F-REI
Research File
2025

F-REI Research Aims Beyond Reconstruction

Fukushima Institute for Research, Education and Innovation (F-REI)

Fureai Center Namie, 6-1 Yazawa-machi, Gongendo, Namie Town, Futaba County, Fukushima 979-1521, Japan

Phone: +81-(0)240-41-9970 | E-mail: madoguchi.h5x@F-REI.go.jp | URL: https://www.F-REI.go.jp/

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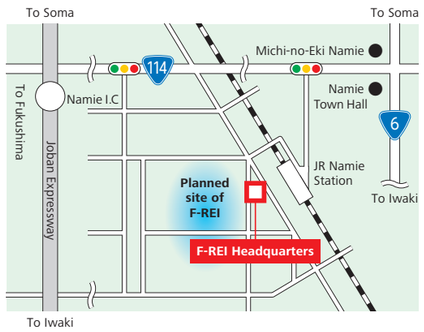
* Please note that our email newsletter as well as interactions on X and Facebook are only available in Japanese.



F-REI
Fukushima Institute for Research, Education and Innovation

F-REI will change the world, creating a bright future from Fukushima

F-REI was established embodying dreams and hopes to the people of Fukushima, Tohoku, and the world.

In order to pave the way beyond reconstruction, Fukushima has had to face various challenges, and that is why there is research that can be undertaken in this area. We will gather insights from around the world and strive for research and development that will significantly aid in addressing these challenges. We will spark innovation and create new industries in the region.

Furthermore, we will continue to nurture the next generation of talent and support the development of science, technology, and the local community.

The challenges facing Fukushima are also the challenges facing the world. That's why we believe that sharing the results and insights gained here and spreading them throughout Japan and worldwide will lead to dreams and hopes for many people. From Fukushima, we will take the first step toward changing the world. Our challenge at F-REI has only just begun.

F-REI
Fukushima Institute
for Research, Education
and Innovation

Center of excellence for creative reconstruction

F-REI was created to inspire hope and dream toward rebuilding and revitalizing Fukushima as well as other parts of Tohoku. To address Fukushima's challenges, pave the way for its reconstruction, and open up its possibilities for the future beyond, we need innovation that allows us to radically rethink how industry and society work—and its creation requires R&D with a long-term vision.

F-REI creates a world-renowned research environment in which researchers can engage in cutting edge R&D, making use of the results for the reconstruction of Fukushima and Tohoku. F-REI is also tasked with sharing the results widely, thereby ensuring that the benefits of Fukushima's reconstruction have global reach and contribute to national growth by driving Japan's scientific & technological capabilities, and industrial competitiveness to become among the world's best.

Four Functions

F-REI combines the four functions below in a complex manner to create a ripple effect both within and outside Japan.

1 Research & Development

Fukushima experienced a complex disaster, on a level unprecedented worldwide. We promote the world's most advanced research focusing on five research areas in which Fukushima has a clear competitive advantage.

2 Industrialization

Utilizing an extensive field centered on Hamadori Area in Fukushima, our research and development results are demonstrated and implemented for innovation and to create new industries.

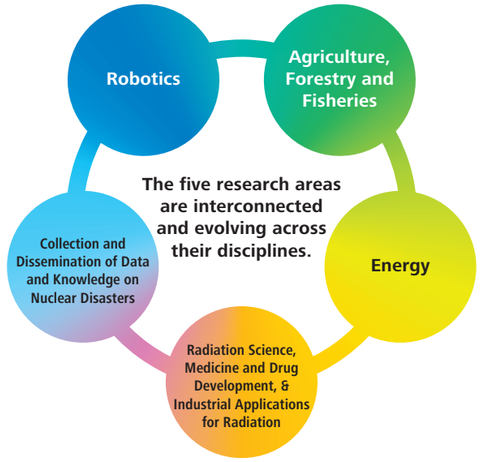
3 Human Resource Development

Looking toward the future beyond reconstruction, we work to encourage next-generation leaders through collaboration with graduate schools, universities, and technical colleges, as well as provide science classes and seminars for elementary, junior high, and high school students.

4 Control Tower

Valuing the reconstruction activities that have been conducted so far in Fukushima and Tohoku, F-REI plays a role among related organizations as a major driving force in promoting collaboration.

Five Research Areas



How will Fukushima achieve reconstruction and build a future beyond the disaster? The first step is of great significance to people around the world. To confront the many ongoing challenges and pave the way toward solutions, innovation that can transform the structure of society and industry is required. Research and development that generate new technologies and knowledge will be essential for taking this first step toward that goal.

F-REI has identified key issues that need to be addressed in Fukushima and research that can only be undertaken in the region, concentrating its efforts on five research areas. Furthermore, by integrating and developing research across various areas, F-REI will serve as a "center of excellence for creative reconstruction," driving the development of science and technology in the region while sharing and spreading the results of its efforts throughout Japan and the world.

F-REI's basic policies

F-REI has formulated the F-REI's basic policies for setting its research themes in consideration of the government documents and other relevant information. F-REI develops the research objectives and concrete research themes of each R&D area based on its vision and common objectives.

Vision

F-REI aims to realize the reconstruction of Fukushima and other parts of the Tohoku region, positioning itself as a center of excellence for creative reconstruction that embodies the dreams and hopes. It leads the way in advancing world-class research and the social implementation and industrialization of its research results while raising Japan's industrial competitiveness to the highest global standards and contributing to economic growth and the improvement of people's lives. To accomplish this, F-REI implements its research themes based on the F-REI's basic policies.

Common objectives

As F-REI takes the initiative in creative reconstruction from the complex disaster in Fukushima, F-REI aims to advance cutting-edge research that will drive industrial revitalization in the Fukushima Hamadori Area, including robotics & drone technology; next-generation agriculture, forestry, and fisheries; and clean energy; as well as the radiation science (nuclear physics, radiochemistry, radiation environmental science, nuclear medicine/drug discovery, and electronic devices, etc.) and the radioecology, with the goal of establishing a world-class research institute that represents Japan.

F-REI's five R&D areas

1. Robotics
2. Agriculture, Forestry and Fisheries
3. Energy
4. Radiation Science, Medicine and Drug Development, & Industrial Applications for Radiation
5. Collection and Dissemination of Data and Knowledge on Nuclear Disasters

Examples of concrete research themes

F-REI's five research areas

1

Robotics

Perspectives on research and development at F-REI (Fukushima)

- **Conduct research and development in Fukushima where a complex disaster took place on robots and drones designed to operate in harsh environments encountered in reactor decommissioning and natural disasters.**

Policy for the area

F-REI will engage in the development of **highly mobile robots** equipped with radiation resistance, water resistance and heat resistance, **research on intelligence** to realize **autonomous control** and **swarm control**, and research on functional expansion to enhance the sensory capabilities of living organisms. F-REI will leverage these achievements to promote the development of **highly mobile robots** that can operate in harsh environments, including reactor decommissioning sites, disaster areas, and outer space. Additionally, F-REI will foster the development of **high-performance drones** designed for long-duration flights with high payload capacities and **autonomous mobile robots**.

Specific research topics include

- Haptics (tactile) technology for remote work support
- Technology that enables autonomous cooperative work by multiple robots and drones
- Drones designed for long-duration flights and high payloads, along with the fuel cell systems that support them
- Robots that integrate strength and sensitivity, designed for flexible operation even in harsh environments
- Performance Evaluation Methods for Field Robots in Harsh Environments and Their Verification at Robot Competitions such as the World Robot Summit
- Radiation-resistant image sensors and diamond semiconductor technology for reactor decommissioning

Robots and drones operating in harsh environments
(Concept illustration)

Director

NONAMI Kenzo
Chairman, Japan Drone Consortium

Deputy Director

MATSUNO Fumitoshi
Professor, Osaka Institute of Technology

F-REI's five research areas

2

Agriculture, Forestry and Fisheries

Perspectives on research and development at F-REI (Fukushima)

- **Given the region's characteristics, which include extensive areas of fallow land and forests affected by the disaster, F-REI will embrace the challenge of advancing next-generation agriculture, forestry, and fisheries that move beyond conventional ideas while leveraging new technological resources that extend beyond conventional ideas.**

Policy for the area

Aim to build a regional recycling-oriented economic model by establishing **a high-profit and large-scale model** driven by highly labor-saving and efficiency through **full automation, robotization, streamlining of** agriculture, forestry and fisheries **work**, as well as the effective use of forest resources.
Simultaneously, F-REI will promote basic research on **breeding, organic farming, and soil improvement** through the use of RI* tracers.

***RI:** Radioisotope

Specific research topics include

- Technology development and demonstration of highly labor-saving agricultural production technologies for land use
- Development and demonstration of fruit production technology for export
- Establishment and demonstration of a wildlife damage management utilizing advanced technologies
- Establishment and demonstration of an energy recycling technology system for facility horticulture
- Development and demonstration of technologies that contribute to integrated crop-livestock farming systems without relying on chemical fertilizers and agricultural chemicals
- Development of new materials utilizing unused agricultural, forestry and fishery resources
- Research on future directions for the reconstruction of agriculture, forestry and fisheries in regions like Fukushima Hamadori Area
- Research on streamlining and automating forestry works

Development of a remote monitoring system
(highly labor-saving production technology development)

Director

SASAKI Akihiro
Advisor (Guest Professor), Nodai Research Institute, Tokyo University of Agriculture, Former Senior Vice-President at the National Agriculture and Food Research Organization

Deputy Director

ARAO Tomohito
Former Director, Central Region Agricultural Research Center, National Agriculture and Food Research Organization

F-REI's five research areas

3

Energy

Perspectives on research and development at F-REI (Fukushima)

● **F-REI leverages existing hydrogen-related facilities and other facilities to achieve carbon neutrality in the region. Simultaneously, contribute to the realization of pioneering smart communities.**

Policy for the area

To position Fukushima as a pioneer in carbon neutrality in Japan, F-REI will conduct research and development centered on **renewable energy**, covering **energy production, storage, transportation, and utilization**. Within this framework, F-REI addresses challenges such as **risk assessment, regulatory compliance, and the establishment of technical standards** to ensure social implementation. Promote research on energy utilization through **hydrogen and ammonia**, along with **carbon dioxide capture** and utilization as an energy source. These efforts aim to contribute to the realization to the creation of a sustainable society through the demonstration that carbon neutrality and even negative emissions can be achieved by basically harnessing renewable energy.

Specific research topics include

- Development of methods for cultivating large algae seedlings, land-based aquaculture, and large-scale aquaculture in coastal and offshore waters of the Pacific Ocean, as well as evaluation methods for blue carbon promotion and carbon dioxide fixation capacity
- Research on the production and underground storage of biochar by utilizing forest biomass resources in the Abukuma Mountains and developing a small-scale FT synthesis device to produce liquid fuel
- Development of high-efficiency hydrogen energy systems to maximize the use of variable renewable energy through local production and consumption of hydrogen, F-REI develops high-efficiency hydrogen energy systems, collaborates with the Soso Districts, including Namie Town, to conduct social verification, and communicate the effectiveness of hydrogen energy utilization to the world

Development of core technologies for blue carbon

Director

YABE Akira
Fellow, Technology and Innovation Strategy Center (TSC), New Energy and Industrial Technology Development Organization (NEDO)

Deputy Director

AKITA Shirabe
Senior Advisor Emeritus, Central Research Institute of Electric Power Industry

NISHIKITANI Yoshinori
Adjunct Researcher, Research Institute for Nanotechnology, Research Organization for Nano & Life Innovation, Waseda University

F-REI's five research areas

4

Radiation Science, Medicine and Drug Development, & Industrial Applications for Radiation

Perspectives on research and development at F-REI (Fukushima)

● **As a research foundation for creative reconstruction following the complex disaster in Fukushima, F-REI conducts research in radiation science, including nuclear physics, radiochemistry, radiation environmental science, nuclear medicine and drug discovery, and electronic devices, while examining their potential applications.**

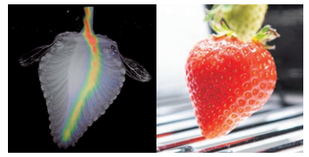
Policy for the area

To contribute to well-being, F-REI promotes not only fundamental research on the use of radiation but also its technological applications across medicine, agriculture, and industry. In the medical field, F-REI focuses on developing **diagnostic technologies** using radiation tracers and developing **molecular-targeted drugs** that employ radiolabeled compounds. In the agricultural and industrial fields, F-REI promotes **research on measurement science** and technological development through the use of radiation.

Specific research topics include

- Development of stable and efficient manufacturing technologies for radionuclides, applicable in medicine, agriculture, and various other fields
- Development of compounds and technologies (DDS: Drug Delivery System) that specifically deliver radioisotopes to appropriate locations, such as cancer cells
- Development of radioisotope imaging technology to enhance agricultural productivity and safe crop production
- Development of radiation imaging techniques that investigate into unexplored areas
- Feasibility study to promote the utilization of radioisotopes

***RI:** Radioisotope



Plant imaging using RI (image)

Director

KATAOKA Kazunori
Director General, Innovation Center of NanoMedicine, Kawasaki Institute of Industrial Promotion

Deputy Director

YAMASHITA Shunichi
Vice President, Fukushima Medical University

CHINO Masamichi
Former Executive Director, National Institutes for Quantum Science and Technology

KINUYA Seigo
Vice President, Kanazawa University

F-REI's five research areas

5

Collection and Dissemination of Data and Knowledge on Nuclear Disasters

Perspectives on research and development at F-REI (Fukushima)

- **Implement comprehensive measures to aid in the creative reconstruction of the Fukushima Hamadori Area, which has experienced multiple disasters**
- **Establish the natural and social sciences as the research foundations that contribute to a new regional revitalization**

Policy for the area

Conduct **research** and **analyses** of **the natural environment** and **local communities** in areas affected by nuclear disasters, as well as **accumulate and disseminate scientific knowledge** to enhance **regional safety**. Additionally, by utilizing the research results from F-REI, we aim to promote regional revitalization and **community consensus building**, thereby **contributing to creating resilient communities where people can live together harmoniously**.

Specific research topics include

- Research on the environmental dynamics of radioactive substances
- Collection and database creation of nuclear disaster data from relevant organizations and local communities
- Adding high value to information through integration with social scientific knowledge on multiple disasters
- Transmission of knowledge for environmental impact assessment, future forecasting, and disaster prevention
- Proposals and dissemination through workshops and international collaboration
- Development of long-term reconstruction and revitalization of communities in cooperation with local residents

Forum on community development utilizing assessment of environmental dynamics

Deputy Director

OHARA Toshimasa
Director General, Asia Center for Air Pollution Research, Japan Environmental Sanitation Center

Research units

Real Haptics

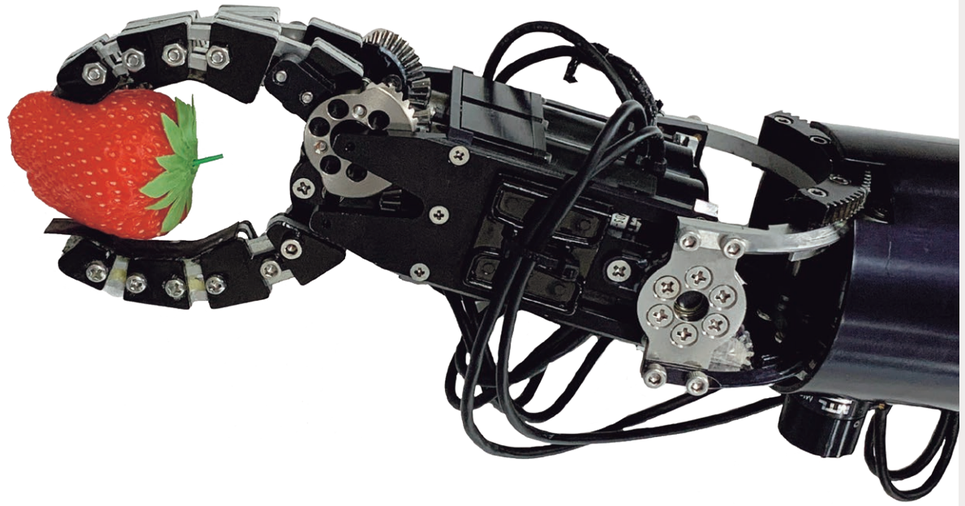
Haptic Teleoperation Research Unit

Unit members

ONISHI Kohei (Unit Leader), OHISHI Kiyoshi (Deputy Unit Leader), ASAI Hiroshi, SAITO Yuki, Padron Parraga Juan Vicente, De Silva Diwadalage Kasun Prasanga

Developed a remote-controlled robot with higher precision and autonomy through the incorporation of “haptic sense.”

This unit conducts research and development on remote-controlled robots designed for being operated in harsh environments, such as high temperature, high humidity, high radiation, and vacuum. The first stage of our research is to develop robots that can be easily operated remotely without any complex electronic components nor computers. Once we achieve this, we plan to introduce “real haptic technology” to the robots, allowing them to perform more delicate tasks. “Haptics” refers to the study of force/tactile perception. Humans can assess the strength and weight of objects based on their force/tactile sensation and can adjust the force they apply accordingly. Soft and fragile objects are handled gently, while heavy and sturdy objects require more force. If robots can make these decisions by their own, they will be capable of performing more delicate tasks. This means they could assist us with their dexterous and gentle movements. The ultimate goal of our unit is to realize robots resembling those found in science fiction novels and movies from the perspective of the “real haptic sense.”

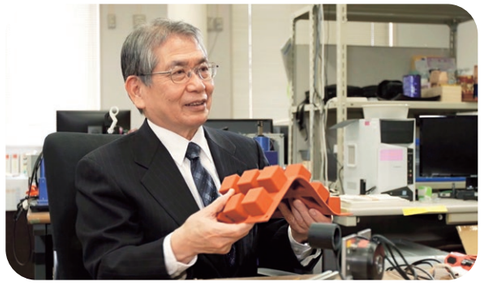


Remote-controlled robots gently pick strawberries with the same sensitivity as human fingertips, utilizing real haptics technology

Haptic Teleoperation Research Unit

Unit Leader

ONISHI Kohei



Born in Tokyo, raised in Wakayama Prefecture. He graduated from the University of Tokyo and received the Ph.D in electrical engineering. He joined the Department of Electrical Engineering, the Faculty of Science and Technology, Keio University as a Research Associate in 1980. He was promoted to Senior Assistant Professor and then Associate Professor. In 1996, he became a full Professor in the Department of Systems Design Engineering and has been a Project Professor since 2018. In 2024, he was appointed as the Unit Leader of the Haptic Teleoperation Research Unit at F-REI. He received numerous awards, including the Medal of Honor with Purple Ribbon in 2016, the Fujihara Award in 2019, and the Hirose Award in 2023. His major publications include “Motion Control Systems” (Wiley, 2011).

Q What is your research policy, and what do you value the most?

A Ultimately, engineering research should serve people’s happiness. That’s why I consistently ask myself, “Will this contribute to happiness in society?” as I pursue my research. I also believe that research itself requires free idea and flexible thinking that are not hindered by limitations. In R&Ds of science and technology, I believe there are two approaches. One is discovery approach based on analytical methodology. The other is an invention approach based on synthesis methodology. Our unit will be able to produce results that are both creative and practical by a perfect balance between these two approaches.

Q What is the future you want to envision with F-REI?

A As Japan enters a super-mature society, the social implementation of robots capable of replacing human tasks is crucial for fostering and maintaining a prosperous and happy life. However, there is a significant gap between our expectations for robots to behave benevolently and perform at a high level and the current capabilities of industrial robots. Our goal at F-REI is to construct a bridge between this gap through research. By advancing remote operation technology, we aim to create robots that enhance our daily lives and expand possibilities for the future.

My favorite quotes:

Do not flatter the world, do not fear the world, and be independent without being isolated; thereby, one can achieve great things

People you admire:

FUKUZAWA Yukichi

Childhood dream:

To become a scientist and research unknown fields

What does research mean to you:

Proof that I am alive

Deputy Unit Leader

OHISHI Kiyoshi

Graduated from the Department of Electrical Engineering, the Faculty of Science and Technology, Keio University in 1981. After receiving his Ph.D. from Keio University, he joined Osaka Institute of Technology as a Lecturer. From 1986, he joined Nagaoka University of Technology as an Associate Professor. And he served as a Professor, Vice President and Executive Director at Nagaoka University of Technology. From 2023, here, he serves as an Emeritus Professor at Nagaoka University of Technology and a Specially Appointed Professor at the Institute for Innovative Science and Technology, Nagasaki Institute of Applied Science Graduate School. In 2024, he was appointed as the Deputy Unit Leader of the Haptic Teleoperation Research Unit at F-REI. He has received numerous awards, including the Minister of Education, Culture, Sports, Science and Technology Award for Contributions to Industry-Academia-Government Collaboration. Moreover, he has received the awards including the IEEJ Industry Applications Society Distinguished Transaction Paper Award, the IEEJ Progress Award, and the IEEJ Achievement Award, as well as the IEEE fellow.

I am fascinated by the field of motion control, where I can explore both complex theories and classic & simple theories with a free mindset. Even now, in my 60s, I remain excited about my research. I find great joy in being involved with the remote control of agricultural harvesting robots in this Research Unit at F-REI. Through collaboration between the robotics industry and agriculture, I hope to address challenges such as labor shortages and rural depopulation while also spreading the value we create in Fukushima to the rest of the world.

Autonomous Robots

Autonomous, Intelligent, and Swarm Control Research Unit

Unit members

TOMIZUKA Masayoshi (Unit Leader), Wang Wei

Shifting from automatic control to autonomous control. Robots that can think for themselves and coordinate with their surroundings transform the future of countries prone to natural disasters.

Recent news highlights advancements such as drones that autonomously deliver packages and autonomous driving that make driving more comfortable. These examples illustrate the remarkable evolution of automatic control technology in the transportation sector in recent years. Unmanned Aerial Vehicles (UAVs) are commonly known as drones, and Unmanned Ground Vehicles (UGVs) represent an advanced form of autonomous driving technology. They are helpful not only for transportation but also for disaster relief. Our unit is dedicated to building advanced automated systems for disaster response by leveraging the advantages of Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs). We are leveraging AI technology to comprehensively develop autonomous robots that exceed basic automatic control from both the hardware and software perspectives; in other words, robots that can think and act on their own and work in cooperation with other robots and people. In the future, we plan to conduct demonstrations at a test site that simulates disaster scenarios. Our goal is to develop technology that is not an empty theory but is applicable in real-world situations.

Laboratory experiments on collaboration between robots and humans

Autonomous, Intelligent, and Swarm Control Research Unit

Unit Leader

TOMIZUKA Masayoshi

After completing his master's degree at Keio University in 1970, he received his Ph. D. degree in Mechanical Engineering from the Massachusetts Institute of Technology in 1974. He joined the University of California, Berkeley in 1974, where he is currently a Professor in the Department of Mechanical Engineering. He has held numerous positions, including President of the American Automatic Control Council (AACC). In 2024, he was appointed as the Unit Leader of the Autonomous, Intelligent, and Swarm Control Research Unit at F-REI. He has published over 1,000 papers and received numerous awards, including the Nichols Medal (International Federation of Automatic Control [IFAC], 2022). He is a member of the National Academy of Engineering in the United States.

Q What inspired you to start your research?

A I became a researcher because my father strongly encouraged me to study mechanical engineering. I believe he entrusted his own dream to me, having studied engineering at Kyoto University himself. In my fourth year of university, I encountered the beautifully structured theory of automatic control, which inspired me to study abroad in the United States, where research was flourishing. While serving as a research assistant at MIT, I earned my Ph.D. and became deeply fascinated by theoretical research, which inspired me to pursue a career as a researcher.

Q What is your research policy, and what do you value the most?

A My days at MIT greatly enriched the mindset needed for engineering research. Specifically, the principle that "theory only matters in engineering when applied to real-world problems" continues to be a vital belief for me today. Research should not be confined to theoretical studies without practical applications or to experimental studies focused on a single system only. With this in mind, it is my policy to develop theories and conduct demonstration experiments to confirm our achievement.

Q What is the future you want to envision with F-REI?

A Japan has many earthquake sources and volcanic zones, and is prone to heavy rains. Although the occurrence of disasters cannot be avoided, it should be possible to save people's lives and prevent the damage from spreading by utilizing AI and robotics technology. Currently, F-REI is conducting research focusing on rescue activities after a disaster occurs, but in the future, one of our goals is to develop technology that can respond at all points during a disaster, such as evacuation guidance and reconstruction activities, in addition to rescue. We will contribute widely to society with AI and automation technology.

My favorite quotes:

Independence and self-respect

Favorite music:

Classical music

What do you do on holidays:

I wake up late in the morning, do some work, and go for a walk to get exercise. I spend my time doing whatever I feel like.

What does research mean to you:

My hobby

Fuel Cell for Drone

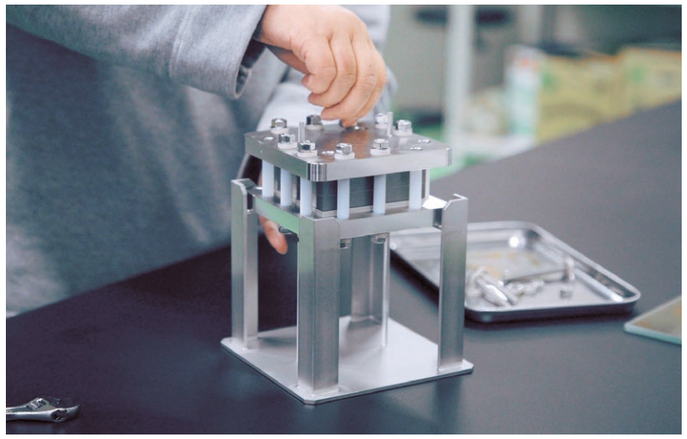
Fuel Cell System Unit

Unit members

IIYAMA Akihiro (Unit Leader), YANAGISAWA Masanari (Deputy Unit Leader), MATSUO Takeshi, FUKAYA Atsuko, UEHARA Tetsuya, OKADA Keiji

We are developing a new fuel cell system to realize the longer flight time and higher payload of next-generation drones.

In disaster situations, when roads are disrupted or buildings have collapsed, it becomes challenging for humans to reach the area to assess the situation or conduct rescue operations. Drones are expected to play a vital role in these scenarios. By operating from the air, drones can access harsh environments that are beyond human reach. They can evaluate the site's condition, confirm the safety of residents, assess the status of infrastructure, and deliver supplies. That is why our unit is focused on developing robust drones specifically designed for emergencies, capable of carrying loads of approximately 10 kg and flying for about two hours. Unfortunately, lithium-ion batteries, commonly used in many drones, cannot achieve the required durability. Therefore, we are researching a hydrogen-based fuel cell system. In collaboration with companies in Fukushima Prefecture, we are working to create a Japanese-made fuel cell system for drones, with the goal of enabling their use in disaster situations.



Fuel cell for Research

Fuel Cell System Unit

Unit Leader

IIYAMA Akihiro

After completing a master's degree in the Department of Mechanical Engineering at the University of Tokyo, he joined Nissan Motor Co., Ltd. After working in engine research and development, he was sent on a company-sponsored study abroad program to the University of California, Berkeley, from 1986 to 1988. He served as General Manager of the Fuel Cell Laboratory and was appointed Expert Leader in the fuel cell field. In 2015, he transferred to the University of Yamanashi, where he currently serves as the Director of the Hydrogen and Fuel Cell Nanomaterials Center. He has also been actively involved in collaboration activities among industry, academia, and the government to promote the development of hydrogen and fuel cell-related industries. In 2024, he was appointed as the Unit Leader of the Fuel Cell System Unit at F-REI.

Q What is your research policy, and what do you value the most?

A What I value most is determining whether research has "good aptitude." In other words, I seek out research that is inherently excellent, much like "natural beauty." To assess this, I evaluate new ideas from multiple perspectives, such as "The performance is excellent, but how durable is it?" or "Are the manufacturing costs and processes realistic?" To ensure that the new value created by our research benefits society, I examine the essence of ideas with a discerning eye.

Q What is the future you want to envision with F-REI?

A Drones are machines with immense potential. If they can fly for more extended periods and carry heavier loads, their applications will become much more diverse, leading to the emergence of new businesses centered around drones. Additionally, if we can produce drones and fuel cells domestically, this manufacturing itself could become a significant industry for Japan. By collaborating with F-REI to develop innovative drones, we aim to launch new businesses in Fukushima and contribute to societal development. This is my vision for the future.

My favorite quotes:

Move forward without fear

What do you do on holidays:

Walking, golf,
day trips to hot springs, skiing

Childhood dream:

Large truck driver

What does research mean to you:

Fulfilling my dreams,
self-actualization

Deputy Unit Leader

YANAGISAWA Masanari

He joined Nissan Motor Co., Ltd. in 1991. Beginning in 1995, he took part in the development of Nissan's first direct injection engine, successfully achieving mass production by employing the QFD method. In 2001, he was involved in joint fuel cell development with UTCFC. By 2006, he had developed the second generation of Nissan's in-house fuel cells, leveraging the experience he gained during that time. In 2008, he was promoted to Section Manager and achieved a world record for the highest power density of 2.5 kW/L. After leaving the company in 2019, he engaged in fuel cell and bioenergy development at various companies around the world. In 2025, he was appointed as the Deputy Unit Leader of the Fuel Cell System Unit at F-REI.

Shifting from gasoline engines to fuel cells. The reason I became involved in research and development is that I was appointed as an engineer with a strong mind, unconstrained by boundaries and not reliant on organizational power, to realize Nissan's newly announced development policy. By discovering future possibilities in technologies that have yet to be discovered, I have strived to establish new principles that do not currently exist in the world, namely complete originality. At F-REI, my mission is to bring essential happiness to society, transcending organizational boundaries and the region of Fukushima.

Actuator

Power Soft Robotics Unit

Unit members

SUZUMORI Koichi (Unit Leader), IDE Toru, URA Daisuke

Aiming to create robots and power support suits that can withstand harsh environments through the evolution of actuators

An actuator is a driving unit that converts energy from electricity, air pressure, hydraulic pressure, etc. into motion to move equipment. Most robots and machines today are driven by actuators that combine electric motors and gears. However, in order to achieve the performance to keep moving even in harsh environments such as rain, dust, shock, vibration, and high temperature, it is necessary to develop new actuators. Our unit is developing new actuators for robots that are operated in harsh environments and disaster response robots that use these actuators. Our goal is to realize a gentle and powerful robot that can work in harsh environments and can exert great power, but can also handle objects with dexterity and gentleness. Specifically, we are considering developing a power support suit that would allow the wearer to lift objects weighing several hundred kilograms. Our goal is to create robots that will be useful to society not only in emergency situations, such as rescue operations during disasters, but also in normal times, such as forest maintenance, logistics, construction work, and factories.

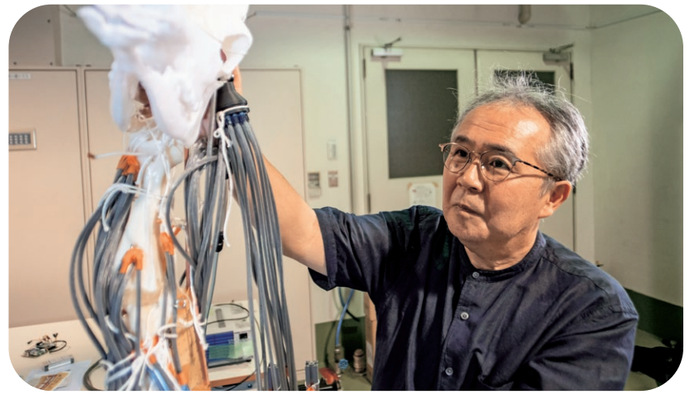
An example of a power support suit operated by artificial muscles

Power Soft Robotics Unit

Unit Leader

SUZUMORI Koichi

Joined Toshiba Corporation in 1984. Engaged in the development of nuclear fuel reprocessing robots and in-pipe inspection robots, etc. In 1990, graduated from Graduate School of Engineering, Yokohama National University. In 2001, became Professor at Okayama University, and since 2014, Professor at the Tokyo Institute of Technology (now Institute of Science Tokyo). Currently Professor Emeritus at Science Tokyo. In 2025, appointed as the Unit Leader of the Power Soft Robotics Unit of F-REI. Received numerous awards, including the 1992 Robotics Society of Japan Technology Award, the 2000 Japan Society of Mechanical Engineers Award (paper), and the 2020 Japan Society of Mechanical Engineers Award (technology).



Q What inspired you to start your research?

A When I was still a graduate student, microcomputers came into the world, and the research of mechatronics began to open up wide. I wanted to freely control large machines and robots using computers and software. With this thought in mind, I joined Toshiba Corporation as a research and development engineer. After working on the development of various industrial robots, I returned to the world of academia and began to engage in research on robots as well as actuators for moving robots.

Q What is your research policy, and what do you value the most?

A "Gentle and powerful" is an image that everyone aspires to, and this applies to robots as well. For example, at a disaster site, robots with great power and gentleness to rescue victims are needed. The same is true for researchers. We are trying to realize power that is useful to the world through engineering. However, no matter how much knowledge and technology we acquire, they are meaningless without gentleness. Our daily goal is to develop robots that are kind and also powerful.

Q What is the future you want to envision with F-REI?

A Robots are not only useful machines that can perform precise tasks and help people, but they also have another aspect to realize an intellectual dream. While our primary mission is to create useful robots, I am also interested in the question of "what is a living thing" through the creation of robots that mimic living things. This intellectual pursuit is also very important to realize a bright and righteous future. Together with F-REI, I want to build a world-class robotics research center, where useful technologies as well as the knowledge that forms the background of those technologies are gathered.

My favorite quotes:

Think globally, act locally
You must be tough to survive,
you must be kind to deserve to live

What do you do on holidays:

I worked on my PC. From now on,
I want to play with my dog and go for a drive.

Childhood dream:

Aircraft designer

What does research mean to you:

Creating new artifacts
that no one has ever seen before

Agroecology

Soil and Plant Multi-Dynamics Research Unit

Unit members

NIHEI Naoto (Unit Leader), Beier Marcel Pascal, Nuanaon Nobchulee

By elucidating the function of organic components in the soil, which has been handled by intuition and experience, and offer new options for the farming methods

Inorganic components such as nitric acid and ammonia have long been considered important as fertilizers in agriculture. However, recent research has revealed that organic components such as amino acids and sugars also affect crop growth. The importance of incorporating organic fertilizers into soil preparation is widely recognized, but its scientific mechanism is still mostly unknown. Therefore, the use of organic fertilizers can only be based on intuition and experience, and even if they are used, the effect may not be sufficient. Our unit is working to elucidate the diverse interactions (multi-dynamics) that occur between soil and plants, including not only inorganic components but also organic components, to determine how organic components act on crops and how they can be used to effectively increase growth efficiency. We aim to realize agroecological farming methods that reproduce the agricultural environment as it is and cultivate crops efficiently by visualizing organic connections in the natural world, including weather, soil gases, and microorganisms.

Setting up test plots for field cultivation trials (top photo)
Sampling at a compost production site (bottom photo)

Soil and Plant Multi-Dynamics Research Unit

Unit Leader

NIHEI Naoto

Born in Iwaki City, Fukushima Prefecture. Graduated from Graduate School Master's Program at Tohoku University, and joined Fukushima Prefectural Government in 1998. From 2013, Associate Professor at Graduate School of Agricultural and Life Sciences, University of Tokyo. In 2020, moved his base to Fukushima University, and from 2023, Professor at Faculty of Food and Agricultural Sciences of the University. In 2024, appointed as the Unit Leader of Soil and Plant Multi-Dynamics Research Unit at F-REI. In 2007, was selected as "The Researchers with Nice Step (NISTEP)," scientists who inspire Japan, by the National Institute of Science and Technology Policy of the Ministry of Education, Culture, Sports, Science and Technology.

Q What inspired you to start your research?

A I had worked at the Fukushima Prefectural Government, but became a researcher out of a desire to do something about local agriculture, which has been decimated by the Fukushima Daiichi Nuclear Power Plant accident. In some parts of Hamadori Area, topsoil, which is necessary for crop cultivation, was removed for decontamination. My motivation for research is to bring soil that can be used for agriculture again to this land, and to show a new option for agriculture around the world, which has become dependent on chemical fertilizers.

Q What is your research policy, and what do you value the most?

A I always try to go out into the field. I visit rice paddies, fields, and laboratories as much as possible and communicate closely with the members. I try to develop research that is not just a theory on the table, using questions and issues that arise in the field as seeds. Although we often do not get good results, when times are tough, I remember the saying, "On a cold day when nothing blooms, extend your roots downwards. Eventually, a big flower will bloom." (By the way, using organic materials also improves the rooting of plants.)

Q What is the future you want to envision with F-REI?

A Real world data coming from the agricultural field is essential for our research. We want to develop technologies that can be truly utilized in society, valuing our connections with the farmers in Fukushima. Another significance of conducting research at F-REI is that we can think about the future together with experts in various fields such as robotics, energy, imaging, and urban development. We hope to promote integrated research that fuses the life sciences, social sciences, and business, and to show the way to a sustainable future.

Favorite music:
Anything as long as it makes me feel good

What do you do on holidays:
Walking (to reduce weight)

Childhood dream:
Police officer

What does research mean to you:
A never-ending challenge

Soil Design

Soil Homeostasis Research Unit

Unit members

FUJII Kazumichi (Unit Leader), MIURA Maki, Forster Daniel James

Reproduce the best soil that nature has produced over a hundred or even a thousand years by humans

The unit's research subject is soil, which is familiar to everyone. In fact, soil has the property of quickly deteriorating if used incorrectly, and it is said that 30% of the world's land area is already covered with deteriorated soil. As land becomes barren, crop yields decline, and the carbon dioxide, methane, and nitrogen released from that soil cause global warming and environmental pollution.
The creation of good soil has become a pressing issue for the future of the global environment and the dietary habits of people around the world. The unit members dig holes in the ground and analyze the balance of clay, sand, and humus, and how organisms such as earthworms and microorganisms are involved in the development of the soil. From the perspective of homeostasis, which is also the name of the unit, we are trying to design the best soil that can produce a good harvest while reducing costs and environmental impact.

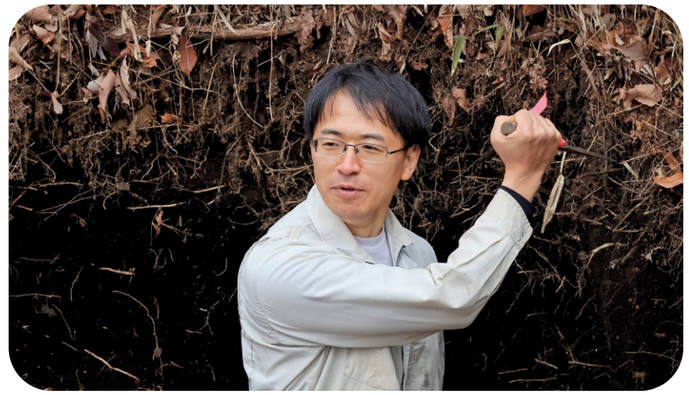
Soil performs a complex function with mixture of clay, sand, and humus, and interaction between organisms and minerals.

Soil Homeostasis Research Unit

Unit Leader

FUJII Kazumichi

Born in Toyama Prefecture in 1981. Completed doctoral program, Graduate School of Agriculture, Kyoto University. After working as a Japan Society for the Promotion of Science Research Fellow and as a Senior Researcher at the Forestry and Forest Products Research Institute, Unit Leader of the Soil Homeostasis Research Unit at F-REI in 2025. Received many awards, including the 1st Young Scholar Award of the Ecological Society of Japan, the 33rd Encouraging Prize of the Japanese Society of Soil Science and Plant Nutrition, and the 15th Japan Prize in Agricultural Sciences, Achievement Award for Young Scientists. Author of "500 Million Years of the Earth," "Soil: The Last Mystery of the Earth," and "Soil and Life: 4.6 Billion Years of History." Also appeared in TV programs, including Crazy Journey, and other media.



Q What inspired you to start your research?

A Originally, I was involved in research on the formation of soil. I was fascinated by basic research on how rocks really become soil and why the same rock becomes different soil in different environments. However, after witnessing the soil degradation problem in Indonesia, I became interested in ecosystems and soil reconstruction. I learned that fertile topsoil was being lost due to the cultivation of tropical rainforests and that people were impoverished. I became interested in solving the soil problem through the design of good soil.

Q What is your research policy, and what do you value the most?

A Normally, we tend to make safe choices to avoid taking risks. However, this attitude is not very good in research. At such times, I remember the words of Matsuo Basho, a famous poet of Japan, *"Meijin wa ayauki ni asobu."* (Only skilled masters can challenge themselves in risky areas, hone their skills, and perfect their art.) We should be well prepared and then go on an adventure. Even if there is no must-win method, try first. In *Shogi*, Japanese chess, I try not to forget the feeling of punching with my eyes closed. I try to approach my research with a challenging spirit.

Q What is the future you want to envision with F-REI?

A The fundamental problem is that humans cannot create soil. I approach this problem with a method called "artificial soil", in which the generation process is accelerated by humans and the balance of materials is adjusted. Soil in Fukushima, where F-REI is based, had lost its topsoil due to decontamination and has been replaced with decomposed granite soil. By beginning from scratch, which is to improve the soil in Fukushima, we hope to demonstrate our philosophy and practice of reconstruction to the rest of Japan, and eventually to the rest of the world.

Favorite music:
"Dig a Hole" by HOSHINO Gen,
"Garden" by FUJII Kaze,
"Last News" by INOUE Yosui,
"Be True To Your School" by The Beach Boys

What do you do on holidays:
Home garden

People you admire:
HABU Yoshiharu, Roger Federer

Childhood dream:
Shogi player (actually, I still want to be one)

Hydrogen Behavior Analysis

Hydrogen Energy System Safety Science and Risk Management Unit

Unit members

SAKODA Naoya (Unit Leader)

Unraveling the Behavior of Hydrogen, the Next-Generation Energy Carrier, to Deliver Safe, Reliable Power

These days, there is a pressing need for achieving carbon neutrality. Hydrogen is attracting a great deal of attention as a next-generation "energy carrier" for carrying electric power. Technological developments for converting electricity to hydrogen and extracting electricity from hydrogen are being conducted worldwide, including water electrolysis, hydrogen storage, and fuel cells, but a common problem is safety. In order to handle hydrogen safely under accurate risk assessment, the Unit analyzes the thermodynamic properties of hydrogen. Based on reliable basic data, we aim to develop risk mitigation measures and implement ideal hydrogen energy systems in society. Once a safe and convenient hydrogen energy system is realized, it will be possible to convert electricity generated from solar and wind power into hydrogen and store it. By distributing and storing the stored hydrogen, a future in which stable electricity can be used safely, even in remote areas or in times of disaster, can be realized.

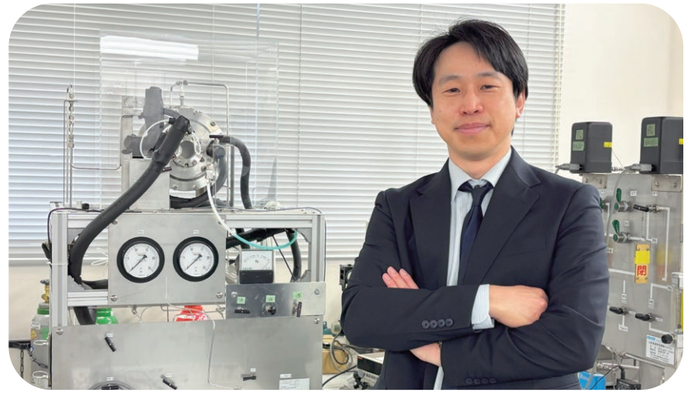
Measurement device of thermal properties of hydrogen

Hydrogen Energy System Safety Science and Risk Management Unit

Unit Leader

SAKODA Naoya

Completed Keio University, Graduate School of Science and Technology, Doctoral course in Engineering in 2006. After serving as Assistant Professor and Associate Professor at the Department of Mechanical Engineering, Kyushu University, Unit Leader of the Hydrogen Energy System Safety Science and Risk Management Unit at F-REI in 2024. Also Professor at the Research Center for Hydrogen Industrial Use and Storage (HYDROGENIUS) and Group Leader of the Department of Thermophysical Properties, HYDROGENIUS, Kyushu University. Has received many awards, including the Japan Society of Mechanical Engineers Award (paper), the Japan Society of Thermophysical Properties Award for Best Paper, and the Japan Society of Refrigerating and Air Conditioning Engineers Award for Academic Achievement.



Q What inspired you to start your research?

A I specialize in thermal engineering and was particularly interested in clarifying the thermal properties of fluids, including gases and liquids, in response to changes in energy, pressure, and temperature. I began hydrogen research when I was involved in obtaining thermophysical property data of hydrogen for the design and operation of hydrogen refueling stations for fuel cell vehicles. I became interested in research to unveil the behavior of hydrogen.

Q What is your research policy, and what do you value the most?

A In experiments to investigate the properties of fluids, it is important to measure temperature, pressure, density, etc. as accurately as possible. For example, in an experiment to know how volume changes when temperature and pressure are changed, even a small error of 0.02°C or 2 kPa can have a large impact on the results. For this reason, data is handled with care and the uncertainties are evaluated. We are committed to collecting reliable data and discussing issues based on that data, aiming for a future in which hydrogen can be used safely.

Q What is the future you want to envision with F-REI?

A "When it comes to excellent hydrogen energy research, the leader is F-REI". We will strive to conduct research that will earn such recognition from around the world. In addition to advancing our specialized fields, we aim to inspire young researchers, collaborate with overseas researchers, and promote interdisciplinary cooperation. We hope that F-REI will spark a movement that will lead to social implementation through new exchanges. We hope that the Hamadori Area of Fukushima will flourish through science and technology and become a vibrant place where children gather.

My favorite quotes:

"Kanken no metsuke"

(By grasping the overall situation while paying attention to details, you can make better decisions.)

Favorite music:

MAROON 5

What do you do on holidays:

Playing with my rescued cat

What does research mean to you:

Pondering how to face nature, reflecting deeply and carrying those thoughts in our hearts.

RI Imaging

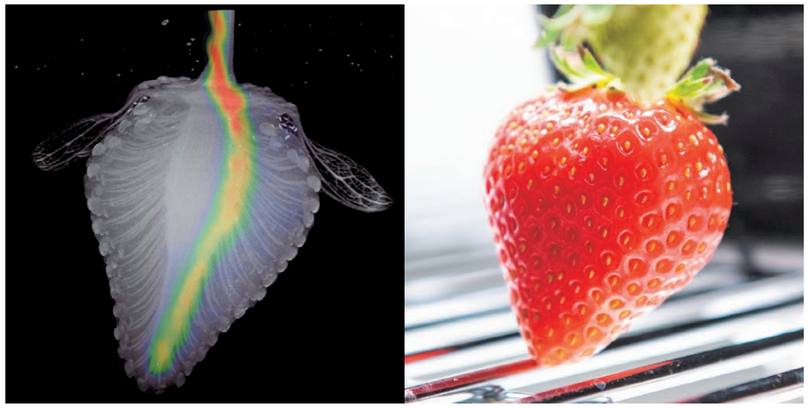
Plant Imaging Research Unit

Unit members

KAWACHI Naoki (Unit Leader), TANOI Keitaro (Deputy Unit Leader), ISHIKAWA Satoru, NAKAI Hiromi

Visualizing the flow of nutrients using the power of radiation – Unveiling the mechanism of life in plants

Just as X-rays can capture images of bones, radiation, if used skillfully, can be used to observe the inside of an object nondestructively. Our research unit conduct RI (radioisotope) imaging technology, which employs radioisotopes to study plants. We visualize how nutrients are absorbed from the soil or atmosphere and how they are transported to specific plant tissues. Visualization of the nutrient flow is a technology that will lead to more efficient production techniques of tasty, high-quality crops efficiently. Until now, it has been considered difficult to visualize data on the farmer's intuition and experience in producing crops with good taste and nutritional value. With RI imaging, however, it is now possible to identify and reproduce the nutrient flow of particularly good crops. Our goal is to create cultivation techniques that maximize plant potentials, and to revolutionize agricultural methods.



Plant imaging using RI (image)

Plant Imaging Research Unit

Unit Leader

KAWACHI Naoki

Graduated from the Graduate School of Physics, University of Tsukuba (PhD in Science). After working at the National Cerebral and Cardiovascular Center and SHI Accelerator Service Ltd., researcher at the Japan Atomic Energy Agency in 2005. Since 2016, Project Leader/Senior Researcher at the Department of Quantum-Applied Biosciences (formerly the Radiation Biology Application Research Department) at the National Institutes for Quantum Science and Technology. In 2024, appointed as the Unit Leader of the Plant Imaging Research Unit at F-REI.

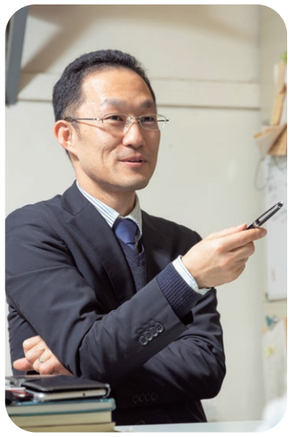
Q What is your research policy, and what do you value the most?

A To elucidate the mechanisms of life through imaging technology. One cannot achieve this major research goal by oneself. What I need is the presence of many geniuses around me who have unique ideas and extraordinary skills. My role is to draw out the ideas of each of these geniuses and fuse them together. In this way, my research style is to orchestrate multiple brains and to amplify their power many times over to drive progress forward.

Q What is the future you want to envision with F-REI?

A A key advantage of imaging is that research results can be conveyed simply by looking at the images. Not only researchers, but also the general public and children can easily understand and we can explain what is happening in plants to them. Taking advantage of this feature, F-REI has set a goal to communicate its research to the general public and surprise them. And then we want to create a relationship where the people of Fukushima, when they have some questions or issues, can think, "Let's ask F-REI."

My favorite quotes:	Favorite music:
Respect	Max Richter
Childhood dream:	**What does research mean to you:**
Baseball player	The most exciting and thrilling time



Deputy Unit Leader

TANOI Keitaro

Born 1976 in Tochigi Prefecture. Doctor of agricultural science. After graduating from the Faculty of Agriculture at the University of Tokyo, learned in master's and doctoral courses at the same university. After serving as an Assistant, Assistant Professor, and Associate Professor, Professor at the University of Tokyo since 2018 (current position). Awards received include the 2021 Award for Contribution to the Dissemination of Nuclear Knowledge and Technology. His publications include the "Agricultural Implications of the Fukushima Nuclear Accident" series. In 2024, appointed as the Deputy Unit Leader of the Plant Imaging Research Unit at F-REI.

As a child, when I learned the population explosion could cause serious food shortages, I began to believe that ensuring food abundance is necessary for achieving world peace. This feeling led me to pursue a doctor of agricultural science. The significance of being involved in research at F-REI is that it is not a mere project, but aims to foster a culture that can be sustained and passed on even as the people involved may change over time. Since the creation of such a culture depends on the involvement of local communities, we want to continue to develop our activities in cooperation with the people of Fukushima.

Radiation Metrology

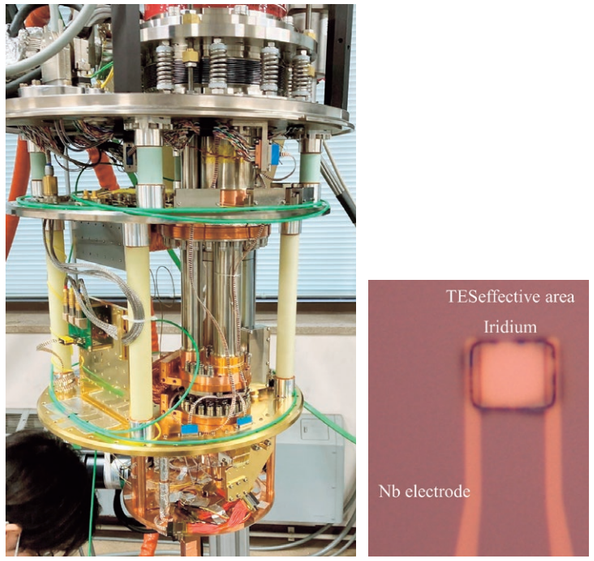
Fundamental Radiation Technology Research and Development Unit

Unit members

TAKAHASHI Hiroyuki (Unit Leader),
TAKEDA Shin'ichiro, ORITA Tadashi, DOBASHI Katsuhiro,Moh Hamdan

By measuring the behavior of gamma rays, invisible abnormalities can be visualized. This will lead to new diagnosis and treatment.

Our unit is working on the development of a new method of diagnosing diseases, using radiation to visualize abnormalities in the body. What makes this possible is the property of radiation to pass through objects. Gamma rays, for example, have the property to penetrate any objects, including the human body and metals. Our goal is to take advantage of this property to look inside the human body. Specifically, we measure gamma rays from patients who have taken a drug that accumulates only in areas where abnormalities are occurring. The key point is the gamma ray emissions from accumulated region. By detecting the gamma ray distribution, we are aiming to develop a technology to diagnose which part of the body the drug is concentrated in, in other words, where the abnormality is occurring. Once this technology is realized, it will be possible to accurately identify the location of abnormalities without surgical procedures, opening the way for new diagnosis and treatment.



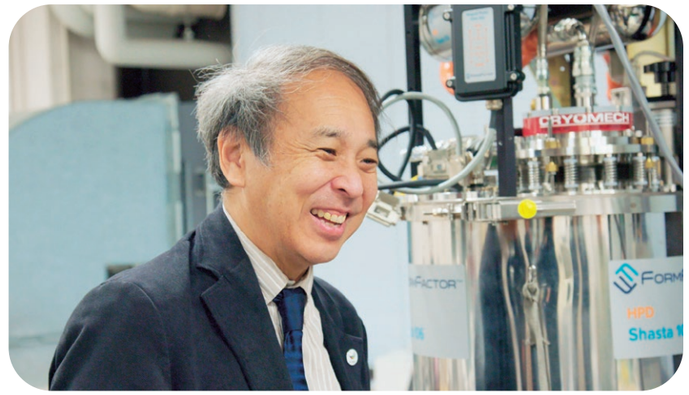
Internal structure of an adiabatic demagnetization refrigerator capable of cooling down to an absolute temperature of 0.05 degrees Kelvin and a superconducting sensor to be installed in the refrigerator
By using this as a detector, we aim to advance radiation measurement technology.

Fundamental Radiation Technology Research and Development Unit

Unit Leader

TAKAHASHI Hiroyuki

Graduated from the Graduate School of Engineering, University of Tokyo (PhD in Engineering). After working as Assistant, Lecturer, and Associate Professor, Professor at the University of Tokyo in 2005. Specializes in radiation metrology, including the development of radiation sensors using gases and photodetectors using superconductors. At the University of Tokyo, also involved in industry-academia and social collaboration works, promoting cooperation with Kumamoto Prefecture and Kumamoto University, concurrently serving as Deputy Director, Division of University Corporate Relations, Specially Appointed Assistant to the President. In 2024, appointed as the Unit Leader of F-REI's Radiation Technology Research and Development Unit. Has received numerous awards, including an honorable mention of the Radiation Award from the Japan Society of Applied Physics, the Technology Award from the Japanese Society for Neutron Science, and the Radiation Award from the Japan Society of Applied Physics.



Q What inspired you to start your research?

A Before becoming a researcher, I wanted to do something a little different from others. Then I focused on radiation. Because radiation has high energy, its presence can be detected even in very small amounts. If we could control and utilize this characteristic well, it would be possible to make something invisible to the eye, such as an abnormality in the body, visible with a very high degree of accuracy. This curiosity was the reason why I started working on radiation metrology.

Q What is your research policy, and what do you value the most?

A Do you steadily accumulate what we are sure to be able to do? Or, do you dare to try something that you think is a little difficult? From the viewpoint of deepening the academic field, I think it is important to take on the latter. However, in most cases, such things that look a little difficult do not work out immediately. That is why we must not give up easily, but persevere in your efforts. I believe this attitude is the most important thing for researchers.

Q What is the future you want to envision with F-REI?

A We tend to have a bad image toward radiation. In Fukushima, this impression is especially strong. However, radiation is something that is flying around us. Sunlight, which sustains our lives and livelihood, is also a type of radiation. In order to overcome radiation, it is important to use radiation in the fields of medicine and biology, rather than to hate it and part ways with it. At F-REI, we want to work on such research that will help connect radiation and human activities.

Favorite music:
Brahms

What do you do on holidays:
Going out

Childhood dream:
Researcher

What does research mean to you:
It's my hobby

Environmental Dynamics

Regional Environmental Co-Creation Unit

Unit members

HAYASHI Seiji (Unit Leader), AONO Tatsuo (Deputy Unit Leader), Kavasi Norbert, SUZUKI Masatoshi, TSUJI Hideki, ISHII Yumiko, IKUSHIMA Shiori, KURIKAMI Hiroshi, SASAKI Yoshito, TERASHIMA Motoki

From the immediate aftermath of the accident to the present, and into the future—observing and predicting the time-dependent “behavior” of radioactive cesium in the environment

Our unit investigates the behavior of radioactive cesium released in large quantities during the nuclear accident at the TEPCO-operated Fukushima Daiichi Nuclear Power Plant. Focusing primarily on river basins, we assess the extent of contamination in natural resources closely tied to people’s daily lives, such as edible wild plants, wild mushrooms, and freshwater fish. In our research, we observe environmental dynamics of radioactive cesium—how it changes and spreads over time—by investigating the mechanisms through which contamination transfers from radioactively contaminated fallen leaves and other organic materials to insects and fish. We are developing approaches to reduce contamination, such as techniques to suppress its transfer, while working with local communities to help restore their way of life as it once was. As part of our efforts to prepare for the future, we are also leveraging numerical simulation models to predict how radioactive cesium remaining in undecontaminated forests may change as human activity resumes, and to reconstruct how radioactive materials moved through river basins in the early aftermath of the Fukushima Daiichi nuclear accident. The simulation results will be incorporated into community rebuilding efforts. Based on the reconstructed results, we will also review and organize approaches to monitoring and environmental management, especially in the early phase following the nuclear accident. These findings will be shared both domestically and internationally.

Filtration of river water samples collected (left photo)
River water samples collected during a routine survey (right photo)

Regional Environmental Co-Creation Unit

Unit Leader

HAYASHI Seiji

After completing the Doctoral Program in Civil and Environmental Engineering at the Graduate School of Engineering, Tohoku University, joined the National Institute for Environmental Studies (NIES) in 1996. Engaged in research on watershed environmental management in the Yangtze River in China and subtropical island regions. Since immediately after the nuclear accident in 2011, has been investigating the environmental dynamics of radioactive substances in river basins in Fukushima and assessing their impacts. Has been residing in Miharu, Fukushima, since 2016. In 2025, appointed as the Unit Leader of the Regional Environmental Co-creation Unit at F-REI. Continues to explore ways to contribute to building a disaster-resilient and sustainable society in collaboration with local communities.

Q What is your research policy, and what do you value the most?

A Environmental research requires more than simply delving into scientific interests—it also calls for a practical mindset focused on how we can protect and improve the environment. Therefore, I always strive to maintain a balance between scientific exploration and a broad perspective. One key role of environmental researchers is to contribute to a more sustainable society. To that end, I make a conscious effort to listen to diverse stakeholders and incorporate their insights into my research to the extent possible, toward the goal of real-world implementation.

Q What is the future you want to envision with F-REI?

A My goal is to provide reliable evidence that can help evacuees make informed decisions about returning to their communities, and ensure that those who have already returned or relocated can live with peace of mind. I also hope to contribute to the restoration of Fukushima’s rich *Satoyama* landscapes—traditional rural areas where people live in harmony with nature—in collaboration with local residents and F-REI’s researchers in other fields. In addition, I aim to share our current initiatives both in Japan and abroad, to promote global preparedness for any future nuclear disaster that might occur.

What do you do on holidays:
Playing tennis, gardening, etc.

People you admire:
DOGO Toshio,
a leading engineer of the Showa era

Childhood dream:
Newspaper journalist

What does research mean to you:
A tool to make a better world

Deputy Unit Leader

AONO Tatsuo

Completed the doctoral program at the Graduate School of Chemistry Research, Kindai University, earning a Ph.D. in Science. Held positions at the Institute of Radiological Sciences, National Institutes for Quantum Science and Technology (NIRS-QST) before joining F-REI in 2023. Currently serves as Deputy Unit Leader of the Regional Environmental Co-creation Unit. Also serves as Visiting Professor in a collaborative course at the Graduate School of Tohoku University. Received the 2009 Paper Award from the Advanced Marine Science and Technology Society (AMSTEC).

If properly managed, radioactive materials and radiation can serve as useful tools that enrich our lives. The Fukushima Daiichi nuclear accident highlighted the risks they could pose once out of control. However, there is no single, all-encompassing solution to these issues. Guided by the words of TERADA Torahiko, a physicist and essayist who emphasized the importance of “fearing correctly,” I make a conscious effort to assess their impacts from broad and elevated perspectives.

Disaster Prevention and Mitigation

Nuclear Disaster Medical Science Unit

Unit members

TAKAMURA Noboru (Unit Leader)

Aiming to systematically organize Fukushima's recovery journey from a medical perspective through analysis of residents' physical and mental health conditions, as well as the state of their communities

In March 2011, Fukushima Prefecture experienced a complex disaster that included a nuclear accident. The recovery process—from the chaos immediately after the accident to the present—stands as an unprecedented case in the global context. Our unit aims to systematically organize Fukushima's recovery journey, and to conduct research and share the knowledge gained as data that contributes to disaster prevention and mitigation both in Japan and abroad. Specifically, we conduct risk assessments of radiation exposure, collect dose data, and conduct studies on residents' mental and physical well-being including maternal and child health, from the perspectives of radiation epidemiology and public health. In addition, we are actively collecting testimonies through resident interviews and identifying issues related to post-disaster radiation protection measures. One of our key objectives is to build a research framework that contributes to reducing future disaster risks, and promote disaster prevention and mitigation both domestically and internationally. We also aim to collaborate with international organizations such as International Commission on Radiological Protection (ICRP), Organisation for Economic Co-operation and Development (OECD), and United Nations Office for Disaster Risk Reduction (UNDRR), to help advance global disaster risk reduction and foster experts capable of playing active roles on the international stage in the fields of disaster prevention and mitigation.

Measurement of ambient dose rates in Tomioka, Fukushima

Nuclear Disaster Medical Science Unit

Unit Leader

TAKAMURA Noboru

Graduated from Nagasaki University School of Medicine and completed the Doctoral Program at the Graduate School of Biomedical Sciences of the same university. Served as Assistant at the School of Medicine and subsequently as Associate Professor in the Department of Public Health, before being appointed Professor at the Atomic Bomb Disease Institute in 2008—all positions held at Nagasaki University. Currently serves as Director of the Great East Japan Earthquake and Nuclear Disaster Memorial Museum, Deputy Director of the Institute of Environmental Radioactivity (IER) at Fukushima University, and Visiting Professor at Higashi Nippon International University. In 2025, appointed as the Unit Leader of the Nuclear Disaster Medical Science Unit at F-REI. Received the Tsunoo Award for Science Excellence in 2005. Publications include *Radiation and Radioactive Materials Q&A*, a compilation of articles originally published in the Fukushima Minpo newspaper.

Q What inspired you to start your research?

A Having become a doctor in Nagasaki, a city that suffered the atomic bombing, I felt a strong sense of responsibility to provide medical support to the growing number of pediatric thyroid cancer patients following the Chornobyl nuclear power plant accident—a commitment I continued for many years while working as a clinical internist. Drawing on this experience, I went to Fukushima immediately after the 2011 Fukushima Daiichi nuclear accident. There, I gave lectures to residents on radiation exposure and its impact on health, and provided recovery support in affected communities as a specialist in radiation health science.

Q What is your research policy, and what do you value the most?

A Through Nagasaki University's reconstruction promotion hubs established in Kawauchi, Tomioka, Okuma, and Futaba, we conduct radiation dose assessments for local residents and engage in risk communication. What I value most in the activities at these hubs is to listen closely to the voices of local residents. Conducting research that contributes to recovery requires understanding of what is actually needed in the affected areas. Listening to local voices is the foundation for research that is community-centered and rooted in reality.

Q What is the future you want to envision with F-REI?

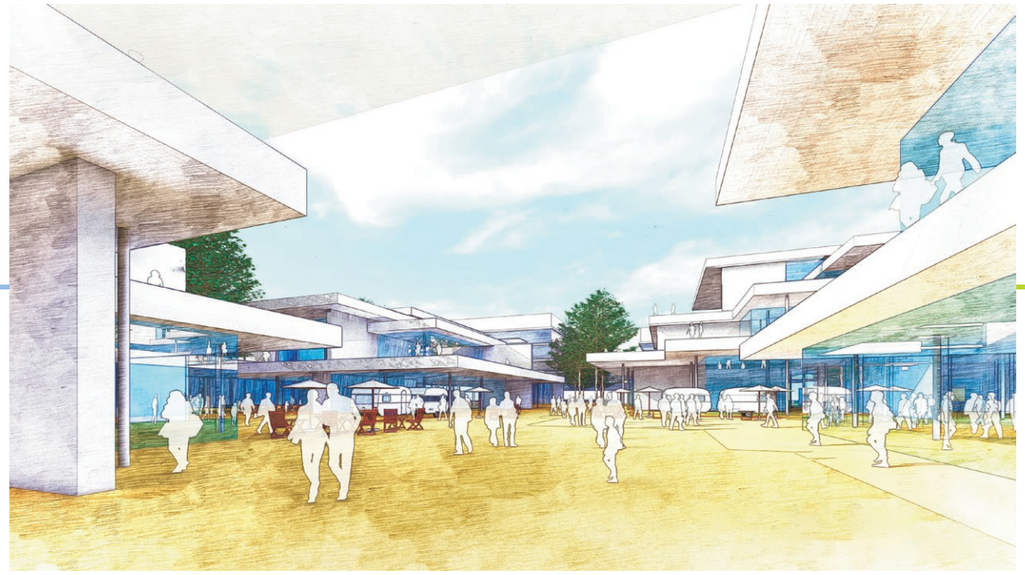
A The path Fukushima has taken over the last 14 years toward recovery is one that no other region in the world has ever walked. Systematically organizing both the successes and setbacks experienced along that path is critically important for advancing disaster prevention and mitigation, not only in Japan, but around the world. This also represents a major responsibility for F-REI. We are committed to building a future in which Fukushima becomes a world-class hub for education and research in disaster prevention and mitigation, and where F-REI produces the next generation of global experts in this field.

Favorite music:
Listening to a wide range of music from classic, jazz, to hard rock

What do you do on holidays:
Going sea fishing, though only once in a while

Childhood dream:
To become an adventurous historian like Indiana Jones

What does research mean to you:
A kind of adventure that contributes to society



Bird's-eye rendering of the F-REI campus (courtesy of Nikken Sekkei Ltd., Nihon Sekkei, Inc., and Pacific Consultants Co., Ltd.)
*Please note that this is a preliminary rendering and the final design may differ.

Accelerating research and facilitating interaction with the local community

F-REI is currently developing a new research hub. The planned construction site spans approximately 16.9 hectares to the west of Namie station. We aim to create a facility that offers an inviting environment where leading researchers and companies from Japan and abroad come together and actively engage in research and development. At the same time, we envision a welcoming, community-based facility where we can work on community development together with local residents. In addition, the site will feature a Collaboration and Exchange Zone with an open plaza tentatively named Central Square, where local residents can feel free to drop by. Plans for the area include a café, dining facilities, shops, and a childcare center. A hands-on science experience space for children is also being planned, to help nurture the next generation.

Fukushima's challenge is paving the way for a better global future!

YAMAZAKI Koetsu
President

Since its establishment in April 2023, F-REI has undertaken a wide range of initiatives aimed at achieving creative reconstruction in Fukushima and the broader Tohoku region, addressing various regional challenges and paving the way for a future beyond recovery.

F-REI conducts research in five key areas: robotics; agriculture, forestry and fisheries; energy; radiation science, medicine and drug development, & industrial applications for radiation; and collection and dissemination of data and knowledge on nuclear disasters. In addition to advancing research within individual fields, we value interdisciplinary collaboration that leverages their respective strengths. Through this integrative approach, we strive to generate outcomes that are distinctive to F-REI.

A major feature of F-REI's research is its goal-oriented approach, with a strong emphasis on demonstration and social implementation. We value both the accumulation of academic knowledge and its application to local communities and society in ways that are useful in people's daily lives. Our mission is to tackle challenges unique to Fukushima, conduct diverse research that is possible only in this region, develop pathways for societal implementation, and disseminate the results to the world.

The number of research groups, which began with just one at the time of founding, has grown to 11 over the past two years. Our current goal is to expand this to 50 by fiscal 2030. As we move forward, we hope to welcome like-minded peers from both Japan and abroad—people who find F-REI's activities exciting—and work together on research and development that we can proudly share with the world. A new research hub is also under development. We expect it to go beyond being a research center and serve as a campus that evolves together with the local community.

F-REI seeks to transform Fukushima's Hamadori Area into a place of transformation and hope, which serves as a center of excellence for creative reconstruction. Our mission is to go beyond the conventional idea of recovery by ensuring that our research takes root in the local community, contributes to people's daily lives, and helps build a future in which Fukushima is seen as a land of aspiration. We hope to become an organization that local people feel proud of and call "our F-REI" with affection. To that end, we are committed to advancing our daily research efforts while deepening collaboration with local industries, municipalities, and residents.

With the belief that our challenges beginning in Fukushima will one day help shape the future of the world, we will continue to move forward as a community-based hub open to the world. We sincerely appreciate your continued support.

YAMAZAKI Koetsu
President
Fukushima Institute for Research, Education and Innovation (F-REI)

Born in Toyama Prefecture. Completed the Master's Program in the Graduate School of Engineering at Kanazawa University in 1976. Doctoral program in Engineering at Osaka University in 1982. Appointed as Professor in the Faculty of Engineering at Kanazawa University in 1994. Became President of Kanazawa University in 2014. Current President of F-REI (since 2023).