P. R., 1 August 2024–7 August 2024
MARGETIC, Davor (Ph. D.) The Rudjer Boskovic Institute, Croatia, 8 October 2024

Scope of Research

Fundamental studies are being conducted for the creation of new functional π-systems with novel structures and properties, and for evaluation of their application as organic semiconducting materials for photovoltaic and electroluminescent devices. The major subjects are: 1) organochemical transformation of fullerenes C_{60} and C_{70}, specifically organic synthesis of endohedral fullerenes by the technique of molecular surgery; 2) generation of ionic fullerene species and their application for the synthesis of functional material; 3) synthesis of new carbon-rich materials by the use of transition metal complex; and 4) creation of new functional π-materials with unique photoelectric properties.

KEYWORDS

π-Conjugated Systems
Functional Materials
Radical Species
Endohedral Fullerenes
Helical Structures

Recent Selected Publications

Zhang, Z.; Zhu, H.; Gu, J.; Shi, H.; Hirose, T.; Jiang, L.; Zhu, Y.; Zhong, D.; Wang, J., Nonplanar Nanographene with a Large Conjugated π-Surface, *J. Am. Chem. Soc*., **146,** 24681-24688 (2024).

Nakazono, R.; Hu, W.; Hirose, T.; Amaya, T., Synthesis and Characterization of a Cyclic Trimer of a Chiral Spirosilabifluorene, *Chem. Eur. J.*, **30,** e202401343 (2024).

Hashikawa, Y.; Okamoto, S.; Murata, Y., Synthesis of Inter-[60]Fullerene Conjugates with Inherent Chirality, *Nat. Commun*., **15,** 514 (2024).

Liu, W.; Huang, G.; Chen, C.-Y.; Tan, T.; Fuyuki, H.; Hu, S.; Nakamura, T.; Truong, M. A.; Murdey, R.; Hashikawa, Y.; Murata, Y.; Wakamiya, A., An Open-Cage Bis[60]fulleroid as Electron Transport Material for Tin Halide Perovskite Solar Cells, *Chem. Commun*., **60,** 2172-2175 (2024).

Huang, G.; Sadai, S.; Hashikawa, Y.; Murata, Y., Reactions of Diaminonaphthalenes with a Cage-Opened C_{60} Derivative, *Asian J. Org. Chem*., **13,** e202300634 (2024).

Division of Synthetic Chemistry
– Synthetic Organic Chemistry –

https://www.fos.kuicr.kyoto-u.ac.jp/eng/

Prof.
OHMIYA, Hirohisa
(D. Eng.)

Assoc. Prof.
NAGAO, Kazunori
(D. Sc.)

Assist. Prof.
MURAKAMI, Sho
(D. Pharm. Sc.)

Students

OTA, Kenji (D3)
ABE, Reiji (D2)
NAKAGAWA, Masanari (D2)
NAKAMURA, Rikako (D2)
MATSUO, Tomotoki (D2)
MITSUI, Atsuhisa (D2)
MIYAMOTO, Yusuke (D2)
GOTO, Yamato (D1)
TAKEKAWA, Yunosuke (D1)
WATANABE, Koh (D1)
SATO, Hinata (M2)
TONOMURA, Asuka (M2)
KISHIDA, Naoto (M1)
SHIMONO, Hiroki (M1)
TOGISHI, Kanata (M1)
YANAGIDA, Ryo (M1)
OJI, Shoichiro (UG)
MURAOKA, Kanji (UG)
NIIKAWA, Tsukasa (UG)

Scope of Research

Our group has been carrying out innovative research on the radical-based organic synthesis by designing catalysts and chemical reactions as well as molecules. Our current research projects include (1) radical-mediated organocatalysis such as N-heterocyclic carbene catalysis or organophotoredox catalysis; (2) radical modification of nucleic acids; and (3) molecular imaging based on boron chemistry.

KEYWORDS

Synthetic Reactions
Photoredox Catalysis
Organocatalysis
Radical Reaction
Boron Molecule

Recent Selected Publications

Watanabe, K.; Nagao, K.; Ohmiya, H., Deoxygenative Geminal Silylboration of Amides Using Silylboronates: Synthesis and Use of α-Boryl-α-Silylalkylamines, *Angew. Chem. Int. Ed.*, **63,** e202411990 (2024).

Shibutani, S.; Nagao, K.; Ohmiya, H., A Dual Cobalt and Photoredox Catalysis for Hydrohalogenation of Alkenes, *J. Am. Chem. Soc.*, **146,** 4375-4379 (2024).

Ota, K.; Nagao, K.; Hata, D.; Sugiyama, H.; Segawa, Y.; Tokunoh, R.; Seki, T.; Miyamoto, N.; Sasaki, Y.; Ohmiya, H., Synthesis of Tertiary Alkylphosphonate Oligonucleotides through Light-Driven Radical-Polar Crossover Reactions, *Nat. Commun.*, **14,** 6856 (2023).

Goto, Y.; Sano, M.; Sumida, Y.; Ohmiya, H., N-Heterocyclic Carbene- and Organic Photoredox-Catalysed *meta*-Selective Acylation of Electron-Rich Arenes, *Nat. Synth.*, **2,** 1037-1045 (2023).

Nakamura, R.; Yamazaki, T.; Kondo, Y.; Tsukada, M.; Miyamoto, Y.; Arakawa, N.; Sumida, Y.; Kiya, T.; Arai, S.; Ohmiya, H., Radical Caging Strategy for Cholinergic Optopharmacology, *J. Am. Chem. Soc.*, **145,** 10651-10658 (2023).

Division of Synthetic Chemistry
– Advanced Inorganic Synthesis –

https://www.scl.kyoto-u.ac.jp/~teranisi/index_E.html

Prof.
TERANISHI, Toshiharu
(D. Eng.)

Assoc. Prof.
SARUYAMA, Masaki
(D. Sc.)

Assist. Prof.
TAKAHATA, Ryo *
(D. Sc.)

Assist. Prof.
TAKEKUMA, Haruka
(D. Sc.)

Program-Specific Assist. Prof.
SATO, Ryota
(D. Sc.)

Program-Specific Assist. Prof.
MATSUMOTO, Kenshi
(D. Sc.)

Program-Specific Assist. Prof.
YAMADA, Takumi
(D. Sc.)

P. D.
WEN, Dingchen
(Ph. D.)

P. D.
CHIGA, Yuki
(D. Sc.)

P. D.
CHEN, Yuexing
(Ph. D.)

*New Research Field Development Project

Students

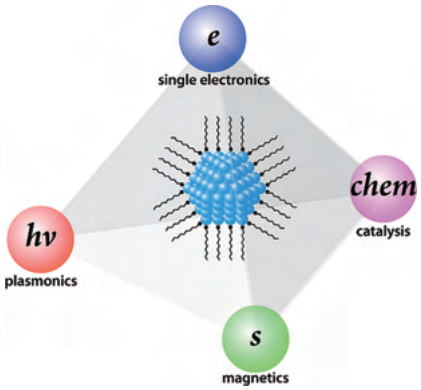
TIAN, Wu (D3) ZHU, Lingkai (D2) NAGAI, Nao (D1) PENG, Xiaoxiao (D1) FUKUYAMA, Mitsuki (M1)
XIA, Yan (D3) JIN, Yirou (D2) LEE, Hyunji (D1) MUTO, Mitsuki (M2)

Guest Res. Assoc.

WANG, Chien-Yi (Bachelor) National Yang Ming Chiao Tung University, Taiwan, 15 April 2024–28 February 2025

Scope of Research

We are focusing on the precise synthesis of inorganic nanoparticles by controlling the primary (size, shape, composition, *etc*.) and secondary (spatial arrangement) structures to tune properties such as electron confinement, carrier oscillation, spin, and catalysis. These high-quality inorganic nanoparticles are applied to both high-performance nanodevices (*e.g.*, single electron transistor, plasmon waveguide, and nanocomposite magnet) and photo-energy conversion materials (*e.g.*, overall water splitting and solar cell).



KEYWORDS

Inorganic Nanomaterials Quantum Dots Plasmonics
Oxidation Reduction Reactions Photocatalysts

Recent Selected Publications

Takekuma, H.; Sato, R.; Iida, K.; Kawawaki, T.; Haruta, M.; Kurata, H.; Nobusada, K.; Teranishi, T., Intrinsic Visible Plasmonic Properties of Colloidal $PtIn_2$ Intermetallic Nanoparticles, *Adv. Sci.*, **11,** 2307055 (2024).
Saruyama, M.; Takahata, R.; Sato, R.; Matsumoto, K.; Zhu, L.; Nakanishi, Y.; Shibata, M.; Nakatani, T.; Fujinami, S.; Miyazaki, T.; Takenaka, M.; Teranishi T., Pseudomorphic Amorphization of Three-Dimensional Nanocrystal Superlattices through Morphological Transformation of Nanocrystal Building Blocks, *Chem. Sci*., **15,** 2425-2432 (2024).
Tahara, H.; Sakamoto, M.; Teranishi, T.; Kanemitsu, Y., Coherent Electronic Coupling in Quantum Dot Solids Induces Cooperative Enhancement of Nonlinear Optoelectronic Responses, *Nat. Nanotechnol*., **19,** 744-750 (2024).
Li, Z.; Saruyama, M.; Asaka, T.; Teranishi, T., Waning-and-Waxing Shape Changes in Ionic Nanoplates upon Cation Exchange, *Nat. Commun*., **15,** 4899 (2024).
Chiga, Y.; Suzuki, W.; Takahata, R.; Kobiyama, E.; Tahara, H.; Kanemitsu, Y.; Shibuta, M.; Sakamoto, M.; Teranishi, T., Tuning of the Photoinduced Electron-Transfer Direction in Porphyrin-Protected Gold Clusters, *J. Phys. Chem. C*., **128,** 3824-3831 (2024).
Suzuki, W.; Takahata, R.; Mizuhata, Y.; Tokitoh, N.; Xue, S.; Teranishi, T., Quantitative Analysis of Air-Oxidation Reactions of Thiolate-Protected Gold Nanoclusters, *Chem. Sci*., **15,** 18896-18902 (2024).

Division of Materials Chemistry
– Chemistry of Polymer Materials –

http://www.cpm.kuicr.kyoto-u.ac.jp/index_en.html

Prof.
TSUJII, Yoshinobu
(D. Eng.)

Assist. Prof.
KINOSE, Yuji
(D. Eng.)

Assist. Prof.
ISHIDA, Koichiro
(D. Agr.)

Researchers (pt.)

MATSUKAWA, Kimihiro (D. Eng.)* SEO, Haruna *Res of Kyoto Inst Technol
IKENAGA, Keiko YANADA, Mizuho
MORIKI, Yoshihito

Students

TAMAMOTO, Ken (D3) KISHIDA, Takaki (M1) SAIDA, Junnosuke (U. G.)
AKAGI, Shikoh (M2) YOSHIGAI, Toshiya (M1) MATSUMOTO, Yuji (U. G.)
SEIKE, Yuki (M2) GOTO, Haruki (M1) YAMAMOTO, Nozomu (U. G.)

Scope of Research

We perform kinetic and mechanistic analyses toward understanding chemical and physicochemical reactions occurring in polymerization systems and better routes for synthesis of well-defined polymers. In particular, new well-defined polymers or polymer assemblies are prepared by living polymerization techniques, and their structure–properties relationships are precisely analyzed. Projects in progress include: 1) kinetics and mechanisms of living radical polymerization (LRP); 2) synthesis of new polymeric materials by living polymerizations and their structure/properties studies; and 3) synthesis, properties, and applications of concentrated polymer brushes (CPB).

KEYWORDS

Precision Polymerization
Living Radical Polymerization
Polymer Brush
Tribology
Hybrid Materials

Recent Selected Publications

Okubo, H.; Hase, K.; Tamamoto, K.; Tsujii, Y.; Nakano, K., In-Situ Observation of Ice-Adhesion Interface Under Tangential Loading: Anti-Icing Mechanism of Hydrophilic PPEGMA Polymer Brush, *Tribol. Lett*., **72,** 96 (2024).

Takahashi, Y; Mizukami, M.; Tsujii, Y.; Kurihara, K., Surface Forces Characterization of Concentrated PMMA Brush Layers under Applied Load and Shear, *Langmuir*, **40,** 325-334 (2023).

Okubo, H.; Kagiwata, D.; Nakano, K.; Tsujii, Y., Layered Structure and Wear Mechanism of Concentrated Polymer Brushes, *Langmuir*, **39,** 18458-18465 (2023).

Ishida, K.; Kondo, T., Evaluation of Surface Free Energy Inducing Interfacial Adhesion of Amphiphilic Cellulose Nanofibrils, *Biomacromolecules*, **24,** 3786-3793 (2023).

Ishida, K.; Kondo, T., Anisotropic Frictional Properties Induced by Cellulose Nanofibril Assembly, *Biomacromolecules*, **24,** 3009-3015 (2023).

Division of Materials Chemistry
– Polymer Controlled Synthesis –

http://os.kuicr.kyoto-u.ac.jp/index.html

Prof.
YAMAGO, Shigeru
(D. Sc.)

Assoc. Prof.
TOSAKA, Masatoshi
(D. Eng.)

Assist. Prof.
KAYAHARA, Eiichi
(D. Eng.)

Techn. Staff
FUJIHASHI, Akiko

P. D.
TOUSSAINT, François
(Ph. D.)

Students

WU, Jia-De (D3)
YAMIN, Naila (D3)
TONG, Tianxiang (D1)
WANG, Donghao (D1)
MIYOSHI, Nanami (M2)
XIE, Xuanhao (M2)
SHINODA, Yukine (M1)
NIU, Zijing (R. S.)
ZHANG, Jingyi (R. S.)
SUZUKI, Jin (U. G.)
TAKIKAWA, Hiroki (U. G.)
NINOMIYA, Teruhiro (U. G.)
MORISHITA, Yuki (U. G.)

Guest Scholars

SEIBERT, Jasmin Tanja (Ph. D.) Karlsruhe Institute of Technology (KIT), Germany, 5 November 2024–11 December 2024
CHANG, I-Hsiang (D4) National Tsing Hua University, Taiwan, 18 November 2024–17 January 2025

Scope of Research

Our research focuses on creation of new organic molecules with potential as key reagents and materials for future science and technologies. Furthermore, we have been developing new organic and polymeric materials based on our tailor-made molecules. For example, we are developing a new living radical polymerization method using heavier heteroatom compounds as controlling agents. Another topic is the synthesis of cycloparaphenylenes, hoop-shaped π-conjugated molecules, based on new synthetic strategies. We also study various condensed states of polymers by both static and dynamic methods to understand the relationship between structure and physical properties.

KEYWORDS

Organic Synthesis Polymer Synthesis Living Radical Polymerization Polymer Properties Curved π-Conjugated Molecules

Recent Selected Publications

Sun, L.; Kayahara, E.; Nishinaga, T.; Ball, M.; Paley, D.; Nukolls, C.; Yamago, S., Synthesis and Physical Properties of Doubly-Annulated [10] Cycloparaphenylene, *Bull. Chem. Soc. Jpn.*, **97,** uoad011 (2024).

Kayahara, E.; Mizuhata, Y.; Yamago, S., Enhanced Host-Guest Interaction between [10]Cycloparaphenylene ([10]CPP) and [5]CPP by Cationic Charges, *Beilstein J. Org. Chem*., **20,** 436-444 (2024).

Takahashi, K.; Mamitsuka, H.; Tosaka, M.; Zhu, N.; Yamago, S., CoPolDB: A Copolymerization Database for Radical Polymerization, *Polym. Chem*., **15,** 965-971 (2024).

Jiang, Y.; Kibune, M.; Tosaka, M.; Yamago, S., Practical Synthesis of Dendritic Hyperbranched Polyacrylates and Their Topological Block Polymers by Organotellurium-Mediated Emulsion Polymerization in Water, *Angew. Chem. Int. Ed.*, **62,** e202306916 (2023).

Tosaka, M.; Takeuchi, H.; Kibune, M.; Tong, T.; Zhu, N.; Yamago, S., Stochastic Simulation of Controlled Radical Polymerization of Dendritic Hyperbranched Polymers, *Angew. Chem. Int. Ed.*, **62,** e202305127 (2023).

Division of Materials Chemistry
– Inorganic Photonics Materials –

http://mizuochilab.kuicr.kyoto-u.ac.jp/indexE.html

Prof.
MIZUOCHI, Norikazu
(D. Sc.)

Assoc. Prof.
MORIOKA, Naoya
(D. Eng.)

Program-Specific Assoc. Prof.
SHIGEMATSU, Ei
(D. Eng.)

Program-Specific Assoc. Prof.
OHKI, Izuru
(D. Bioscience)

Assist. Prof.
NISHIKAWA, Tetsuri
(D. Eng.)

Program-Specific Assist. Prof.
HERBSCHLEB, Ernst David
(Ph. D.)

Program-Specific Res.
FUJIWARA, Masanori
(D. Sc.)

Students

KAWASE, Riku (D2)
NAKAMURA, Masaya (D1)
DEGUCHI, Hiroshige (D1)
OKAJIMA, Kazuki (M2)
KAMIYAMA, Naoya (M2)
OHORI, Masanao (M1)
KONDO, Kazuki (M1)
NAKAGAWA, Hiromu (M1)
KITAYAMA, Motoki (U. G.)
SHIOTAHI, Ryo (U. G.)

Researchers (pt.)

KAWASHIMA, Hiroyuki (Ph. D.)
SO, Frederick Tze Kkit (D. Eng.)
MORITA, Kohki

Scope of Research

NV centers in diamond have been extensively interested because a single spin of the NV center can be manipulated and detected at room temperature. Furthermore, a spin-coherence time of the NV center is very long. The spin-coherence time is the time to retain coherence (superposition state) and directly relates to the sensitivity of sensors of magnetic field, electric field and temperature. Therefore, the unique and excellent properties of the NV center are expected to be applied for quantum computing, quantum communication, bio-imaging, and high-sensitive sensor with nano-scale resolution.

KEYWORDS

Diamond
Quantum Materials
NV Center
Quantum Sensing
Quantum Information Science

Recent Selected Publications

Herbschleb, E. D.; Chigusa, S.; Kawase, R.; Kawashima, H.; Hazumi, M.; Nakayama, K.; Mizuochi, N., Robust Sensing via the Standard Deviation with a Quantum Sensor, *APL Quantum.*, **1,** 046106 (2024).

So, F. T.-K.; Hariki, N.; Nemoto, M.; Shames, A. I.; Liu, M.; Tsurui, A.; Yoshikawa, T.; Makino, Y.; Ohori, M.; Fujiwara, M.; Herbschleb, E. D.; Morioka, N.; Ohki, I.; Shirakawa, M.; Igarashi, R.; Nishikawa, M.; Mizuochi, N., Small Multimodal Thermometry with Detonation-Created Multi-Color Centers in Detonation Nanodiamond, *APL Materials*, **12,** 051102 (2024).

Fujiwara, M.; Fu, H.; Hariki, N.; Ohki, I.; Makino, Y.; Liu, M.; Tsurui, A.; Yoshikawa, T.; Nishikawa, M.; Mizuochi, N., Germanium-Vacancy Centers in Detonation Nanodiamond for All-Optical Nanoscale Thermometry, *Appl. Phys. Lett.*, **123,** 181903 (2023).

Division of Materials Chemistry
– Nanospintronics –

https://www.scl.kyoto-u.ac.jp/~onoweb/

Prof.
ONO, Teruo
(D. Sc.)

Assoc. Prof.
SHIOTA, Yoichi
(D. Eng.)

Assist. Prof.
HISATOMI, Ryusuke
(D. Eng.)

Program-Specific Assoc. Prof.
KARUBE, Shutaro
(D. Sc.)

Program-Specific Assist. Prof.
NARITA, Hideki
(Ph. D.)

Program-Specific Res.

MATSUMOTO, Hiroki (D. Sc.)

Support Staff

TANAKA, Yuko

Students

JANG, Heechan (D3)
KAWARAZAKI, Ryo (D3)
KOMIYAMA, Haruka (D3)
TAGA, Kotaro (D3)
HAYASHI, Daiju (D3)
YE, Feifan (D3)
SUGIURA, Itaru (D2)
TSENG, Chih-Hsiang (D2)
IIJIMA, Ryo (D1)
TAKAHASHI, Hiroyuki (M2)
TOKORO, Fugo (M2)
MANDOKORO, Tetsuma (M2)
INAOKA, Yuma (M1)
TAKAHASHI, Takuya (M1)
YOSHIDA, Shoko (M1)

Guest Res. Assoc.

PARK, Jungmin (Ph. D.) KAIST, Korea, R., 1 March 2024–31 March 2025

Scope of Research

Conventional electronics uses only the charge of electrons, while traditional magnetic devices use only the spin degree of freedom of electrons. Aiming at complete control of both charge and spin in single solid-state devices, an emerging field called spintronics is rapidly developing and having an impact on information technologies. By combining the atomic-layer deposition with nanofabrication, we focus on the development of spin properties of various materials and the control of quantum effects in mesoscopic systems for novel spintronics devices.

KEYWORDS

Spintronics
Magnetism
Magnetic Materials

Recent Selected Publications

Shiota, Y.; Taniguchi, T.; Hayashi, D.; Narita, H.; Karube, S.; Hisatomi, R.; Moriyama, T.; Ono, T., Handedness Manipulation of Propagating Antiferromagnetic Magnons, *Nat. Commun*., **15,** 9750 (2024).

Kobayashi, Y.; Itoh, T.; Hisatomi, R.; Moriyama, T.; Shiota, Y.; Fan, X.; Ono, T., Spin-Torque Ferromagnetic Resonance Based on Current-Induced Impedance, *Appl. Phys. Lett*., **125,** 022405 (2024).

Narita, H.; Ishizuka, J.; Kan, D.; Shimakawa, Y.; Yanase, Y.; Ono, T., Magnetization Control of Zero-Field Intrinsic Superconducting Diode Effect, *Adv. Mater.*, **35,** 2304083 (2023).

Moriyama, T.; Sánchez-Tejerina, L.; Oda, K.; Ohkochi, T.; Kimata, M.; Shiota, Y.; Nojiri, H.; Finocchio, G.; Ono, T., Micromagnetic Understanding of Evolutions of Antiferromagnetic Domains in NiO, *Phys. Rev. Mater.*, **7,** 054401 (2023).

Hayashi, D.; Shiota, Y.; Ishibashi, M.; Hisatomi, R.; Moriyama, T.; Ono, T., Observation of Mode Splitting by Magnon-Magnon Coupling in Synthetic Antiferromagnets, *Appl. Phys. Express*, **16,** 053004 (2023).

Division of Biochemistry
– Biofunctional Design-Chemistry –

https://www.scl.kyoto-u.ac.jp/~bfdc/index.html

Prof.
FUTAKI, Shiroh
(D. Pharm. Sc.)

Assoc. Prof.
IMANISHI, Miki
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Assist. Prof.
KAWAGUCHI, Yoshimasa
(D. Pharm. Sc.)

Program-Specific Assist. Prof.
KIMURA, Seigo
(D. Pharm. Sc.)

Students

IWATA, Takahiro (D3)
KURIYAMA, Masashi (D3)
MICHIBATA, Junya (D3)
OTONARI, Kenko (D3)
IDA, Naka (D2)
NAKAGAWA, Yuna (D2)
TANAKA, Kamui (D2)
KASAHARA, Chisato (M2)
UEHATA, Yusuke (M2)
YAMASAKI, Daisuke (M2)
BABA, Nozomi (M1)
TAKEUCHI, Kosuke (M1)
KIKKAWA, Ayumi (M1)
KIYOKAWA, Megumi (M1)
NISHIJIMA, Hiroto (M1)
OBATA, Keito (M1)
SASAKI, Yuri (M1)
FURUYAMA, Yusei (U. G.)
SEKIGUCHI, Kaname (U. G.)
UCHIDA, Azumi (U. G.)

Scope of Research

The ultimate goal of our research is the regulation of cellular functions by designed peptides and proteins. Current research subjects include (1) development of novel intracellular delivery systems aiming at elucidation and control of cellular functions using designed membrane permeable peptide vectors, (2) elucidation of the DNA or RNA binding modes of nucleic acid binding proteins, and design of artificial regulators of gene expression, (3) elucidation and control of membrane curvature, and (4) design of stimulation-responsible artificial peptides and proteins.

KEYWORDS

Membrane-Permeable Peptides
Intracellular Delivery
Peptide Design
DNA/RNA Binding Protein
Membrane Curvature

Recent Selected Publications

Michibata, J.; Kawaguchi, Y.; Hirose, H.; Eguchi, A.; Deguchi, S.; Takayama, K.; Xu, W.; Niidome, T.; Sasaki, Y.; Akiyoshi, K.; Futaki, S., Polysaccharide-Based Coacervate Microgel Bearing Cationic Peptides That Achieve Dynamic Cell-Membrane Structure Alteration and Facile Cytosolic Infusion of IgGs, *Bioconjug. Chem*., **35,** 1888-1899 (2024).

Otonari, K.; Asami, Y.; Ogata, K.; Ishihama, Y.; Futaki, S.; Imanishi, M., Highly Sequence-Specific, Timing-Controllable m^{6}A Demethylation by Modulating RNA-Binding Affinity of m^{6}A Erasers, *Chem. Commun*., **61,** 69-72 (2025).

Kawaguchi, Y.; Kawamura, Y.; Hirose, H.; Kiyokawa, M.; Hirate, M.; Hirata, T.; Higuchi, Y.; Futaki, S., E3MPH16: An Efficient Endosomolytic Peptide for Intracellular Protein Delivery, *J. Controlled Release*, **367,** 877-891 (2024).

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Tanaka K.; Suda A.; Uesugi M.; Futaki S.; Imanishi M., Xanthine Derivatives Inhibit FTO in an L-ascorbic Acid-Dependent Manner, *Chem. Commun*., **59,** 10809-10812 (2023).

Division of Biochemistry
– Chemistry of Molecular Biocatalysts –

https://www.scl.kyoto-u.ac.jp/~plant/index.html

Prof.
YAMAGUCHI, Shinjiro
(D. Agr.)

Assist. Prof.
MASHIGUCHI, Kiyoshi
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Assist. Prof.
HAYASHI, Kengo
(D. Sc.)

Program-Specific Assist. Prof.
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(D. Agr.)

Program-Specific Res.
SUN, Rui
(D. Life Sc.)

Students

ZHAO, Shuo (D1)
HUANG, Yihao (D1)
ZHANG, Wenqiang (D1)
JIANG, Yue (M2)
XU, Qianfan (M1)
WANG, Zizheng (R. S.)
KANG, Yuan (R. S.)

Scope of Research

Plant hormones are a group of small molecules that are synthesized by plants and control their growth, development and environmental responses. This laboratory aims at elucidating how plant hormones are made and act in plants. Towards this goal, we combine chemical (organic chemistry, biochemistry, and analytical chemistry) and biological (molecular genetics, physiology, molecular biology, genomics) approaches. We are also looking for new hormone-like compounds by using mutant plants that show morphological phenotypes.

KEYWORDS

Plant Hormone
Strigolactone
Biosynthesis
Cytochrome P450
Receptor

Recent Selected Publications

Mashiguchi, K.; Morita, R.; Tanaka, K.; Kodama, K.; Kameoka, H.; Kyozuka, J.; Seto, Y.; Yamaguchi, S., Activation of Strigolactone Biosynthesis by the DWARF14-LIKE/KARRIKIN-INSENSITIVE2 Pathway in Mycorrhizal Angiosperms, but Not in Arabidopsis, a Non-Mycorrhizal Plant, *Plant Cell Physiol.*, **64,** 1066-1078 (2023).

Cui, J.; Nishide, N.; Mashiguchi, K.; Kuroha, K.; Miya, M.; Sugimoto, K.; Itoh, J.-I.; Yamaguchi, S.; Izawa, T., Fertilization Controls Tiller Numbers via Transcriptional Regulation of a *MAX1*-like Gene in Rice Cultivation, *Nat. Commun.*, **14,** 3191 (2023).

Mashiguchi, K.; Seto, Y.; Onozuka, Y.; Suzuki, S.; Takemoto, K.; Wang, Y.; Dong, L.; Asami, K.; Noda, R.; Kisugi, T.; Kitaoka, N.; Akiyama, K.; Bouwmeester, H.; Yamaguchi, S., A Carlactonoic Acid Methyltransferase That Contributes to the Inhibition of Shoot Branching in Arabidopsis, *Proc. Natl. Acad. Sci. U.S.A.*, **119(14),** e2111565119 (2022).

Ishida, T.; Watanabe, B.; Mashiguchi, K.; Yamaguchi, S., Synthesis and Structure-Activity Relationship of 16,17-Modified Gibberellin Derivatives, *Phytochem Lett.*, **49,** 162-166 (2022).

Mashiguchi, K.; Seto, Y.; Yamaguchi, S., Strigolactone Biosynthesis, Transport and Perception, *Plant J.*, **105,** 335-350 (2021).

Division of Biochemistry
– Molecular Biology –

https://www.scl.kyoto-u.ac.jp/~molbio/index.html

Assoc. Prof.
TSUGE, Tomohiko
(D. Sc.)

Assist. Prof.
KATO, Mariko
(D. Agr.)

Students

HAGHIR, Shahrzad (D3)
ODOI, Miku (D2)
SILVOSA MILLADO, Cyrose Suzie (D1)

Guest Scholar

KAWACHI-REUSCHER, Miki (D. Agr.) Georg-August-Universität Göttingen, Germany, 7 October 2024−15 October 2024

Scope of Research

This laboratory aims to clarify the molecular bases of regulatory mechanisms involved in plant development, especially morphogenesis and environment adaptation, using techniques of forward and reverse genetics, molecular biology, and biochemistry. Current major subjects are: 1) COP9 signalosome modulating signal transduction in the nuclei, 2) RNA processing mediated gene expression regulation, 3) phospholipid signaling in cell morphogenesis, and 4) transcriptional network for cell morphogenesis.

KEYWORDS

Morphogenesis
mRNA Processing
Phospholipid Signaling
Signal Transduction
COP9 Signalosome

Recent Selected Publications

Kato, M.; Watari, M.; Tsuge, T.; Zhong, S.; Gu, H.; Qu, L.-J.; Fujiwara, T.; Aoyama, T., Redundant Function of the *Arabidopsis* Phosphatidylinositol 4-Phosphate 5-Kinase Genes *PIP5K4-6* is Essential for Pollen Germination, *Plant J.*, **117,** 212-215 (2024).

Akagi, C.; Kurihara, Y.; Makita, Y.; Kawaguchi, M.; Tsuge, T.; Aoyama, T.; Matsui, M., Transcriptional Activation of Ribosome-Related Genes at Initial Photoreception is Dependent on Signals Derived from Both the Nucleus Ans the Chloroplants in *Arabidopsis thaliana*, *J. Plant Res.*, **136,** 227-238 (2023).

Watari, M.; Kato, M.; Blanc-Mathieu, R.; Tsuge, T.; Ogata, H.; Aoyama, T., Functional Differentiation among the *Arabidopsis* Phosphatidylinositol 4-Phosphate 5-Kinase Genes *PIP5K1*, *PIP5K2* and *PIP5K3*, *Plant Cell Physiol.*, **63,** 635-648 (2022).

Zhang, X.; Nomoto, M.; Garcia-León, M.; Takahashi, N.; Kato, M.; Yura, K.; Umeda, M.; Rubio, V.; Tada, Y.; Furumoto, T.; Aoyama, T.; Tsuge, T., CFI 25 Subunit of Cleavage Factor I is Important for Maintaining the Diversity of 3′ UTR Lengths in *Arabidopsis thaliana* (L.) Heynh, *Plant Cell Physiol.*, **63,** 369-383 (2022).

Division of Biochemistry
– Chemical Biology –

https://www.scl.kyoto-u.ac.jp/~uesugi/

Prof.
UESUGI, Motonari
(D. Pharm. Sc.)

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(D. Pharm. Sc.)

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Assist. Prof.
SINGH, Vaibhav Pal
(D. Med. Sc.)

Students

FARRAG, Asmaa Mostafa Abdelbari Soliman (D3)
TSERENDAGVA, Manchir (D2)
LATOS, Krystian (D1)
HELMS, Melanie (M2)
HERRERA, Matthew Dewell (R. S.)
AYATOLLAHI, Parisa Sadat (R. S.)
OBEID Omar (R. S.)

Guest Res. Assoc.

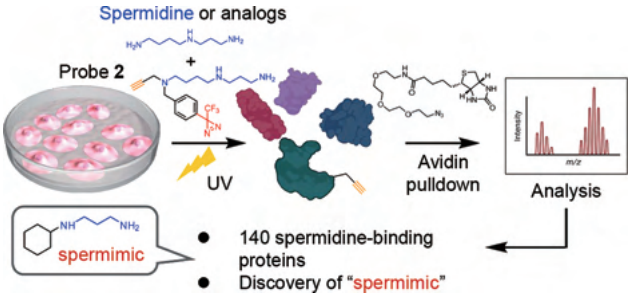
KIM, Hyosuk (Ph. D.) Yonsei University, Korea, R., 1 April 2023–31 March 2026

Scope of Research

Chemical biology is an interdisciplinary field of study that is often defined as "chemistry-initiated biology." As biological processes all stem from chemical events, it should be possible to understand or manipulate biological events using chemistry. Our laboratory has been discovering or designing unique organic molecules that modulate fundamental processes in human cells. Such synthetic organic molecules often serve as tools for basic cell biology. Discovery or design of small molecules with unique biological activities permits small-molecule-initiated exploration of complex cellular events. Our mission is to create a new world of bioactive synthetic molecules: new modes of activity, new shapes, and new sizes. We hope that these basic studies open new avenues for small-molecule applications in a range of fields.

KEYWORDS

Chemical Biology
Chemical Genetics
Self-Assembly
Immunology
Chemical Library



Recent Selected Publications

Singh, V. P.; Hirose, S.; Takemoto, M.; Farrag, A. M. A. S.; Sato, S.; Honjo, T.; Chamoto, K.; Uesugi, M., Chemoproteomic Identification of Spermidine-Binding Proteins and Antitumor-Immunity Activators, *J. Am. Chem. Soc.*, **146(24),** 16412-16418 (2024).

Toh, K.; Nishio, K.; Nakagawa, R.; Egoshi, S.; Abo, M.; Perron, A.; Sato, S.; Okumura, N.; Koizumi, N.; Dodo, K.; Sodeoka, M.; Uesugi, M., Chemoproteomic Identification of Blue-Light-Damaged Proteins, *J. Am. Chem. Soc.*, **144(44),** 20171-20176 (2022).

Nishio, K.; Toh, K.; Perron, A.; Goto, M.; Abo, M.; Shimakawa, Y.; Uesugi, M., Magnetic Control of Cells by Chemical Fabrication of Melanin, *J. Am. Chem. Soc.*, **144(37),** 16720-16725 (2022).

Ado, G.; Noda, N.; Vu, H. T.; Perron, A.; Mahapatra, A. D.; Arista, K. P.; Yoshimura, H.; Packwood, D. M.; Ishidate, F.; Sato, S.; Ozawa, T.; Uesugi, M., Discovery of a Phase-Separating Small Molecule That Selectively Sequesters Tubulin in Cells, *Chemical Science*, **13,** 5760-5766 (2022).

Jin, S.; Vu, H. T.; Hioki, K.; Noda, N.; Yoshida, H.; Shimane, T.; Ishizuka, S.; Takashima, I.; Mizuhata, Y.; Beverly Pe, K.; Ogawa, T.; Nishimura, N.; Packwood, D.; Tokitoh, N.; Kurata, H.; Yamasaki, S.; Ishii, K. J.; Uesugi, M., Discovery of Self-Assembling Small Molecules as Vaccine Adjuvants, *Angew. Chem. Int. Ed.*, **60(2),** 961-969 (2021).

Division of Environmental Chemistry
– Molecular Materials Chemistry –

https://www.scl.kyoto-u.ac.jp/~moma/index-e.html

Prof.
KAJI, Hironori
(D. Eng.)

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SHIZU, Katsuyuki
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Assist. Prof.
SUZUKI, Katsuaki
(D Human & Envirnmtl. Studies)

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CHOI, Heekyoung *
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TANAKA, Hiroyuki
(D. Sc.)

*New Research Field Development Project

Techn. Staff
MAENO, Ayaka

Techn. Staff
NAKAJIMA,Yuuki

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MURAKAMI, Kimiya (D3)
FUJINAKA, Masatoshi (D3)
SATO, Hiroki (D2)
ISHIHARA, Kuraudo (D1)
ONOE, Renon (M2)
YASUDA, Yuka (M2)
FUKUSHIMA, Shohei (M2)
KAWABATA, Kazuhiro (M1)
KOZAKA, Shunsuke (M1)
TAKARAKO, Masataka (M1)
UCHIKAWA, Ryosuke (U. G.)
KONDO, Ryo (U. G.)
TAKAHASHI, Kento (U. G.)

Guest Scholar

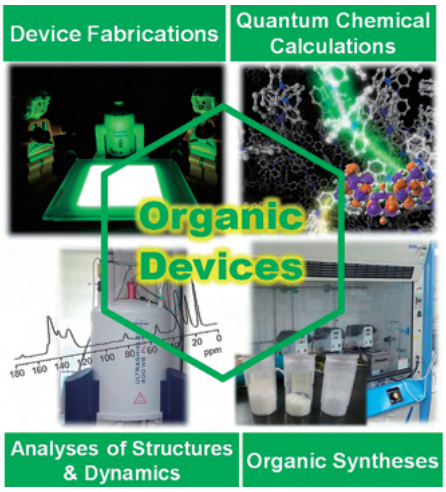
HUDSON, Zachary (D. Chem.) The University of British Columbia, Canada, 20 February 2024–31 March 2024

Guest Res. Assoc.

JUNG, Andre Philipp Karlsruhe Institute of Technology, Germany, 2 September 2024–17 September 2024
BERGMANN, Katrina University of British Columbia, Canada, 30 September 2024–20 December 2024

Scope of Research

Our research goal is to develop high-performance organic electroluminescence devices, organic solar cells, and polymer materials. Toward this, we carry out syntheses, device fabrications, precise structure characterizations, and quantum chemical calculations for high functional organic materials. Along with exploring novel synthetic routes and novel devices, we perform detailed analyses of structures and dynamics, mainly by sophisticated solid-state NMR spectroscopy, in order to obtain structure–dynamics–property relationships.



KEYWORDS

Organic Light-Emitting Diodes
Quantum Chemical Calculation
Dynamic Nuclear Polarization Enhanced NMR
Solid-State NMR
Amorphous Materials

Recent Selected Publications

Okumura, R.; Tanaka, H.; Shizu, K.; Fukushima, S.; Yasuda, Y.; Kaji, H., Development of an Organic Emitter Exhibiting Reverse Intersystem Crossing Faster than Intersystem Crossing, *Angew. Chem. Int. Ed*., **63,** e202409670 (2024).
Shizu, K.; Kaji, H., Quantitative Prediction of Rate Constants and Its Application to Organic Emitters, *Nat. Commun*., **15,** 4723 (2024).
Shizu, K.; Ren, Y.; Kaji, H., Promoting Reverse Intersystem Crossing in Thermally Activated Delayed Fluorescence via the Heavy-Atom Effect, *J. Phys. Chem. A*, **127,** 439-449 (2023).
Tanaka, H.; Mizuhata, Y.; Tokitoh, N.; Miyamoto, R.; Kanamori, K.; Kaji, H., Multiple Stimuli-Responsive Supramolecular Organic Framework under Concomitant Emission Color Changes, *J. Phys. Chem. C*, **127,** 20459-20465 (2023).
Suzuki, K.; Kaji, H., Torsion Angle Analysis of a Thermally Activated Delayed Fluorescence Emitter in an Amorphous State Using Dynamic Nuclear Polarization Enhanced Solid-State NMR, *J. Am. Chem. Soc.*, **145,** 16324-16329 (2023).

Division of Environmental Chemistry
– Hydrospheric Environment Analytical Chemistry –

https://inter3.kuicr.kyoto-u.ac.jp/scope_E.html

Prof.
SOHRIN, Yoshiki
(D. Sc.)

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TAKANO, Shotaro
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ZHENG, Linjie
(D. Sc.)

Assist. Prof. *
ALAM, Mahboob
(Ph. D.)

*New Research Field Development Project

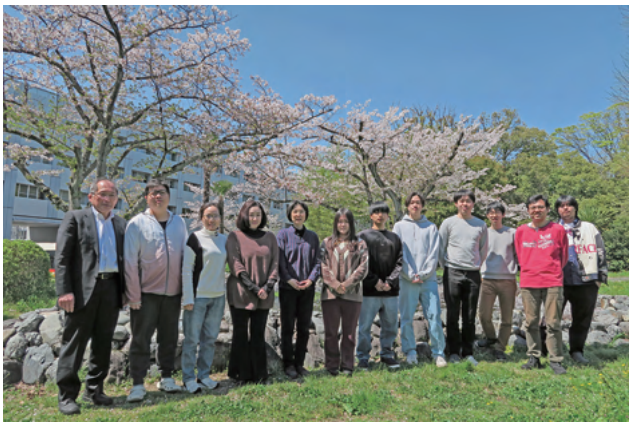
Techn. Staff
NAKAHARA, Fumiko

Students

CHAN, Cheuk-Yin (D3)
MATSUOKA, Kohei (D2)
KAKIMOTO, Ryochi (M2)
YUNOKI, Keisuke (M2)
GODA, Aoi (M1)
GOSHONA, Shinya (M1)
MIZUTANI, Atsuki (M1)

Scope of Research

(i) Biogeochemistry of trace elements in the hydrosphere: Novel analytical methods are developed for trace metals and their isotopes. Distribution of trace elements in the hydrosphere and their effects on the ecosystem are investigated. The study also covers hydrothermal activity, deep biosphere, and paleocean. (ii) Ion recognition: Novel ligands and ion recognition system are designed, synthesized, and characterized.



KEYWORDS

Marine Chemistry
Analytical Chemistry
Trace Elements
Stable Isotopes
Metal Ion Recognition

Recent Selected Publications

Ueki, R.; Zheng, L.; Takano, S.; Sohrin, Y., Distributions of Zirconium, Hafnium, and Niobium in the Indian Ocean: Influence of Lithogenic Sources on Incompatible Elements, *Mar. Chem*., **260,** 104365 (2024).

Takano, S.; Kanamura, H.; Sohrin, Y., Multielemental Isotopic Analysis for Trace Metals in Geochemical Samples, Part 2: Nickel, Copper, Zinc, Cadmium, and Lead in Sediments, Atmospheric Particles, and Plankton, *ACS Earth Space Chem.*, **8,** 547-553 (2024).

Zheng, L.; Minami, T.; Takano, S.; Sohrin, Y., Distributions of Cadmium, Nickel, Zinc, Copper, and Iron in the Western South Pacific Ocean: Local Sources of the Nutrient-Type Trace Metals, *Mar. Chem.*, **263-264,** 104411 (2024).

Takano, S.; Kanamura, H.; Sohrin, Y., Multielemental Isotopic Analysis for Trace Metals in Geochemical Samples, Part 1: Dissolved Iron, Nickel, Copper, Zinc, Cadmium, and Lead in Seawater, *ACS Earth Space Chem.*, **8,** 702-711 (2024).

Chan, C.-Y.; Zheng, L.; Sohrin, Y., The Behaviour of Aluminium, Manganese, Iron, Cobalt, and Lead in the Subarctic Pacific Ocean: Boundary Scavenging and Temporal Changes, *J. Oceanogr.*, **80,** 99-115 (2024).

Cheng, Y.; Cai, P.; Chen, H.; Yuan, L.; Jiang, X.; Zhang, S.; Chen, Y.; Luo, Y.; Sohrin, Y., Nitrate and Silicate Fluxes at the Sediment–Water Interface of the Deep North Pacific Ocean Illuminated by $^{226}Ra/^{230}Th$ Disequilibria, *Geochim. Cosmochim. Acta*, **383,** 81-91 (2024).

Division of Environmental Chemistry
– Chemistry for Functionalized Surfaces –

https://www.scl.kyoto-u.ac.jp/~yoeki/

Prof.
HASEGAWA, Takeshi
(D. Sc.)

Assoc. Prof.
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(D. Eng.)

Assist. Prof.
SHIOYA, Nobutaka
(D. Sc.)

Res. (pt.)
MATSUDA, Hiroshi
(D. Eng.)

Students

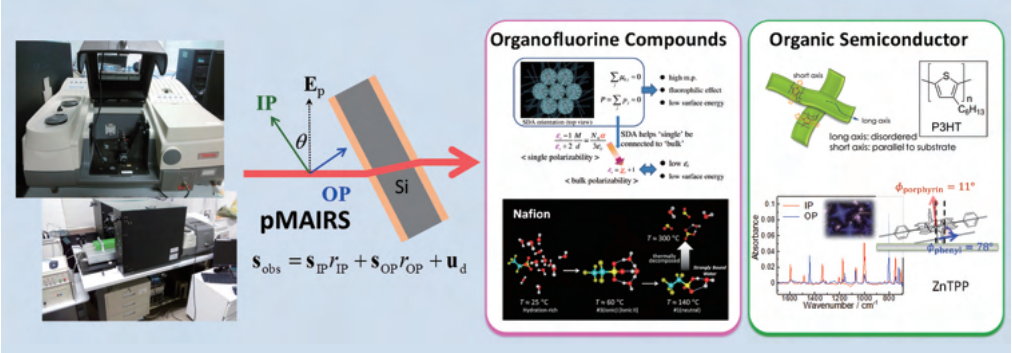
OKA, Takayuki (D1)
ARAKI, Taisuke (M2)
SUGIMOTO, Emi (M2)
OONUKI, Tomoya (M1)

Scope of Research

To understand the chemical structure and properties of a molecular aggregated system, the keywords of molecular interactions and orientation are focused on, and the molecular aggregates are investigated by using originally developed spectroscopic techniques. The current major topics are: (1) perfluoroalkyl-specific properties in a condensed system; (2) controlling factors of molecular packing and orientation in a thin film of an organic semiconductor compound; (3) development of new molecular orientation analytical technique “MAIRS2.”

KEYWORDS

Infrared and Raman Spectroscopy
Surface and Interface Chemistry
Perfluoroalkyl Compounds
Organic Semiconductors
pMAIRS and MAIRS2



Recent Selected Publications

Shioya, N.; Yoshida, M.; Fujii, M.; Eda, K.; Hasegawa, T., Disappearance of Odd-Even Effects at the Substrate Interface of *n*-Alkanes, *J. Am. Chem. Soc*., **146(46),** 32032-32039 (2024).

Araki, T.; Oka, T.; Shioya, N.; Hasegawa, T., Molecular Symmetry Change of Perfluoro-n-Alkanes in ‘Phase I’ Monitored by Infrared Spectroscopy, *Anal. Sci.*, **40(9),** 1723-1731 (2024).

Shioya, N.; Mori, T.; Ariga, K.; Hasegawa, T., Multiple-Angle Incidence Resolution Spectrometry: Applications in Nanoarchitectonics and Applied Physics, *Jpn. J. Appl. Phys.*, **63(6),** 060102 (2024).

Hasegawa, T.; Nakagawara, A.; Takagi, T.; Shimoaka, T.; Shioya, N.; Sonoyama, M., Phonon Modes Controlled by Primary Chemical Structure of Partially Fluorinated Dimyristoylphosphatidylcholine (DMPC) Revealed by Multiple-Angle Incidence Resolution Spectrometry (MAIRS), *J. Chem. Phys*., **160(6),** 064704 (2024).

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Division of Environmental Chemistry
– Molecular Microbial Science –

https://molmicro.kuicr.kyoto-u.ac.jp/en/

Prof.
KURIHARA, Tatsuo
(D. Eng.)

Assoc. Prof.
KAWAMOTO, Jun
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Assist. Prof.
OGAWA, Takuya
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Specially Contracted Staff
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Researcher (pt.)
SUWANAWAT, Nittikarn

Students
ZHU, Mengshan (D3)
TSUDZUKI, Taiku (D3)
INOUE, Hiromu (D2)
YOUN, Jae Hyung (D1)
YANG, Yuanzheng (D1)
SAKAMOTO, Daiki (M2)
SHIODA, Yudai (M2)
YOSHIDA, Riki (M2)
SHIMODA, Kaichi (M1)
TAKANO, Haruka (M1)
YAMASHITA, Atsuki (M1)
SANKARALINGAM, Nivitha Vani (M1)

Scope of Research

Microorganisms are found almost everywhere on Earth. They have a great diversity of capacities to adapt to various environments, including chemically and physically unusual environments. Our main subject is to clarify the molecular basis of environmental adaptations of microorganisms and their application. Specific functions of proteins and lipids with essential roles in environmental adaptation of extremophilic microorganisms are of our particular interest. We also undertake mechanistic analysis of microbial enzymes, in particular, those involved in unique metabolic pathways, and their application.

KEYWORDS
Extremophiles
Bacterial Cold-Adaptaion Mechanism
Polyunsaturated Fatty Acid
Phospholipid Acyltransferase
Extracellular Membrane Vesicle

Recent Selected Publications

Zhu, M.; Kawamoto, K.; Imai, T.; Ogawa, T.; Kurihara, T., Enhancing Extracellular Membrane Vesicle Productivity of *Shewanella vesiculosa* HM13, a Prospective Host for Vesiculation-Mediated Protein Secretion, by Weakening Outer Membrane-Peptidoglycan Linkage, *J. Biosci. Bioeng.*, **138,** 137-143 (2024).

Inoue, H.; Kawano, K.; Kawamoto, J.; Ogawa, T.; Kurihara, T., Rapid Screening and Identification of Genes Involved in Bacterial Extracellular Membrane Vesicle Production Using a Curvature-Sensing Peptide, *bioRxiv*, 05.20.594893 (2024).

Casillo, A.; Fanina, S.; Kamasaka, K.; Kawamoto, J.; Kurihara, T.; Lanzetta, R.; Corsaro, M. M., Structural Study of a Polysaccharide Component of *nfnB* Mutant of *Shewanella vesiculosa* HM13, *Carbohydr. Res.*, **541,** 109148 (2024).

Kamasaka, K.; Kawamoto, J.; Tsudzuki, T.; Liu, Y.; Imai, T.; Ogawa, T.; Kurihara, T., Capsular Polysaccharide-Mediated Protein Loading onto Extracellular Membrane Vesicles of a Fish Intestinal Bacterium, *Shewanella vesiculosa* HM13, *bioRxiv*, 04.25.538355 (2023).

Ogawa, T.; Kuboshima, M.; Suwanawat, N.; Kawamoto, J.; Kurihara, T., Division of the Role and Physiological Impact of Multiple Lysophosphatidic Acid Acyltransferase Paralogs, *BMC Microbiol.*, **22,** 241 (2022).

Division of Multidisciplinary Chemistry
– Polymer Materials Science –

https://www.scl.kyoto-u.ac.jp/~polymat/e-index.html

Prof.
TAKENAKA, Mikihito
(D. Eng.)

Assoc. Prof.
OGAWA, Hiroki
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Assist. Prof.
NAKANISHI, Yohei
(D. Eng.)

Assist. Prof.
SHIBASAKI, Kazuki *
(D. Eng.)

*New Research Field Development Project

Techn. Staff

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TATEISHI, Nayuko

Students

SEKO, Tamio (D3)
HAMAMOTO, Hiroki (D3)
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SAWADA, Satoshi (D1)
TAMURA, Yukiko (D1)
BANDO, Shusuke (D1)
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SHIRAISHI, Harunori (M2)
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HOSOMI, Yu (M2)
KUBO, Haruki (M1)
TOBITA, Naoto (M1)
YOSHINO, Syunki (M1)
SHIMOTSU, Yui (U. G.)
TAKAGI, Jumpei (U. G.)
MATSUMOTO, Ryohei (U. G.)

Scope of Research

The structure and molecular motion of polymer substances are studied, mainly using scattering methods such as X-ray, neutron, and light with intent to solve fundamentally important problems in polymer science. The main projects are studied on 1) the morphologies and the dynamics of self-assembling processes in block copolymers, 2) the hierarchical structures in crystalline polymer and rubber-filler systems, 3) the viscoelastic effects in glassy materials, 4) formation processes and ordering structures in polymer thin films.

KEYWORDS

Polymer Physics
Self Assembly
Hierarchical Structure
Polymer Properties
Softmatter

Recent Selected Publications

Nakanishi, Y.; Ishige, R.; Ogawa, H.; Huang, Y.; Sakakibara, K.; Ohno, K.; Kanaya, T.; Takenaka, M.; Tsujii, Y., Unified Explanation for Self-Assembly of Polymer-Brush-Modified Nanoparticles in Ionic Liquids, *Polym. J.*, **55,** 1199-1209 (2023).

Shibata, M.; Nakanishi, Y.; Abe, J.; Arima-Osonoi, H.; Iwase, H.; Shibayama, M.; Motokawa, R.; Kumada, T.; Takata, S.; Yamamoto, K.; Takenaka, M.; Miyazaki, T., Structural Changes of Polystyrene Particles in Subcritical and Supercritical Water Revealed by in situ Small-Angle Neutron Scattering, *Polym. J.*, **55,** 1165-1170 (2023).

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Watanabe, Y.; Nishitsuji, S.; Takenaka, M., Anomalous Small-Angle X-ray Scattering Analyses on Hierarchical Structures of Rubber–Filler Systems, *J. Appl. Crystallogr.*, **56(2),** 461-467 (2023).

Kishimoto, M.; Takenaka, M.; Iwabuki, H., Spatial Distribution of the Amorphous Region Constrained by Polymer Crystallites, *Macromolecules*, **56(1),** 207-214 (2023).

Division of Multidisciplinary Chemistry
– Molecular Rheology –

https://molrheo.kuicr.kyoto-u.ac.jp/en/

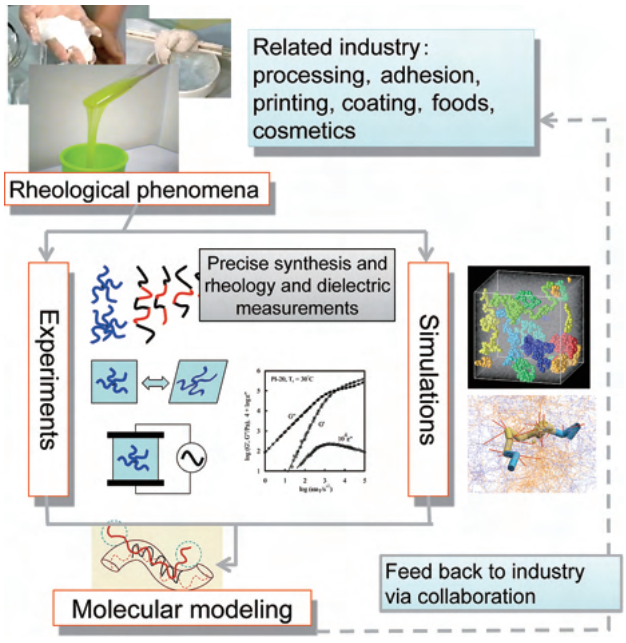
Assoc. Prof.
MATSUMIYA, Yumi
(D. Eng.)

Students

TOSAKI, Tomohiro (M2)
YAMAMOTO, Ayumu (M2)
HAYASHI, Taichi (M1)
TOMIMURA, Yuya (M1)
SAKAGUCHI, Keiki (U. G.)
TAKAOKI, Sayako (U. G.)

Scope of Research

Research focus is placed on the molecular origin of rheological properties of various materials. Depending on time and temperature, homogeneous polymeric materials exhibit typical features of glass, rubber, and viscous fluid while heterogeneous polymeric systems exhibit plasticity in addition to these features. For basic understanding of these features, the molecular motion and structures at various scales are studied for polymeric systems in deformed state. Rheological measurements are performed with various rheometers. Auto-correlation of the molecular orientation is also investigated with dynamic dielectric spectroscopy. Analysis of rheological and dielectric behavior elucidates a new aspect of softmatter physics.



KEYWORDS

Rheology
Soft Matter
Dielectric Spectroscopy
Mesoscopic Model

Recent Selected Publications

Matsumiya, Y.; Watanabe, H., Non-university of Constraint Release Relaxation in Entangled Linear Polymers of Various Chemical Structures, *Rubber Chem. Tech*., **97(4),** 471-511 (2024).

Zhang, Y.; Tang, J.; Chen, Q.; Kwon, Y.; Matsumiya, Y.; Watanabe, H., Nonlinear Stress Relaxation of End-Associative Star Chain. 2. Behavior Under Double-Step Strain, *J. Soc. Rheol. Jpn.*, **52(2),** 143-160 (2024).

Zhang, Y.; Tang, J.; Chen, Q.; Kwon, Y.; Matsumiya, Y.; Watanabe, H., Nonlinear Stress Relaxation of End-Associative Star Chain. 1. Behavior Under Single-Step Strain, *J. Soc. Rheol. Jpn*., **52(2),** 123-141 (2024).

Division of Multidisciplinary Chemistry
– Molecular Aggregates –

https://www.scl.kyoto-u.ac.jp/~wakamiya/english/index.html

Prof.
WAKAMIYA, Atsushi
(D. Eng.)

Senior Lect.
MURDEY, Richard
(Ph. D.)

Assist. Prof.
NAKAMURA, Tomoya
(D. Eng.)

Assist. Prof. *
TRUONG, Minh Anh
(D. Eng.)

*New Research Field Development Project

Program-Specific Assist. Prof.
OHASHI, Noboru
(D. Eng.)

Specially Appointed Assist. Prof.
CHEN, Chien-Yu
(Ph. D.)

Students

TAN, Tiancheng (D3)
HASEGAWA, Akio (D2)
MIYAKE, Yuki (D1)
HARATA, Fuyuki (D1)
HIRA, Shota (D1)
ALY, Aly (D1)
ADACHI, Yuta (M2)
SAKAMOTO, Chihiro (M2)
WAN, Linbo (M2)
CHO, Woojin (M1)
LING, Yükhe (M1)
YANASE, Ibuki (M1)
NORIEGA, Javier Pablo (M1)

Program-Specific Researchers

IWASAKI, Yasuko
MATSUSHIGE, Yuko

Researchers (pt.)

SHIMAZAKI, Ai

Assist. Techn. Staff

HARAMATSU, Megumi

Guest Scholar

YU, Ming-Hsuan (D3) National Taiwan University, Taiwan, 12 September 2024–3 December 2024

Scope of Research

We design and synthesize unique electronic materials with sophisticated device applications in mind. These materials have novel solid-state aggregation structures or well-defined interface orientation that promote efficient electrical current flow or enhance device lifetime. Electronic devices based on these new materials are then evaluated using advanced measurement techniques, and the results are used to inform the next direction of the materials chemistry. We call this synergistic approach for achieving our research goals “Needs Inspired Fundamental Science”.

KEYWORDS

Molecular Design and Synthesis Molecular Aggregation Functional Materials Semiconductors Perovskite Solar Cells

Recent Selected Publications

Truong, M. A.; Ueberricke, L.; Funasaki, T.; Adachi, Y.; Hira, S.; Hu, S.; Yamada, T.; Sekiguchi, N.; Nakamura, T.; Murdey, R.; Iikubo, S.; Kanemitsu, Y.; Wakamiya., A., Tetrapodal Hole-Collecting Monolayer Materials Based on Saddle-Like Cyclooctatetraene Core for Inverted Perovskite Solar Cells, *Angew. Chem. Int. Ed.*, **63,** e202412939 (2024).

Tan, T.; Murdey, R.; Sumitomo, S.; Nakamura, T.; Truong, M. A.; Wakamiya, A., Anhydrous *N*,*N*-Dimethyl-*N*,*N*-Dineopentylammonium Fluoride Electrolyte for Fluoride Ion Batteries, *Chem. Mater*., **36,** 4533-4560 (2024).

Hu, S.; Thiesbrummel, J.; Pascual, J.; Stolterfoht, M.; Wakamiya, A.; Snaith, H. J., Narrow Bandgap Metal Halide Perovskites for All-Perovskite Tandem Photovoltaics, *Chem. Rev*., **124,** 4079-4123 (2024).

Liu, W.; Huang, G.; Chen, C.-Y.; Tan, T.; Fuyuki, H.; Hu, S.; Nakamura, T.; Truong, M. A.; Murdey, R.; Hashikawa, Y.; Murata, Y.; Wakamiya, A., An Open-Cage Bis[60]Fulleroid as an Electron Transport Material for Tin Halide Perovskite Solar Cells, *Chem. Commun*., **60,** 2172-2175 (2024).

Nakamura, T.; Kondo, Y.; Ohashi, N.; Sakamoto, C.; Hasegawa, A.; Hu, S.; Truong, M. A.; Murdey, R.; Kanemitsu, Y.; Wakamiya, A., Materials Chemistry for Metal Halide Perovskite Photovoltaics, *Bull. Chem. Soc. Jpn*., **97,** uoad025 (2024).

Advanced Research Center for Beam Science – Particle Beam Science –

https://pbs.kuicr.kyoto-u.ac.jp/en/

Prof.
WAKASUGI, Masanori
(D. Sc.)

Assoc. Prof.
TSUKADA, Kyo
(D. Sc.)

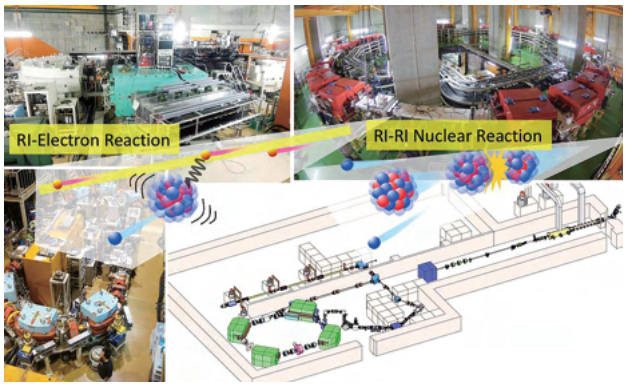
Techn. Staff
TONGU, Hiromu

Students

YOSHIDA, Satoru (M2)
TACHIBANA, Mariko (M2)
MAEDA, Yusei (M2)
KAGAMI, Rin (M1)
KOBAYASHI, Hiroki (M1)

Scope of Research

One of our research is an experimental research for unstable nuclear structures by means of the electron and heavy-ion accelerators. We address the technical development in an RI beam production driven by a high-energy electron beam, an electron scattering from the RI's in combination with the RI target inserted in an electron storage ring, and the precision mass measurement for extremely short-lived and rare exotic nuclei using a heavy-ion storage ring. We will address some technical development aiming at a nuclear photo-absorption cross-section measurement and the beam recycling in a heavy-ion storage ring to study the nuclear reactions involving rare exotic nuclei.



KEYWORDS

Beam Physics
Unstable Nuclear Physics
Electron Linac
Accelerator Physics
Storage Ring

Recent Selected Publications

Tsukada, K.; Abe, Y.; Enokizono, A.; Goke, T.; Hara, M.; Honda, Y.; Hori, T.; Ichikawa, S.; Ito, Y.; Kurita, K.; Legris, C.; Maehara, Y.; Ohnishi, T.; Ogawara, R.; Suda, T.; Tamae, T.; Wakasugi, M.; Watanabe, M.; Wauke, H., First Observation of Electron Scattering from Online-Produced Radioactive Target, *Phys. Rev. Lett.*, **131,** 092502 (2023).

Ogawara, R.; Abe, Y.; Ohnishi, T.; Enokizono, A.; Hara, M.; Hori, T.; Ichikawa, S.; Kurita, K.; Maehara, Y.; Suda, T.; Tsukada, K.; Wakasugi, M.; Watanabe, M.; Wauke, H., Ion-Trapping Properties of SCRIT: Time Evolutions of 138Ba Charge State Distributions, *Nucl. Instr. Met.*, **B541,** 90-92 (2023).

Miyata, K.; Ogawara, R.; Ishikawa, M., Improvement of Crystal Identification Accuracy for Depth-of-Interaction Detector System with Peak-to-Charge Discrimination Method, *Sensors*, **23,** 4584 (2023).

Li, H. F.; Naimi, S.; Sprouse, T. M.; Mumpower, M. R.; Abe, Y.; Yamaguchi, Y.; Nagae, D.; Suzaki, F.; Wakasugi, M.; Arakawa, H.; Dou, W. B.; Hamakawa, D.; Hosoi, S.; Inada, Y.; Kajiki, D.; Kobayashi, T.; Sakaue, M.; Yokoda, Y.; Yamaguchi, T.; Kagesawa, R.; Kamioka, D.; Moriguchi, T.; Mukai, M.; Ozawa, A.; Ota, S.; Kitamura, N.; Masuoka, S.; Michimasa, S.; Baba, H.; Fukuda, N.; Shimizu, Y.; Suzuki, H.; Takeda, H.; Ahn, D. S.; Wang, M.; Fu, C. Y.; Wang, Q.; Suzuki, S.; Ge, Z.; Litvinov, Yu. A.; Lorusso, G.; Walker, P. M.; Podolyak, Zs.; Uesaka, T., First Application of Mass Measurements with the Rare-RI Ring Reveals the Solar r-Process Abundance Trend at A = 122 and A = 123, *Phys. Rev. Lett.*, **128,** 152701 (2022).

Kusumoto, T.; Inoue, S.; Ogawara, R.; Kodaira, S., Measurement of the Energy Spectrum of Laser-Accelerated Protons Using FNTD: Development of an Easy and Quick Method for Energy Spectrometry, *Radiat. Meas.*, **151,** 106715 (2022).

Advanced Research Center for Beam Science – Laser Matter Interaction Science –

https://en.laser.kuicr.kyoto-u.ac.jp/

Prof.
TOKITA, Shigeki
(D. Eng.)

Assist. Prof.
OKAZAKI, Daiki
(D. Eng.)

Assist. Prof.
KIRITA, Yuri
(D. Sc.)

Res (pt.)
HASHIDA, Masaki
(D. Eng.)

Researcher (pt.)
MASUNO, Shin-ichiro

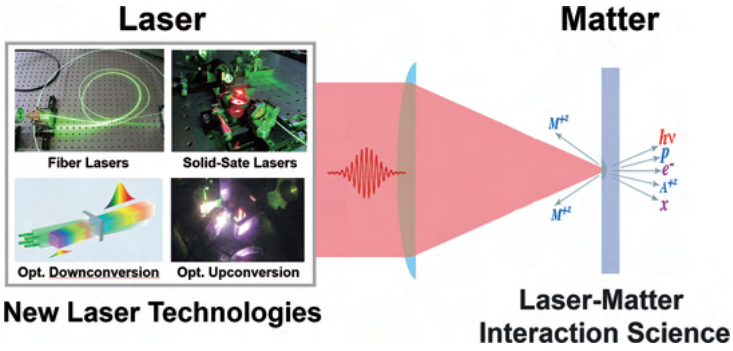
Assist. Techn. Staff
MATSUMOTO, Keiko

Students
UETA, Isshin (M1)
HIYANE, Soshi (M1)
LEE, Sungho (M1)
WU, Xinlei (R. S.)

Scope of Research

We are developing cutting-edge high-intensity laser sources and studying experimental research on the laser interaction with matter by using the new laser sources. We are promoting cross-disciplinary research based on high-intensity laser technologies such as development of high-intensity mid-infrared solid-state lasers and fiber lasers, research on particle acceleration and wavelength conversion with plasmas produced by high-intensity ultrafast lasers, development of laser isotope separation method for neutrino research, and search for dark matter using high-intensity lasers.

KEYWORDS
High Power Laser Optics
Ultrafast Laser Physics
Laser-Plasma Interaction Physics
Laser Isotope Separation
Dark Matter



Recent Selected Publications

Furuse, H.; Ueno D.; Omata K.; Imai M.; Tokita, S., Mid-Infrared Fine-Grained Er:Y_2O_3 Laser Ceramics Fabricated by Spark Plasma Sintering, *Ceram. Int.*, **50,** 46925-46931 (2024).

Li, E.; Uehara, H.; Tokita S.; Zhao, M.; Yasuhara, R., High-Power, Single-Frequency Mid-Infrared Laser Based on a Hybrid Fe:ZnSe Amplifier, *Infrared Phys. Technol.*, **136,** 105071 (2024).

Ogawa, I.; Hiraiwa, T.; Nakajima, J.; Yuhaku, R.; Tozawa, M.; Niki, H.; Tokita, S.; Miyanaga, N.; Uemukai, M.; Rittirong, A.; Umehara, S.; Matsuoka, K.; Yoshida, S., Laser Isotope Separation to Study for the Neutrino-Less Double Beta Decay of ^{48}Ca, *J. Phys. Conf. Ser.*, **2586,** 012136 (2023).

Goya, K.; Sasanuma, H.; Ishida, G.; Uehara, H.; Tokita, S., Fusion Splicing of Plastic Optical Fibers Using a Mid-IR Fiber Laser, *Appl. Phys. Express*, **16,** 052006 (2023).

Homma, K.; Tesileanu, O.; Nakamiya, Y.; Kirita, Y.; Chiochiu, C.; Cuciuc, M.; Giubega, G.; Hasada, T.; Hashida, M.; Ishibashi, F.; Kanai, T.; Kodama, A.; Masuno, S.; Miyamaru, T.; Neagu, L.; Rodrigues, V. R. M.; Rosu, M. M.; Sakabe, S.; Tamlyn, J.; Tazlauanu, S. V.; Tokita, S., Challenge of Search for Cosmological Dark Components with High-Intensity Lasers and beyond, *Eur. Phys. J. A.*, **59,** 109 (2023).

Advanced Research Center for Beam Science
– Electron Microscopy and Crystal Chemistry –

http://eels.kuicr.kyoto-u.ac.jp/EMCC/home-en.html

Assoc. Prof.
HARUTA, Mitsutaka
(D. Sc.)

Assist. Prof.
NEMOTO, Takashi
(D. Sc.)

Program-Specific Res.
KIYOMURA, Tsutomu

Program-Specific Res.
KADONO, Toshiharu
(D. Sc.)

Researcher (pt.)

OGAWA, Tetsuya (D. Sc.)

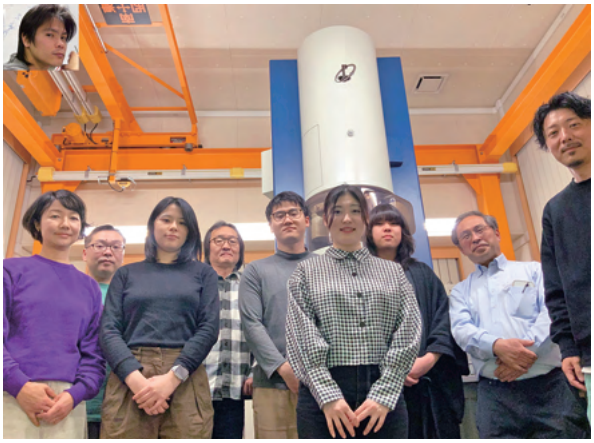
Students

LIN, I-Ching (D3)
YASUI, Kentaro (M2)
JO, Yoshiyuki (M2)
SEKOGUCHI, Maho (M1)

Scope of Research

In the field of nanotechnology, the importance of high spatial resolution analysis of materials further increases. We study the structure and the electronic state of materials at atomic scale through direct imaging of atoms or molecules by (scanning) transmission electron microscopy ((S)TEM) combined with energy dispersive X-ray spectroscopy (EDS) and electron energy-loss spectroscopy (EELS), which gives the information of elemental and electronic state. And we are studying with the aim of establishing new analytical methods using electron microscopes and evaluating materials using these methods.

KEYWORDS
STEM
EELS
EDS
Elemental Mapping
Electronic State



Recent Selected Publications

Lin, I-C.; Haruta, M.; Nemoto, T.; Kurata, H., Isotropic Behavior of Oxygen Vibrations in $PbTiO_3$ Investigated by Ti $L_{2,3}$-Edge Electron Energy-loss Spectroscopy, *Phys. Rev. B.*, **110,** [035109-1]-[035109-8] (2024).

Lin, I-C.; Haruta, M.; Nemoto, T.; Goto, M.; Shimakawa, Y.; Kurata, H., Extraction of Anisotropic Thermal Vibration Factors for Oxygen from the Ti $L_{2,3}$-Edge in $SrTiO_3$, *J. Phys. Chem. C.*, **127(36),** 17802-17808 (2023). Supplemental cover

Iwashimizu, C.; Haruta, M.; Nemoto, T.; Kurata, H., Different Atomic Contrasts in HAADF Images and EELS Maps of Rutile TiO_2, *Microscopy*, **72(4),** 353-360 (2023). Editor's Choice

Haruta, M.; Kikkawa, J.; Kimoto, K.; Kurata, H., Comparison of Detection Limits of Direct-Counting CMOS and CCD Cameras in EELS Experiments, *Ultramicroscopy*, **240,** [113577-1]-[113577-6] (2022).

Haruta, M.; Nemoto, T.; Kurata, H., Sub-picometer Sensitivity and Effect of Anisotropic Atomic Vibrations on Ti $L_{2,3}$-Edge Spectrum of $SrTiO_3$, *Appl. Phys. Lett.*, **119,** [232901-1]-[232901-5] (2021). Featured Article

Advanced Research Center for Beam Science – Atomic and Molecular Structures –

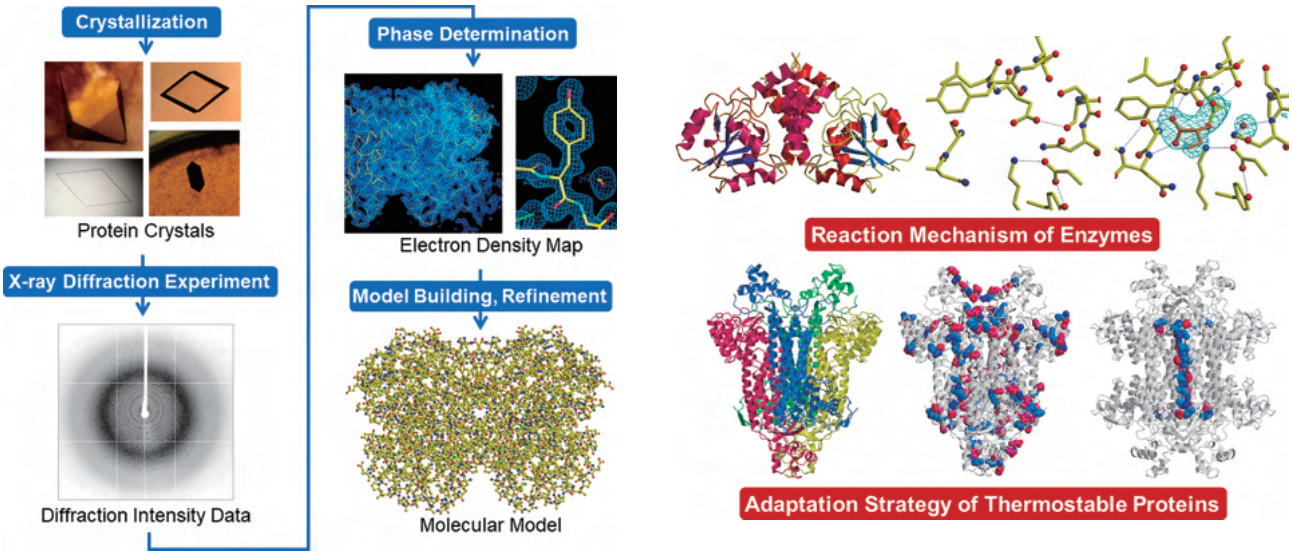
https://www.scl.kyoto-u.ac.jp/~fujii/indexE.html

Assist. Prof.
FUJII, Tomomi
(D. Sc.)

Scope of Research

This laboratory analyzes X-ray crystallographic structures of biological macromolecules and studies the structural biology about the relationships between protein structures and their functions and properties based on the crystal structures. The main research themes are elucidation of the reaction mechanism of enzymes, the relationship between the multiform conformation and the functional variety of proteins, the structural basis for the domain-arrangements of multi-domain proteins or protein-protein interactions, structure determination for structure-based protein engineering and industrial application, and the adaptation strategy of proteins from thermophilic or cold-adapted bacteria.

KEYWORDS
Crystal
X-ray Crystallographic Analysis
Structural Biology
Protein Crystallography
Structure and Function



Recent Selected Publications

Fujii, T.; Sato, A.; Okamoto, Y.; Yamauchi, T.; Kato, S.; Yoshida, M.; Oikawa, T.; Hata, Y., The Crystal Structure of Maleylacetate Reductase from *Rhizobium* sp. Strain MTP-10005 Provides Insights into the Reaction Mechanism of Enzymes in Its Original Family, *Proteins: Structure, Function, and Bioinformatics*, **84,** 1029-1042 (2016).

Fujii, T.; Yamauchi, T.; Ishiyama, M.; Gogami, Y.; Oikawa, T.; Hata, Y., Crystallographic Studies of Aspartate Racemase from *Lactobacillus sakei* NBRC 15893, *Acta Crystallogr. Sect. F Struct. Biol. Cryst. Commun.*, **71,** 1012-1016 (2015).

Fujii, T.; Goda, Y.; Yoshida, M.; Oikawa, T.; Hata, Y., Crystallization and preliminary X-ray Diffraction Studies of Maleylacetate Reductase from *Rhizobium* sp. Strain MTP-10005, *Acta Crystallogr. Sect. F Struct. Biol. Cryst. Commun.*, **64,** 737-739 (2008).

Fujii, T.; Oikawa, T.; Muraoka, I.; Soda, K.; Hata, Y., Crystallization and Preliminary X-ray Diffraction Studies of Tetrameric Malate Dehydrogenase from the Novel Antarctic Psychrophile *Flavobacterium frigidimaris* KUC-1, *Acta Crystallogr. Sect. F Struct. Biol. Cryst. Commun.*, **63,** 983-986 (2007).

Fujii, T.; Sakai, H.; Kawata, Y.; Hata, Y., Crystal Structure of Thermostable Aspartase from *Bacillus* sp. YM55-1: Structure-based Exploration of Functional Sites in the Aspartase Family, *J. Mol. Biol.*, **328,** 635-654 (2003).

International Research Center for Elements Science – Synthetic Organotransformation –

https://www.scl.kyoto-u.ac.jp/~elements/en/

Prof.
NAKAMURA, Masaharu
(D. Sc.)

Assoc. Prof.
ISOZAKI, Katsuhiro
(D. Eng.)

Senior Lect.
PINCELLA, Francesca
(D. Eng.)

Assist. Prof.
DOBA, Takahiro
(D. Sc.)

Program-Specific Assist. Prof.
NAKAGAWA, Yuka
(D. Sc.)

Program-Specific Assist. Prof.
MINEO, Keito
(D. Agr.)

Students

ISERI, Kenta (D2)
YIN, Haozhi (D2)
WU, Beiling (D2)
GO, Touran (D2)
CHEN, Litian (D1)
ZHANG, Hao (D1)
UEDA, Kyosuke (M2)
SHIKAMI, Satoshi (M2)
TAKEUCHI, Soshi (M1)
WANG, Nan (M1)
JAYAWEERA KANKANAMGE, Hema Malani (R. S.)
ANDO, Masaki (U. G.)
SEKIYA, Sota (U. G.)
SOGA, Teppei (U. G.)

Program-Specific Res.

IMAI, Makiko (D. Agr.)
KATHRIARACHCHIGE DON, Suresh Kalum Kathriarachchi (D. Sc.)

Researchers (pt.)

MATSUMURA, Hiroyuki (D. Eng.)
AOKI, Satoshi (D. Sc.)
AVENA, Ramon Francisco Bernardino
NAKAMURA, Yuki

Scope of Research

Our research activity focuses on the development of new molecular transformations, which can contribute to better or ideal synthesis of functional molecules as well as to exploitation of new chemical (metal and carbon) resources. The present research subjects are (1) metal-catalyzed carbon–carbon and carbon–heteroatom bond forming reactions by using universal metals such as iron (2) development of small metallic nanocluster catalysts based on supramolecular approaches (3) utilization of woody biomass as the renewable carbon resources by mild catalytic transformations of wood molecules into useful compounds and materials.

KEYWORDS

Iron Catalysis Organotransformation Woody Molecular Transformation Supramolecular & Superatomic Catalysis

Recent Selected Publications

Saito, R.; Isozaki, K.; Mizuhata, Y.; Nakamura, M., Synthesis of N_2-Type Superatomic Molecules, *J. Am. Chem. Soc.*, **146,** 20930-20936 (2024).
Lu, S.; Agata, R.; Nomura, S.; Matsuda, H.; Isozaki, K.; Nakamura, M., Regioselective Propargylic Suzuki-Miyaura Coupling by SchPROP-Iron Catalyst, *J. Org. Chem.*, **89,** 8385-8396 (2024).
Pincella, F.; Isozaki, K.; Sato, R.; Teranishi, T.; Takaya, H.; Nakamura, M., Reusable Magnetite Nanoparticle (Fe_3O_4 NP) Catalyst for Selective Oxidation of Alcohols under Microwave Irradiation, *ACS Omega*, **9,** 24477-24488 (2024).
Isozaki, K.; Matsuda, H.; Agata, R.; Jeon, J.; Wu, B.; Pincella, F.; Ikenaga, M.; Tachibana, Y.; Ohta, Y.; Nakamura, M., Synthetic Urushiols from Biorenewable Carbon Resources: Chemical Conversion of Enzymatic Degradation Products of Wood Lignin to an Ancient *yet* Future Coating Material, *RSC Sustain.*, **2,** 1358-1362 (2024).
Isozaki, K.; Iseri, K.; Saito, R.; Ueda, K.; Nakamura, M., Dual Catalysis of Gold Nanoclusters: Photocatalytic Cross-Dehydrogenative Coupling by Cooperation of Superatomic Core and Molecularly Modified Staples, *Angew. Chem. Int. Ed.*, **136,** e202312135 (2024).
Nakajima, S.; Hashimoto, T.; Lu, S.; Hashizume, D.; Matsuda, H.; Hatakeyama, T.; Isozaki, K.; Takaya, H.; Nakamura, M., SciPROP-R: An Effective Bisphosphine Ligand for the Chemo-Selective Iron-Catalyzed Suzuki-Miyaura Coupling of Alkyl Chlorides, *Bull. Chem. Soc. Jpn.*, **96,** 1298-1309 (2023).

International Research Center for Elements Science – Advanced Solid State Chemistry –

https://www.scl.kyoto-u.ac.jp/~shimakgr/indexE.html

Prof.
SHIMAKAWA, Yuichi
(D. Sc.)

Assoc. Prof.
KAN, Daisuke
(D. Sc.)

Assist. Prof.
GOTO, Masato
(D. Sc.)

Techn. Staff
ICHIKAWA, Noriya
(D. Eng.)

Program-Specific Res.

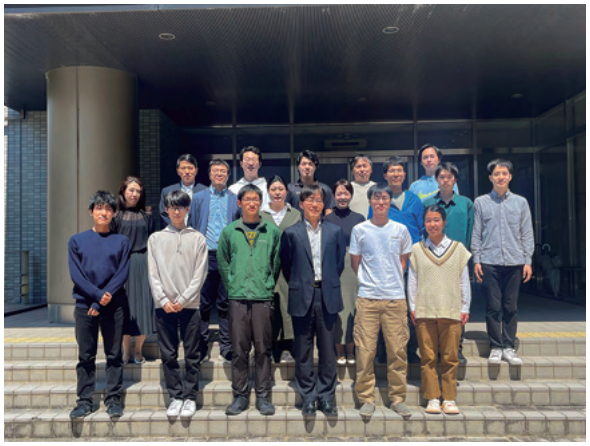
JI, Kunlang (Ph. D.)
LPUTERA, Kevin (Ph. D.)

Students

IIHOSHI, Makoto (D3)
ISODA, Yosuke (D3)
SHEN, Yufan (D3)
XIE, Ling-Ling (D3)
CHEN, Chen (D3)
WATANABE, Rei (D2)
ITO, Mayuri (M2)
FUJI, Souta (M2)
MAKI, Rintaro (M1)
TSURUNAGA, Daiki (M1)

Scope of Research

Transition metal oxides have a wide variety of interesting and useful functional properties, including electronic conduction, superconductivity, ferroelectricity, and ferromagnetism. In fact, some of these oxides are used in current electronic devices. Our research mainly focuses on perovskite-structured transition metal oxides with novel functional properties due to complex couplings between their lattices, charges and spins. We are currently exploring such functional oxides with advanced oxide-synthesis techniques such as high-pressure synthesis and epitaxial thin film growth.



KEYWORDS

Solid State Chemistry
High Pressure Synthesis
Heterointerface
Functional Metal Oxides
Epitaxial Thin Film Growth

Recent Selected Publications

Shen, Y.; Ooe, K.; Yuan, X.; Yamada, T.; Kobayashi, S.; Haruta, M.; Kan, D.; Shimakawa, Y., Ferroelectric Freestanding Hafnia Membranes with Metastable Rhombohedral Structure down to 1-nm-thick, *Nat. Commun*., **15,** 4789 (2024).

Xie, L.; Isoda, Y.; Nakamizo, S.; Majima, T.; Hosokawa, S.; Nitta, K.; Shimakawa, Y.; Kan, D., Impact of Interfacial Proton Accumulation on Protonation in a Brownmillerite Oxide, *Adv. Funct. Mater*., **34,** 2410084 (2024).

Watanabe, R.; Goto, M.; Kosugi, Y.; Kan, D.; Shimakawa, Y., Oxygen Release and Incorporation Behaviors in $BaFeO_3$ Polymorphs with Unusually High-Valence Fe^{4+}, *Chem. Mater.*, **36,** 2160-2112 (2024).

Iihoshi, M.; Goto, M.; Shimakawa, Y., Stabilities of Charge Disproportionated States by Successive Charge Transitions of Mixed and Unusually High Valence $Fe^{3.5+}$ in $LnBaFe_2O_6$ (*Ln* = Pr, Sm), *Chem. Mater*., **36,** 6047-6052 (2024).

Injac, S. D.; Mullens, B. G.; Denis Romero, F.; Avdeev, M.; Barnett, C.; Yuen, A. K. L.; Amano Patino, M.; Mukherjee, S.; Vaitheeswaran, G.; Singh, D. J.; Kennedy, B. J.; Shimakawa Y., Characterisation of $Pb_2Rh_2O_7$ and $Y_2Rh_2O_7$: an Unusual Case of Pyrochlore Stabilisation under High Pressure, High Temperature Synthesis Conditions, *J. Mater. Chem. C*., **12,** 3077-3089 (2024).

International Research Center for Elements Science – Organometallic Chemistry –

https://www.om.kuicr.kyoto-u.ac.jp/

Prof.
OHKI, Yasuhiro
(D. Eng.)

Assist. Prof.
TANIFUJI, Kazuki
(D. Sc.)

Assist. Prof. *
IZU, Hitoshi
(D. Sc.)

*New Research Field Development Project

Res. (pt.)

FUJISAKI, Yoshie

Students

TANAKA, Kanata (D1)
MATSUOKA, Yuto (D1)
SHIMOYAMA, Sayaka (M2)
SUNAMI, Kohei (M2)
SAEED, Hassan (R. S.)
ADACHI, Taira (U. G.)
YAMAMOTO, Kodai (U. G.)

Guest Res. Assoc.

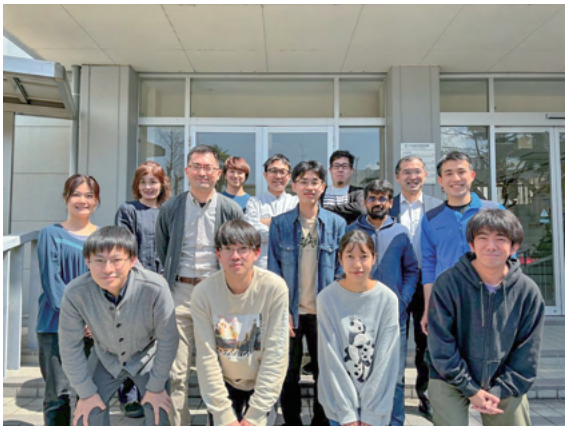
JAMIL, Mohamad Shazwan Shah (Ph.D.) Universiti Teknologi Malaysia, Malaysia, 16 July 2024–12 October 2024

Scope of Research

Developing efficient energy storage systems and innovative material production processes is a significant challenge for chemists in contributing to a sustainable society. We approach these problems using transition metal clusters, of which multiple metal atoms work together as catalysts and functional materials. Our laboratory focuses explicitly on creating a new method to synthesize the clusters with atomic precision and applying the obtained clusters to difficult chemical conversions, such as the reduction of CO_2 and N_2.

KEYWORDS

Transition Metal Clusters
Homogeneous Catalysis
Nitrogen Fixation
Bioinorganic Chemistry



Recent Selected Publications

Izu, H.; Shimoyama, S.; Tanifuji, K.; Ohki, Y., Synthesis of Cubic [Mo_3S_4M] (M = Rh, Ir) Clusters for Borylation of C–H Bonds in Aromatic Compounds, *Organometallics*, **43,** 3251-3257 (2024).

Matsuoka, Y.; Sakai, Y.; Izu, H.; Shimoyama, S.; Fujisawa, M.; Tada, M.; Lakshan, N. M.; Sameera, W. M. C.; Tanifuji, K.; Ohki, Y., Silylation of N_2 Catalyzed by Cubic [Mo_3S_4Ni] Clusters Bearing Mo-bound Cyclopentadienyl Ligands, *Coord. Chem. Res.*, **1,** 100001 (2024).

Izu, H.; Bhave, D. G.; Matsuoka, Y.; Sameera, W. M. C.; Tanifuji, K.; Ohki, Y., Synthesis, Characterization, and Catalytic Activity of a Cubic [Mo_3S_4Pd] Cluster Bearing Bulky Cyclopentadienyl Ligands, *Eur. J. Inorg. Chem.*, **26,** e202300399 (2023).

Ohki, Y.; Munakata, K.; Matsuoka, Y.; Hara, R.; Kachi, M.; Uchida, K.; Tada, M.; Cramer, R. E.; Sameera, W. M. C.; Takayama, T.; Sakai, Y.; Kuriyama, S.; Nishibayashi, Y.; Tanifuji, K., Nitrogen Reduction by the Fe Sites of Synthetic [Mo_3S_4Fe] Cubes, *Nature,* **607,** 86-90 (2022).

Lee, C. C.; Kang, W.; Jasniewski, A. J.; Stiebritz, M. T.; Tanifuji, K.; Ribbe, M. W.; Hu, Y., Evidence of Substrate Binding and Product Release via Belt-Sulfur Mobilization of the Nitrogenase Cofactor, *Nat. Catal.*, **5,** 443-454 (2022).

International Research Center for Elements Science – Nanophotonics –

https://www.scl.kyoto-u.ac.jp/~opt-nano/en/index.html

Assoc. Prof.
HIRORI, Hideki
(D. Sc.)

P. D.
ZHANG, Zhenya
(D. Sc.)

Students

UMETANI, Hiroto (M1)
WATANABE, Yuichi (M1)

Scope of Research

Our research interest is to understand optical and quantum properties of nanometer-structured materials and to establish opto-nanoscience for creation of innovative functional materials. Space- and time-resolved laser spectroscopy is used to study optical properties of semiconductor quantum nanostructures and strongly correlated electron systems in low-dimensional materials. The main subjects are as follows: 1) investigation of optical properties of single nanostructures through the development of a high-resolution optical microscope, 2) ultrafast optical spectroscopy of excited states of semiconductor nanostructures, 3) photophysics of solar cell materials, and 4) engineering material properties with lights.

KEYWORDS

Femtosecond Laser Spectroscopy
Quantum Dots
High Harmonic Generation
Single Photon Spectroscopy
Perovskites

Recent Selected Publications

Zhang, Z.; Kanega, M.; Maruyama, K.; Kurihara, T.; Nakajima, M.; Tachizaki, T.; Sato, M.; Kanemitsu, Y.; Hirori, H., Spin Switching in $Sm_{0.7}Er_{0.3}FeO_3$ Triggered by Terahertz Magnetic-Field Pulses, *Nature Mater.*, doi: 10.1038/s41563-024-02034-4 (2024).

Nakagawa, K.; Mao, W.; Sato, S. A.; Ago, H.; Rubio, A.; Kanemitsu, Y.; Hirori, H., Hot Electron Effect in High-Order Harmonic Generation from Graphene Driven by Elliptically Polarized Light, *APL Photonics*, **9,** 076107 (2024).

Sekiguchi, F.; Narita, H.; Hirori, H.; Ono, T.; Kanemitsu, Y., Anomalous Behavior of Critical Current in a Superconducting Film Triggered by DC plus Terahertz Current, *Nature Commun.*, **15,** 4435 (2024).

Maruyama, K.; Zhang, Z.; Takumi, M.; Satoh, T.; Nakajima, M.; Kanemitsu, Y.; Hirori, H., Tesla-Class Single-Cycle Terahertz Magnetic Field Pulses Generated with a Spiral-Shaped Metal Microstructure., *Appl. Phys. Express*, **17,** 022004 (2024).

Hirori, H.; Sato, S. A.; Kanemitsu, Y., High-Order Harmonic Generation in Solids: The Role of Intraband Transitions in Extreme Nonlinear Optics, *J. Phys. Chem. Lett.*, **15,** 2184-2192 (2024).

Bioinformatics Center
– Chemical Life Science –

https://cls.kuicr.kyoto-u.ac.jp/en/

Prof.
OGATA, Hiroyuki
(D. Sc.)

Assoc. Prof.
ENDO, Hisashi
(D. Environmental Sc.)

Assist. Prof.
OKAZAKI, Yusuke
(D. Sc.)

Assist. Prof. *
HIKIDA, Hiroyuki
(D. Agr.)

Specially Appointed Assoc. Prof.
NECHES, Russell Young
(Ph. D.)

Specially Appointed Assist. Prof.
MENG, Lingjie
(D. Sc.)

Program-Specific Res.
SATO, Takuya
(D. Agr.)

Program-Specific Res.
JIANG, Siyu
(Ph. D.)

Program-Specific Res.
KIM, Suhyun
(Ph. D.)

Proj. Res.
OKUDA, Shiho
YAMAGISHI, Yuki

*New Research Field Development Project

Students
YANG, Qingwei (D3)
ZHANG, Ruixuan (D3)
LIU, Wenwen (D2)
WU, Junyi (D2)
CHEN, Jingjie (D1)
ZHANG, Liwen (D1)
KIKUYA, Saki (M2)
NAGASAKA, Koumei (M2)
TANG, Wei (M2)
ZHAO, Hongda (M2)
SASAKI, Hiroto (M1)
YU, Zhaoxi (R. S.)
SHENBAGAN, Shaanaav Daniel (R. S.)
OUYANG, Chengzhou (R. S.)
NOZAWA, Tomohito (U. G.)

Guest Research Associate
DEMORY, David (Ph. D.) CNRS – BIOM Laboratory, France, 18 February 2024–6 March 2024

Scope of Research

We are interested in understanding the functioning and evolution of biological systems at varying scales from tiny microbes up to the Earth's environment, by leveraging rapidly accumulating big data in life science and bioinformatics approaches. We currently focus on 1) the evolution of viruses and their links to the origin of life, 2) microbial ecology in different ecosystems, and 3) the development of bioinformatics methods and biological knowledge resources for biomedical and industrial applications. To fuel these research activities, we take part in environmental sampling campaigns such as *Tara* Oceans. Our resources and developed tools are accessible through GenomeNet (www.genome.jp) to scientific communities and the public.

KEYWORDS GenomeNet Bioinformatics Environmental Genomics Virology Molecular Evolution

Recent Selected Publications

Zhang, L.; Meng, L.; Fang, Y.; Ogata, H.; Okazaki, Y., Spatiotemporal Dynamics of Giant Viruses within a Deep Freshwater Lake Reveal a Distinct Dark-Water Community, *ISME J.*, **18 (1),** wrae182 (2024).

Wu, J.; Meng, L.; Gaïa, M.; Hikida, H.; Okazaki, Y.; Ogata, H., Gene Transfer Among Viruses Substantially Contributes to Gene Gain of Giant Viruses, *Mol. Biol. Evol.*, **41,** msae161 (2024).

Kijima, S.; Hikida, H.; Delmont, T. O.; Gaïa, M.; Ogata, H., Complex Genomes of Early Nucleocytoviruses Revealed by Ancient Origins of Viral Aminoacyl-tRNA Synthetases, *Mol. Biol. Evol.*, **41,** msae149 (2024).

Zhao, H.; Meng, L.; Hikida, H.; Ogata, H., Eukaryotic Genomic Data Uncover an Extensive Host Range of Mirusviruses, *Curr. Biol.*, **34,** 2633-2643.e3 (2024).

Ban, H.; Endo, H.; The EukBank Team; Kuwata, A.; Ogata, H., Global Distribution and Diversity of Marine Parmales, *Microbes Environ.*, **39,** ME23093 (2024).

Nishimura, Y.; Yamada, K.; Okazaki, Y.; Ogata, H., DiGAlign: Versatile and Interactive Visualization of Sequence Alignment for Comparative Genomics. *Microbes Environ.*, **39,** ME23061 (2024).

Bioinformatics Center
– Mathematical Bioinformatics –

https://www.bic.kyoto-u.ac.jp/takutsu/index.html

Prof.
AKUTSU, Tatsuya
(D. Eng.)

Assoc. Prof.
TAMURA, Takeyuki
(D. Inf.)

Assist. Prof.
MATSUI, Motomu
(Ph. D.)

Guest Scholar
ZHANG, Han
(Ph. D.)

Nankai University, China, P. R., 15 July 2024–14 January 2025

Guest Scholar
MELKMAN, Avraham
(Ph. D.)

Ben-Gurion University of the Negev, Israel
11 November 2024–23 December 2024

Guest Res. Assoc.*
SUN, Liangjie
(Ph. D.)

*JSPS Postdoctoral Fellowships for Research in Japan, China, P. R., 1 November 2023–31 October 2025

Students

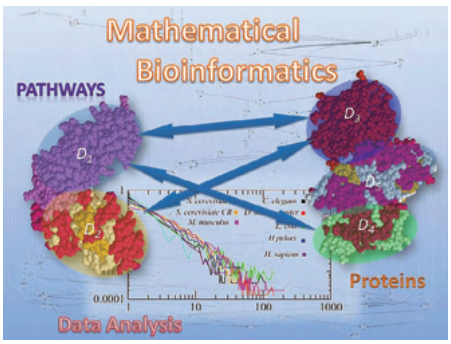
TAKAGI, Motoshige (D3)
OHTOMO, Masahiro (D3)
NAKASHIMA, Shogo (D3)
MU, Lixuan (D3)
SHIOTA, Koji (D3)
LIU, Chunting (D3)
MA, Yier (D3)
FUJITA, Satoki (D3)
GHAFOOR, Mamoona (D3)
YANG, Ziwei (D2)
WU, Chenyao (D2)
CUI, Yan (M2)
IWAKI, Takuma (M2)
KUANG, Jinxiang (R. S.)

Scope of Research

Due to the rapid progress of genome sequencing technology, whole genome sequences of organisms ranging from bacteria to human have become available. In order to understand the meaning behind the genetic code, we have been developing algorithms and software tools for analyzing biological data based on advanced information technologies such as theory of algorithms, artificial intelligence, and machine learning. We are currently studying the following topics: systems biology, scale-free networks, metabolic networks, phylogenetic trees, neural networks, chemo-informatics, and discrete and stochastic methods for bioinformatics.

KEYWORDS

Complex Networks
Boolean Networks
Neural Networks
Metabolic Networks
Phylogenetic Trees



Recent Selected Publications

Ghafoor, M.; Akutsu, T., On the Generative Power of ReLU Network for Generating Similar Strings, *IEEE Access*, **12,** 52603-52622 (2024).
Pan, Q.; Zhong, J.; Akutsu, T.; Liu, Y.; Liu, R., Distributed Pinning Control: Stabilizing Large Boolean Networks Subjected to Perturbations, *IEEE Trans. Cybern*., **54,** 7094-7102 (2024).
Tokuhara, Y.; Akutsu, T.; Schwartz, J-M.; Nacher, J. C., A Practically Efficient Algorithm for Identifying Critical Control Proteins in Directed Probabilistic Biological Networks, *npj Syst. Biol. Appl*., **10,** 87 (2024).
Tamura, T., Trimming Gene Deletion Strategies for Growth-Coupled Production in Constraint-Based Metabolic Networks: TrimGdel, *IEEE ACM Trans. Comput. Biol. Bioinform*., **20,** 1540-1549 (2023).
Tamura, T., MetNetComp: Database for Minimal and Maximal Gene-Deletion Strategies for Growth-Coupled Production of Genome-Scale Metabolic Networks, *IEEE ACM Trans. Comput. Biol. Bioinform*., **20,** 3748-3758 (2023).

Bioinformatics Center
– Bio-knowledge Engineering –

https://www.bic.kyoto-u.ac.jp/pathway/index.html

Prof.
MAMITSUKA, Hiroshi
(D. Sc.)

Senior Lect.
NGUYEN, Hao Canh
(D Knowledge Science)

Program-Specific Res.

LEE, John Christer Jun Rong (M. Mathematics)

Students

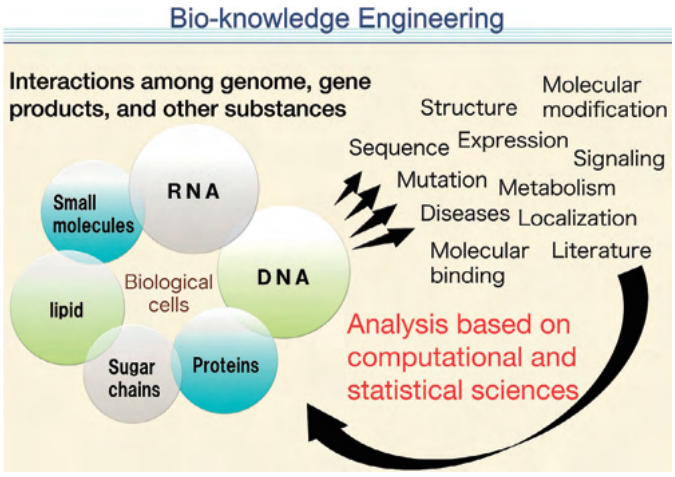
JIANG, Zhiqian (M1)
OKAMURA, Natsumi (U. G.)

Guest Res. Assoc.

GERLETTI, Pietro (M. Sc. Bioinformatics) Robert Koch Institute, Germany, 4 September 2024–15 October 2024
TÖRÖK, Dora (M. Sc.) Semmelweis University, Hungary, 13 September 2024–12 December 2024

Scope of Research

We are interested in graphs and networks in biology, chemistry, and medical sciences, including metabolic networks, protein-protein interactions and chemical compounds. We have developed original techniques in machine learning and data mining for analyzing these graphs and networks, occasionally combining with table-format datasets, such as gene expression and chemical properties. We have applied the techniques developed to real data to demonstrate the performance of the methods and find new scientific insights.



KEYWORDS

Bioinformatics Machine Learning
Data Mining Artificial Intelligence Systems Biology

Recent Selected Publications

Cao, T.; Sun, L.; Nguyen, C. H.; Mamitsuka, H., Learning Low-Rank Tensor Cores with Probabilistic ℓ0-Regularized Rank Selection for Model Compression, *Proceedings of the 33rd International Joint Conference on Artificial Intelligence (IJCAI 2024)*, 3780-3788 (2024).

Nguyen, D. A.; Nguyen, C. H.; Petschner, P.; Mamitsuka, H., SPARSE: A Sparse Hypergraph Neural Network for Learning Multiple Types of Latent Combinations to Accurately Predict Drug-drug Interactions, *Bioinformatics (Proceedings of the 30th International Conference on Intelligent Systems for Molecular Biology (ISMB 2022))*, **38(Supplement 1),** i333-i341 (2022).

You, R.; Qu, W.; Mamitsuka, H.; Zhu, S., DeepMHCII: A Novel Binding Core-Aware Deep Interaction Model for Accurate MHC II-peptide Binding Affinity Prediction, *Bioinformatics (Proceedings of the 30th International Conference on Intelligent Systems for Molecular Biology (ISMB 2022))*, **38(Supplement 1),** i220-i228 (2022).

Nguyen, C. H.; Mamitsuka, H., Learning on Hypergraphs with Sparsity, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, **43(8),** 2710-2722 (2021).

Nguyen, D. H.; Nguyen, C. H.; Mamitsuka, H., ADAPTIVE: leArning DAta-dePendenT, concIse molecular VEctors for fast, Accurate Metabolite Identification from Tandem Mass Spectra, *Bioinformatics (Proceedings of the 27th International Conference on Intelligent Systems for Molecular Biology (ISMB/ECCB 2019))*, **35(14),** i164-i172 (2019).