

Researchers are now spreading their wings from Tohoku to the world.

TI-FRIS

Tohoku Initiative for Fostering Global Researchers for Interdisciplinary Sciences

TI-FRIS



The Ministry of Education, Culture, Sports, Science and Technology (MEXT)'s Strategic Professional Development Program for Young Researchers aims to enhance the research productivity of Japan. It supports universities and research institutions that promote the strategic development of excellent researchers. The project includes incorporating information about the best models in other countries into good examples of the development of researchers in Japan, creating programs for developing the world's top-class researchers, and establishing a coordinated system for researcher development (e.g., a system to publish papers in leading international journals, to obtain overseas research grants, etc.) rather than disparate schemes in each laboratory.

(https://www.jst.go.jp/innov-jinzai/sekai/en/index.html)

In 2020, the Tohoku Initiative for Fostering Global Researchers for Interdisciplinary Sciences (TI-FRIS) was selected as a MEXT Strategic Professional Development Program for Young Researchers. TI-FRIS, led by Tohoku University, formed a consortium with universities in the Tohoku region Hirosaki University, Iwate University, Akita University, Yamagata University, Fukushima University, and Miyagi University of Education as well as the Mitsubishi Research Institute, Inc. In partnership with cooperating research institutions and companies in Japan and worldwide, the initiative establishes a new researcher development program covering the whole Tohoku region for TI-FRIS Fellows selected from participating universities to help them grow to the world's top-class researchers with interdisciplinarity, internationality, and sociability, and demonstrates its effectiveness.



Interdisciplinarity

the ability to carry out interdisciplinary research with researchers in different fields

Internationality

the ability to conduct research through friendly competition with researchers around the world



Sociability

the ability to work with society to translate research outcomes into social applications





Message from the Program Manager

The Tohoku region of northern Japan is faced with numerous challenges from a declining birth rate to disaster recovery and the need to switch to green energy. These are issues that concern the future of humanity and are deeply connected to the SDGs, and they are shared globally. The seven national universities of the Tohoku region all have their strengths in terms of independent research related to these challenges. They have built strong foundations and boast good track records in education and research in all of these areas.

TI-FRIS aims to foster world-class researchers who will be essential to addressing those challenges. They must be equipped with interdisciplinarity (able to develop interdisciplinary research with researchers in different fields), internationality (to conduct research through friendly competition with researchers around the world), and sociability (to work with society to translate research outcomes into social applications).

TI-FRIS is led by Tohoku University, which has been working to foster research talent based on interdisciplinary research. A consortium was formed with participating universities in the Tohoku region Hirosaki University, Iwate University, Akita University, Yamagata University, Fukushima University, and Miyagi University of Education as well as the Mitsubishi Research Institute, Inc. - all of which possess their own research strengths. This program seeks to harness those advantages and their characteristic initiatives. In partnership with cooperating research institutions and companies in Japan and worldwide, TI-FRIS provides programs on interdisciplinary researcher exchange, international collaborative research, and social implementation of

research, as well as a basic transferable skills training program. These programs will create a diverse, creative forum to flexibly serve and support the independent growth of researchers. Through these programs, we aim to develop researchers to lead international collaborative research projects and projects to implement research findings in society.



Toshiyuki Hayase Program Manager

Frontier Research Institute for Interdisciplinary Sciences Tohoku University



The TI-FRIS Secretariat sits within the Frontier Research Institute for Interdisciplinary Sciences at Tohoku University, the lead institution. The Program Manager oversees the initiative overall, while the Program Steering Committee made up of members from each participating institution deliberates on important matters related to the initiative. The Advisory Board and External Evaluation Committee are made up of third-party experts. The Faculty Evaluation Committee selects and assesses program candidates of TI-FRIS Fellows, while the Program Development Working Group is responsible for the general implementation of the programs. Domestic and international mentors provide support to TI-FRIS Fellows. With its online researcher exchange and meeting system, TI-FRIS has established the conditions for both researcher exchanges and efficient working of the committees.







Under TI-FRIS, a consortium has been formed with seven national universities of the Tohoku region with track records of partnership in all areas of education and research, as well as the Mitsubishi Research Institute, Inc. a multidisciplinary international thinktank. This researcher development program is being rolled out in partnership with research institutions and companies in Japan and worldwide, based on the building of a network that harnesses the strengths of each institution. This global network, anchored in the Tohoku region, will create a tremendously diverse and creative forum.



Researcher Development Program

Five programs are being implemented under this initiative in order to foster field-leading world-class researchers who are equipped with the ability to develop interdisciplinary research with researchers in different fields (interdisciplinarity), the ability to conduct research through friendly competition with researchers around the world (internationality) and the ability to work with society to translate research outcomes into social applications (sociability). These are the International Collaborative Research Program, the Interdisciplinary Researcher Exchange Program, the Social Implementation Program, the Transferable Skills Training Program, and the Common Program.





Hub Meeting

*Online event



The 1st **TI-FRIS** International Symposium *Online event

The 1st TI-FRIS International Symposium was held on March 23-24, 2021. TI-FRIS Fellows introduced their research and the stakeholders. interacted with each other. Many participated in this symposium online.

Hub Meeting is an interdisciplinary opportunity to interact with a wide range of young researchers. This meeting supports the growth of young researchers to understand the importance of interdisciplinary research and to be able to use it. The presentations will focus on "what is interesting about my field," "what is the research method in my field," and "introduction of problems that are not likely to be solved only within my field."



The 1st Hub Meeting "Next Generation Exercise"



Assistant Professor Presenter Joii Kusuvama (TI-FRIS Fellow)

Frontier Research Institute for Interdisciplinary Sciences, Tohoku University / Life and Environments



The 2nd Hub Meeting

"Atomic Diffusion Bonding: Room Temperature Bonding of Wafers for Creating Various New Devices"





Professor Presenter Takehito Shimatsu

Frontier Research Institute for Interdisciplinary Sciences. Tohoku University / Information and Systems



3.25

The 3rd Hub Meeting "Engineering a better culture environment outside the body"



Assistant Professor Presenter Yuji Nashimoto (TI-FRIS Fellow)

Frontier Research Institute for Interdisciplinary Sciences, Tohoku University / Life and Environments

Transferable Skills Training Program

*Online event

TI-FRIS holds lectures by top researchers or experts from Japan and worldwide who have a lot of achievements to strengthen the TI-FRIS Fellows' essential skills to be the world's top-class researchers. Lectures of FY2020 were held in the TI-FRIS symposium. TI-FRIS promotes the flexible operation of the program by holding online lectures and archiving the recorded videos.

Lecture Course on Interdisciplinary Research

"Virus Research from Cellular to Global Level"

Assistant Professor Yuki Furuse

Institute for Frontier Life and Medical Sciences, Kyoto University



Lecture Course on Industrial R&D and Social Implementation

"Encouragement of Social Implementation Theory"

Research Director Shinichi Kamei Mitsuhishi Research Institute Inc



Lecture Course by Top Researchers

"What I have learned in establishing and running an international collaboration"

Professor Nicolas Produit University of Geneva



"Toward understanding of disease-causing protein aggregation"

Professor Young-Ho Lee Korea Basic Science Institute



Lecture Course on Societal Impact

"Crossing between science and social / human science — a case of ELSI / RRI assessment practice on emerging science"

Associate Professor

Ryuma Shineha

Research Center on Ethical, Legal and Social Issues, Osaka University





TI-FRIS Fellows are selected from participating universities every year. The program takes up to five years, with a follow-up period of five further years. In the programs provided by TI-FRIS, they will engage in regular interdisciplinary researcher exchanges with different specializations and institutions, ongoing international collaborative research with overseas researchers, and the application of research findings in society.



Hirofumi Tazoe Associate Professor Hirosaki University Institute of Radiation Emergency Medicine Starting Year: 2020 My study is method development of radionuclide in environmental and biological samples. In addition to solid

environmental and biological samples. In addition to solid phase extraction and mass-spectrometry, development of automated separation system is also investigated for establishment of international standard

Keywords 1. Radionuclide 2. Chemical separation 3. Automated system



Osamu Nomura Assistant Professor

Hirosaki University Graduate School of Medicine Starting Year: 2021

We will develop a mobile lab to measure the real-time emotions of healthcare professionals in a crisis situation such as the COVID-19 pandemic to prevent their burnout for sustainable healthcare provision.

Keywords 1. Medical Education 2. Emotions 3. Learning science



Katsuyuki Takahashi Associate Professor Iwate University ■ Faculty of Science and Engineering

Starting Year: 2020 Applications utilizing high-density radicals produced in the plasma generated by the pulsed power technology for agriculture and food industries, such as an environmental management system for plant growth and keeping freshness of fruits and vegetables, are investigated.

Keywords 1. High voltage 2. Plasma 3. Collaboration of agriculture and engineering



Kentaro Murata Assistant Professor Iwate University = Faculty of Science and Engineering Starting Year: 2020

Toward the practical application of microwave wireless power transfer technology, in addition to improving transfer efficiency, we aim to break multifaceted barriers, such as detecting the location of dead-battery devices and avoiding radio interference with human and existing wireless systems.

Keywords 1. Wireless power transfer 2. Wireless communication 3. Radar



Madoka Ichikawa-Seki Assistant Professor

Iwate University Faculty of Agriculture Starting Year: 2021

Fasciolosis is a one of important parasitic zoonoses. The aim of the present study is to develop a diagnostic method for the disease which have global demand

Keywords 1. Zoonosis 2. Parasitology 3. Liver fluke



Naoya Onizawa Associate Professor

Tohoku University Research Institute of Electrical Communication Starting Year: 2020

The objective of this study is to establish invertible logic that can realize "bidirectional computing", where a current computing technology realizes only forward computing. In addition, the application using invertible logic is developed for artificial intelligence and various social issues.

Keywords 1. Computer science 2. Neural networks 3. Simulated annealing



Yasunori Okamoto Assistant Professor

Tohoku University = Frontier Research Institute for Interdisciplinary Sciences Starting Year: 2020

Artificial metalloenzymes (ArMs) are constructed by introduction of a synthetic catalyst into a protein scaffold. The current challenge is the concurrent use of ArMs with various catalysts, such as synthetic metal complexes and biocatalysts, leading to systems catalysis.

Keywords 1. Artificial metalloenzyme 2. Protein Engineering 3. Biofunctional Chemistry



Yuanyuan Guo Assistant Professor

Tohoku University Frontier Research Institute for Interdisciplinary Sciences Starting Year: 2020

I am interested to bridge the gap between engineering and biology by developing multimodal fibers and biosensors to study complex biological systems, particularly the brain.

Keywords 1. Neurotechnology 2. Bioelectronics 3. Multifuntional fibers



Joji Kusuyama Assistant Professor

Tohoku University = Frontier Research Institute for Interdisciplinary Sciences Starting Year: 2020

My hypothesis is that the placenta is a transducer that conveys maternal information to their children. I try to utilize placental function for the prevention of lifestyle-related diseases and congenital diseases in the next generation.

Keywords 1. Endocrinological Metabology 2. Exercise Physiology 3. Epigenetics



Yuta Nakayasu Assistant Professor

Tohoku University = Frontier Research Institute for Interdisciplinary Sciences Starting Year: 2020

I use the green processes to convert the wood resources into various carbon materials and apply them to energy device materials that contribute to electricity storage and electricity creation. The goal is to incorporate these devices into our lives and create an eco-friendly lifestyle.

Keywords 1. Woody biomass 2. Green devices/Green processes 3. Eco-lifestyle creation



Yuji Nashimoto Assistant Professor

Tohoku University
Frontier Research Institute for Interdisciplinary Sciences
Starting Year: 2020

My research interest is a development of a cell culture platform to engineer organ-mimic models. In TI-FRIS project, we develop electrochemical sensors and scanning probe microscopy for the new cell culture platform.

Keywords 1. Microphysiological system 2. Scanning probe microscopy 3. Microfluidic device



Takuya Mabuchi Assistant Professor

Tohoku University = Frontier Research Institute for Interdisciplinary Sciences Starting Year: 2020

The research involves theoretical and computer simulation studies of biomolecular and materials systems. Current research activities span both development of new computational methods and theoretical characterization of proton/hydroxide transport and protein/Polymer phase behavior in biomolecular and polymer materials systems.

Keywords 1. Molecular simulations 2. Ion transport 3. Self-assembly of proteins/polymers



Hiroya Abe Assistant Professor

Tohoku University = Frontier Research Institute for Interdisciplinary Sciences Starting Year: 2021

All living things have outstanding functions throughout the body. My research aims to understand and mimic the functions of nature and beyond nature, based on Electrochemistry, Polymer science, Analytical chemistry.

Keywords 1. Biomimetics 2. Electrochemistry 3. Polymer science



Chrystelle Bernard Assistant Professor

Tohoku University Frontier Research Institute for Interdisciplinary Sciences Starting Year: 2021

Deformation behavior of polymer particles under impact and at the scale of the microstructure. Understanding of polymer coating by cold spray process. Development of polymer coating by cold spray and its characterization. Understanding of the deposition mechanisms of polymer powder.

Keywords 1. Nanomechanics 2. Polymer 3. Cold spray process



Kazutoshi Haga Associate Professor Akita University •

Graduate School of International Resource Sciences Starting Year: 2020

I am conducting research on the separation technology of

valuable metals using mineral processing for unused resources. Combination of surface analysis and information technology with mineral processing technology is also investigating.

Keywords 1. Mineral processing 2. Extractive metallurgy 3. Surface analysis



Naoki Kawano Lecturer Akita University =

Graduate School of Engineering Sciences Starting Year: 2021

Phosphors for radiation measurements have gained attention for various applications such as medical devices, resource exploration and security. In this program, I will develop transparent ceramic phosphors for radiation measurements.

Keywords 1. Scintillator 2. Dosimeter 3. Transparent ceramics



Hirovuki Matsui Associate Professor Yamagata University Graduate School of Organic Materials Science

Starting Year: 2020

We develop ultraflexible electronic devices using organic semiconductors and digital printing such as inkjet. Such devices can visualize the distribution of temperatures. pressures and electric fields on soft and curved surfaces.

Keywords 1. Organic transistors 2. Organic electronics 3. Applied physics



Takan Oto Assistant Professor

Yamagata University Graduate School of Science and Engineering Starting Year: 2020

In this research, by deeply understanding optical characterizations for nanolasers fabricated by the introduction of semiconductor and/or metal nanostructures, we will develop nanolasers with low threshold power and multi-functionality and promote their new applications for various research fields.

Keywords 1. Nanolasers 2. Nanostructure physics 3. Semiconductor optical devices



Sho Kobavashi Associate Professor Yamagata University

Faculty of Agriculture, Food, Life and Environmental Sciences Starting Year: 2021

Glutathione (GSH) is most major endogenous antioxidant and depletion of GSH induce cell death called as ferroptosis. In this study, to elucidate the mechanism of ferroptosis, I address to search for functional ingredients derived from foods that affect the GSH redox system.

Keywords 1. Glutathione 2. Ferroptosis 3. Functional ingredients



Daitaro Ishikawa Associate Professor Fukushima University

Faculty of Food and Agricultural Sciences Starting Year: 2020

The aim of this study is to develop the evaluation method of structural state of food/material polymers due to the effects of external perturbations in the processes using spectroscopic technology and complementarily X-ray analysis, thermal analysis and component analysis. The results of this study will lead to propose new spectroscopic technology and to develop new materials.

(evwords 1. Spectroscopy 2. Imaging 3. Structure-property relationship



Shogo Nishiyama Associate Professor

Mivagi University of Education Faculty of Education Starting Year: 2020

My primary research is in observational astronomy and astrophysics. By observing stars, star clusters and galaxies. I want to understand how they formed, how they evolved and what physical laws govern the formation and evolution of them

Keywords 1. Infrared astronomy 2. Black hole 3. Stellar spectroscopy





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