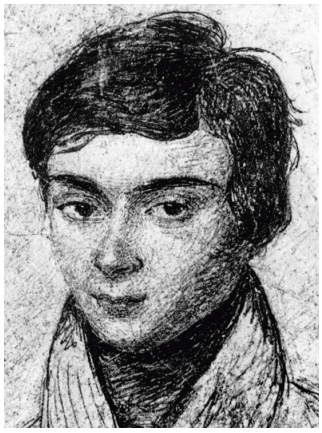
Advanced Science and Technology | Course of Mathematics

Algebra



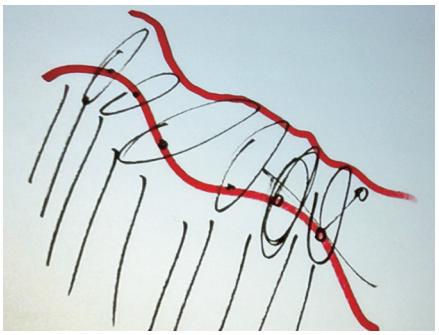
Research Themes
*Representation Theory, Algebraic Lie Theory
*Number Theory, Arithmetic of Automorphic Form

Prof.
TERAI Naoki
■Research Themes
Combinatorial Commutative Algebra

Assoc. Prof.
SUZUKI Takeshi
■Research Themes
Representation theory/ Combinatorics/Lie theory/ Integrable systems

Asst. Prof.
ISHIKAWA Yoshihiro
■Research Themes
Automorphic forms / Hodge theory/ Zeta integral/Relativerepresentations/ Covering groups

Geometry



Geometry is the study of figures, which are technically called manifolds.
Differential geometry is the field of the precise study of the shape of manifolds, using cues such as curvature and the behaviour of geodesics of (Riemannian) manifolds. Here geodesics are generalisations of straight lines in Euclidean space. On the other hand, topology is the field of the study of topological properties of manifolds by mapping algebraic invariants onto them.
The basic algebraic invariants, for instance, are fundamental groups, homotopy groups, homology groups and cohomology groups.

Prof. KONDO Kei
■Research Themes
Global Riemannian geometry (especially geodesic theory)/Non-smooth analysis/Exotic structures/Minimal submanifolds from aspects of PDEs/Origami

Prof. JINZENJI Masao
■Research Themes
Geometry/Mathematical Physics/ Fundamentals of Condensed Matter Physics

Prof. TORII Takeshi
■Research Themes
Algebraic Topology/Homotopy Theory

Assoc. Prof. MONDEN Naoyuki
■Research Themes
Mapping class group/ 4-dimensional topology

Analysis

We study various problems concerning differential equations, probability theory,functional analysis, dynamical systems, and statistics from the point of analysis.

Prof. OSHITA Yoshihito

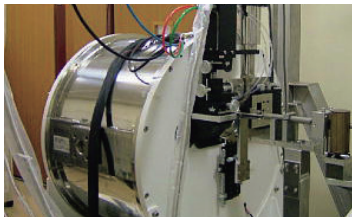
■Research Themes

Nonlinear PDE

Advanced Science and Technology

Course of Physics

Quantum Structural Physics in Correlated Matter



In recent years, it is known that topological insulators, topological semimetals, etc. undergo large physical property changes in small electric and magnetic fields, related to the even-oddity of wave functions and bands. However, its creation requires control of the Fermi surface, control of spin-orbit interaction, and control of space and time reversibility. We create and study pure topological materials by means of quantum structural physics.

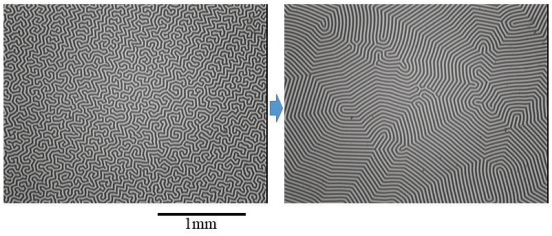
Prof. NOGAMI Yoshio

■Research Themes
Quantum structural physics/
Topological insulators

Assoc. Prof. KONDO Ryusuke

■Research Themes
Quantum structural physics/
Topological insulators

Quantum Physics in Correlated Matter

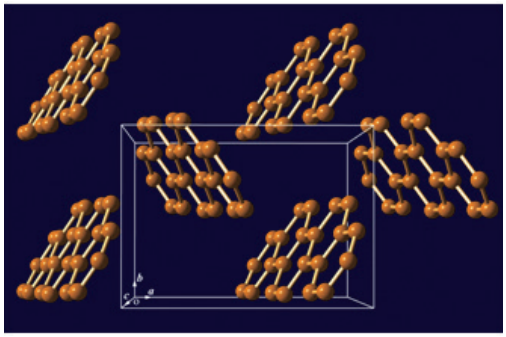


Space-time chaos and nonequilibrium pattern formation in magnetic materials.Spin-wave Relaxation.

Prof. MINO Michinobu

■Research Themes
Spin-Wave/Magnetic domain structure/Chaos

Physics in Advanced Functional Materials



Novel magnetism and superconductivity in molecular materials.
Development of superconductor and magnetism in molecular materials, layered compounds and van der Waals compounds.

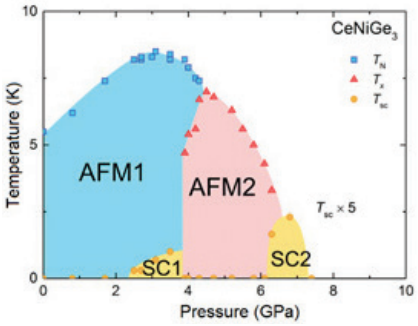
Prof. IKEDA Naoshi

■Research Themes
Solid state physics/
Magnetism/Superconductivity

Assoc. Prof. KAMBE Takashi

■Research Themes
Solid state physics/
Magnetism/Superconductivity

Materials Physics in Extreme Environments



The properties of material under extreme conditions, such as under high pressure and high magnetic field, exhibit unconventional and anomalous characteristics. Our research group is dedicated to investigating the unexplored states of matter under these extreme conditions. In order to accomplish this objective, we are actively developing the advanced experimental techniques. We are seeking the original research using the advanced experiment techniques.

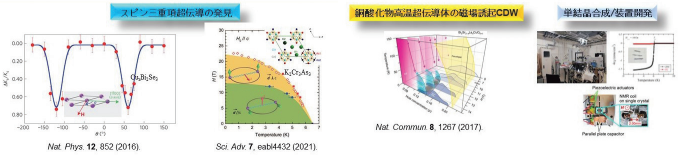
Prof. KOBAYASHI Tatsuo

■Research Themes
Solid state physics/Magnetism/ Superconductivity

Assoc. Prof. ARAKI Shingo

■Research Themes
Solid state physics/Magnetism/ Superconductivity

Low Temperature Condensed Matter Physics



We use nuclear magnetic resonance (NMR) technique to study various quantum physical phenomena at low temperatures. In particular, we search for spin-triplet, topological superconductivity, and are interested in understanding the mechanism of superconductivity in various classes of materials including copper oxides, iron pnictides, heavy fermion compounds, non-centrocymmetric materials.
One of our current projects is on topological superconductors, whose surface states can be used for quantum computing. Here, the term "topological" means that the wave function describing superconductivity has a non-zero topological invariant, just as a donut where the number of hole is invariant against deformation.

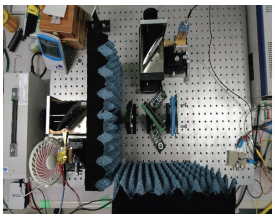
Prof. ZHENG Guo-qing

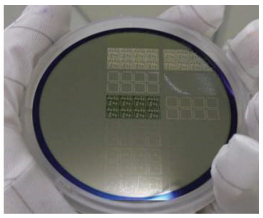
■Research Themes
Topological superconductivity/ Spin-triplet superconductor/NMR

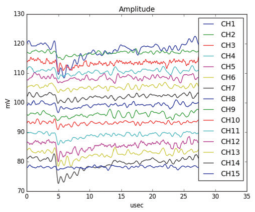
Assoc. Prof. KAWASAKI Shinji

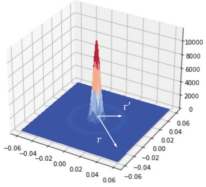
■Research Themes
Topological superconductivity/ Spin-triplet superconductor/NMR

Astroparticle Physics









We are studying the advanced analysis methods to measure the CMB polarization to search for the imprint of the cosmic inflation. We are also developing superconducting detectors to study neutrinos from the sun.

Prof. ISHINO Hirokazu

■Research Themes
Cosmic Microwave Background/LiteBIRD/ Superconducting Detectors

High Energy Physics

Particle physics is the study of the properties of elementary particles, which are the smallest units that make up matter, and the forces (interactions) that connect them. Particle physics is also closely connected to understanding the universe. Our laboratory promotes experimental research through accelerator experiments and astrophysical observations. In particular, we focus on particles called neutrinos and are trying to elucidate their properties and the mysteries of the universe through a variety of experiments.

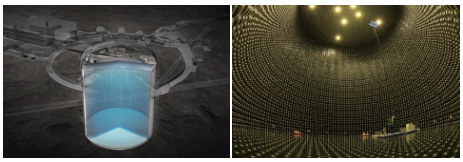


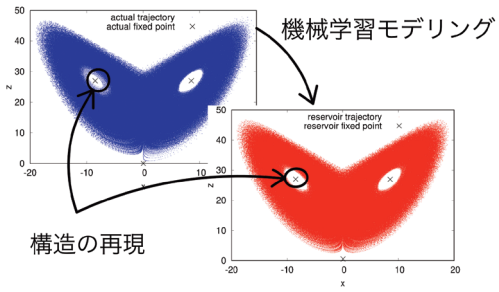
Photo courtesy of J-PARC Center and Kamioka Observatory, ICRR, University of Tokyo

Assoc. Prof.
KOSHIO Yusuke

■ Research Themes

Astro-particle physics/nuclear physics/neutrino physics/supernova

Mathematical Science for Data Engineering



We develop mathematical theories (topology, dynamical systems, etc.), methods, and software for data analysis and utilization and apply them to various fields such as materials science, geology, meteorology, and life science.

Prof. OBAYASHI Ippei

■Research Themes
Topological data analysis/ Persistent homology / Applied mathematics

Senior Asst. Prof. NAKAI Kengo

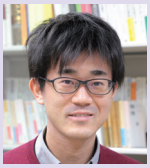
■Research Themes
Applied mathematics/ Machine learning

Applied Mathematics

The main research theme of our group is developing and explicating fundamental theories for mathematical models via applications of commutative algebra and probability theory to computational algebra and stochastic models.

Prof. HAYASAKA Futoshi

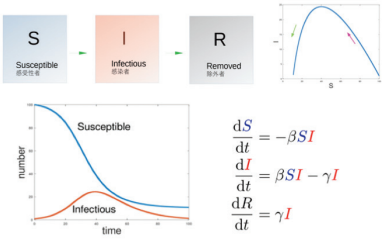
■Research Themes
Algebra/Commutative algebra



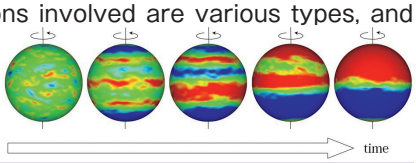
Assoc. Prof. KAWAMOTO Yosuke

■Research Themes
Probability theory/Analysis/Random matrices/Infinite particle systems

Mathematical Analysis of Models



This group deals differential equations, which are often mathematical models describing natural phenomena. We investigate mathematical methods for analysing the equations and also the applications of equations. The equations involved are various types, and the methods used include analysis, dynamical systems theory, numerical analysis, and so on.



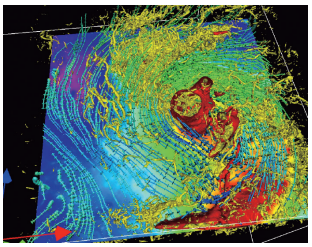
Prof. SASAKI Toru

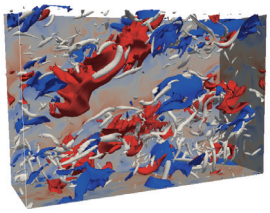
■Research Themes
Differential equations/Applied analysis/ Mathematical biology

Prof. OBUSE Kiori

■Research Themes
Nonlinear dynamics/Fluid dynamics

Numerical Analysis of Flow Phenomena





Computational and data science of multi-scale and multi-physics complex flow phenomena using supercomputers; information reduction, extraction, and visualization of big data of complex flow phenomena by mathematical and scientific methods; collaborative research to understand complex flow phenomena in various fields such as astronomy, meteorology, environment, and engineering.

Prof. ISHIHARA Takashi

■ Research Themes

Fluid dynamics/Turbulence physics/ Numerical simulation/Computational Science/Data Science

Assoc. Prof. SEKIMOTO Atsushi

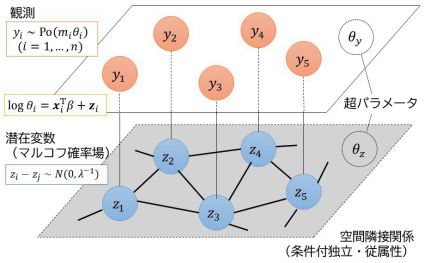
■ Research Themes

Thermal fluid/Turbulence/Dynamical systems / Numerical simulation / Transport phenomena/Adjoint inverse analysis/Data-driven computation

Statistical Data Analysis

We conduct education and research on statistical theories and methodologies required to analyze data on various issues in the environmental and life sciences, natural and social sciences. Statistical science is a fundamental technology of data analysis and machine learning, and provides the most effective means of presenting an objective view based on scientific evidence. We wish to contribute to solving various issues, with making use of drastically improving computer ability.

潜在マルコフ確率場による疾病地図データの空間解析



Prof. SAKAMOTO Wataru

■ Research Themes

Computational statistics/ Biostatistics/Statistical model selection

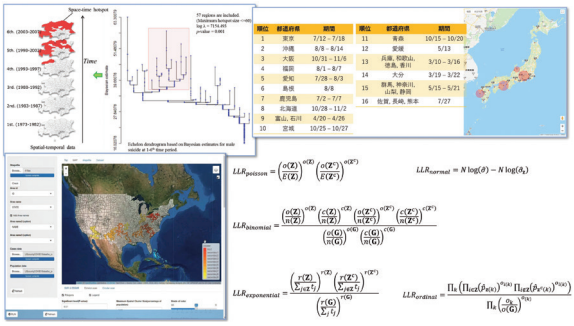
Senior Asst. Prof. TAKAGISHI Mariko

■ Research Themes

Multivariate data analysis/ Psychometrics

Spatio-Temporal Statistics

The detection of problems such as the occurrence of infectious diseases or the mapping of natural disaster hazards is crucial and fundamental. While there are powerful and useful tools like geographical information systems (GISs) available, determining the location of space-time clusters for large quantities of spatial data or extensive time series poses significant challenges. This study aims to establish methods for identifying disease clusters or contaminant clusters, commonly referred to as hotspots, in various types of spatio-temporal data, as well as develop corresponding software.

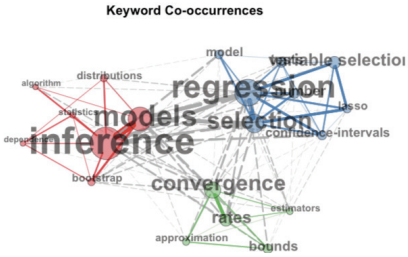


Prof. ISHIOKA Fumio

■ Research Themes

Spatial statistics/Computational statistics/ Echelon analysis/Spatial clusters/Spatial scan statistics/Spatial epidemiology

Computational Statistics



There are various types of data in data analysis. It is important to analyze obtained multivariate data, text data, picture data, and other data types. We apply and develop computational statistical approaches and methods to understand these data.

Prof. IIZUKA Masaya

■Research Themes

Categorical data analysis/Software/ Principal component Analysis/IR

Senior Asst. Prof. OHKUBO Yusaku

■Research Themes

Life sciences/Ecology and environmental studies/Ecostatistics

Advanced Science and Technology

Course of Computer Science

Computer Engineering

We aim to establish new technologies of hardware and software for computer infrastructures. In computer hardware, we conduct interdisciplinary research on cutting-edge optical technologies (e.g., hologram memory and laser) and integrated circuits (VLSI) which act as the brain of computers. In computer software, we focus on the following research topics: construction methods of new operating systems (OS) and security technologies for OS, mobile devices, and IoT; technologies for supporting group collaboration with computers and networks; and interdisciplinary issues in artificial intelligence and computing technologies.

Prof. YAMAUCHI Toshihiro

■Research Themes
Operating System/System Software/ Computer Security/System Security/ IoT Security

Prof. WATANABE Minoru

■Research Themes
Information and communication/Computer system/Reconfigurable system/FPGA/ Optically reconfigurable gate array

Assoc. Prof. NOMURA Yoshinari

■Research Themes
Operating system/groupware

Assoc. Prof. Lin Donghui

■Research Themes
Multiagent Systems/Services Computing/Intelligent Computing

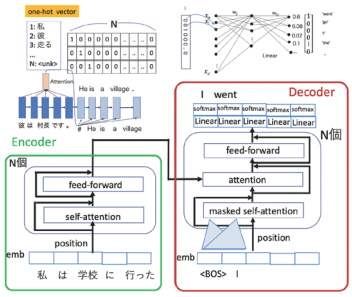
Asst. Prof. KOBAYASHI Satoru

■Research Themes
Network management/ System operation

Asst. Prof. WATANABE Nobuya

■Research Themes
Programming Language Processor/ Parallel Processing/Hardware Design System/Computer Architecture/ Reconfigurable System/FPGA/Hardware Design Automation/Language Processor

Pattern Information Processing



Our research interests include basic theories of pattern recognition and understanding, and applied fields of visual information processing, language information processing, and speech information processing. As research on Pattern Information Processing, we apply methods from neuroscience and artificial intelligence such as machine learning, statistics, artificial intelligence, and data mining to design appropriate feature representations and discriminative models for images, videos, texts, and speeches.

Prof. OKABE Takahiro

■Research Themes
Computer vision/Computational photography/ Image processing/ Computer graphics

Prof. AKASHI Takuya

■Research Themes
Artificial intelligence / Computer vision / Neuroscience/ Image recognition/ Human interface

Assoc. Prof. TAKEUCHI Koichi

■Research Themes
Natural language processing/Deep neural network model/Large language model

Assoc. Prof. HARA Sunao

■Research Themes
Speech processing/Signal processing/ Spoken dialog system/Lifelogs/ Multimodal information processing

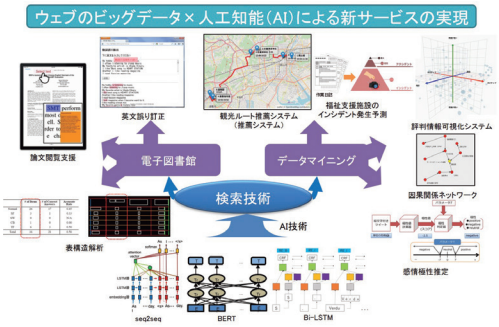
Asst. Prof. YOSHIDA Michitaka

■Research Themes
Computer vision/ Computational photography/ Compressive sensing

Asst. Prof. ENDO Yoshitaka

■Research Themes
Computer vision/ Computational photography/ Compressive sensing

Intelligent Design



In the division of Intelligent Design, our research focuses on developing technologies that efficiently search for desired information and discover valuable insights from the vast amount of Big Data available on the Web, utilizing artificial intelligence and other related approaches. Additionally, we explore digital libraries that enable users to seamlessly navigate between the virtual world of cyberspace, connected by the Internet, and the physical reality. Our research also includes stream delivery technologies for multimedia information, including audio and video, with a particular emphasis on the integration of Internet broadcasting and data communications.

Prof.
OHTA Manabu

■Research Themes

Web Information Retrieval/Web Mining/Digital Library

Assoc. Prof.
GOTOH Yusuke

■Research Themes

Streaming Delivery in Broadcasting Environments/Spatial Computing

Senior Asst. Prof.
MATSUDA Yuki

■Research Themes

Internet of Things/Sensing/Information Network

Senior Asst. Prof.
WEI Bo

■Research Themes

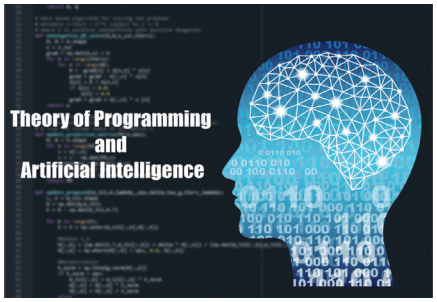
Adaptive media transmission/ Intelligent network management/ Integrated communication and sensing

Asst. Prof.
UWANO Fumito

■Research Themes

Reinforcement Learning/Distributed Artificial Intelligence

Theory of Programming and Artificial Intelligence



We conduct a wide range of research on basic theory and applications of computational intelligence, mathematical informatics, and software engineering. Specifically, we promote research on machine learning algorithms, mathematical programming, distributed algorithms, software measurement and analytics, mining software repositories, human behavior analysis, human-machine interaction, computer vision and so on.

Prof. NAKAGAWA Hiroyuki

■Research Themes

Autonomous software/ Self-adaptive software/Agents/ Software engineering/Requirements engineering/Software design

Prof. TAKAHASHI Norikazu

■Research Themes

Information and mathematical engineering

Asst. Prof. MIGITA Tsuyoshi

■Research Themes

Computer vision

Prof. MONDEN Akito

■Research Themes

Empirical software engineering

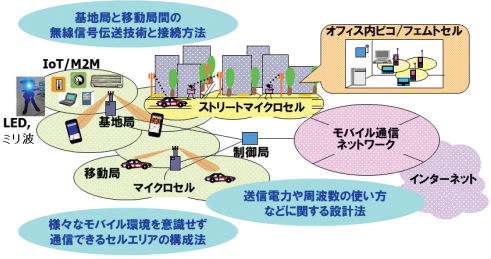
Asst. Prof. INAYOSHI Hiroki

■Research Themes

Computer security/Privacy leakage detection

Advanced Science and Technology | Course of Information and Communication Systems

Mobile Communications



This laboratory is working on research on new wireless technologies with the aim of realizing next generation mobile radio communication systems beyond 5G. Our major research challenges include OFDM/OFDMA and MIMO channel signal transmission to realize ultra high-speed and large-capacity systems with more than 10 Gbps, radio wave propagation and link budget technologies for seamless and flexible service area implementation. Furthermore, we are researching LED visible light communication as a new communication system, and wireless signal separation/demodulation technology aiming at the ultimate effective use of frequencies.

Prof. UEHARA Kazuhiro

■Research Themes

Mobile communication engineering

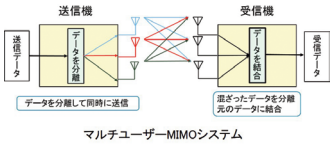
Assoc. Prof. TOMISATO Shigeru

■Research Themes

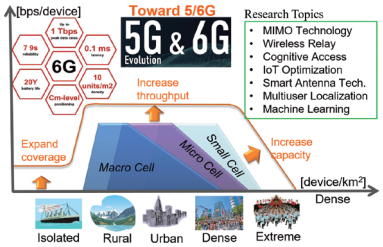
Mobile communication engineering

Multimedia Radio Systems

Our laboratory aims to 5G/6G wireless communication systems which can realize the high-speed wireless communication as "anytime, anywhere, anyone." Our research topics are most on the MIMO wireless communication system, MIMO relay, Overload MIMO system, IoT relay, smart antenna technology as ESPAR, LCX and RIS, wireless communication with machine learning, IoT devices localization. We are also developing the wireless technology for smart sensing and communication, cognitive radio, learning technique and prediction methods for wireless environment.



マルチユーザーMIMOシステム



Prof. DENNO Satoshi

■Research Themes

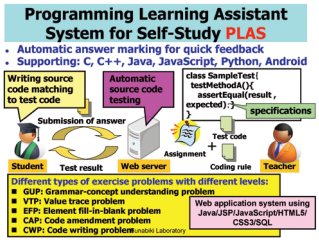
Wireless communication/Signal processing/5G,6G wireless system/MIMO system/relay communications

Assoc. Prof. HOU Yafei

■Research Themes

5G,6G wireless system/IoT localization/Smart antenna technology/Machine learning for wireless system

Distributed System Design



We study practical and useful research topics in the Information Communication Technology (ICT), including programming learning assistant systems, wireless local-area networks, distributed computing systems, multimedia application systems, AR-based navigation systems, big data analysis, IoT application systems, to achieve our mission of the human resource developments for next generations. Currently, 38 international students from five countries are studying together with Japanese students in our laboratory.

Prof. FUNABIKI Nobuo

■Research Themes

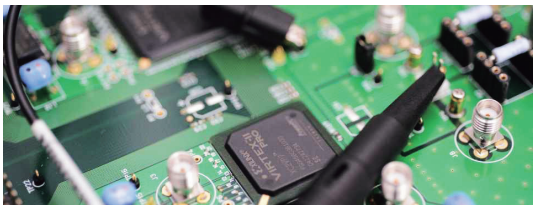
Programming learning/WLAN/Multimedia/IoT application/Distributed computing system

Senior Asst. Prof. HTOO HTOO SANDI KYAW

■Research Themes

serious game/gamification/programming learning assistant system/graph theory

EMC Design



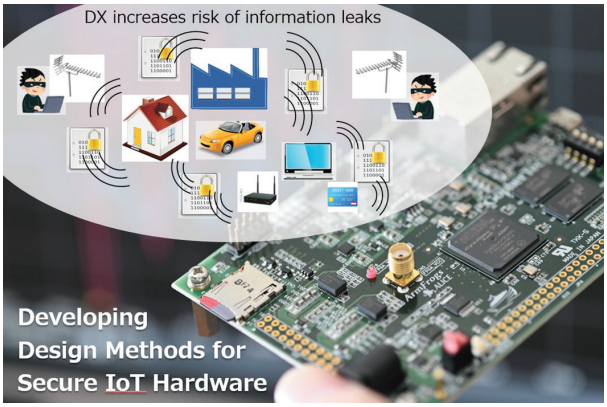
Optical and Electromagnetic Waves (OEW) Lab studies research topics that aim to improve electrical, electronic, and telecommunication systems in speed and reliability. Our research is related to specific design technology to intentionally control and reduce unintentional electromagnetic waves, or electromagnetic noise, generated by electrical, electronic, and telecommunication equipment. Such design technology is called EMC design. EMC is short for electromagnetic compatibility and means the ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable disturbance to anything in that environment. EMC consists of two aspects, EMI (electromagnetic interference) and EMS (electromagnetic susceptibility). The former is the ability that a system cannot interfere with other systems or subsystems. In contrast, the latter is the one that system must continue to operate correctly in the presence of interference from others or transient.

Prof. TOYOTA Yoshitaka

■Research Themes

Electromagnetic Compatibility (EMC)/Hardware Security/Safe and Security

Secure Hardware Design



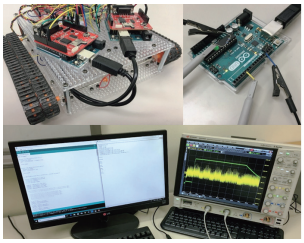
In an era where various devices are connected to the internet, and data is exchanged and stored, information security technology is essential for using services with confidence. Our research lab focuses on studying hardware design technologies.

Assoc. Prof. IOKIBE Kengo

■Research Themes

Hardware security / Electromagnetic information leakage / Electronics packaging / Modeling / IoT / Electromagnetic Compatibility / LiDAR

Information Security



Consequently, securing and safeguarding communication and service delivery has become a critical issue.
In our research laboratory, we are committed to the research and development of cryptography, random number generation, and related technologies. Our goal is to ensure that internet-connected devices, such as medical devices, automobiles, and smart home appliances, can operate securely and safely in this changing scenario.
By applying encryption and random number techniques, we aim to provide reliable solutions that safeguard sensitive data and prevent security threats. Our research explores enhancing encryption algorithms, producing high-quality random numbers, and designing secure communication protocols. Through these endeavors, we aspire to create a dependable environment where individuals and organizations can confidently use internet-connected devices without jeopardizing their security and privacy.

Prof. NOGAMI Yasuyuki

■Research Themes

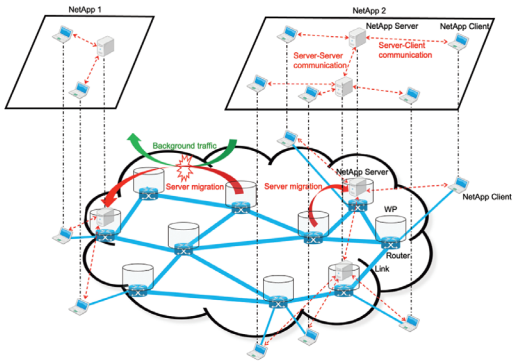
Information security/Discrete mathematics/Modern cryptography/ Post-quantum cryptography/ Homomorphic encryption/IoT/AI-related security/Secure protocols

Assoc. Prof. KODERA Yuta

■Research Themes

Information security/Discrete mathematics/Modern cryptography/ Post-quantum cryptography/ Homomorphic encryption/IoT/AI-related security/Secure protocols

Network Systems



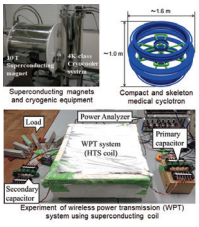
In the after-corona era, a remote world (decentralized society) is expected to arrive, and social and economic activities that do not require face-to-face interaction will take root as the new normal. In this research field, we focus on the Internet, which is becoming increasingly important as an ICT infrastructure supporting the new normal. We design the future Internet by predicting the services that will be needed on the Internet in the future and identifying the possibilities and limitations of various newly created technologies.

Assoc. Prof. FUKUSHIMA Yukinobu

■ Research Themes

Information network/Network virtualization/ Edge computing/Knowledge-defined networking

Applied Superconductivity Engineering



Superconducting technology is expected to contribute to our society by improving the efficiency of energy systems derived from the high current density of superconductors and creating new technologies through the application of high magnetic fields. In our laboratory, we have been developing high-efficiency and low-loss superconducting electrical devices using low-temperature superconducting wires and high-temperature superconductors (bulk and thin-film wires). We have also developed compact and/or high-field superconducting magnets for medical and/or fusion applications.

Prof. KIM Seokbeom

■Research Themes
Superconductivity/ Energy applications/ Medical and fusion applications /Wireless power transmission/ Electromagnetic field analysis

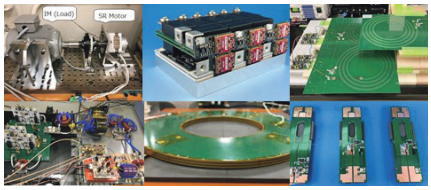
Assoc. Prof. UEDA Hiroshi

■Research Themes
Superconductivity/ Energy applications/Medical and fusion applications/Wireless power transmission/Electromagnetic field analysis

Asst. Prof. INOUE Ryouta

■Research Themes
Superconductivity/ Energy applications/Medical and fusion applications/Wireless power transmission/Electromagnetic field analysis

Electric Power Conversion System Engineering



The following are examples of specific research topics.
*SR motor drive method that achieves both low torque ripple and low input current ripple
*High power density three-phase inverters using GaN-HEMTs for EV applications
*Stable resonant inductive coupling wireless power transfer system independent of manufacturing variation and magnetic interference
*High frequency resonant inverter for plasma generator applications
*Ultra-thin and low-loss coils for IH cooking heaters
*Rectifier-integrated printed-circuit-board winding structures

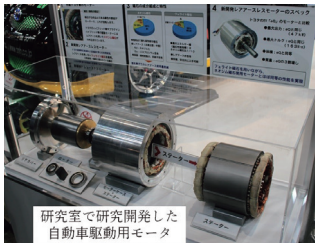
Prof. HIRAKI Eiji

■Research Themes
Power Electronics

Asst. Prof. ISHIHARA Masataka

■Research Themes
Power Electronics

Motor System Engineering



Currently, motors are used in a variety of locations from industry and transportation to the home, and more than half of all electricity generated in Japan is consumed by motors. Therefore, the improvement of motor efficiency is very effective in reducing energy-related carbon dioxide emissions, and is a very important research topic from the perspective of countermeasures against global warming and the depletion of energy resources. Accordingly, we are conducting research on "high performance motors" and "bearingless motors and magnetic bearings utilizing magnetic levitation" with the aim of "reducing the environmental burden caused by motors.

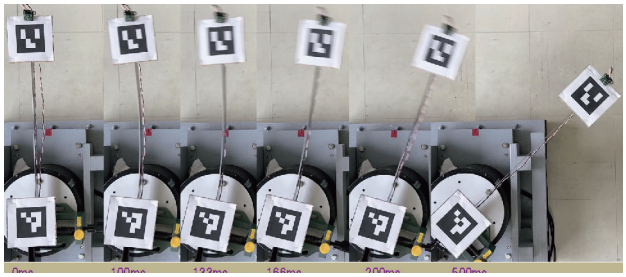
Prof. TAKEMOTO Masatsugu

■Research Themes
Electrical machines/Generators/Electrical machinery/Motor drive/Power electronics

Asst. Prof. TSUNATA Ren

■Research Themes
Electrical machines/Generators/Electrical machinery/Motor drive/Power electronics

Electronic Control Engineering

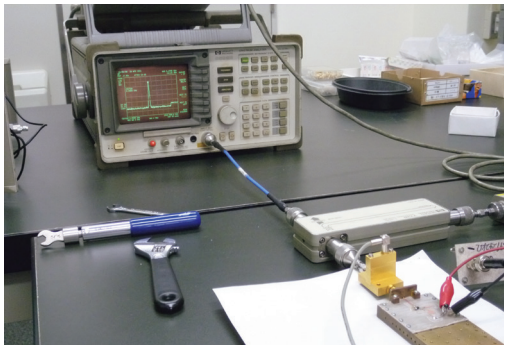


Control system optimization and its application are under research to develop theories and techniques, aiming to enhance electronic control technology widely employed in the current society.

Assoc. Prof. IMAI Jun

■Research Themes
Control engineering/Distributed parameter systems / Robust control

Microwave Circuits

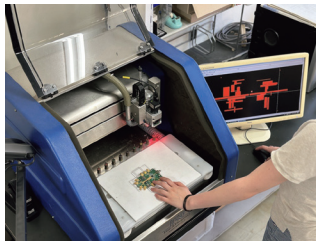


The microwave circuits laboratory principally conducts research on microwave circuits such as oscillators, microwave passive circuits such as power dividers/combiners, and other electromagnetic circuits for applications such as mobile communications, satellite broadcasting/communications, and wireless electric power transmissions.

Assoc. Prof. SANAGI Minoru

■Research Themes
Electrical and electronic engineering/Electronic devices and equipment/Microwave engineering

Optoelectronic and Electromagnetic Wave Engineering



Research on wireless power transfer systems and devices using electromagnetic and acoustic waves, measurement systems for antenna system characteristics for mobile communications beyond 5G, network construction of IoT devices and sensor devices, medical devices using light, and sensor systems using optical fiber, etc.

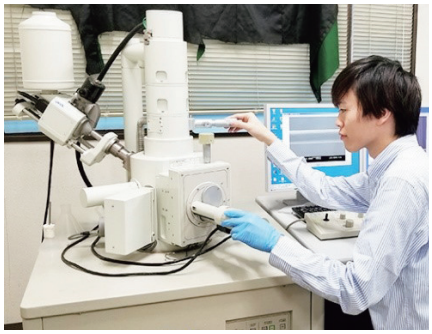
Prof. TAKAHASHI Yasushi

■Research Themes
High-Q Nanocavity/ photonic Charge Sensor/ Silicon Photonics/ Space Photonics

Assoc. Prof. FUJIMORI Kazuhiro

■Research Themes
Wireless power transfer/Electromagnetic field measurement/IoT network/Optical fiber sensor

Nanodevice and Materials Engineering



Semiconductors are used not only in computers, but also in various other places, such as solar cells, thermoelectric conversion devices and other power generation elements, and sensors that sense temperature and light. In addition to silicon, which is widely used today, our research targets new semiconductor materials with mechanical flexibility and excellent electrical properties, such as carbon nanotubes and semiconductive nanosheets, and we are conducting a series of research from structural control and design at the nanoscale (one billionth of a meter) to practical scale. We also perform research on defect properties and engineering in semiconducting materials.

Prof. HAYASHI Yasuhiko

■Research Themes
Semiconductor/Nanocarbons/Two-dimensional materials/Flexible devices/Crystal defect and engineering

Assoc. Prof. YAMASHITA Yoshifumi

■Research Themes
Semiconductor/Nanocarbons/Two-dimensional materials/Flexible devices/Crystal defect and engineering

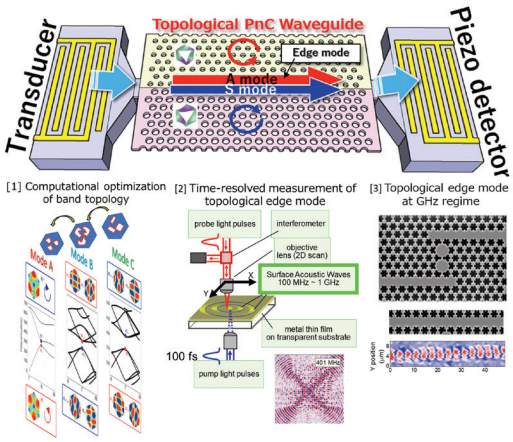
Asst. Prof. SUZUKI Hiroo

■Research Themes
Semiconductor/Nanocarbons/Two-dimensional materials/Flexible devices/Crystal defect and engineering

Asst. Prof. NISHIKAWA Takeshi

■Research Themes
Semiconductor/Nanocarbons/Two-dimensional materials/Flexible devices/Crystal defect and engineering

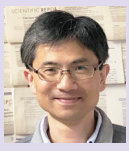
Multiscale Device Design



Research themes:

i) Design and application of novel artificial materials "metamaterials" that enable one to control light, electromagnetic, acoustic, and elastic waves as needed.
ii) Nanomaterials/devices design by first-principles and large-scale molecular simulation methods.
iii) Quantum-classical hybrid computation methods, machine learning, and artificial intelligence for designing the novel functionality of materials/devices.

In particular, we are currently focusing on "topological phononics" that is, as an analogy of physics on topological insulators/superconductors, a novel approach to the design of extremely efficient acoustic/elastic wave devices operating at ultra high-frequency (GHz) regimes.



Prof. TSURUTA Kenji

■Research Themes
Applied physics/Nano-micro sciences/Nanomaterials engineering/Electronic materials engineering

Advanced Science and Technology | Course of Intelligent Mechanical Systems

Intelligent Systems Optimization

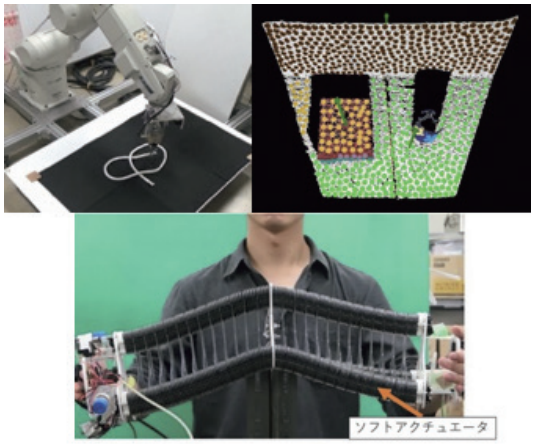
Since various kinds of radioactive wastes generate from nuclear-related facilities, medical-related facilities, etc., these must be safely disposed. The Fukushima Daiichi Nuclear Power Station accident occurred by the Great East Japan Earthquake in March 2011, and surrounding environment was contaminated by radioactive materials. Our laboratory is doing research and development (R & D) for improvement of the reliability of engineering technologies and advancement of safety assessment technologies, environmental dynamics such as behaviour of radioactive materials in the environment contaminated by the Fukushima Daiichi Nuclear Power Station accident, radiation safety such as shielding and dose analyses, and their systems for design and analysis evaluation.

Assoc. Prof. SATO Haruo

■ Research Themes

Nuclear engineering/Radioactive waste (Backend engineering)/Environmental dynamics/ Radiation safety (Radiation engineering)

Intelligent Adaptive and Learning System



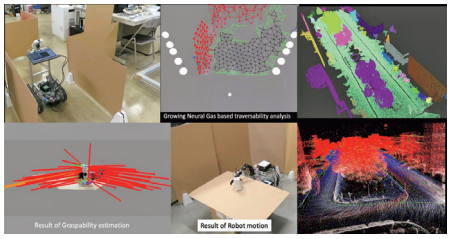
In our research field, our aim is to achieve robots capable of performing complex tasks, and we conduct fundamental research on advanced cognitive capabilities such as problem-solving, decision-making, and environment perception. Additionally, we strive for the social implementation of robots and engage in applied research in areas such as healthcare and rehabilitation.

Prof. MATSUNO Takayuki

■ Research Themes

Surgical assistive robot/Manipulator robot

Adaptive Autonomous Systems



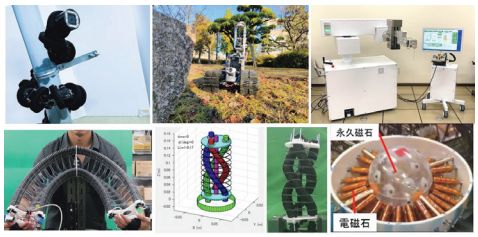
We are conducting research on space perception and recognition to realize robots capable of executing autonomously in various environments. As a methodological foundation for these technologies, we are engaged in fundamental research on computational intelligence, represented by neural networks and evolutionary computation. Furthermore, by applying the developed methods to autonomous mobile robots and verifying their effectiveness, we aim to establish autonomous systems that function effectively in real-world environments.

Assoc. Prof. TODA Yuuichirou

■ Research Themes

Soft computing

Biorobotics



We research and develop robots that are highly adaptable to the environment like living organisms, robots that cooperate with humans, and robots that can be applied to humans. For example, we are researching and developing a snake-like robot that can move through various environments like a biological snake, and a rescue robot for disaster response. We are also developing a remote-controlled needle-puncturing medical robot and a rehabilitation device using soft actuators.

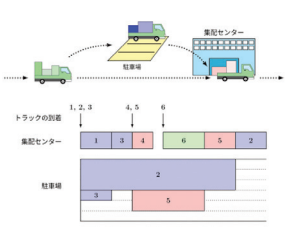
Prof.
KAMEGAWA Tetsushi

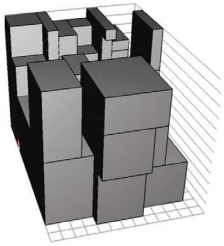
■Research Themes
Robotics/Snake robots/Rescue robots/
Medical robots

Asst. Prof.
SHIMOOKA So

■Research Themes
Soft robotics/Mechatronics/Actuator/
Medical and welfare engineering

Mathematical Systems Optimization





Operations research is a mathematical and scientific method for making better decisions on practical issues. In particular, we use mathematical system optimization to solve various problems in production, logistics, and transportation. Specifically, we deal with production scheduling problems, such as creating work schedules in factories, cargo loading and sorting problems in warehouses and transportation companies, optimal elevator operation management, and the development of algorithms to improve the efficiency of EC site operations.

Prof.
TANAKA Shunji

■Research Themes
Operations research/Mathematical systems optimization/Scheduling/logistics

Assoc. Prof.
YANAGAWA Yoshinari

■Research Themes
Industrial Engineering/Production Management/Social Sytems Engineering

Asst. Prof.
KAWAMOTO Takaki

■Research Themes
Operations Research/Combinatorial Optimization/Assignment Algorithms

Intelligent Mechanical Control

System control technology helps machines, electronics, and even chemicals work smoothly and safely in our everyday lives. In our lab, we try to make more intelligent systems that combine real life and computers, creating a better, more convenient society. We mainly focus on advanced ideas such as nonlinear control theory and data-driven control methods to achieve this. Our research covers everything from fundamental theories to practical uses in society. We aim to help people live more comfortably, safely, and sustainably by better controlling the technologies around us.

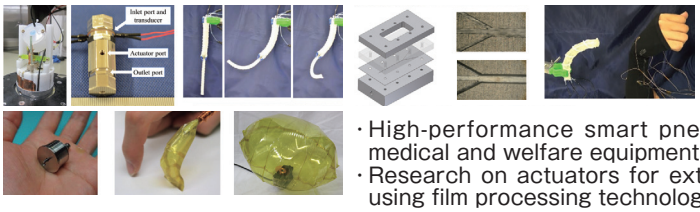
Prof. NISHIMURA Yuki

■Research Themes
System Control Theroy/Nonlinear Control/Stochastic Control

Asst. Prof. IKEZAKI Taichi

■Research Themes
System Control Theroy/Data-Driven Control/Cyber-securty

Sysetm Integration



Our research is about actuators and device for mechatronics and their system applications.
- Application of micro actuators and special environmental mechanisms
- Microreactors and microfluidic devices
- High-performance smart pneumatic artificial muscles, soft mechanisms, and medical and welfare equipment applications
- Research on actuators for extreme environments and devices for space probes using film processing technology

Prof. KANDA Takefumi

■Research Themes

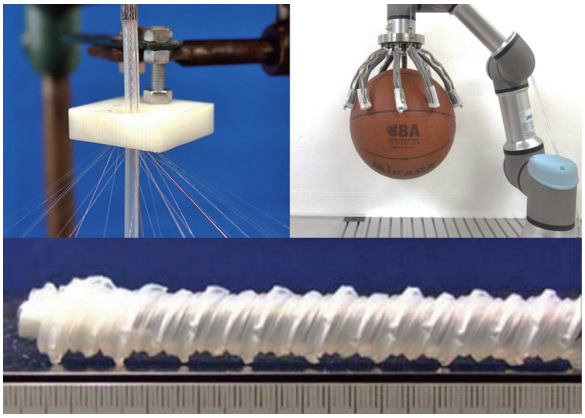
Actuator/Sensor/Mechatronics/Softmechanism/Welfare device/Microsystem/Microreactor/Specific environment/Ultrasonics/Piezoelectricity/Microchannel

Asst. Prof. YAMAGUCHI Daisuke

■Research Themes

Actuator/Sensor/Mechatronics/Softactuator/Softmechanism/Microsystem/Specific environment/Extreme environment/Spacecraft/Lunar exploration/Pneumatics/Ultrasonics/Piezoelectricity

Soft Mechanical Systems



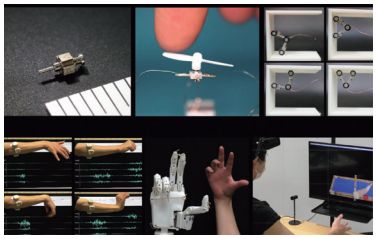
Our laboratory conducts research on the design, fabrication, and control of novel soft actuators, artificial muscles, and soft sensors using flexible materials. We are also engaged in the development of soft robots that integrate these components, aiming to create next-generation robots that are safe, gentle, and capable of smooth, human-friendly motion.

Assoc. Prof. WAKIMOTO Shuichi

■Research Themes

Actuator/Sensor/Mechatronics/Softactuator/Softmechanism/Medical device/ Welfare device

Mechatronic Systems



The Mechatronics Systems Laboratory is engaged in creative and fundamental research and development of new sensors and actuators, applied research and development of robot hands and medical diagnosis and measurement devices using these technologies, and research and development of peripheral technologies. In particular, we focus on sensors and actuators based on the piezoelectric effect as a driving principle, and our research ranges from basic research such as driving theory to design, development, and evaluation of new devices, as well as applied research such as robot control using these devices.

Prof. MASHIMO Tomoaki

■Research Themes

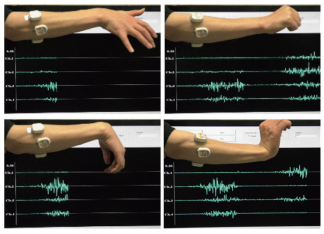
Microrobotics/Actuators/Sensors/Ultrasonic motors

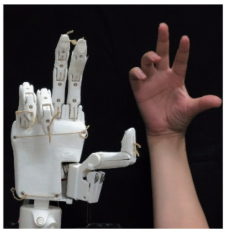
Asst. Prof. IZUHARA Shunsuke

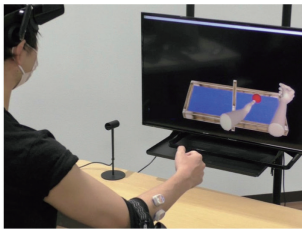
■Research Themes

Microrobotics/Actuators/Sensors/Ultrasonic motors

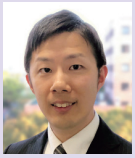
Biomechatronics







Our research group focuses on the mechanisms of biological systems, and conducts research on biological signal processing/analysis as well as their application to human-machine interfaces. In particular, we aim to support independent living for people with physical disabilities through the development of robots that can be controlled by biological signals.



Assoc. Prof. SHIBANOKI Taro

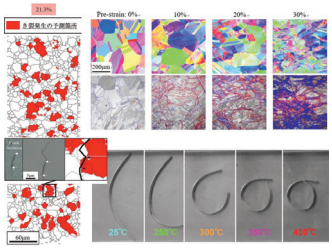
■Research Themes

Robotics, Mechatronics, Medical and Welfare Engineering

Advanced Science and Technology

Course of Advanced Mechanics

Structural Materials



Our research focuses on metallic materials, composite materials, and functional materials to create the required material properties by controlling their microstructures. With the motto “Seeing is believing,” we emphasize the importance of observing, thinking about, and modeling phenomena by ourselves. Laboratory students have access to a variety of state-of-the-art electron microscopy systems and are able to learn micro-sampling techniques, as well as observation and analysis techniques at the atomic level.

Prof. OKAYASU Mitsuhiro

■Research Themes

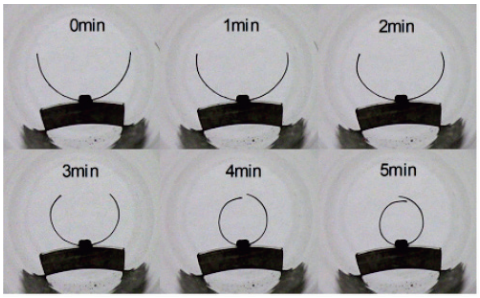
Structural Materials/Composites/
Functional Materials/Microstructures

Asst. Prof. ARAKAWA Jinta

■Research Themes

Structural Materials/Composites/
Functional Materials/Microstructures

Fuctional Materials



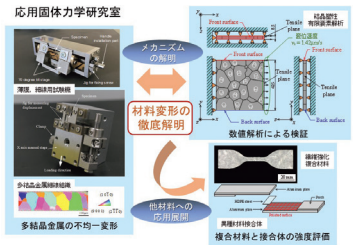
Shape memory alloys are materials that return to their original shape when heated after deformation. However, our laboratory has developed alloys that, contrary to shape memory alloys, deform more and more when heated. This phenomenon can be applied to the manufacture of high-strength, thin-walled tubes, which has been difficult. We are also developing materials with opposite coefficients of thermal expansion, which shrink when heated and expand when cooled, and novel alloys that allow bimetallic motion with a single type of alloy.

Assoc. Prof. TAKEMOTO Yoshito

■Research Themes

Structural Materials/Composites/
Functional Materials/Microstructures

Applied Solid Mechanics



The target of our research is deformation, damage and fracture of various practical materials, including metallic and polymeric materials. We conduct experimental observations of nonuniform deformations for the materials and the corresponding numerical simulations in various levels.

Prof. TADA Naoya

■Research Themes

Fracture /
Damage / Deformation /
Solid mechanics

Assoc. Prof. UEMORI Takeshi

■Research Themes

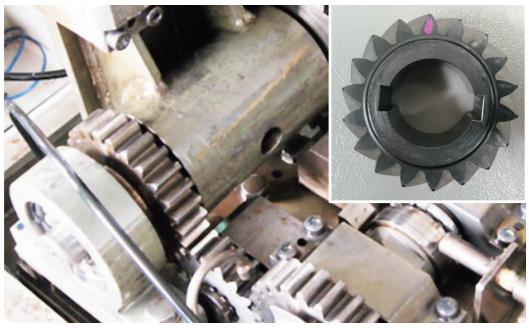
Constitutive equation /
Deformation / Numerical analysis /
Mechanics of plasticity

Asst. Prof. SAKAMOTO Junji

■Research Themes

Fracture / Fatigue /
Vibration / Fracture mechanics

Machine Design and Tribology



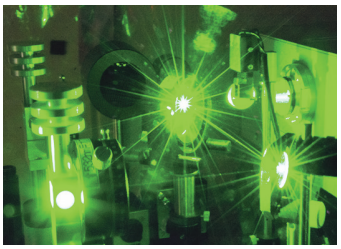
In order to realize a carbon-neutral or decarbonized society, mechanical systems are required to be highly efficient, lightweight, and have a low environmental impact. At the mechanical design laboratory, we apply cutting-edge surface modification methods, coating methods and analysis methods to study technologies that dramatically improve the life, efficiency, and functionality of power transmission elements for EVs and various tribo-elements.

Assoc. Prof. SHIOTA Tadashi

■Research Themes

Mechanical element/Tribology/Gear/Fatigue strength/Low friction and wear/Surface modification/Coating

Nontraditional Machining



Along with the rapid progress of industrial technology, various new materials with excellent properties have been developed. Most of these materials are difficult to machine by the conventional mechanical methods, and the demand for machining of fine complicated shapes has been increased. Our laboratory is researching on high-performance and high-functional nontraditional machining methods, such as Electron Discharge Machining (EDM), Electron Beam Machining (EBM), and Laser Beam Machining (LBM) with using electric, electronic, optical energies. In addition, we are developing novel machining methods for the next generation.

Prof. OKADA Akira

■Research Themes

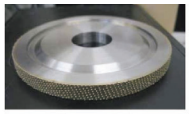
Nontraditional machining technology

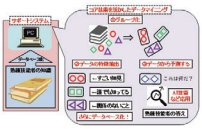
Asst. Prof. SHINONAGA Togo

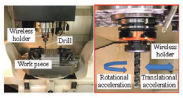
■Research Themes

Electron beam machining/Laser beam machining

Manufacturing Engineering







Studies on high efficiency, high precision, high quality, optimization, and intelligent automation of machining, which is the basic technology of manufacturing, and its peripheral technologies are carried out. In particular, advanced manufacturing technology for both machine tool users and builders is being developed through studies on not only grinding, cutting and abrasive finishing or their evaluation technology, but also further development of AI / IoT technology specialized in the field of manufacturing.

Prof. OHASHI Kazuhito

■Research Themes

Manufacturing Engineering/Grinding/Machining (Cutting)/Abrasive Machining

Senior Asst. Prof. KODAMA Hiroyuki

■Research Themes

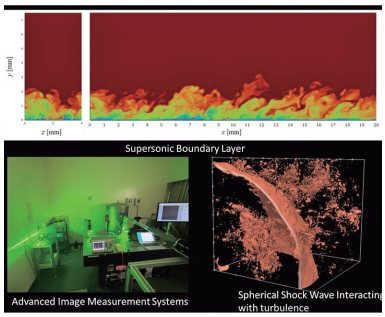
Manufacturing Engineering/Machining (Cutting)/Grinding/Abrasive Machining/Data Mining

Asst. Prof. KANEKO Kazuki

■Research Themes

Mechanical Engineering/Manufacturing Engineering/Grinding/Machining (Cutting)/Abrasive Machining

Aerodynamics



Our laboratory mainly studies the aerodynamics of high-speed flows related to the field of aerospace engineering. In particular, for the development of the next generation of passenger aircraft that will fly at speeds faster than the speed of sound, we are taking on the challenge of reducing frictional resistance on the aircraft and noise caused by shock waves generated by the aircraft, by making full use of advanced image measurement technology, large-scale numerical simulations, and data analysis based on AI technology. We are working on a wide range of topics, from elucidating fundamental physics to applied research.

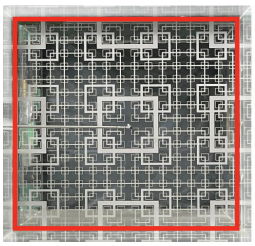
Prof.
KOUCHI Toshinori

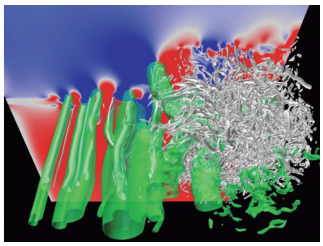
■Research Themes
Aerodynamics/Aerospace Engineering/
Mechanical engineering

Asst. Prof.
TANAKA Kento

■Research Themes
Aerodynamics/Aerospace Engineering/
Mechanical engineering

Fluid Dynamics





Assoc. Prof.
SUZUKI Hiroki

■Research Themes
Fluid Dynamics/Turbulence Engineering/
Mechanical Engineering

The Fluid Dynamics Laboratory studies the motion of fluids, such as air and water, from a mechanical perspective in order to elucidate flow phenomena, build models and improve the efficiency with which flow energy is utilised. Specifically, our work covers: (i) elucidating and modelling flow fluctuations known as turbulence; (ii) creating high-fidelity flow simulations and verifying their reliability; (iii) developing and enhancing the reliability of experimental flow-field measurement techniques using wind-tunnel facilities; and (iv) developing component devices that harness fluid energy.

Heat Transfer Engineering

The Heat Transfer Engineering Laboratory conducts research on understanding the basic phenomena of heat and mass transfer for the effective use of thermal energy and developing products with industrial needs. Specifically, we are conducting a wide range of research such as thermal energy transport and storage using latent heat, development of a new desiccant air conditioning system, investigations of droplet condensation, evaporation and freezing behavior with controlling the surface properties of an object, microcapsules containing latent heat storage materials, and numerical analysis of absorption and reflection by generation and functional thermal radiation films.

Prof.
HORIBE Akihiko

■Research Themes
Latent heat storage/
Heat transport/Polymer
sorbent/Microcapsule/Droplet/
Surface properties/Thermal radiation

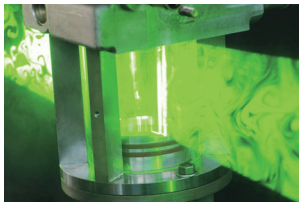
Assoc. Prof.
YAMADA Yutaka

■Research Themes
Latent heat storage/
Heat transport/Polymer
sorbent/Microcapsule/Droplet/
Surface properties/Thermal radiation

Asst. Prof.
ISOBE Kazuma

■Research Themes
Latent heat storage/
Heat transport/Polymer
sorbent/Microcapsule/Droplet/
Surface properties/Thermal radiation

Heat Power Engineering



Heat Power Engineering Laboratory focuses on combustion research for improving thermal efficiency and reducing harmful exhaust emissions. In-cylinder gas flow, spray and combustion processes are measured with ultra high-speed imaging, spectroscopy of emissions from chemical reactions, and lasers. Furthermore, CFD simulations are performed to predict and to elucidate those processes. Effective use of hydrogen, e-fuels and bio-fuels that contribute to carbon neutrality are also targeted.

Prof. KAWAHARA Nobuyuki

■Research Themes
Thermal Engineering /Internal Combustion Engine/Combustion/Laser Diagnostic/Numerical Simulation

Assoc. Prof. KOBASHI Yoshimitsu

■Research Themes
Thermal Engineering/ Internal Combustion Engine/Combustion/Fuel/ Compression Ignition

Asst. Prof. TSUBOI Kazuya

■Research Themes
Thermal Engineering/ Combustion Engineering & Science/Computational Fluid Dynamics

Advanced Science and Technology

Course of
Urban Environment Development

Aseismic Design of Structures

Wind Resistance Group

Wind and tidal power generation are being developed by applying flow-induced oscillations in structures such as bridges caused by wind and water currents.

Earthquake Resistance Group

Our research is a combination of analytical simulation, earthquake damage surveys, and structural experiments in order to evaluate and improve the seismic performance of buildings for disaster mitigation and earthquake-resistant cities. Focusing on sustainability, we explore innovative earthquake-resistant structural systems, such as hybrid designs featuring CLT timber walls and reinforced concrete.

Prof. HIEJIMA Shinji

■Research Themes
Wind engineering/Vibration engineering/ Wind power generation/Tidal current power generation

Assoc. Prof. ALWASHALI Hamood

■Research Themes
Seismic evaluation of buildings/seismic retrofit/performance assessment design/ building structure/seismic disaster mitigation

Design of Steel Structures

Research and education are conducted on the advanced methods of construction and maintenance of civil infrastructures. The types of infrastructures of our interest include railway, road, river, port, and soil structures such as tunnels, bridges, dams, banks. In terms of research topics, particular focuses are placed on the development of the state-of-the-art structural monitoring and nondestructive inspection techniques for the infrastructures under operation. To this end, we are developing physio-chemical models of structures, materials, and measurements, and validate the models and the monitoring/testing techniques built on them through computer simulations and experiments.

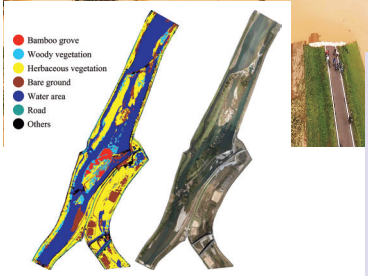
Prof. NISHIYAMA Satoshi

■Research Themes
infrastructure/construction/maintenance/ steel structure/monitoring/nondestructive inspection

Assoc. Prof. KIMOTO Kazushi

■Research Themes
infrastructure/construction/maintenance/ steel structure/monitoring/nondestructive inspection

Hydraulic Engineering



We have conducted education and research on water flow analysis and hydraulic design methods for various hydraulic structures in rivers and coastal areas, which are related to the creation of diverse aquatic environments that can coexist with nature.

Assoc. Prof. YOSHIDA Keisuke

■Research Themes
Hydraulic Engineering

Assoc. Prof. AKOH Ryosuke

■Research Themes
Social Infrastructure(Civil Engineering/Architecture/ Disaster Prevention)/ Hydroengineering

Geotechnical and Groundwater Engineering

Study on Prediction of Slope Failure during Heavy Rainfall
Development of Monitoring and Numerical Modeling Methods for Safety Assessment of River Levees against Seepage

Prof. KOMATSU Mitsuru

■Research Themes
Unsaturated soils/Analysis of seepage flow/Soil moisture

Assoc. Prof. FURUKAWA Zentaro

■Research Themes
Geodisaser Prevention Engineering/ Geoenvironmental Engineering/ Vegetation

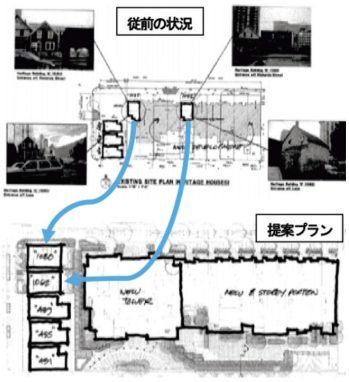
Architectural Design and Theory

Development and Design Technical Practices of Design for Environmental Sustainability

Assoc. Prof. KAWANISHI Atsushi

■Research Themes
Architectural Design/ Architectural Theory/Design/ Architectural Planning/Urban Planning

Architecture and Urban Spatial Planning



A mechanism for inheriting a housing as a good stock from a previous eneration as a living housing for future generations, handing down the culture and the community or the characteristics in the district, and how to use them, how to control new development, We are proceeding with research, keeping in mind these ideas. So far, We are doing research on from the design control method of individual architecture to architectural planning / planning history and urban patial planning, history related to architecture and planning / legal system and ts implementation, in both Japan and overseas cities.

Assoc. Prof. HORI Hirofumi

■Research Themes
Architecture and urban spatial planning/Architecture and urban design policies/Architecture and urban landscape/Area based management/ Business improvement district

Senior Asst. Prof. HASHIDA Ryohei

■Research Themes
Architectural plan/ Housing theory / Modern history

Urban and Transport Planning

Realizing Sustainable Cities: In Japan, Sustainable cities are required in a declining birthrate and aging society. To realize safe, secure, and vibrant cities and transportation, we are researching efficient urban and transportation planning that takes into consideration the environment and people's lives.
Specifically, We are conducting research on the following topics.
1) traffic safety 2) public transportation plannin 3) barrier-free transportation planning
4) clarification of the actual situation of the spongification phenomenon that occurs in the process of population decline
5) compact city planning 6) landscape-oriented city planning
7) measures for city planning in line with the history of historical and cultural civil engineering heritage that take advantage of the uniqueness of the region.

Prof.
HASHIMOTO Seiji

■Research Themes
Urban Transportation Planning/Community Development by Transportation Policy/Traffic Calming

Assoc. Prof.
HIGUCHI Teruhisa

■Research Themes
Civil Engineering History/Historical Structures Preservation and Utilization/Visual Town Planning/Disaster Prevention

Assoc. Prof.
UJIHARA Takehito

■Research Themes
Urban Planning/ Urban Environment /Urban Transportation

Wood-Based Materials

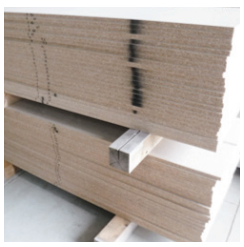
Although wood is a natural material with excellent mechanical properties, it has some weaknesses due to its biological origin. To overcome these weaknesses, previous researchers have developed various timber composite members and wood-based materials manufactured by gluing or connecting timber and small elements of wood. Now, to promote large-scale timber structure with a view to decarbonization, we will use the latest analytical and measurement techniques to provide theoretical support for fracture phenomena of existing wood-based materials and timber composite member; additionally, we will propose new combinations and forms of them on the basis of this analysis.

Asst. Prof. SUDO Ryutaro

■Research Themes
Wood-Based Material/ Timber Engineering

Wood Resource Utilization

Wood is significantly different from other agricultural and marine products in that, with proper management, it can store carbon over the long term. Maximizing this capability could potentially help mitigate global warming. Our laboratory is working toward further mitigating global warming by recycling wood. Additionally, we are conducting research on the effective use of wood resources by combining recycled wood with adhesive technologies.



Prof. KORAI Hideaki

■Research Themes
Wood resources/Wood-based materials/Wood adhesion/ Recycled wood/ Carbon storage

Design of Concrete Structures

Concrete is the foundation of social infrastructure that supports this substance civilization. However, the act of building a structure with concrete, or the act of building concrete itself is an act that destroys the natural environment. I want to own a car, I want to travel abroad, I want to live with a flush toilet, a TV, a cooler, but I also want to protect the natural environment. Developing a sustainable society may be the answer to this contradiction of humanity. In this laboratory, we address the goals of a sustainable society from the concrete perspective.

Prof.
AYANO Toshiki

■Research Themes
Construction material/
Concrete engineering

Assoc. Prof.
FUJII Takashi

■Research Themes
Construction material/
Concrete engineering

Urban and Building Environmental Engineering

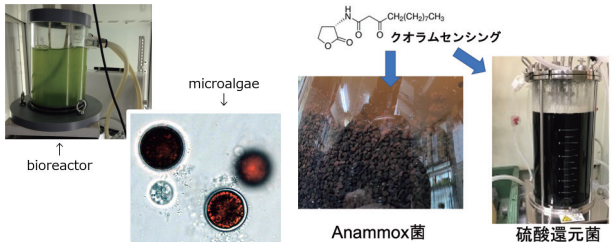
Energy is essential for maintaining human activity. However, consuming energy not only causes global environmental issues such as global warming and energy resource depletion, but also causes local (urban) environmental issues such as heat island phenomenon and air pollution. We have been researching in our laboratory to clarify the way urban structures and the related energy systems should be built in the near future in order to realize a comfortable urban environment while maintaining a sustainable earth.

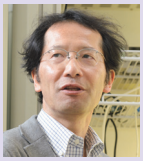
Prof. NARUMI Daisuke

■Research Themes
Sustainable Urban and Architectural Design/Carbon Neutral/Energy System/Heat Island

Water Environment and Sanitation

"Water" is essential for our lives and livelihoods, and also works as a medium of transporting substances on both local and global scales. Therefore, the sustainability of our life and ecosystem can be easily threatened by the excess usage and pollution of water resources.We are doing education and researches on "water quality control technology (water treatment)" and "relationship between material transport and aquatic ecosystems" to solve or prevent such issues for water resources. We hope to make our society safe, comfortable, and sustainable.





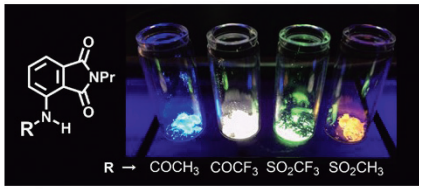
Prof. NAGARE Hideaki

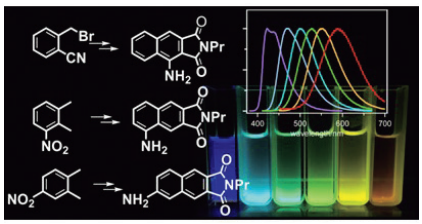
■Research Themes
Water environment/Water treatment/
Resource recovery/Chemical substances

Innovative Chemistry

Course of Chemistry

Synthetic and Physical Organic Chemistry





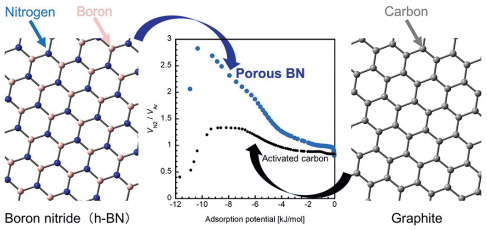
In Synthetic and Physical Organic Chemistry research area, we investigate organic photochemistry to develop novel functional molecule, such as luminescent materials organic semiconductors. Our research subjects are as follows.

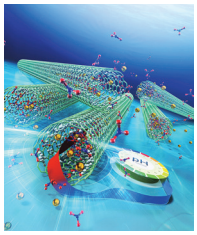
Assoc. Prof. OKAMOTO Hideki

■Research Themes
Organic photochemistry/Organic functional molecule/Fluorescence/Polycyclic aromatic hydrocarbon/Organic semiconductor

Inorganic Chemistry

Since the adsorption of molecules and ions into solid pores proceeds spontaneously by selecting the appropriate material, so that the separation and purification process of mixtures can be constructed without any energy supply. We focus on fundamental phenomena to stabilize adsorbed species and to determine the ability. That can build design guidelines for inorganic porous materials that we should aim for in the next generation.



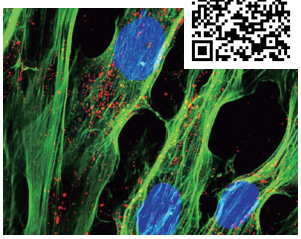


Prof. OHKUBO Takahiro

■Research Themes
Adsorption/Separation/Pore/Nanocarbon/Porous ceramics

Nanochemistry

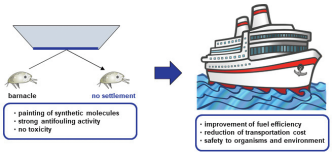
The aim of our research is to explore nanometrology by exploiting the novel functionality of inorganic nanomaterials. We are currently investigating nanoscale properties of biological samples and electronic devices, through optical responses of nanodiamonds and metallic nanoparticles.



Prof.
FUJIWARA Masazumi

■Research Themes
Nanoscience / Quantum technology/Inorganic chemistry/Analytical chemistry

Organic Chemistry



Development of New Synthetic Reactions and Its Application to the Synthesis of Biologically Active Organic Compounds

Biologically active natural products have been regarded as the promising drug candidates and useful tool for life science. Particularly, because of their potent biological activities, natural products isolated from marine organisms have attracted much attention of organic chemists, biologists, and pharmacologists. We are studying the developing new synthetic reactions and its application to the total synthesis and structural elucidation of biologically active organic molecules such as marine toxins, antitumor, and antifouling compounds.

Prof. KADOTA Isao

■Research Themes

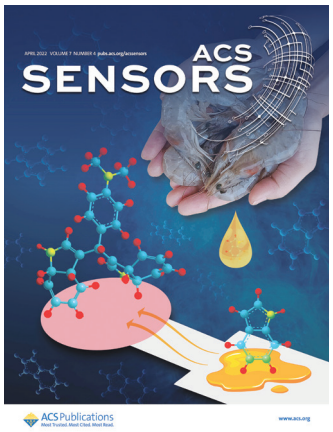
Organic Synthesis/Natural Product/ Total Synthesis/Biologically Active Molecule/Structural Elucidation/ Antifouling Agent

Assoc. Prof. TAKAMURA Hiroyoshi

■Research Themes

Organic Synthesis/Natural Product/Total Synthesis/Biologically Active Molecule/ Structural Elucidation/Antifouling Agent

Analytical Chemistry



We are developing a high-performance separation and determination methods using a laser and simple chemical sensors using paper substrates. We are also developing analytical methods for vesicles released by biological cells, environmental pollutants, active components contained in food, and chemicals that serve as indicators of food degradation. We are also working on research on high-performance separation using capillary electrophoresis and new analytical methods with nanochannels.

Prof. KANETA Takashi

■Research Themes

Analytical Chemistry / Bioanalysis/Environmental Analysis and Food Analysis

Assoc. Prof. TAKEYASU Nobuyuki

■Research Themes

Nanotechnology/Materials / Nanomaterials

Innovative Chemistry

Course of Applied Chemistry

Inorganic Materials

Synthesis and characterization of functional ceramic thin films
Developments of functional ceramic materials by soft chemical methods
Biogenous iron oxides for novel nanometric materials
Catalysis related to ferroelectricitys

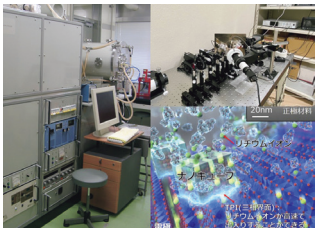
Prof. FUJII Tatsuo

■Research Themes
Inorganic Materials/Ceramics/Thin Films & Fine Particles/Magnetic Materials/Dielectric Materials/Battery Materials

Assoc. Prof. KANO Jun

■Research Themes
Inorganic Materials/Ceramics/Thin Films & Fine Particles/Magnetic Materials/Dielectric Materials/Battery Materials

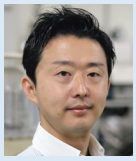
Solid State Chemistry



Research on the development of new functional ceramics (structural materials and electronic materials) and their application to various electronic elements and electrochemical devices has been carried out. Attempts have been made to fabricate ceramics using internal stress and interfaces between different substances, and to fabricate ceramic solids from liquid and gas phases. Attempts have also been made to fabricate ceramics using internal stress and interfaces between different materials, and to fabricate ceramic solids from liquid and gas phases. We comprehensively evaluate the effects of mechanical external force, electric field application as an external field, and electromagnetic wave irradiation on the electromagnetic properties of ceramics.

Prof. KISHIMOTO Akira

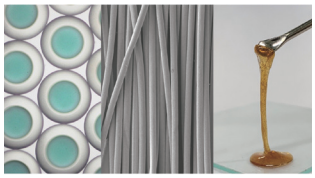
■Research Themes
Ceramics/Functional materials/Millimeter-wave irradiation heating/Ionic conductor/Dielectric materials



Assoc. Prof. TERANISHI Takashi

■Research Themes
Ceramics/Functional materials/Millimeter-wave irradiation heating/Ionic conductor/Dielectric materials

Interface Process Engineering



With a focus on process innovation as a driver for product innovation, our laboratory pursues interdisciplinary research based on chemical engineering approaches, integrating diverse fields through the key concept of interfaces. By combining polymer chemistry, biotechnology, organic synthesis, microfluidics, and computational science, we explore the multiscale design of functional soft-matter —from molecules to structures—including particles, capsules, fibers, and ionic liquid–based materials.

Prof. ONO Tsutomu

■Research Themes
Chemical engineering/Interfacial chemistry/Polymer chemistry/Microfluidics/Soft Matter

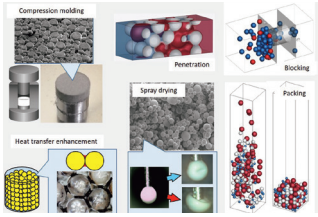
Assoc. Prof. WATANABE Takaichi

■Research Themes
Chemical engineering/Interfacial chemistry/Polymer chemistry/Microfluidics/Soft Matter

Asst. Prof. IIDA Yuya

■Research Themes
Chemical engineering/Interfacial chemistry/Molecular and numerical simulation

Fluid and Particle Process Engineering



In chemical processes for producing inorganic materials, organic materials, and polymer materials, particulate solid material so called "Powder" are used as intermediates and final products. Our research works are investigation and establishment for the designing and controlling methods of a series of processes from production to handling of particulate solid materials. Main topics are development of dry surface cleaning method, compression molding, powder property evaluation method, kneading, layer formation during drying, particle generation by spray drying as a process involving heat and mass transfer, gas-solid chemical heat storage. We are also conducting mesoscale numerical calculations of particle dispersion systems as basic research on interfacial phenomena and interactions between particles.

Prof. GOTOH Kuniaki

■Research Themes

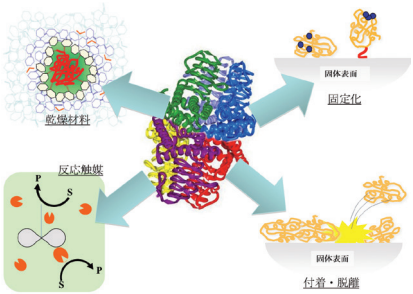
Chemical engineering/Powder technology/ Thermal engineering/Heat and mass transfer/Numerical simulation

Assoc. Prof. NAKASO Koichi

■Research Themes

Chemical engineering/Powder technology/ Thermal engineering/Heat and mass transfer/Numerical simulation

Bioprocess Engineering



Our laboratory was initially dedicated to the engineering applications of proteins, concentrating on the development of techniques to stabilize proteins and enhance their functional performance, as well as investigating the mechanisms underlying protein adsorption onto solid surfaces. Building upon this foundational work, we are presently engaged in research focused on drying technologies critical for protein stabilization, advanced functionalization of dried materials, and the creation of sophisticated sensing systems that employ proteins as functional components.

Prof. IMAMURA Koreyoshi

■Research Themes

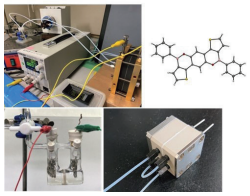
Chemical Engineering/Drying/ Spectroscopy/Food Engineering

Asst. Prof. IMANAKA Hiroyuki

■Research Themes

Biochemical Engineering / Protein Engineering / Biosensor / Intermolecular Interactions

Synthetic Process Chemistry



We study innovative organic synthetic processes driven by organic electron transfer reactions. In these electrochemical methods, electricity is used as a driving force, enabling the greener chemical transformation without toxic and hazardous chemical reagents. Based on the electrochemical organic synthesis, we focus on developing novel chemical transformations for facile access to organic functional materials such as active materials for organic semiconductors and light-emitting materials, and biologically active compounds. Microflow reactions have attracted a great deal of attention in recent years, and we are also working to develop reactions that combine flow chemistry with electrochemical methods. The machine learning-assisted optimization of organic chemistry has also been investigated.

Prof. SUGA Seiji

■Research Themes

Organic photochemistry/ Organic functional molecule/ Fluorescence/Polycyclic aromatic hydrocarbon/Organic semiconductor

Assoc. Prof. MITSUDO Koichi

■Research Themes

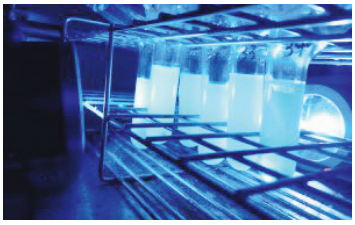
Organic photochemistry/ Organic functional molecule/ Fluorescence/Polycyclic aromatic hydrocarbon/Organic semiconductor

Asst. Prof. SATO Eisuke

■Research Themes

Organic photochemistry/ Organic functional molecule/ Fluorescence/Polycyclic aromatic hydrocarbon/Organic semiconductor

Organometallic Chemistry



Modern synthetic methods are required to construct complex molecules from readily available materials. We are trying to develop an innovative catalytic system, using not only the typical transition-metal catalyst but also organocatalyst and photocatalyst.

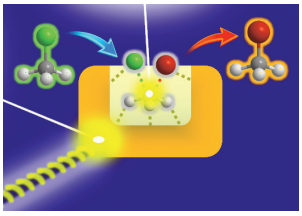
Prof. MIURA Tomoya

■Research Themes
Organic Synthetic Chemistry/ Organometallic Chemistry/ Nanotechnology and Materials

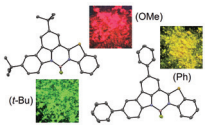
Asst. Prof. YAMAZAKI Ken

■Research Themes
Organic Synthetic Chemistry/ Organometallic Chemistry/ Computational Chemistry

Synthetic Organic Chemistry



We develop catalysts and catalytic reactions for the chemical fixation of carbon dioxide (CO_2). CO_2 is not only a greenhouse gas but also a renewable carbon source, and CO_2 fixation is an important technology for the creation of carbon-neutral societies based on circular economy. On the other hand, fluorescent dyes and circularly polarized luminescence (CPL) dyes are expected to find various applications such as organic functional materials. We study these subjects taking advantage of organic synthesis.



Prof. EMA Tadashi

■Research Themes
Organic synthesis/Catalysis/Carbon Dioxide fixation/Fluorescent dyes/Circularly polarized luminescence dyes

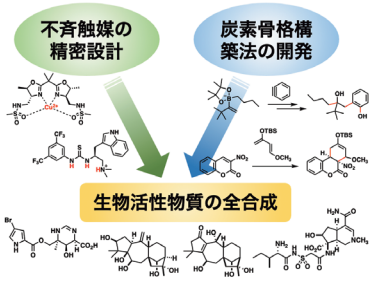
Assoc. Prof. TAKAISHI Kazuto

■Research Themes
Organic synthesis/Catalysis/Carbon Dioxide fixation/Fluorescent dyes/ Circularly polarized luminescence dyes

Asst. Prof. NITTA Natsumi

■Research Themes
Organic synthesis/Catalyst/Carbon dioxide fixation reaction/Fluorescent dye/Circularly polarized light emitting dye

Bioorganic Chemistry



There have been obtained many natural organic compounds that exhibit unique biological activities. These bioactive substances are useful as pharmaceuticals and their lead compounds. We are developing methods for the chemical synthesis of these bioactive compounds with diverse functional groups and complex carbon skeletons. Considering the viewpoint of “clean,” that is environmentally benign, organic synthetic chemistry, we have been designing a catalyst system that can stereoselectively synthesize organic compounds with various functional groups, and have been developing carbon-carbon bond formation reactions that can construct complex carbon skeletons.

Prof. SAKAKURA Akira

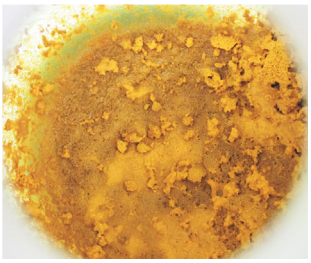
■Research Themes
Synthetic organic chemistry/ Bioactive natural compound/ Catalyst/Total synthesis

Assoc. Prof. MIZOGUCHI Haruki

■Research Themes
Synthetic organic chemistry/Bioactive natural compound/Catalyst/Total synthesis

Industrial Catalysis

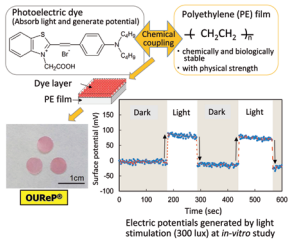
To promote research and technological development of innovative chemical catalytic methods of great industrial importance for solving global problems. Although the Faculty of Engineering of Okayama University was established with high expectations from the people of Okayama Prefecture, we recognize that our contribution to the local community is still far from sufficient, and we will promote practical application-oriented chemical research based on coordination chemistry to achieve harmony between the economy and the environment through down-to-earth regional and industry-academia collaboration. Through research and other activities, we aim to nurture proud Japanese people with a firm and unshakable core.



Senior Asst. Prof.
OSHIKI Toshiyuki

■Research Themes
Carbon recycling/Homogeneous catalysis/Polymer synthesis

Polymeric Materials



Electric potentials generated by light stimulation (300 lux) at *in-vitro* study

Nanomaterials of High-Performance Polymers
– Creation of Super Materials by Novel Methodology for Morphology Control –
Development of a Retinal Prosthesis by Using Photoelectric Dye-Coupled Polyethylene Films (Okayama University-Type Retinal Prosthesis)
Functionalized Polysaccharide Material
Microwave Assisted Polymeric Material Processing
Biodegradable Polymeric Composite Material

Prof.
UCHIDA Tetsuya

■Research Themes
Nanotechnology/Materials/Composite materials and interfaces/Nanotechnology/Materials/Polymer materials/Life Science/Biomaterials

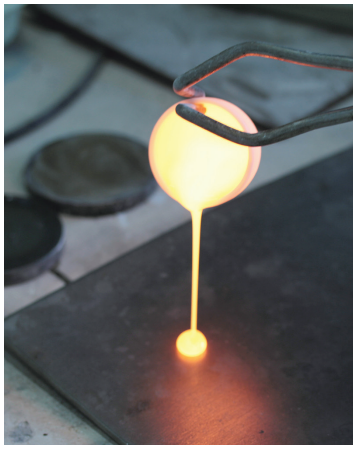
Senior Asst. Prof.
OKIHARA Takumi

■Research Themes
Nanotechnology/Materials/Polymer materials/Nanotechnology/Materials/Green sustainable chemistry and environmental chemistry/Nanotechnology/Materials/Organic functional materials

Asst. Prof.
KIMURA Naotaka

■Research Themes
Polymer Science/Polymeric Materials /Composites/Carbon Nanotube/ Nanomaterials/Retinal Prosthesis/Wood Science

Environmental Amorphous Materials Science

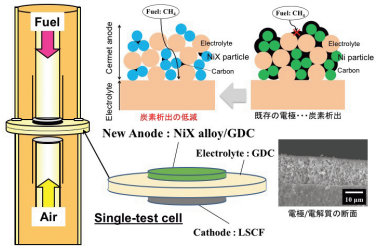


Glass has excellent properties of transparency and moldability, which gives it various applications used in our daily life such as clear windows, containers, bottles, lens and fiber-form optics and so on. Another advantage of glass is its ability as a solvent, which allows it to dissolve and retain various elements including toxic and/or radioactive ones. Glass can be a key material to solve environmental and energy problems. In our group, we contribute to resource and energy saving through the research and development of functional glass and ceramic materials. We are also studying on efficient process of recycling inorganic wastes based on physics and chemistry of glass materials.

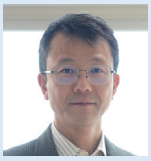
Assoc. Prof.
BENINO Yasuhiko

■Research Themes
Glass science/Environmental inorganic materials science/Inorganic materials chemistry

Environmental Inorganic Materials Science



We are developing novel electrode materials and electrolytes to enhance the performance of solid oxide fuel cells, which are gaining attention as a clean and efficient power generation system. Specifically, our focus lies on the utilization of biogas as a fuel. Additionally, we are working on the development of new separation materials that achieve efficient water/alcohol and oil/water separation with low energy consumption. This is accomplished by leveraging the unique pore structure of zeolites, the superhydrophilicity of titanium oxide photocatalysts, and the combination of hydrophilic and hydrophobic surfaces.



Prof. KAMESHIMA Yoshikazu

■Research Themes
Inorganic materials chemistry / Inorganic environmental materials/ Inorganic interface chemistry

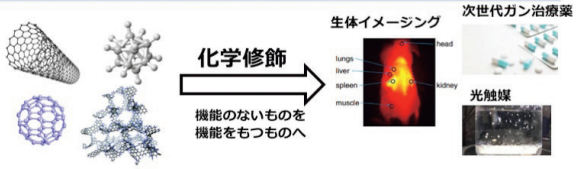
Assoc. Prof. NISHIMOTO Shunsuke

■Research Themes
Inorganic materials chemistry / Inorganic environmental materials/ Inorganic interface chemistry

Advanced Organic Materials

有機機能材料学研究室

有機反応による化学修飾で機能性分子を！



有機機能材料学研究室では，有機化学を駆使し，緻密な分子設計に基づく有機機能材料の開発を行うことで，環境技術や人類に貢献することを目指しています。

期待される応用分野
ホウ素中性子捕捉療法、光触媒、グリーンケミストリー

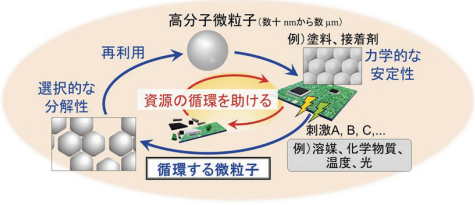
研究室HPはこちら

Our research interests include (1) chemistry of nanocarbons (fullerenes and carbon nanotubes), (2) chemistry of main group elements, (3) self-assembly and photoproperties of organic semiconductors, (4) chemical modification of clusters, and (5) fabrication and properties of nanohybrids.

Assoc. Prof. TAJIMA Tomoyuki

■Research Themes
Organic Chemistry/Photochemistry/ Nano carbon chemistry/Main group element chemistry

Environmental Polymer Chemistry



Polymer materials are indispensable as materials that support our daily lives, and by precisely controlling their molecular structures and aggregation states, it is possible to express advanced functions. We are studying the development of materials that contribute to environmental conservation, such as plant-derived biomass plastics and super engineering plastics.

Prof. SUZUKI Daisuke

■Research Themes
Polymer chemistry/Polymer physics/Organic chemistry/ Physical chemistry/Environmental materials

Assoc. Prof. YAMAZAKI Shinichi

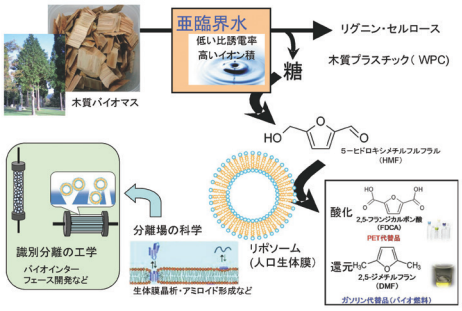
■Research Themes
Polymer chemistry/ Polymer physics/Organic chemistry/Physical chemistry/ Environmental materials

Asst. Prof. ATARASHI Hironori

■Research Themes
Polymer chemistry/ Polymer physics/Organic chemistry/Physical chemistry/ Environmental materials

Environmental Process Engineering

In order to convert an unusable material to a valuable material, we research to propose an environmental-friendly chemical processes. We proposed the three chemical processes shown in the figure to produce a monomer to make a bioplastic from woody biomass. As the first process, we used subcritical water to hydolyze cellulose and hemicellulose. We converted monosaccharide to 2,5-Hydroxymethylfrufral (HMF) by the quick extraction as called as Slug Flow as the second process. We proposed a converting chemical process using a metal catalyst with liposome, which is an artificial cell membrane, to produce 2,5-frandicarboxylic acid.



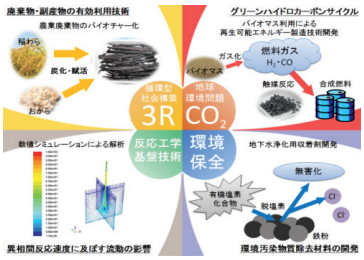
Prof.
KIMURA Yukitaka

■Research Themes
Environmental-friendly chemical processes/Slug flow

Assoc. Prof.
SHIMANOUCHI Toshinori

■Research Themes
Environmental-friendly chemical processes/Slug flow

Environmental Reaction Engineering



Our research targets are in four fields, the development of a recyclable society, global environmental problems, environmental protection, and basic reaction engineering technology. Our goal is to address these issues using chemical engineering approaches. Our recent research has focused on recycling waste, biomass, and green hydrocarbons, searching for effective catalysts to remove contamination matter in groundwater, and stirring operation between different phases.

Prof. Uddin Md. Azhar

■Research Themes
Chemical reaction engineering/ Catalytic chemistry

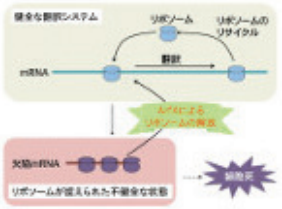
Prof. FUKUDA Nobuko

■Research Themes
Materials chemistry/Plasmonics/Surface spectroscopy/Sensing

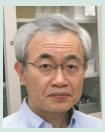
Earth, Environmental and Life Sciences

Course of Biological Sciences

Molecular Genetics



1. Transcriptional Regulation
2. Reproductive and Behavioral Biology
3. Nutritional and Metabolic Genetics



Prof. NAKAGOSHI Hideki
■Research Themes
Drosophila/Homeostasis/Stress response/Metabolism/Fertility/Sexual behavior

Prof. ABO Tatsuhiko
■Research Themes
Life Science/Genetics/Molecular biology

Assoc. Prof. CHADANI Yuhei
■Research Themes
Life Science/Molecular biology/Ribosome, translation, nascent polypeptide

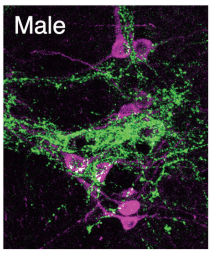
Plant Ecology and Evolution

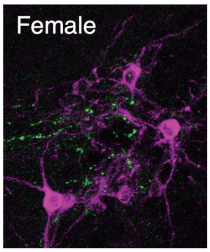
Why are some species able to cope with environmental changes? How have organisms responded to environmental change in the past? We are interested in how plant species cope with and even adapt to environmental changes such as climate change and land use.
We conduct research using field surveys, common garden experiments, diversity manipulation experiments, ecological genomics, and ecological niche modeling, with a particular focus on sources of genetic diversity that enable rapid evolutionary responses and mechanisms of population maintenance through interactions among organisms.

Prof. MIMURA Makiko
■Research Themes
Evolutionary ecology/Ecological genetics/Environmental changes

Asst. Prof. NAKAHORI Kiyoshi
■Research Themes
Conservation ecology of Oriental dollarbird (Eurystomus orientalis)

Neural Control of Behavior





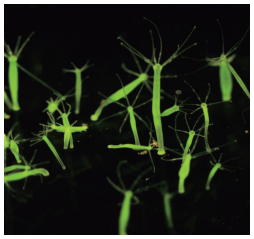
I am studying the behavioral control mechanisms in vertebrates, particularly focusing on the neuroendocrine regulatory mechanisms and the mechanisms involved in sexual differentiation.

Prof. SAKAMOTO Hirotaka
■Research Themes
Neuroendocrinology

Assoc. Prof. OTI Takumi
■Research Themes
Neuroendocrinology

Assoc. Prof. OGOSHI Maho
■Research Themes
Hormones/Hormone receptors/Hormone systems/Endocrinology/Comparative Endocrinology/Evolution

Environmental Biology and Chronobiology

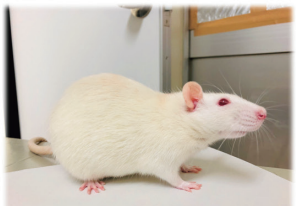
To reveal the principles of animal evolution, we conduct genome-wide studies using basal animals. In particular, we focus on unique ecology related to environmental adaptation and interactions between organisms, and aim to elucidate its molecular mechanism.

Prof.
YOSHII Taishi
■Research Themes
Chronobiology/
Circadian clock/
Drosophila melanogaster

Prof.
ANSAI Satoshi
■Research Themes
Evolutionary biology/
Genetics/Genomics/
Genome editing

Prof.
HAMADA Mayuko
■Research Themes
Animal evolution/
Genome/Symbiosis/
Environmental adaptation

Chemical Correlation and Control




In our laboratory, we are conducting research on a wide range of contents from physiological actions of hormones to transcriptional regulatory mechanisms of genes, using mice, rats, chickens, frog, medaka and mudskipper.

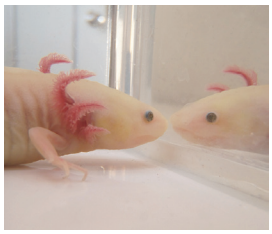
Prof. SAKAMOTO Tatsuya
■Research Themes
Hormones/Hormone receptors/Hormone systems/Endocrinology/Comparative endocrinology/Evolution

Assoc. Prof. AIZAWA Sayaka
■Research Themes
Hormones/Hormone receptors/Hormone systems/Endocrinology/Comparative endocrinology/Evolution

Prof. TAKEUCHI Sakae
■Research Themes
Hormones/Hormone receptors/Hormone systems/Endocrinology/Comparative endocrinology/Evolution

Asst. Prof. AKIYAMA Tadashi
■Research Themes
Hormones/Hormone receptors/Hormone systems/Endocrinology/Comparative endocrinology/Evolution

Developmental Biology



We are interested in unraveling the molecular basis of plant growth and development. Our current research is focusing on
I. Function of polyamines in growth and development
II. Molecular mechanism of establishment and maintenance of shoot epidermis-specific gene expression
Urodele amphibians, such as newts and axolotls, can regenerate their missing body parts. In contrast, we cannot regenerate "body parts". Our ultimate goal is to understand the tricks of their higher regeneration ability and to apply their tricks onto higher vertebrates.

Prof. SATOH Akira

■ Research Themes

Limb regeneration/Regeneration biology/Organ regeneration/FGF signaling/Axolotl

Prof. TAKAHASHI Taku

■ Research Themes

Life Science/Plant molecular biology and physiology/Genetics/Morphology and anatomical structure

Assoc. Prof. MOTOSE Hiroyasu

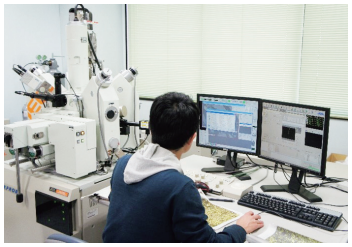
■ Research Themes

Life Science/Cell biology

Earth, Environmental and Life Sciences

Course of Earth Science

Petrology



Rocks record the history from their formation up to the present. Therefore, by observing and analyzing the rock's chemical composition and the types and compositions of the constituent minerals, it is possible to unravel the history of the rock. Deciphering these past geological phenomena can also help us to understand the mechanisms of geological phenomena occurring on the Earth today. We are particularly interested in the formation mechanisms of rocks that make up the ocean floor and plate convergence zones.

Assoc. Prof. NOZAKA Toshio

■Research Themes

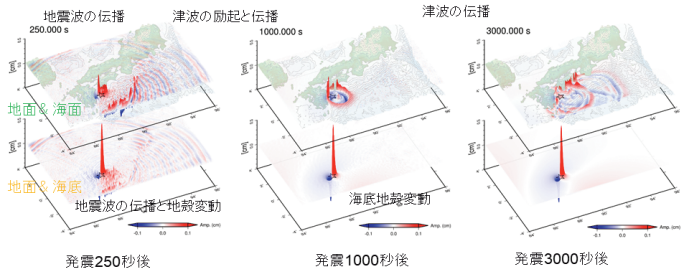
Metamorphic rock/Igneous rock/ Geology/Crust/Mantle

Assoc. Prof. NAKAMURA Daisuke

■Research Themes

Metamorphic rock/Igneous rock/ Geology/Crust/Mantle

Seismology



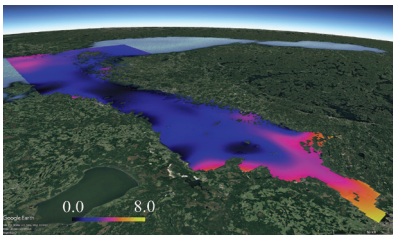
・Modelling of seismic and tsunami waves
・Study on strong motion

Prof. TAKENAKA Hiroshi

■Research Themes

Computational seismology/ Strong motion/Tsunami

Geoinformatics



One of research theme is to develop models that contribute to the evaluation of earthquake resistance and safety by applying data on active faults and seismotectonics to long-term and probabilistic hazard assessment of future earthquakes and simulation of landform evolution in 100,000-year time scale. We also modeling the dynamics of the environmental parameters or environmental substances by using Geoinformatics. For the purpose, AI and Kriging method by Python or R are combined with GIS applications are employed.

Prof. KUMAMOTO Takashi

■Research Themes

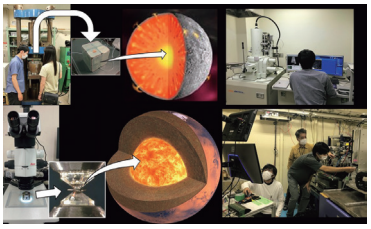
Seismic Hazard assessment/Landform Evolution Simulation

Asst. Prof. YAMAKAWA Junji

■Research Themes

Geostatistics/AI/Kriging/Geographic Information System (GIS)

Physics of the Earth and Planetary Interiors



We investigate structures and properties of materials which consist of Earth and planetary interiors to clarify phenomena occurring in the Earth and planetary interiors. Planetary interior environments are produced in the lab using high-pressure devices, such as large-volume press and diamond anvil cell.

Prof.
URAKAWA Satoru

■Research Themes
Earth and planetary core/Mineral physics/ Amorphous and liquid

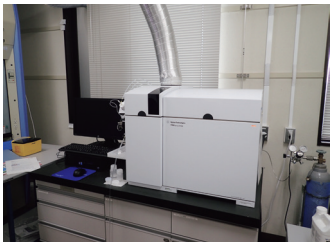
Prof.
TERASAKI Hidenori

■Research Themes
Planetary core/Formation and evolution of the core/Physical properties of liquids

Asst. Prof.
Sakurai Moe

■Research Themes
Earth's mantle/Hydrous mechanism/Experimental mineralogy

Geochemistry



A wide variety of research topics, starting from the origin and evolution of the solar system to modern environmental problems, are being studied by the members of the geochemistry group. Instruments such as the ICP-OES, ICP-MS, TIMS are used in combination with the state-of-the-art clean laboratory to obtain high-precision data from various planetary and environmental materials including meteorites, terrestrial rocks and minerals, calcifying organisms such as corals and sea urchins, and river and groundwater. High quality geochemical data are used to investigate the processes responsible for the evolution of planets, continental crust, modern and ancient ocean, and the impact of human activities on the environment such as the effect of ocean acidification on the calcification of marine organisms.

Prof. INOUE Mayuri

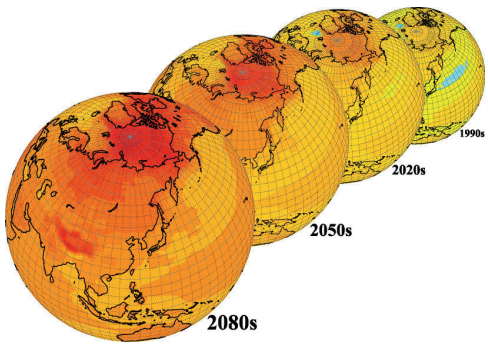
■Research Themes
Paleoenvironments/Coral reefs/ Biomineralization

Assoc. Prof. YAMASHITA Katsuyuki

■Research Themes
Meteorites/Continental crust/River water/ Groundwater/Asian dust

Atmospheric Sciences

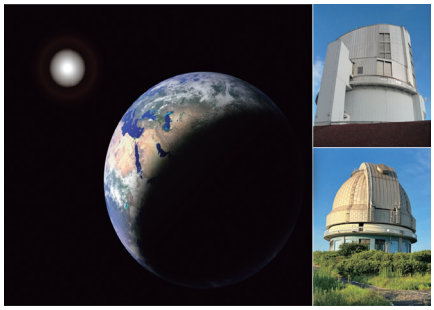
The global circulation of the atmosphere and local atmospheric phenomena occur through various mechanisms. What factors contribute to climate change from the past to the future, as exemplified by global warming? In the atmospheric science section, we study the mechanisms behind extreme weather and climate change by comprehensively utilizing numerical simulations, observation products, and reanalysis datasets. We also develop numerical models to understand physical processes and mechanisms of climate change, for more accurate climate predictions.



Prof. NOZAWA Toru

■Research Themes
Atmospheric physics/Climate change/Global warming/Numerical simulation

Planetary Sciences



How do planets form? The formation and evolution of planets involve a complex interplay between planetary accretion, atmospheric chemistry, and mineralogical processes that occur deep within the planetary interiors. Thanks to the discovery of exoplanets, our understanding of planet formation and atmospheric evolution has been advancing by leaps and bounds. In the Planetary Science course, we collaborate with observation teams that explore the population of exoplanets and study their atmospheres, aiming to uncover the origins of both the solar system and exoplanets.

Assoc. Prof. HORI Yasunori

■Research Themes

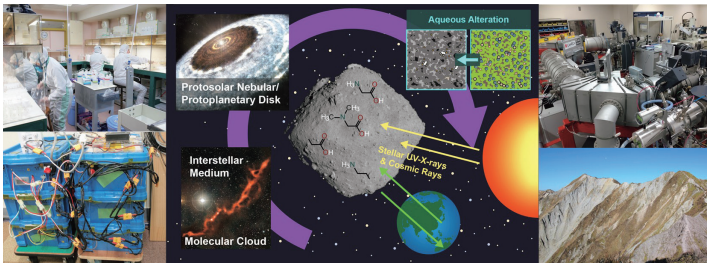
Planet formation/Exoplanets/Planetary atmospheres/Astrobiology

Earth, Environmental and Life Sciences

Course of Planetary Materials Science

Planetary Materials Analytical Chemistry

We are exploring the pathway of material evolution over 13.8 billion years from the birth of the universe to the present through comprehensive materials science with analytical chemistry. Through the analysis of meteorites and extraterrestrial materials by sample returns, in addition to terrestrial volcanic and metamorphic rocks, we are exploring to understand the origin, evolution, and dynamics of materials in space and time, in an attempt to understand the roots of humankind. The exploration of the origin of life using methods that integrate inorganic and organic chemistry will continue to grow in the future.



Prof. MAKISHIMA Akio

■ Research Themes

Silicate planets/Origin of elements origin of life and life-forming materials/Energy storage

Prof. KOBAYASHI Katsura

■ Research Themes

Geochemistry/Petrology/Materials science

Prof. TANAKA Ryoji

■ Research Themes

Geochemistry/Cosmochemistry/Isotope geochemistry/Petrology/Astrobiology

Assoc. Prof. KUNIHIRO Tak

■ Research Themes

Asteroid/The solar nebula

Assoc. Prof. POTISZIL Christian

■ Research Themes

Prebiotic Chemistry/Origin of Life/Organic Matter/Asteroids/Meteorites

Asst. Prof. KITAGAWA Hiroshi

■ Research Themes

Petrology/Geochemistry/Geochronology/Analytical chemistry

Planetary Materials Experimental Physics

Phase relations and melting relations of Earth and planetary materials. Structure, rheology, elastic and electrical properties of Earth's mantle and core materials. Element partitioning between mantle minerals and mantle/core materials. Combine studies of extraterrestrial and terrestrial materials in terms of mineralogy, texture, composition, and spectroscopic properties to interpret the current nature and geological history of other solar system bodies, especially Mars and carbonaceous asteroids.

Prof. YOSHINO Takashi
■Research Themes
Earth and Planetary Material Sciences/ Mineral physics

Prof. YAMAZAKI Daisuke
■Research Themes
High Pressure Earth Science/Mineral Physics

Assoc. Prof. ISHII Takayuki
■Research Themes
Earth and Planetary Material Sciences/ Mineral physics

Assoc. Prof. MORIGUTI Takuya
■Research Themes
Earth and Planetary Material Sciences/ Mineral physics/Magmalogy

Asst. Prof. MASHINO Izumi
■Research Themes
Earth and Planetary Material Sciences/ Mineral physics

Prof. XUE Xianyu
■Research Themes
Mineral physics/Magmalogy/Spectroscopy

Assoc. Prof. YAMASHITA Shigeru
■Research Themes
Petrology/Magmalogy

Planetary Surface Environmental Science

Our research target is planetary surface/near-surface environments to understand the past geological processes and present status in anticipation of future manned missions especially on the Moon and Mars. To achieve this, our division is conducting a wide range of research with various approaches, such as remote sensing data analysis, in-situ geophysical data analysis, numerical simulations, laboratory experiments, and extraterrestrial sample analysis.

Prof. KAMEDA Jun
■Research Themes
Structural geology

Assoc. Prof. RUJ Trishit

Assoc. Prof. IZAWA Matthew Richar
■Research Themes
Astrobiology/Meteorites/ Mars/Asteroids/Remote sensing/Spectroscopy

Earth, Environmental and Life Sciences

Course of
Rural and Environmental Sciences

Applied Ecology

In the last few decades, biodiversity loss has been a big issue all over the world. As you know, human activities are one of the most primary factors, which modify the natural habitats of animal and plant species, cause the decline of their population, and sometimes completely make them extinct. To live as a well-behaved passenger on the future earth, we first need to understand the relationship between biodiversity and human activities. In our laboratory, we study for and actually perform for conservation and appropriate management of biodiversity. And, we believe these should be done based on accurate knowledge about biology, ecology, and environmental science. We are targeting various taxa, such as endangered fishes, invasive crustaceans, and native herbaceous plants.

Prof. NAKATA Kazuyoshi

■Research Themes
Conservation ecology/Ecology and civil engineering/Biological invasion/Aquatic animals/Crustaceans.

Asst. Prof. KATSUHARA Koki

■Research Themes
Plant ecology/Plant-animal interaction/Species coexistence/Asian dayflower/Semi-natural grassland.

Environmental Biogeochemistry

Agriculture is responsible for emissions of greenhouse gases (GHGs) such as carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). Production of these gases in farmland soil results from biological processes like organic matter decomposition, nitrification and denitrification, and highly depends on organic matter inputs. We aim at analyzing the effects of organic matter amendment on GHGs emissions. In particular, we are interested in agricultural soil amended with livestock compost.

Prof. MAEDA Morihiro

■Research Themes
Greenhouse gases/Nitrogen/Phosphorus/Sediment/Soil/Organic waste/Water

Environmental Conservation

In today's global society, where the effects of climate change are becoming increasingly severe, agricultural land, as a production base, is expected to contribute to mitigation and adaptation for climate change through rainwater recharge, organic matter conservation, and greenhouse gas reduction, while producing food in a sustainable and stable manner. Therefore, we are conducting research on management methods of agricultural land through investigation, experimentation, monitoring, and prediction of soil, water, chemicals, and atmospheric environments at multi-layered spatial scales from the earth to the arable land.

Prof. MORI Yasushi

■Research Themes
Soil organic matter/Macropore/Greenhouse gas emission/Infiltration

Water Resources Management

We attempt to solve problems related to water quantity and quality from a plot to watershed scale. Our research focuses on the harmony between the environment and human activities, such as the optimal allocation of water quantity (stabilization of food production) in response to global warming and population growth, and the solution of water environment problems caused by human activities.

Prof. SOMURA Hiroaki

■Research Themes
Irrigation and Drainage/Environmental Meteorology/Soil Hydrology/Watershed Management

Environmental Hydrology

Hydrology is the science which deals with water cycle on global or regional scales through observation of hydrological processes and numerical simulations. To enhance reliability of flood control in river basins, we need hydrological models that can represent the regional hydrological cycle and predict flood discharges accurately. Our laboratory works on developing mathematical models that quantitatively accounts for the water cycle and probability statistical models that express the scale and frequency of hydrological and meteorological phenomena for appropriate water management, disaster prevention and mitigation against floods and impact assessment of climate change on flood/drought damages.

Prof. CHIKAMORI Hidetaka

■Research Themes
Hydrological cycle/Flood/Drought/Disaster Risk Reduction

Assoc. Prof. KUDO Ryoji

■Research Themes
Hydrological cycle/Flood/Drought/Disaster Risk Reduction

Design and Management of Environmental Infrastructures

This laboratory conducts research on the design and maintenance of agricultural irrigation facilities and social infrastructure facilities—such as dams, reservoirs, and irrigation tunnels—through numerical simulations, experiments, and field investigations. For example, efforts are being made to assess the condition of these facilities by understanding their density distribution using "muography," a technique that estimates soil density based on cosmic-ray muons arriving on Earth from space.

Prof. NISHIMURA Shinichi

■Research Themes
Geotechnical engineering/Irrigation and rural engineering

Assoc. Prof. SHIBATA Toshifumi

■Research Themes
Geotechnical engineering/Numerical analysis

Material Cycles and Waste Management

To achieve Sustainable Development Goals, it is indispensable to promote citizens behavior modification and drive social transformation along the lines with 3R hierarchy which means Reduce as the 1st priority followed by Reuse and Recycle. Our laboratory aims to support science-based/data-driven decision making in MSW management planning, establish good practices on 3Rs, and expand their actual practices.

Prof. FUJIWARA Takeshi

■ Research Themes
Environmental System Engineering/ Waste managment

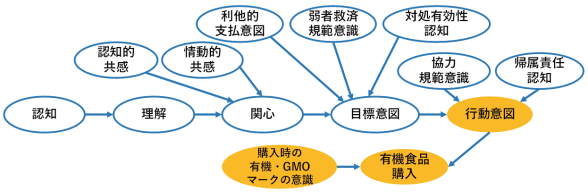
Asst. Prof. HABUER

■ Research Themes
Waste managment/LCA/Material flow analysis/Environmental impact assesment

Science for Sound Material-Cycle

To support rational and effective decision making on municipal solid waste management toward sustainable society, our laboratory aims to accumulate the scientific base by the following research activities:
・Detail survey on municipal solid waste generation, demographics, 3R behavior, pro-environmental attitudes, lifestyle, and household expenditure in Japan and Vietnam
・Exploring influence factors and Bayesian modeling of waste generation and 3R behavior
・Political effect prediction on 3Rs and reliability verification
・Accuracy improvement on sales prediction of food items by Deep Learning toward food loss reduction

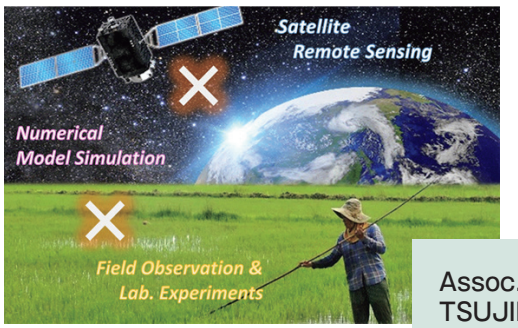
有機食品の購買行動の規定因モデル



Assoc. Prof. MATSUI Yasuhiro

■ Research Themes
Municipal Solid Waste/Food loss from business sectors/Combustion ash from wood biomass/3Rs/Behavior modification/Behavior modeling/Bayesian network/Life Cycle Assessment (LCA)/GIS/Collection and transport

Environmental Data Science



The aim is to contribute to the planning of future predictions and adaptation strategies related to the environment, disaster prevention, climate change, and food production. The research will focus on methods for integrating and socially implementing field surveys and measurements related to soil, water, vegetation, and the atmosphere, as well as remote sensing using artificial satellite observations and numerical simulations.

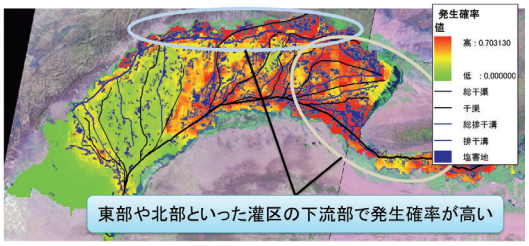
Assoc. Prof. TSUJIMOTO Kumiko

■ Research Themes
Land-atmosphere interaction/Soil moisture/ Micro-wave remote sensing/Climate change impact assessment

Assoc. Prof. FUKUMOTO Yutaka

■ Research Themes
Regional Environmental Engineering / Geotechnical Engineering

Field Data Analysis



We obtain a diverse range of data from fieldwork. For example, they are quantitative data from observations using infrared sensor cameras and qualitative data from interviews to the local residents. In our laboratory, we use geographical information databases to analyse the impact of the environmental issues such as abandonment of farmland and agricultural damage by wildlife. Our laboratory also contributes to build a sustainable society by developing planning methods that include a vision for the future of the local communities based on both quantitative and qualitative data, and by putting these plans into practice.

Prof.
KUKI Yasuaki

■Research Themes

Rural planning/Community planning/Damage by wildlife/Abandoned farmland/Ordinance/Land use

Prof.
MORITA Hidenori

■Research Themes

geospatial Informatics/geoinformatics/ rural planning

Earth, Environmental and Life Sciences

Course of Environmental Ecology

Plant Ecology

The stand structure and dynamics of forests are researched to demonstrate the mechanism of regeneration in forests. The eco-physiological characteristics of invasion, establishment, survival, and growth in relationship to whole-plant water use and matter production of tree species are analyzed to determine the strategies of different species. Based on these research results, an optimal model in the management of forests is constructed for the sustainable conservation of the forests.

Prof. MIKI Naoko

■Research Themes

Plant physiological ecology/ Water use characteristics/ Drought stress

Assoc. Prof. MIYAZAKI Yuko

■Research Themes

Plant reproductive ecology/ Environmental responses/ Forest dynamics

Environmental Soil Science

In order to develop re-vegetation techniques for forests after disturbances such as fires or clear-cutting, we study the change factors that regulate the dynamics of nutrient mineralization, immobilization, and turnover in the soil-plant ecosystems. We also study techniques of utilization and recycling of organic waste as a re-vegetation material.

Prof. SHIMA Kazuto

■Research Themes

Nutrient dynamics in soil-plant ecosystems

Forest Ecology

We conduct research at various scales, from genes to entire ecosystems, with the aim of understanding the structure, function, and dynamics of forest ecosystems that provide a variety of ecosystem services to human society. Special attention is paid to the mechanisms of elemental cycles and the role of organisms in elemental cycles.

Prof. HIROBE Muneto

■Research Themes

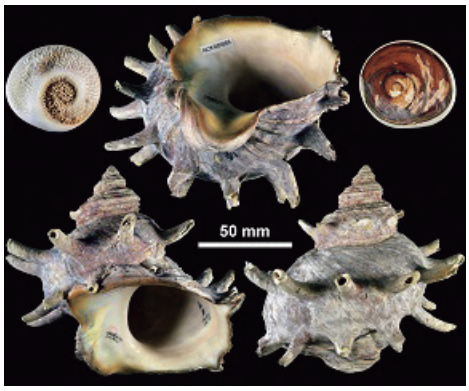
Elemental cycles/Structure, function, and dynamics of forest ecosystems

Prof. HYODO Fujio

■Research Themes

Food web/Isotopes/Feeding habit/Soil ecology

Conservation of Aquatic Biodiversity

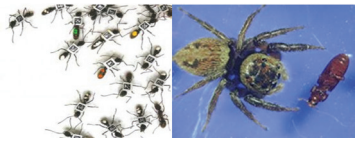


Molluscs including shellfish, snails, slugs and so on are a very diversified animal group and consist of more than 80,000 Recent species in the world, but their taxonomy and recognition of species are still poorly understood. For example, Turbo sazae is one of the most well-known marine snails in Japan since ancient age, but nevertheless the species has long been misidentified with Turbo cornutus, a species endemic to China, until recently and documented to be unnamed in 2017. Another edible species Tegula kusairo exhibited the similar case and it was described as a new species in 2020. Furthermore, many species become extinct or critically endangered by artificial environmental changes before recognizing their presences by human beings. The alpha-taxonomy of this group is thus highly important and an urgent matter in terms of biodiversity conservation.

Assoc. Prof. FUKUDA Hiroshi

■Research Themes
Taxonomy/Systematics/Malacology/Biodiversity/Conservation biology

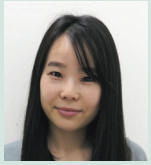
Insect Ecology



We research behavior, ecology and evolution mainly using insects. Research topics are the evolutionary process from the view point of natural selection and/or sexual selection, environmental effects on traits in animals, life-history evolution, and applied entomology in evolutionary biology.

Prof. MIYATAKE Takahisa

■Research Themes
Evolutionary biology/Animal behavior/Entomology/Ethology/Chronobiology/Beetle/Fly/Ant



Asst. Prof. FUJIOKA Haruna

■Research Themes
Evolutionary biology/Animal behavior/Entomology/Ethology/Chronobiology/Beetle/Fly/Ant

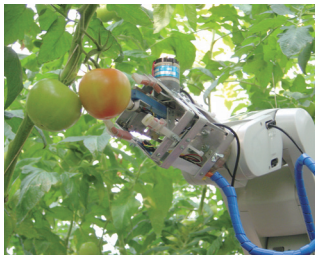
Evolutionary Ecology

Using several insects, we are conducting researches for evolution and ecology. Specifically, we focus on reproductive behavior, learning behavior and life history, and analyze them to clarify their adaptive significance. We are also analyzing the physiological mechanisms gene expression that control these behavioral traits for understanding their proximate factors. In addition, we will apply the experimental results as above to the development of technology for pest control methods and are attempting to expand our research into applied researches.

Assoc. Prof. OKADA Kensuke

■Research Themes
Ecology

Bioproduction Systems Engineering



In our laboratory, we are conducting research on agricultural robots that contribute to automation and labor saving in biological production, plant factories that propose new farming methods in an optimal environment based on biological measurements, and smart agriculture that navigates agriculture based on big data such as farm environment and yields, all based on a systems engineering approach, in preparation for the serious labor shortage and other agricultural problems our country will face in the near future. We are also conducting research on smart agriculture, which navigates agriculture based on big data such as the farm environment and yields.

Prof. MONTA Mitsuji

■Research Themes
Agricultural Engineering/Agricultural Machinery

Assoc. Prof. NAMBA Kazuhiko

■Research Themes
Agricultural Engineering/Agricultural Machinery

Resources Management

The effective and sustainable management method of local resources is studied in a viewpoint of social science.

Assoc. Prof. DATAI Hisashi

■Research Themes
Resource Managements/Agricultural Economics

Food and Environmental Policy

Toward the "Asian Ways" of Sustainable Development: Viewing Our Food and Environment from Social, Political, and Economic Perspectives

Social sciences and humanities (SSH) can contribute to solving food and environmental problems. We are especially employing area studies/political and economic perspectives to broadly re-examine these issues in Asia, such as agriculture, resource industries, environmental policies, community-based development, disaster management, etc. The 21st century is believed to be the Asian century. The future of our world thus largely rests on how Asia commits to sustainability. Based on domestic, foreign, and international research from Asia and other regions, we wish to examine changes in human–nature relationships and the balance between development and the environment.

Prof. UBUKATA Fumikazu

■Research Themes
Development studies/Environmental studies/Policy/Asia/Area studies/Social sciences and Humanities (SSH)

Assoc. Prof. OHNAKA Katsutoshi

■Research Themes
Food security/Development and environment/Policy/Asia/Area studies/Social sciences and Humanities (SSH)

International Rural Studies

Based on field surveys in Asia, we examine relationships between rural development and the environment in contemporary globalized societies. We also explore how we can redirect ourselves toward "sustainable development" from the perspective of local communities.

Prof. KIM Doo-Chul

■Research Themes

Rural Geography/Environmental Geography

Assoc. Prof. HONDA Yasuko

■Research Themes

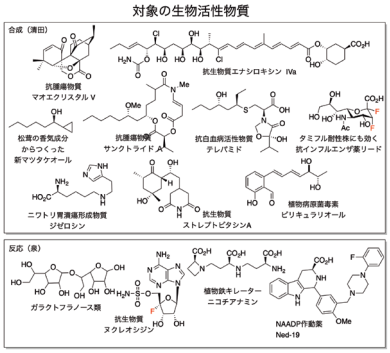
Rural Sociology/Environmental Sociology

Earth, Environmental and Life Sciences

Course of
Agricultural and Biological Chemistry

Applied Natural Product Chemistry

Our research targets are biologically active natural organic compounds. Using synthetic organic chemistry, we aim to elucidate the mechanism of activity expression and structure-activity relationship of physiologically active substances, and to apply them to agricultural chemicals and medicines.

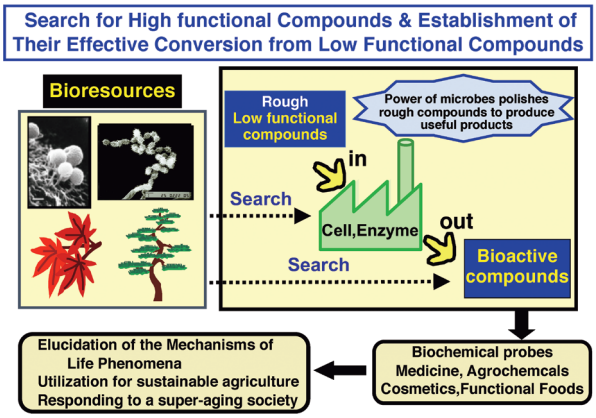


Overview: Synthesis and activity evaluation of natural organic compounds and analogues, Elucidation of biosynthetic pathways of physiologically active substances, Application of biocatalysts (microorganisms and enzymes) to organic synthesis, Development of useful organic reactions
Target: antibiotics, plant pathogenic toxins, plant hormones, anorexia, insect attractants; repellents, aroma substances
Development: anticancer agents, antitumor agents, antiviral agents (influenza, novel coronavirus, HIV), herbicides, antibiotics, insecticides, perfumeries

Prof. KIYOTA Hiromasa
■Research Themes
Organic synthesis/Natural product chemistry/Medicinal chemistry/Pesticide chemistry

Prof. IZUMI Minoru
■Research Themes
Glycotechnology/
Chemical Biology

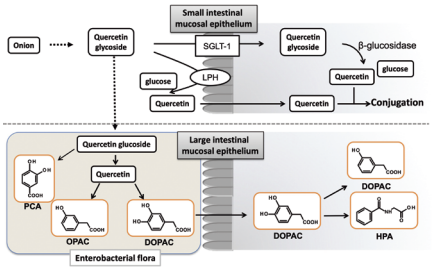
Chemistry of Bioactive Compounds



Search for bioactive organic compounds produced by microorganisms and plants, i.e., highly-functionalized compounds, and study on microbial conversion of these highly-functionalized compounds from low-functional compounds.

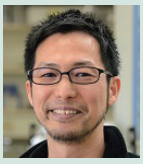
Prof. NITODA Teruhiko
■Research Themes
Applied Microbiology/Natural Products/
Chemistry/Enzyme Chemistry

Food Biochemistry



The values of foods are defined by three categories: nutritional function, sensory function, and health-maintenance function. Our research has been focused on health promotion and disease prevention.

Prof. NAKAMURA Yoshimasa
■Research Themes
Food Chemical Biology (Biological and physiological functions of food phytochemicals)/Functional Mechanism and Bioavailability of Food Factors



Assoc. Prof. NAKAMURA Toshiyuki
■Research Themes
Food Chemical Biology (Biological and physiological functions of food phytochemicals)/Functional Mechanism and Bioavailability of Food Factors

Chemistry of Bio-signalling

In particular, our research focuses on stress signaling regulating stomatal movement. Stomatal pores, which are formed by pairs of guard cells in the epidermis especially of leaves, regulate gas exchange for photosynthesis and transpirational water loss. Guard cells can perceive various stimuli such as light, CO_2, pathogen infection, and various phytohormones such as abscisic acid, then transducing the inputs to a change in stomatal aperture. Using multidisciplinary approaches, we aim to reveal the detailed mechanisms of signaling cascading from stress sensing to stomatal aperture regulation in guard cells. We also study the basic mechanisms of heavy metal and salt stress responses in plants using model plants as well as cultured cells. Our research advance will contribute to develop new technologies that improve crop productivity and safety.

Prof. MURATA Yoshiyuki

■Research Themes

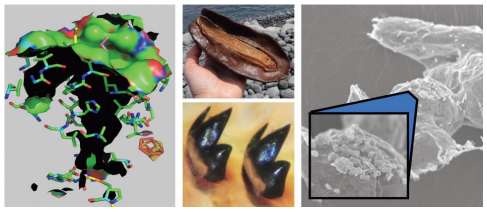
Plant physiology/Molecular biology/ Electrophysiology/Agricultural and biological chemistry

Assoc. Prof. MUNEMASA Shintaro

■Research Themes

Plant physiology/Molecular biology/ Electrophysiology/Agricultural and biological chemistry

Microbiological Chemistry



We are conducting research to elucidate the metabolic functions of microorganisms and others so as to apply them to solving environmental problems and producing useful materials. We are pioneering a new field of bioinorganic chemistry that elucidates the interaction between proteins and minerals at the molecular level, such as microorganisms that breathe iron, marine organisms that produce magnetite, and catalytic mechanisms of metalloenzymes. In our laboratory, we are promoting interdisciplinary education and research that incorporates information systems such as machine learning and computational chemistry into general-purpose experimental methods such as genetic engineering, protein engineering, genome editing, and RNA engineering.

Prof. TAMURA Takashi

■Research Themes

Biofuel hydrogen/ Chemoautotrophic bacteria/Biomineralization

Prof. KANAO Tadayoshi

■Research Themes

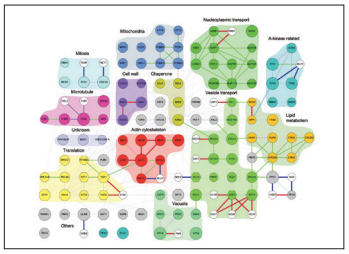
Applied microbiology/ Acidophilic bacteria/ Iron- and sulfur-oxidizing bacteria

Prof. NEMOTO Michiko

■Research Themes

Biomineralization/Omics

Cellular Systems Chemistry



We aim to understand the operating mechanisms of eukaryotic cells by treating them as systems, and to apply this understanding for practical use.

The Moriya group focuses on yeast cells, studying both the detrimental effects and the advantageous outcomes caused by protein overexpression.

The Maeda group focuses on plant glycans, investigating their physiological functions and their impact on the immune system.

Prof. MORIYA Hisao

■Research Themes

Eukaryotes/Systems Biology/ Applied Microbiology

Assoc. Prof. MAEDA Megumi

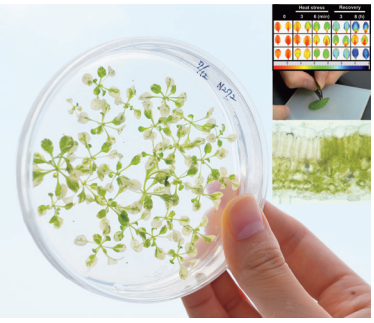
■Research Themes

Eukaryotes/Functional Glycobiochemistry/ Immunology

Earth, Environmental and Life Sciences

Course of Plant Stress Science

Plant Genetics and Physiology



Our life on earth cannot continue without the atmospheric environment, which is maintained by oxygenic photosynthesis. Plants perform photosynthesis in chloroplasts, where light energy is converted into chemical energy by a series of electrochemical reactions. In contrast, land plants are exposed incessantly to excess light energy or harsh atmospheric environments that engender 'photodamage'. How do plants cope with such photosynthetic inactivation? What are the key elements to maintaining or even maximizing chloroplast functions? Our group studies various aspects of chloroplast development and photosynthesis. By understanding the factors involved in photoprotection and chloroplast function, we aim to improve crop productivity against atmospheric stress over the long term.

Prof. SAKAMOTO Wataru

■Research Themes

Chloroplast/Photosynthesis

Assoc. Prof. MATSUSHIMA Ryo

■Research Themes

Amyloplast/Starch biosynthesis

Assoc. Prof. OZAWA Shin-Ichiro

■Research Themes

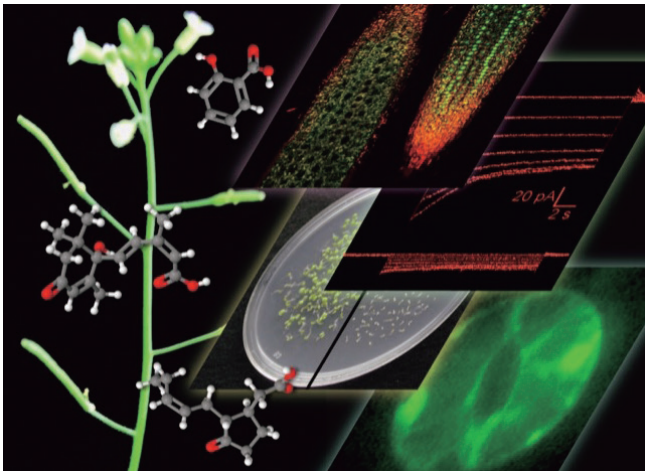
Light-harvesting complex/Protein structural biology

Assoc. Prof. OKEGAWA Yuki

■Research Themes

Photosynthetic electron transport/ Redox regulation

Signaling Mechanisms



Did you know that plants, despite being rooted in one spot, are actually quite adaptable to changes in their environment? It's fascinating to think about how they sense and respond to these changes without having a nervous system or brain like animals do. This is a question that scientists are still trying to answer. Our research group is specifically investigating how plants integrate and analyze environmental information, even at the tissue level, to determine the best response as individuals. We're focusing on plant hormone responses and chromatin regulation, using techniques like physiological and molecular biology, as well as molecular genetics. Our ultimate goal is to apply this knowledge to develop stress-tolerant crops that can thrive even in challenging conditions. By understanding how plants handle environmental stress, we can help create a more sustainable and resilient food supply for the future.

Prof. HIRAYAMA Takashi

■Research Themes

Environmental response mechanism of plants/ Plant molecular genetics/Model plants/Epigenetics/Stomatal movement/Integration of environmental stimuli in plants

Assoc. Prof. MORI Izumi

■Research Themes

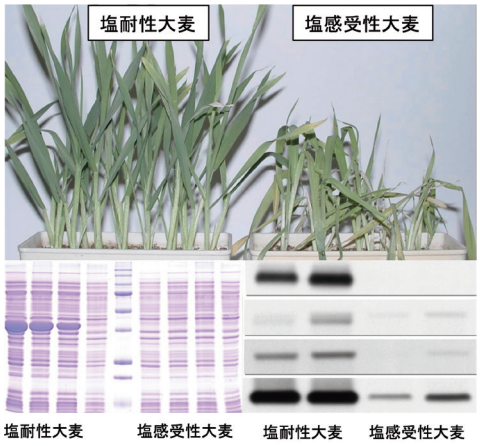
Environmental response mechanism of plants/ Plant molecular genetics/Model plants/Epigenetics/Stomatal movement/Integration of environmental stimuli in plants

Assoc. Prof. IKEDA Yoko

■Research Themes

Environmental response mechanism of plants/ Plant molecular genetics/Model plants/Epigenetics/Stomatal movement/Integration of environmental stimuli in plants

Plant Cytomolecular Biochemistry



Plants are sensitive to various environmental stimuli. They respond to physical, chemical, and biological stress factors. Consequently, plants can undergo changes in their development, morphology, and physiology during their life cycle. We have used biochemical and molecular biological techniques to elucidate the functions of enzymes, proteins, and gene regulating factors, which are all related to stress tolerance mechanisms of plant cells under environmental stress conditions. Through our research, we aim at developing plants that can adapt well to adverse and extreme environments to resolve difficulties such as food shortages and environmental degradation.

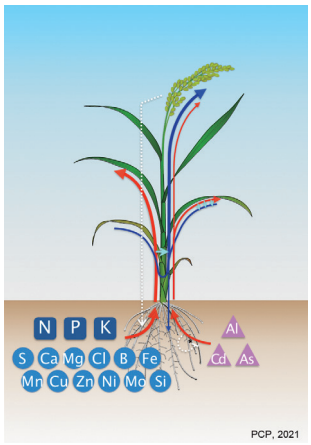
Assoc. Prof.
SUGIMOTO Manabu

■Research Themes
Environental Stress Biochemistry

Asst. Prof.
RIKIISHI Kazuhide

■Research Themes
Plant Molecular Genetics

Plant Stress Responses



Since plants cannot move, they must cope with various environmental stresses. In our group, we are focusing on "mineral stress" including deficiency of essential nutrients or excess of toxic and essential elements. We are working on the identification of transporters involved in the uptake, root-to-shoot translocation, and distribution/redistribution of different mineral elements mainly in rice, and on the regulatory mechanisms of these transporters in response to environmental changes. Our goal is to improve the productivity and safety of crops through the manipulation of transporters.

Prof.
MA Jian Feng

■Research Themes
Plant stress/Mineral transport/Transporters

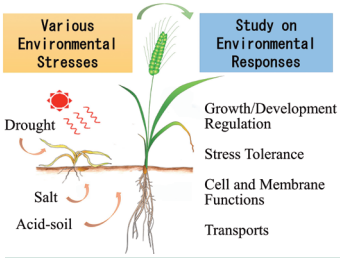
Assoc. Prof.
YAMAJI Naoki

■Research Themes
Plant stress/Mineral transport/Transporters

Assoc. Prof.
MITANI Namiki

■Research Themes
Plant stress/Mineral transport/Transporters

Plant Molecular Physiology



Our research has been focusing on the molecular, cellular, and physiological response and adaptation mechanisms of plants under environmental stresses. We report ion conduction in the plasma membrane and water conducting aquaporins in the tonoplast. We also report the relationship of transport function and structure regarding guard-cell-type ALMT family malate transporters.

Prof.
KATSUHARA Maki

■Research Themes
Ion transport/Water transport/Root/Salt stress

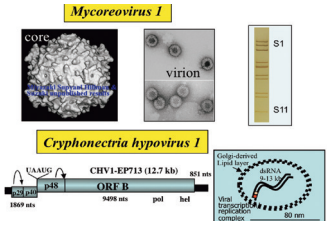
Assoc. Prof.
SASAKI Takayuki

■Research Themes
Acid-soil stress/Aluminum tolerance/Malate transporter/Stomatal closure

Asst. Prof.
UTSUGI Shigeko

■Research Themes
Drought stress/Aquaporin /Water transport/Seed

Molecular Virology



Plant growth is influenced by various microorganisms including both beneficial and harmful ones. Among them are plant-infecting viruses that cause serious damage to crops and mycoviruses infecting phytopathogenic fungi that serve as biocontrol (virocontrol agents). Also, an increasing number of bacteria and fungi mutualistic to plants that enhance plant growth and stress tolerance. This group is mainly engaged in the three projects below.

Assoc. Prof. KONDO Hideki

■Research Themes

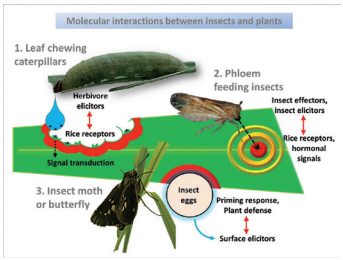
Virus/Phytopathogenic fungi/Plant Disease/Plant-Microbe Interactions/ Plant Pathology/Biological Control

Assoc. Prof. HYODO Kiwamu

■Research Themes

Virus/Phytopathogenic fungi/Plant Disease/Plant-Microbe Interactions/ Plant Pathology/Biological Control

Plant-Insect Interactions



Establishment of effective plant defense systems against herbivores in natural history reflects the existence of extremely variable interactions between plants and insects, also known as co-evolution process. Our group strives to understand, at a molecular level, the mechanisms of activation, signal transduction and metabolic basics of plant defenses triggered after the recognition of insect attack. Furthermore, we target sustainable pest control by the use of natural enemies and their attraction to herbivore-infested plants by the emissions of various volatile organic compounds (VOCs) from plants.

Prof. GALIS Ivan

■Research Themes

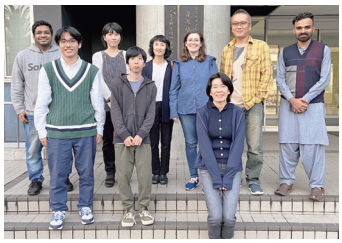
Plant-insect interactions/Plant defense mechanisms/Chemical ecology/Herbivore

Assoc. Prof. SHINYA Tomonori

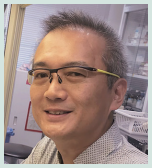
■Research Themes

Plant-insect interactions/Plant immunity/ Biofunctional molecules

Plant-Environmental Microbiology



By understanding the ecology of Methylobacterium species, which utilize methanol released by plants and dominate on leaves, we will apply their function as growth-promoting bacteria to agriculture. We are also analyzing the rhizosphere microbial community structure in crop ecosystems. On the other hand, we are trying to uncover the mechanism of growth and mortality of bloom-forming phytoplankton, which cause damage to fisheries, by focusing on symbiotic bacteria.



Assoc. Prof. TANI Akio

■Research Themes

Plant growth promoting bacteria/ Methylotrophs/Lanthanides

Assoc. Prof. UEKI Shoko

■Research Themes

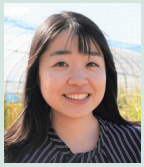
Bloom-forming phytoplankton/Marine bacteria

Plant-Pathogen Interactions

Rice is the world's most important crop, and improving rice is an important research challenge. Our ultimate goal is to design new rice varieties that exhibit resilience against abiotic stresses while augmenting essential agronomic traits. To achieve this ambitious goal, we investigate immunoreceptors and the small G protein OsRac1, both of which play pivotal roles in rice immunity. We firmly believe that we can successfully engineer a robust rice immune system by acquiring a comprehensive understanding of the functions performed by immunoreceptors and OsRac1.

Prof.
KAWANO Youji

■Research Themes
Rice/Immunity/NLR

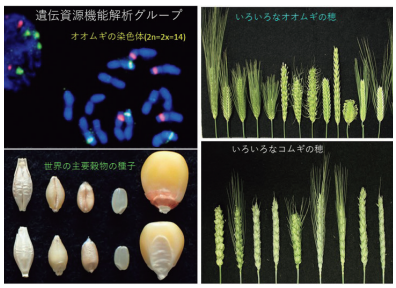


Asst. Prof.
FUKADA Fumi

■Research Themes
Plant pathology, Plant-microbe interaction

Plant Functional Genomics

Barley, the fourth most important cereal crop in the world, typically has seeds with adhered hulls. This hulled seed trait is suitable for breweries. Some naked seed mutants with easily separable hulls were generated through spontaneous mutation. They are suitable for food usage. We have revealed that barley awns and spike hulls are photosynthetically active. Our current research specifically examines molecular identification and characterization of beneficial genes controlling (1) seed morphology and quality, including water soluble healthy dietary fiber, and (2) photosynthetic contribution of awns and hulls by using mutants. We seek application of our basic findings to practical breeding.



Prof. TAKETA Shin

■Research Themes
Barley/Seed/Gene hunting/Plant molecular genetics/Plant physiology

Asst. Prof. Dr.
YAMASHITA Jun

■Research Themes
Wild plant/Database/Evolution/Adaptation/Resources

Plant Diversity Analysis

We conserve and evaluate barley genetic resources (varieties and lines) collected from all over the world. These genetic resources vary in characteristics depending on the location of collection and purpose of use, for example, there are regional differences in vernalization requirements (the degree of low-temperature exposure required for flowering). Based on our evaluation of genetic resources, we carry out genetic analysis, gene isolation, and functional analysis of stress tolerance, such as grain dormancy and disease resistance, for application use.

Prof. HISANO Hiroshi

■Research Themes
Plant molecular breeding/Plant genetic resources/Barley

Assoc. Prof. SAISHO Daisuke

■Research Themes
Plant breeding/Plant Molecular genetics/Population genetics/Barley

Integrated Genomic Breeding

Rice is cultivated globally and exhibits a wide range of phenotypic variations resulting from genetic diversity. These variations serve as valuable genetic resources for enhancing rice plants to meet human needs. Although many of these traits are governed by numerous genes, the genetic foundations and biological functions of the majority remain largely unknown, hindering their practical application. To address this, we leverage useful phenotypic variations from diverse rice germplasms and identify the underlying genes by combining recent advancements in genomics and bioinformatics. Our efforts are focused on developing new breeding materials and proposing more effective breeding methodologies.

Prof.
YAMAMOTO Toshio

■Research Themes
Crop breeding/Genome/
Polyploidy

Assoc. Prof.
NAGAKI Kiyotaka

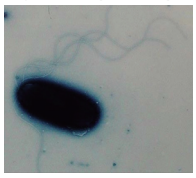
■Research Themes
Genome/Chromosome/
Haploid

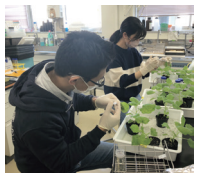
Assoc. Prof.
FURUTA Tomoyuki

■Research Themes
Crop breeding/
Wild species/Bioinformatics

Genetic Engineering

Understanding the pathogenicity of plant pathogens and elucidating plant defense mechanisms against plant pathogens is essential for plant disease control. Our research is focused on elucidating the pathogenicity of plant pathogens and plant resistance mechanisms at the genetic level using molecular genetic methods, with a view to their application in disease control.



Prof. ICHINOSE Yuki

■Research Themes

Pathogenicity of phytopathogenic bacteria/Virulence factor

Assoc. Prof. MATSUI Hidenori

■Research Themes

Pathogenicity of phytopathogenic bacteria/Virulence factor

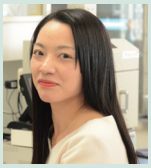
Asst. Prof. SAKATA Nanami

■Research Themes

Pathogenicity of phytopathogenic bacteria/Virulence factor

Plant Genome Dynamics Analysis

Our laboratory conducts genetic and breeding research on sweetpotato. Using a Next Generation Sequencer (hereinafter referred to as NGS) that outputs a huge amount of DNA sequence data, we are working on the development of DNA markers and gene identification related to important agricultural traits such as disease and pest resistance and yield. We are also conducting gene expression analysis (Iso-Seq, RNA-seq analysis, etc.) to elucidate the mechanism of disease resistance, and also developing novel genotyping systems applicable to polyplpoid crop species.

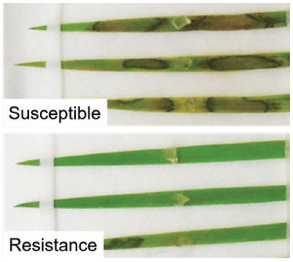



Prof. MONDEN Yuki

■Research Themes

Sweetpotato/Plant breeding and genetics/Genetic analysis/NGS/Poyploid/Cultivar discrimination/DNA marker

Plant Pathology



The Food and Agriculture Organization (FAO) reports that over 850 million people face insufficient access to food, and an estimated 24,000 people succumb to hunger daily. Given that plant diseases cause annual yield losses of up to 20% in food and cash crops, continuous improvement and advancement of pest management systems is essential to sustainably feed a growing world population. To achieve this goal, we focus on elucidating the molecular mechanisms that govern plant immunity and pathogen virulence, and on innovating new technologies to control plant diseases.

Prof. TOYODA Kazuhiro

■Research Themes

Plant pathology/Molecular plant pathology/Plant-microbe interactions

Prof. NOUTOSHI Yoshiteru

■Research Themes

Plant pathology/Plant immunity/Plant chemical biology/Infection strategy of filamentous plant pathogen/Plant defense activators/Biocontrol

Plant Genetics and Breeding

Molecular genetic study on diversity of crops and their wild relatives and its application to breeding

Prof. Dr. NISHIDA Hidetaka

■Research Themes

Plant breeding

Studies on genetic diversity and agronomic traits in crop genetic resources including wheat, and development of DNA markers available for marker-assisted selection

Asst. Prof. Dr. NISHIMURA Kazusa

■Research Themes

Plant breeding

Identification of useful genes in crops, especially wheat and barley.

Development of rapid genotyping methods, and cultivar identification methods.

Postharvest Physiology

We focus on a molecular understanding of fruit ripening and senescence using the omics approach, gene engineering and genetic analysis in fruit, vegetables and flowers. Based on the basic understanding, we develop functional technology to improve quality and to reduce postharvest loss of horticultural crops, which are useful in both developed and developing countries.

Prof. USHIJIMA Koichiro

■Research Themes

Molecular Physiology/Plant Genetics

Plant Production Science




過繁茂する雑草の防除

Development and systematization of production technology for crop cultivation based on improvement of productivity and environment conservation

Assoc. Prof. TANAKA Yu

■Research Themes
Crop Science

Assoc. Prof.
NAKASHIMA Yoshitaka

■Research Themes
Weed Science Establishment of an appropriate management system for weed vegetation and its effective use for environmental protection

Pomology

Okayama prefecture, known as a "Fruit Kingdom", is famous for the production of high-quality fruit, mainly peaches and grapes. One of the aims of our laboratory is to establish new resolution and cultivation methods to improve the productivity and quality of peaches and grapes. We also attempt to elucidate the physiological and genetic mechanisms regulating important agronomic traits, such as fruit development, ripening, texture, and inner disorder, by combining field-based experiments and molecular biological approaches.

Prof.
FUKUDA Fumio

■Research Themes
Peach/Grape/Fruit development/Fruit ripening/Fruit quality/Inner disorder/Nondestructive evaluation/Postharvest storage/Cultivation method/Eye tracking/Smart agriculture

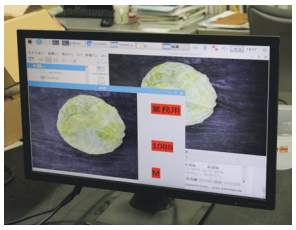
Assoc. Prof.
HIRANO Ken

■Research Themes
Grape/Fruit development/Fruit ripening/Fruit quality/Seedlessness/Parthenocarpy/Plant growth regulator/Aroma component

Assoc. Prof.
KAWAI Takashi

■Research Themes
Peach/Fruit development/Fruit ripening/Fruit quality/Inner disorder/Nondestructive evaluation/Postharvest storage/Softening trait/Genetic analysis/3D point cloud analysis

Vegetable Crop Science



Investigation of physiological characteristics related to vegetable production and development of production systems

We are conducting research on vegetable production, such as tomatoes and strawberries, from the perspective of how the growing environment affects crop quality, yield and other agricultural traits. Recently, we especially focus on efficient environmental control in greenhouse cultivation and pollination control in strawberry production.

Another research theme is the use of the flowering hormone (florigen) in vegetable production and breeding. We are conducting basic research and developing technologies to efficiently deliver florigen using grafting for cruciferous vegetables such as cabbage and radish.

We are also carrying out various other studies on vegetables, such as the evaluation of quality characteristics of traditional vegetables, the development of efficient watering technology in cucumber cultivation, and the development of vapor pressure deficit (VPD) control methods in the cultivation of melons and eggplants.

Prof. YASUBA Ken-ichiro

■Research Themes
Vegetable crop science/Agricultural information science

Asst. Prof. MOTOKI Ko

■Research Themes
Vegetable crop science

Control of Flowering

Our research includes breeding, flowering regulation, cultivation, and post-harvest utilization techniques based on the physiology of flowers and vegetables. Future agriculture must be friendly to plants, people, and the environment. We contribute to future agriculture by developing rational and simple environmental control, fertilization, and irrigation technologies.

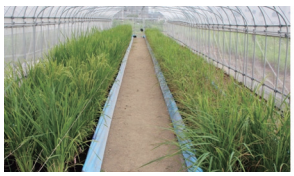
Prof. GOTO Tanjuro

■Research Themes
Root restriction/High temperature/Physiological disorder/Flowering control

Assoc. Prof. ENDO Minori

■Research Themes
Vegetable horticulture/Strawberry/Asparagus

Crop Science



Environmental destruction is progressing now at an unprecedented scale, in the form of global warming and accompanying desertification, salt accumulation in soil, depletion of water resources, and so on. On the other hand, the human population continues to increase, and there is strong demand for expansion of food production. Therefore, in addition to improving the grain yield in arable land suitable for cultivation, production of agricultural crops is necessary even in inadequate lands affected by water shortage, salt accumulation etc. In this field we conduct physiological and ecological research and education concerning various crops for the purpose of improving crop production under defective environmental conditions.

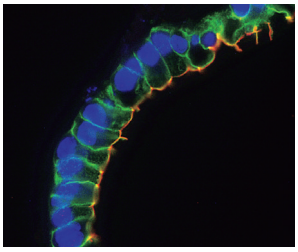
Prof. HIRAI Yoshihiko

■Research Themes
Rice/Salt tolerance/Grain yield

Asst. Prof. TOMITA Asami

■Research Themes
Rice/Breeding/Abiotic stress tolerance

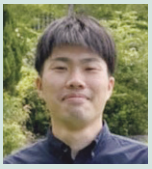
Reproductive Physiology



We investigate the reproductive mechanisms of mammals, particularly the functions of the ovary, oviduct, and uterus, aiming contribution to the efficient production of livestock animals and human reproductive medicine.

Prof. KIMURA Koji

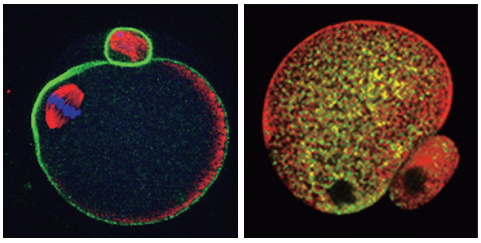
■Research Themes
Reproductive Physiology/Endocrinology/ Cell Physiolo



Asst. Prof. KAWANO Kohei

■Research Themes
Reproductive Physiology/Endocrinology/ Cell Physiolo

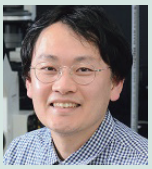
Animal Development and Reproductive Biotechnology



We are developing new more effective IVF systems and micromanipulation techniques for gametes in mammals including humans. Through these technological developments, we are also undertaking basic studies to make clear the systems of gamete (oocytes and spermatozoa) formation, fertilization and early development, as well as applied studies to improve the efficiency in the production of more value-added useful animals. The details are as follows.

Prof. FUNAHASHI Hiroaki

■Research Themes
Reproductive biology/Oocyte maturation/Sperm capacitation/In vitro embryo production/Mitochondrial quality control

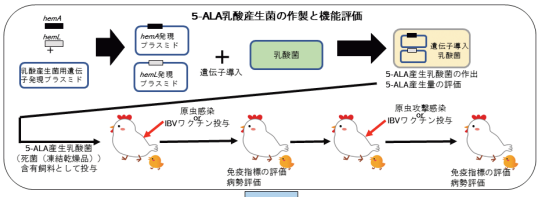


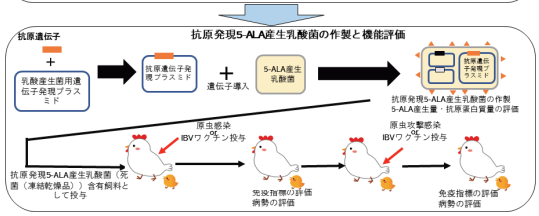
Assoc. Prof. WAKAI Takuya

■Research Themes
Reproductive biology/Oocyte maturation/Sperm capacitation/In vitro embryo production/Mitochondrial quality control

Animal Physiology

To obtain the knowledge for homeostasis system by elucidating pathogenesis and immune system using chicken and parasite as an experimental model. Also, exploration of beneficial microorganisms, feed crops, nutrients etc. that have protective effects against infectious diseases or effects of symptom alleviation, and vaccine development for livestock.



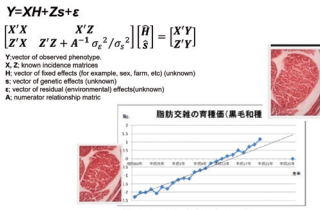


Prof. HATABU Toshimitsu

■Research Themes
Host-Parasite relationship/Probiotics/Avian coccidiosis/Vaccine development

Animal Breeding and Genetics

The aim of animal breeding and genetics is to investigate invisible genetic events using statistical and molecular genetics analysis. In particular, we are interested in genetic evaluation using genomic information and the genetic diversity in the animal population. Through our research activity, young scientists are encouraged to acquire the necessary knowledge and techniques to pursue scientific careers in quantitative genetics in the post-genome era. Additionally, we are studying the effects of pre-slaughter fasting stress on meat quality and skeletal muscle protein degradation. By accurately estimating the genetic traits of animals and elucidating the mechanisms by which stress impacts productivity, we strive to optimize animal production systems..



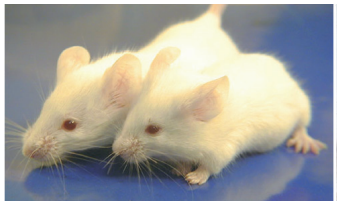
Assoc. Prof. IBI Takayuki

■Research Themes
Animal Breeding

Asst. Prof. KATSUMATA Sachi

■Research Themes
Animal Nutrition and Physiology

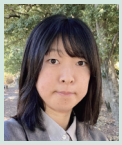
Applied Animal Genetics



Our lab investigates the genetic factors underlying human and animal diseases by analyzing genes responsible for hereditary diseases in experimental animals and livestock. We mainly focus on the functions of genes involved in reproductive function and bone growth by utilizing mutant mice and genetically modified mice/rats through genome editing. For industrial animals, we explore favorable and unfavorable genetic variants and evaluate genetic diversity from genome sequences, with the aim of utilizing these genetic characteristics.

Prof. TSUJI Takehito

■Research Themes
Animal genetics/Genome/Genetic disease/Mouse/Cattle



Asst. Prof. NAGAE Mayuko

■Research Themes
Reproductive biology/Reproductive endocrinology/Developmental engineering/Animal genetics/Genetic diseases/Mouse/Rat

Animal Nutritio and Feed Science

Nutrition is the study of a series of biological processes necessary for life. The goal of nutrition study is to improve human health and quality of life. Animal nutrition is a field that has been expanded to include animals. In our laboratory, we are doing research using a variety of animals, i.e., model animals, food-producing animals (livestock), wild animals, and companion animals. The research using model animals aims to clarify biochemical and physiological mechanisms associated with nutrition and metabolism. The members working on the projects use model animals and cultured cells for functional analyses of food. Several students work on food processing and its control. They are examining the characteristics of microorganisms involved in fermentation to improve the safety and value of food and feed. Our goal is to solve problems in the industries, clarify the functions of food and feed, and achieve technological innovation related to nutrition, metabolism, and health.

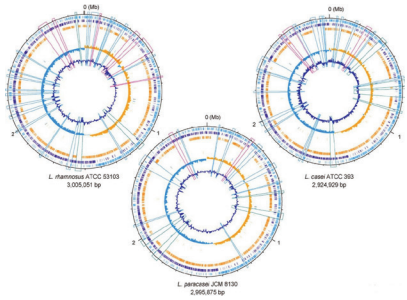
Prof. NISHINO Naoki

■Research Themes
Nutrition/food/Hygiene/management/Farm animal/Wild animal/Companion animal

Assoc. Prof. TSURUTA Takeshi

■Research Themes
Food Immunology/Functional Food Science

Animal Applied Microbiology

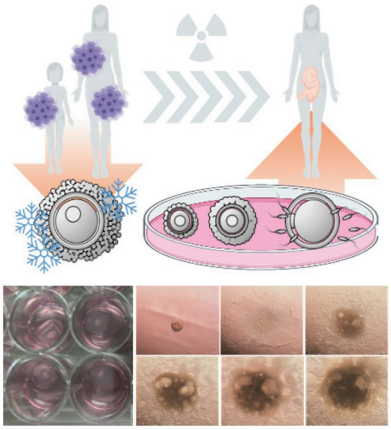


It has become clear that gut microbiota (microflora) changes depending on the food components ingested by humans and their lifestyle, and that differences and changes in the microflora affect human health and disease. Morita group analyzes the gut microbiota of humans and animals, and tries elucidating the functions of the microbiota.
In Arakawa group, roles and application of beneficial microorganisms, mainly lactic acid bacteria, for processing and preservation of milk and egg products are researched. In particular, it is aimed to create novel safe and high quality milk and egg products using functional substances from and fermentation techniques with lactic acid bacteria.
In addition, both groups also carry out whole-genome analysis of intestinal bacteria, bifidobacteria and lactic acid bacteria radically to understand them.

Assoc. Prof. ARAKAWA Kensuke

■Research Themes
Milk and egg science/Lactic acid bacteria/
Food microbiology

Assisted Reproductive Technology



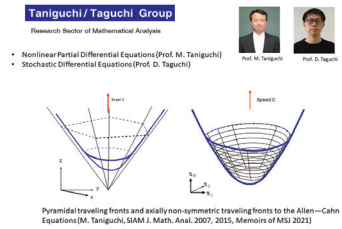
Our laboratory aims to develop safer and more reliable assisted reproductive technologies by analyzing in detail the effects of the environment surrounding oocytes, sperm, and embryos. We are engaged in research on cryopreservation of gametes and embryos for the purpose of fertility preservation (ability to conceive) due to cancer treatment, etc., and in vitro culture of ovarian tissue and oocytes. We are committed to conducting research to contribute not only to the medical field but also to animal production and species conservation.

Asst. Prof. TASAKI Hidetaka

■Research Themes
Reproductive Medicine/Oocyte/Ovary/
Fertility Preservation

Interdisciplinary Science

Mathematical Analysis



Research Area “Mathematical Analysis” is devoted to theory on partial differential equations, theory of probability, functional analysis, dynamical systems and statistics.
For theory on partial differential equations, we study multi-dimensional traveling fronts appearing in reaction-diffusion models in physics, chemistry and biology. For theory of probability, we study stochastic partial differential equations and their discrete models.

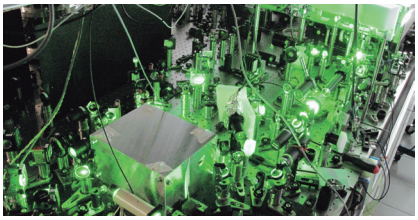
Prof. TANIGUCHI Masaharu

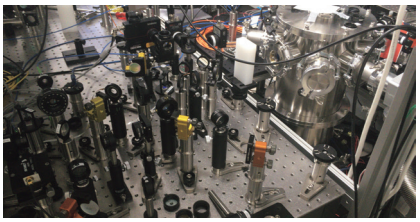
■Research Themes
Partial differential equations/Theory of probability/Functional analysis/ Dynamical systems/Statistics

Assoc. Prof. KAWAMOTO Masaki

■Research Themes
Partial Differential Equations/Quantum Mechanics/ Nonlinear Analysis

Extreme Quantum Physics





We are creating new research fields, e.g. innovative quantum optics using the nucleus, and a coherent quantum beam based on a novel principle and so on, aiming at future development of both fundamental and applied science.

Prof. YOSHIMURA Koji

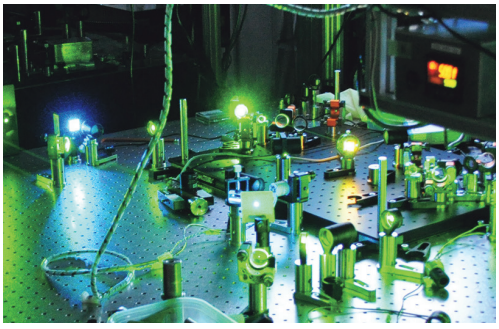
■Research Themes
Nuclear physics/Low-energy particle physics/ Atomic physics

Assoc. Prof. YOSHIMI Akihiro

■Research Themes
Nuclear physics/ Low-energy particle physics/ Atomic physics

Physics of Quantum Universe

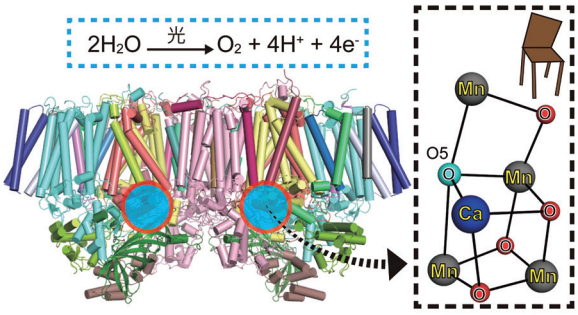
Based on knowledge and techniques developed in various fields of physics, such as particle-nuclear physics, astrophysics, and atomic, molecular, optical physics, experimental research leading to the construction of physics models beyond the new laws of fundamental physics: the particle standard theory. We are mainly carrying out table-top experiments that do not use high-energy accelerators. We have developed various key technologies such as high-performance lasers, high-performance detectors, targets with high quantum coherence, and molecular cooling techniques, and are conducting research using experimental apparatuses that are unique in the world.



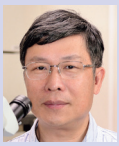
Assoc. Prof. UETAKE Satoshi

■Research Themes
Atomic physics/Quantum optics/Particle physics

Structural Biology



Proteins are responsible for all life phenomena. We study protein structures using cryo-electron microscopy and synchrotron radiation X-rays to understand protein function better. The knowledge gained will help us to understand protein functions profoundly and to create new catalysts and technologies.



Prof. SHEN Jian-Ren

■Research Themes

Photosynthesis/Membrane proteins/Plant mineral transporter/Structural biology

Prof. SUGA Michihiro

■Research Themes

Photosynthesis/Membrane proteins/Plant mineral transporter/Structural biology

Assoc. Prof. AKITA Fusamichi

■Research Themes

Photosynthesis/Membrane proteins/Plant mineral transporter/Structural biology

Asst. Prof. NAKAJIMA Yoshiki

■Research Themes

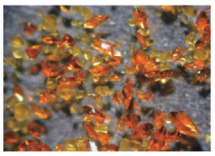
Photosynthesis/Membrane proteins/Plant mineral transporter/Structural biology

Asst. Prof. SAITOH Yasunori

■Research Themes

Photosynthesis/Membrane proteins/Plant mineral transporter/Structural biology

Coordination Chemistry



***Total* and *Absolute* Spontaneous Resolution**

In our research group, we are studying on the synthesis of novel transition metal and lanthanoid complexes with unique molecular and crystal structures, which are expected to exhibit useful magnetic and optical properties and highly selective reactivity. In particular, we are challenging to synthesize manganese model clusters for the oxygen-evolving center in photosystem-II, metal complexes that exhibit stimuli-responsible spin-crossover or chromotropic behavior, and to elucidate the mechanism of absolute spontaneous resolution, which selectively generates optically active compounds from non-chiral sources.

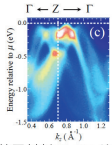
Prof. SUZUKI Takayoshi

■Research Themes

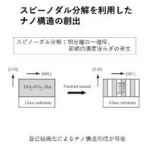
Oxygen-Evolving Catalyst/ Polynuclear Complexes/ Spontaneous Resolution/ Chirality

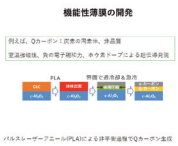
Physics of Solid Surfaces and Interfaces

ARPES装置



熱電材料のバンド構造





Functionalities of solid materials are studied from the viewpoint of electronic states. Experimental studies of electronic states lead to elucidating the origin and/or mechanism of the functionalities and also give the strategy to improve the functionalities in materials. Advanced electron spectroscopy techniques are employed to conduct the research for electronic states in materials in detail. Researches of self-organized nanostructured thin films and development of new thin films with functionalities such as superconductivity and metal-insulator transition are performed. The physical properties of the films are investigated from the viewpoint of electronic states.

Prof. YOKOYA Takayoshi

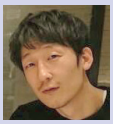
■ Research Themes

Electronic states/photoemission spectroscopy/ Elucidation of the mechanism of functionality

Assoc. Prof. MURAOKA Yuji

■ Research Themes

Thin films/Surface/Interface

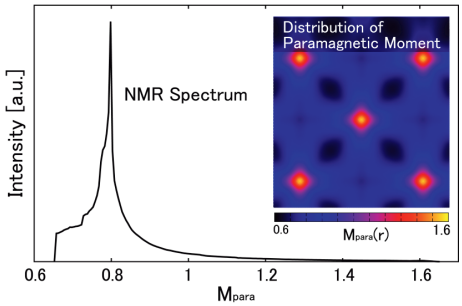


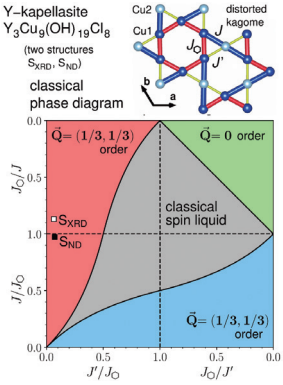
Assoc. Prof. OOTSUKI Daiki

■ Research Themes

Electronic Structure/Photoemission Spectroscopy/ Strongly Correlated Electron Systems/Functional Materials

Quantum Many-Body Physics





We are interested in modern problems of solid state theory and computational materials science. We focus on connecting the microscopic structure of materials to experimental measurements. The objective is to understand complex properties like magnetism and superconductivity and to discover and design new materials. Our method development aims at more precise and realistic description of materials and at making more physical quantities accessible by increasing computational efficiency.

Prof. ICHIOKA Masanori

■ Research Themes

Magnetism/Superconductivity/Solid state physics/Computational physics

Assoc. Prof. ADACHI Hiroto

■ Research Themes

Magnetism/Superconductivity/Solid state physics/Computational physics

Prof. JESCHKE Harald Olaf

■ Research Themes

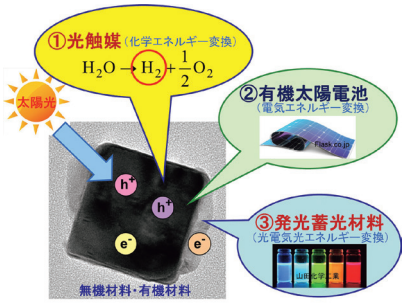
Magnetism/Superconductivity/Solid state physics/Computational physics

Assoc. Prof. OTSUKI Junya

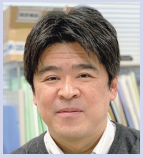
■ Research Themes

Magnetism/Superconductivity/Solid state physics/Computational physics

Surface Physical Chemistry



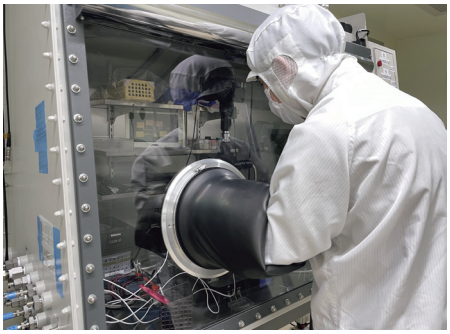
Photocatalysts have attracted considerable attention due to their potential applications for water-splitting to generate hydrogen gas by using solar energy. As H2 is clean and free from CO2 emissions, photocatalysts are expected to address many problems such as the energy crisis, environmental pollution, and global warming. However, the efficiency of photocatalysis is still not sufficient for industrial use; hence, further activity enhancement is required. The efficiency of photocatalysis is determined by the competition between electron-hole pair recombination and the rate of charge transfer to the reactant molecules. Therefore, we are studying the behaviors of photogenerated charge carriers to elucidate the mechanism. These researches should shed light on the development of highly efficient solar light driven water splitting photocatalysts.



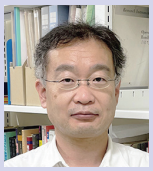
Prof. YAMAKATA Akira

■Research Themes
Photocatalysis/Solar cells/
Ultrafast laser spectroscopy/
Reaction dynamics

Quantum Physics in Condensed Matter



The objective of our group is to study new functional materials and devices through chemical and physical approaches. Main research subjects are to develop superconductors with high transition temperature and novel physical properties, and to exploit new functional devices made of organic molecules, two-dimensional layered materials, and topological materials.

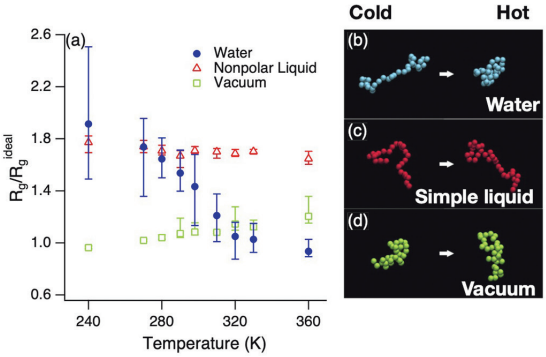


Assoc. Prof. GOTO Hidenori

■Research Themes
Solid-state chemistry/Superconductor/
Two-dimensional layered material/
Organic FET

Theoretical Physical Chemistry

By using theoretical approaches such as statistical mechanics, thermodynamics, and molecular simulation, we are tackling a wide range of research issues related to liquids, solutions, interfaces, phase transitions, polymers, proteins, viruses, and cells. The latest research topics include solute size dependence of hydrophobic interactions, solubility of solutes, effective interactions, ion-specific effects on phase separation, structure of interfaces near the triple critical point of three-phase equilibrium systems, structural stability of proteins, co-solvent effects on proteins, and design principle of biological molecular motors and their efficiency of the free energy transduction, etc.

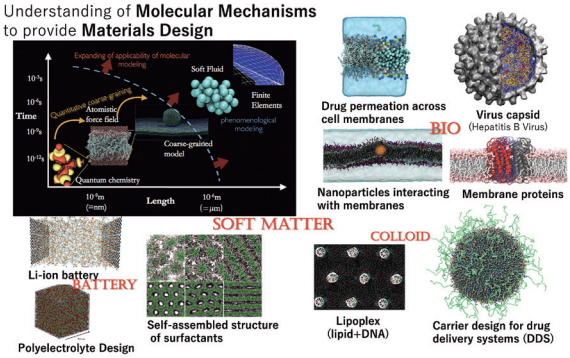


Prof. KOGA Kenichiro

■Research Themes
Interface/Nano-confined system/
Wetting transition/Phase transition/
Solvent-induced interaction/
Hydrophobic interaction/Aqueous
solution/Ion-specific effect

Theoretical and Computational Chemistry

We use molecular simulation techniques to understand and predict various functions of molecules and molecular assemblies such as lipid membranes, aiming to inform the design of new materials. In order to tackle technical issues in bio- and soft-materials, we utilize multiscale molecular modeling, ranging from sub-atomic scales of quantum mechanics, to the coarse-grained molecular level, reaching to the micron scale. By developing these simulation techniques and applying them to contemporary problems, we expand the frontiers of molecular simulations.

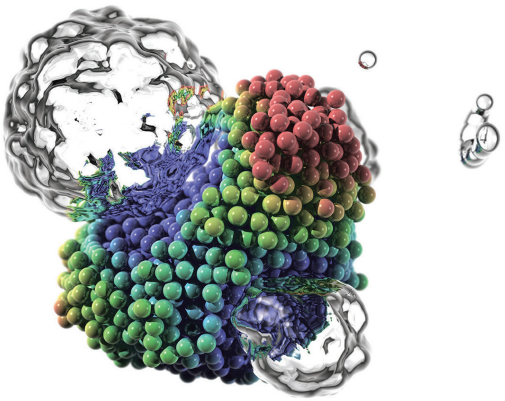


Prof. SHINODA Wataru

■Research Themes

Computational chemistry/Molecular simulation/Biomembranes/Lipid membranes/Biomolecular self-assembly/Soft materials

Theoretical Chemistry



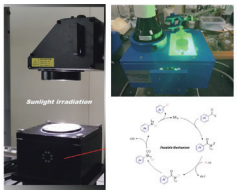
We use computer simulations and statistical mechanics theory to explore the unusual properties of water and ice.

Assoc. Prof. MATSUMOTO Masakazu

■Research Themes

Theoretical chemistry/Molecular dynamics/Science of water and ice

Functional Organic Chemistry



By utilizing transition metal catalysts, we can develop organometallic reagents and complexes that exhibit reactivities and selectivities distinct from those observed in classical methods. Additionally, precise control over the reactivities of both the reagents and catalysts can be achieved by fine-tuning the ligands (organic compounds) bonded to the transition metals. Our focus is on advancing the development of new carbon-carbon bond-forming reactions, capitalizing on the unique characteristics of organometallic complexes composed of metals and organic compounds. These reactions serve as a foundation for synthetic organic processes.

Prof. NISHIHARA Yasushi

■Research Themes

Transition metal catalysts/Organic photovoltaics/Organic field-effect transistors/Bond activation/Organoboron chemistry/Organofluorine chemistry

Asst. Prof. MORI Hiroki

■Research Themes

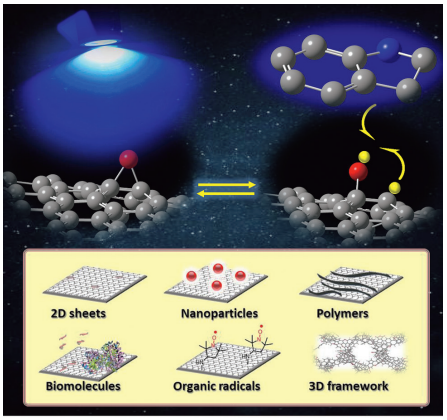
Transition metal catalysts/Organic material chemistry/Functional polymers/Organic solar cells/Organic semiconductors/Semiconducting polymers/Heteropolycyclic aromatic compounds

Asst. Prof. TANAKA Kenta

■Research Themes

Synthetic organic chemistry/Photocatalysis/Visible light/Organophotocatalyst/Flow synthesis/Electrosynthesis

Functional Molecular Engineering



We create materials that enrich our lives by designing, synthesizing, and evaluating functional molecules and materials. In collaboration with academia and industry both in Japan and overseas, we will develop a variety of applications, including catalysts, power storage devices, high-strength materials, biomaterials, antibacterial and antiviral materials, and environmental improvement. We aim to conduct cutting-edge research by exploring new fields and integrating different fields, without being confined to existing research fields.

Prof. NISHINA Yuta

■Research Themes

nanomaterials/organic materials/carbon materials/biomaterials/electrochemistry/catalysis