



TOHOKU
UNIVERSITY

Annual Report 2020



TOHOKU FORUM for CREATIVITY



Message from the Director

Toward the Promotion of the Tohoku Forum for Creativity

Amid the Corona disaster, society continues to struggle for new ways to live. Like most institutions around the world, the Tohoku Forum for Creativity (TFC) had to adjust and cancel or postpone many activities. Still, we have been trying to create new styles, such as hosting events mostly online. Although there are various restrictions, the scope of our activities is expanding through the integrated use of cyber and physical space.

Since its establishment in 2013, the TFC has promoted the "Forum for Creativity" as its main project. Thematic Programs invite leading researchers to stay at our university for about three months. Young researchers and corporate researchers are also invited to participate in it, forming a diverse intellectual network and delving into a single theme from a fresh and multifaceted perspective. We also have Junior Research Programs which provide young researchers with opportunities to develop their own future-oriented research fields.

In FY2020, in the midst of the COVID-19 pandemic, we were able to implement one Thematic Program "Designing the Human-centric IoT Society –Cooperative Industry–Academic Strategies for Creative Future Connection–," while one Junior Research Program "Dawn of Gravitational-wave Cosmology and Theory of Gravity" was partially implemented with the extension of its period until FY2021. We also held Corona-related seminars as well as data science-related ones. These programs and events were held online or in a hybrid form of face-to-face and online, which was a new approach for our activities.

In addition, the Design Hub for our Future Society and the Research DX Support Center were newly established in November 2020. The Design Hub for our Future Society will support social value creation in collaboration with diverse social actors and thereby envision a better design for our future society. Besides several industry collaboration programs already running, we have an open call for "Future Society Design Programs," scheduled to start in FY2022. The Research DX Support Center will help in promoting DX to create an information environment that facilitates creative research activities. Another part of its activities is Research DX Strategy Seminars, which focus on the operation of research DX at universities. In the future, we are planning to host more practice-oriented seminars that focus on the use of data in the field.

I would like to express my sincere gratitude to all those who have contributed to our activities throughout this year. I also would like to take this opportunity to ask for your continued cooperation and support in the future. In the history of humankind, various advances in science and culture have resulted from facing crises. At the Tohoku Forum for Creativity, we hope to contribute to such positive change through our various activities.

Tohoku Forum for Creativity Director
Tohoku University Executive Vice President (for Research)

Motoko Kotani

Overview of the Tohoku Forum for Creativity

Since its foundation, Tohoku University produced a number of academic achievements and leaders under the spirit of Research First, the philosophy of Open Doors, and the policy of Practice-Oriented Research and Education. To develop this unique tradition further, the university is striving to contribute to global society and nurture creative talent under the slogans "Creation on the Leading Edge" and "Challenge for Great Changes." In this vein, the Tohoku Forum for Creativity (TFC) was established in 2013.

Mission

The TFC supports the creation of new knowledge that can improve the future of our societies. To produce new knowledge, it is necessary to prepare opportunities for collaboration in which various researchers can interact, as well as to cultivate emerging talent who can demonstrate their creativity in cooperation with others. Furthermore, to produce knowledge that benefits society, it is indispensable to collaborate and communicate with different stakeholders such as companies, local governments, citizens, etc. Besides these points, we cannot ignore the importance of an environment that fosters creative research activities, because academic research is now becoming more and more inseparable from the utilization of data. With the above in mind, our missions are the following:

Building "A Fellowship of Knowledge" which Contributes to the Solution of the Major Issues Faced by Humanity

The TFC supports the creation of new research fields and the solution of social issues by providing opportunities for researchers to collaboratively tackle the increasingly advanced and complex issues facing society.

Educating Global Leaders to Build the Future of Humanity

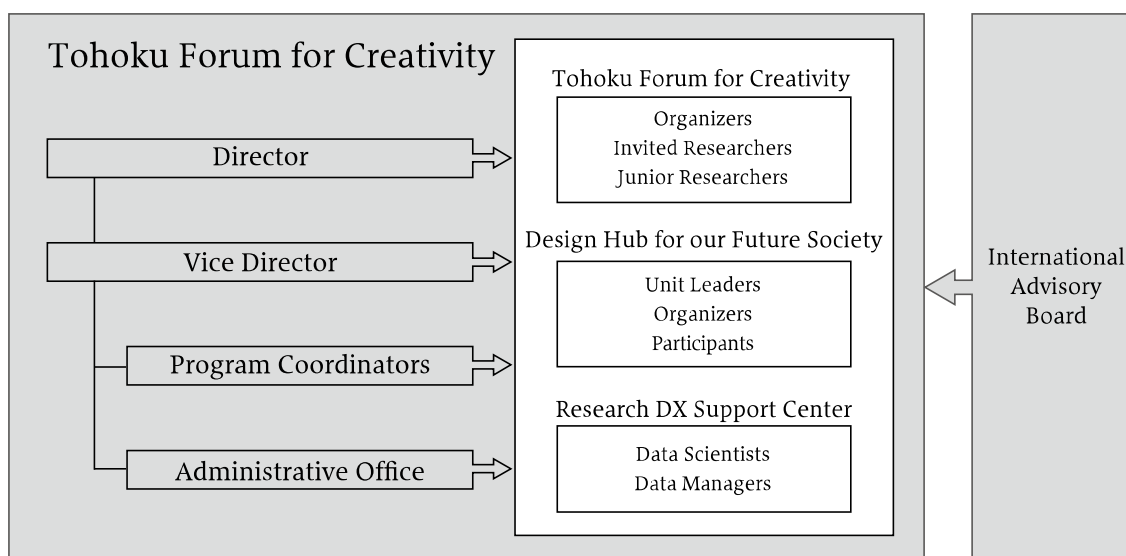
The TFC cultivates global and creative talent by promoting the participation of young researchers and students in our programs, and fostering an environment in which they can interact closely with world-class researchers.

Contributing to Society by Sharing Academic Advances

The TFC promotes the sharing of knowledge by providing opportunities for intellectual exchange between researchers and the general public, including the children who will lead society in the future, through the planning and hosting of public events.

Supporting the Organization of an Information Environment for Creative Research

The TFC supports the organization of an information environment which facilitates creative research through the promotion of DX (Digital Transformation).



TFC Projects and Organizations

The "Forum for Creativity" Project

The TFC was established in 2013 as an organization equipped with Japan's first international visitor research institution. Since then, it has run the "Forum for Creativity" project as its main task. Its objective is to contribute to solving the major issues faced by humanity and support the creation of new research fields by providing opportunities for researchers to collaboratively tackle an issue. For this purpose, we call for thematic programs from throughout the world, covering all academic domains, from the humanities and social sciences to the natural sciences and engineering. The TFC then selects themes for concentrated discussions over a three-month period, for which it invites leading international researchers and hosts international symposia or workshops. It is also actively engaged in the cultivation of global and creative talent by promoting the participation of young researchers and students in our programs. In addition to several Thematic Programs, Junior Research Programs, in which young researchers exercise their initiative for creating new research fields, are hosted every year.

Design Hub for our Future Society

The TFC supports social value creation in collaboration with various stakeholders such as companies, local governments, citizens, etc. and the cultivation of young talent through collaborative activities. To assume this role, the Design Hub for our Future Society was established within the TFC in November 2020. Already, some collaborative programs involving business partners have started. Additionally, the call is now open for "Future Society Design Program" proposals, scheduled to start in FY2022.

Research DX Support Center

The TFC supports the promotion of DX to organize an information environment which facilitates creative research, in view of the current situation, in which research activities are becoming more and more inseparable from the utilization of data. To assume this role, the Research DX Support Center was established within the TFC in November 2020. The Center supports the DX promotion through surveying the situation in Japan and the world, as well as through information-sharing activities such as seminars.

Tohoku Forum for Creativity, Organization for Research Promotion, Tohoku University

Tohoku Forum for Creativity Programs

- Thematic Programs
- Junior Research Programs
- Emerging Perspectives Programs
- Outreach Events

Design Hub for our Future Society

Mathematical Science Unit

- Global Academy-Industry Collaboration and Fostering of Young Generation
- Mathematics Education for Industry Engineers

Humanities and Social Sciences Unit

- Future Society Design School from the Viewpoint of ELSI
- Academy-Industry Collaboration Program

Collaborative Innovation Unit

- Forum for Innovative Social Design considering Society 5.0
- Academy-Industry-Government Collaboration for Open Innovation

Research DX Support Center

- Advanced Research DX Environment
- DX Support by Data Scientists / Data Managers

Advisors

Special Advisors

The TFC has invited two world leaders in business and academia to provide comprehensive advice about the activities of the TFC.

Tetsuro Higashi	Former CEO Tokyo Electron Limited
Makoto Kobayashi	Honorary Professor Emeritus High Energy Accelerator Research Organization

International Advisory Board

The International Advisory Board was established as an organization to evaluate the proposed thematic programs gathered from throughout the world, and to provide advice on the activities of the TFC.

Sayaka Dake	Professor Graduate School of Law, Tohoku University
Arjen Doelman	Director of Lorentz Center Lorentz Center, Center for Scientific Workshops in All Disciplines
Peter Gruss	President/CEO Okinawa Institute of Science and Technology Graduate University
Yuko Harayama	Executive Director RIKEN
Mathias Kläui	Professor Institute of Physics, Johannes Gutenberg-University Mainz
Toru Nakano	Professor Graduate School of Frontier Biosciences, Osaka University
Hirosi Ooguri	Director Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo Institutes for Advanced Study, The University of Tokyo
Huey-Jen Jenny Su	President National Cheng Kung University (NCKU)
Katsuya Yamori	Professor Research Center for Disaster Reduction Systems, Disaster Prevention Research Institute, Kyoto University



Designing the Human-centric IoT Society -Cooperative Industry-Academic Strategies for Creative Future Connection-

Program Theme

While the innovations driven by IoT and AI are expected to greatly contribute to our society, IoT and AI may have unexpected negative effects, depending on how they are developed and implemented in society. The "human-centric IoT society" is realized as a social system where human beings and computers harmonize with each other. The aim of this thematic program is to discuss issues of future human-centric IoT societies through industry-academic collaborations.

A salient feature of this program is the introduction of technology assessment methods including cross-cutting discussions, which comprehensively cover liberal arts, technology and science.

This program examined, through technology-assessment and design-thinking methods, how we should design the near-future IoT society to maximize human well-being. For this purpose, students and young engineers, who will play a central role in the near-future society, gathered from various fields to have diverse and practical discussions through lectures, workshops, international symposia, citizen cafés, and so on.



Events

- TEL & TFC collaboration and follow-up Workshops: Designing the Human-centric IoT Society: Shaping a "New Normal" (September 23, 2020 – September 25, 2020 / September 30, 2020)
- School for the Design of a Future Society (October 2020 – March 2021)
- International symposium 1: The 30th Annual Conference of Japanese Neural Network Society (JNNS2020) (December 2, 2020 – December 4, 2020)
- International symposium 2: The 2nd International Symposium on Designing the Human-centric IoT Society (December 5, 2020)
- International symposium 3: The 9th RIEC International Symposium on Brain Functions and Brain Computer (December 5, 2020)
- Public outreach event: Café philosophique "IoT Society and Human Well-being" (December 20, 2020)
- Public outreach event 2: Café philosophique "What is Human-centric IoT Society?" (February 23, 2021)

Program Organizers

- Yoshihiko Horio (Tohoku University)
- Ayumi Hirano-Iwata (Tohoku University)
- Kiyotaka Naoe (Tohoku University)
- Shigeo Sato (Tohoku University)
- Yasunari Takaura (Tohoku University)
- Yasunori Yamanouchi (Tohoku University)
- Masato Morishima (Tokyo Electron Limited)
- Sumie Segawa (Tokyo Electron Limited)
- Mitsuyuki Yamaguchi (Tokyo Electron Limited)

Communication Manager

- Fumiko Shima (Tokyo Electron Limited)





Principal Invited Researchers

- Yutaka Sakaguchi (University of Electro-Communications)
- Yuko Murakami (Rikkyo University)
- Jordi Madrenas (Polytechnic University of Catalonia)
- Pawel Herman (KTH Royal Institute of Technology)
- Jordi Soriano-Fradera (University of Barcelona)
- Wilten Nicola (University of Calgary)

Co-hosted by

- Research Institute of Electrical Communication, Tohoku University
- Center for Science, Technology and Well-being Research, Graduate School of Arts and Letters, Tohoku University

In cooperation with

- WISE Program for AI Electronics, Tohoku University



Dawn of Gravitational-wave Cosmology and Theory of Gravity

Program Theme

Gravitational waves, the existence of which was first predicted by Albert Einstein in 1916, waited 100 years to finally be directly detected in 2015. This discovery implies that we have acquired a new "eye" to view our Universe and it represents the dawn of a new era: gravitational-wave cosmology. This new tool will drastically advance our understanding of the Universe by allowing us to observe various objects that are invisible to observations based on electromagnetic waves, such as distant astronomical bodies and even the very moment right after the birth of the Cosmos, called "cosmic inflation." On the other hand, gravitational waves are figuratively called "ripples in the fabric of spacetime," which implies that spacetime itself is considered a kinematical object in our current understanding of gravity. Among the known four fundamental forces, the nature of gravity is not as well understood observationally as electromagnetism, weak force, or strong force. Gravitational waves and their observations will no doubt unveil missing pieces in our understanding of the law of gravity. Placed in such an exciting period of cosmological and astrophysical research, both theoretical and observational, our main theme of this program is to initiate and further the next generation of cosmology and gravitational theories, keywording observational aspects of gravitational waves. This program was originally scheduled to be implemented during the FY2020, but due to the COVID-19 pandemic, it was extended for two years, from 2020 to 2021. In FY2020, a lecture meeting and a dialogue between Professor Takaaki Kajita and Professor Emeritus Rainer Weiss, and the School of Modern Physics were held.



Main Organizer
Atsushi Naruko (Kyoto University)



Program Organizers

Atsushi Naruko (Kyoto University)
Rampei Kimura (Waseda University)
Naoya Kitajima (Tohoku University)
Ryo Namba (RIKEN)
Kenji Toma (Tohoku University)
Linyu Peng (Keio University)

Sponsors

- Graduate Program on Physics for the Universe, Tohoku University
- Japan Society for the Promotion of Science

Events

- [Canceled] School (April 14, 2020 – April 17, 2020)
- School on Modern Physics (August 31, 2020 – September 3, 2020)
- Special Lectures by Nobel laureates "Gravitational waves -From their first detection to future observations-" (November 25, 2020)

Environmental and Financial Risks in Market-oriented Societies



Life is full of risks, and, in recent decades, we have confronted an unprecedented scale of natural disasters, environmental problems, and financial crises, which have had devastating effects on people's lives. Therefore, risks are considered important research agendas among policymakers and researchers. Against this background, our program will identify environmental and financial risks, and study how people in market-oriented societies react to these risks and prepare for such uncertainty. We hope that this program will help minimize costs incurred from such unexpected events in the private sector. In order to conduct comprehensive analyses, we provide the first platform for initiating research collaborations between environmental and financial economists and sharing of research experiences around the world.

Events

- Seminar Series by Tohoku University WISE Programs "Create the New Normal"
6th Seminar: Infection and its Impacts on Society –Past, Present and Future–
(November 5, 2020)
- Young Researchers Meeting on Environmental Risks
(December 16, 2020)
- Young Researcher Meeting on Social Risks
(January 20, 2021)

Constructing a Healthy Society: the Road from an Integrated Biobank to the Real World

The Tohoku Medical Megabank Organization is constructing an integrated biobank, which already consists of biospecimen and information on cohort studies, genome information, and metabolome information from 150,000 participants. The next goal is to achieve a healthy society by utilizing the biobank: finding the genetic causes and calculating the personal risk of diseases, as well as developing next generation medicine. With these goals in mind we started this program entitled: "Constructing a healthy society: the road from an integrated biobank to the real world."

The 150,000-people-scale biobank will be invaluable in constructing a healthy society and thus maximizing its utilization is of key importance. We believe the four fields of novel biomarkers, drug development, prevention through genomics, and prediction from the genome to be the most promising areas. Throughout this program, we will discuss matters from a variety of viewpoints with guest speakers from a wide range of backgrounds including academia, industry, ethics, communication, and municipalities.

Events

- How to utilize metabolome analysis in cohort studies?
(November 18, 2020)

POST 2011 Tohoku Triple Disaster: Lessons and their Global Application on Multi-hazards and Cascading Disasters

This program will discuss the post 2011 strategy as a memorial event of the 2011 Great East Japan triple disaster (earthquake, tsunami and nuclear accident) that pointed out the importance of mitigating major disasters through the perspectives of multi-hazards (spatial scale: more than one disaster occurs at the same time) and their cascading effect (temporal scale: escalating disaster effect over time). Following the Sendai Framework for Disaster Risk Reduction (SFDRR) and Sustainable Development Goals (SDGs), the aim of this program is to systematically discuss the issues with outstanding experts from interdisciplinary fields to minimize casualties, damages and their cascading impacts from multi-hazards on a global scale based on lessons from the 2011 Tohoku triple disasters.

Events

- Pre-event 1 (Collaboration with Berlin Science Week): Learning from disasters for a resilient society: Experiences from the Great East Japan earthquake and tsunami and COVID-19 pandemic (November 2, 2020)
- Pre-event 2: IRIDeS symposium on 10 years after the Great East Japan Earthquake and the future (March 7, 2021)



Photo by IRIDeS

Quantum-Annealing-based High-performance Computing – Optimizing Real-world Systems



Large-scale combinatorial optimization problems are becoming ever more important in various fields such as disaster prevention, finance, logistics/traffic, medicine, or state-of-the-art technologies like bioinformatics. Efficient methods to solve these large-scale problems are indispensable, since they require a huge amount of computation power.

Recently, Quantum Annealing (QA) is attracting attention as an efficient solver of these large-scale computational problems. With QA, solutions are searched for in a massive parallel manner, based on quantum phenomena.

However, for application in real-world systems, quantum methods must be combined with more conventional supercomputers, which provide the required large-scale computations.

This program will bring together researchers and students from many fields, in order to solve some of the world's most pressing problems through a combination of quantum and conventional computing.

Events

- Pre-event: Quantum and quantum-inspired computation for real-world optimization (March 8, 2021)



Other Activities | August 28, 2020

Falling Walls Lab Sendai 2020

Like every year, the Falling Walls Lab Sendai was held jointly with the Falling Walls Foundation of Germany on August 28, 2020. In this presentation competition, young researchers and entrepreneurs explain their work to a general audience in just three minutes. In 2014, Tohoku University held the first such competition in Asia. This year, due to COVID-19, the contest was held online for the first time. A distinguished jury selected the best three presentations. Two finalists from Falling Walls Lab Sendai, Ms. Xinyi Yang and Dr. Jonas K. H. Fischer were nominated to join the Falling Walls Remote Finale, in the Emerging Talents Category.



November 4, 2020

Emerging Talents Day

Dr. Jonas K. H. Fischer, one of the winners of FWL Sendai, was selected as 1 of 10 winners in the Emerging Talents category, by the international jury at the Falling Walls Remote Finale hosted from Berlin.

November 2, 2020

Public Lecture Event at Berlin Science Week 2020

Learning from disasters for a resilient society: Experiences from the Great East Japan earthquake and tsunami and COVID-19 pandemic



Data-driven Science Webinar for Experimentalists



Mathematics, data science, and AI are being applied in various fields in natural sciences, applied sciences, and social sciences. This application is becoming one of the factors that determine the value of research. On the other hand, the "new normal" has arrived due to the current spread of the novel Coronavirus. It is expected that the experimentalist research community will become active in the search for new experimental research methodologies focusing on data science.

This webinar series consists of online lectures for experimentalists, to understand the tools and methods of the research utilizing mathematics, data science, and AI. The target of the lectures is as broad as possible without limiting the fields.

The seminars provided a place for interdisciplinary researchers to meet, including introducing the latest research tools and methods for beginners of information science but also for experts. This seminar was held twice a month, seven times in total. The first session was an overview with five online lectures. From the second session, lectures were held with questions and answers.



Events

- 1st Seminar: Data-driven Science Webinar for Experimentalists (May 28, 2020)
- 2nd Seminar: Data-driven Approach to Materials Science (June 16, 2020)
- 3rd Seminar: Fusion of Simulation Science and Data Science (July 3, 2020)
- 4th Seminar: Invitation to Data-driven "Dry" Life Science (July 17, 2020)
- 5th Seminar: Data Science in Social Science (July 29, 2020)
- 6th Seminar: Data Assimilation Integrating Experiment and Simulation (August 20, 2020)
- 7th Seminar: Introduction to Computational Materials Science & Materials Informatics (September 7, 2020)

Seminar Series by Tohoku University WISE Programs "Create the New Normal"



A new virus has been spreading around the world since the spring of 2020. Few people could have imagined our current lives before then. The new coronavirus is making us change our lives at a rapid pace. But why should we change our lives, and how? We cannot fully fathom it yet, since it is not just the first new virus humanity has encountered in a long time, but also because we have never lived a life in such a connected world as today.

In this series of six seminars, leading researchers in Japan discuss COVID-19, for which enormous amounts of information have already been gathered.

How is COVID-19 different from the viral infections we have experienced so far? What do we know and what do we not know by now? We want this to be a place to gain knowledge, to think and to understand. We also consider what we can do to help, so that a new life can be created. We hope that this seminar provides an opportunity to think about what we can do to coexist with and overcome COVID-19, and to take action to make our new lives happier.



Events

- 1st Seminar: What is COVID-19?
(June 26, 2020)
- 2nd Seminar: Large-scale Infectious Disease as a Disaster –
discussion on DRR for Building Resilient Society
(July 16, 2020)
- 3rd Seminar: The Covid-19 Pandemic and the International
Regime in the 21st Century
(September 10, 2020)
- 4th Seminar: The Green New Deal and The Green Recovery of
East Asia in the Post Pandemic of COVID-19
(October 2, 2020)
- 5th Seminar: To Leverage Artificial Intelligence in a new era
with COVID-19
(October 19, 2020)
- 6th Seminar: Infection and its Impacts on Society –Past,
Present and Future–
(November 5, 2020)



Other Activities | July 10, 2020

The Role of International Collaboration and Culture regarding the COVID-19 Pandemic



Other Activities | July 29, 2020



Special Lecture by Prof. Tasuku Honjo "Peek into the Mystery of Acquired Immunity"



Other Activities | September 4, 2020

5th Open Innovation Consortium Symposium in WEB



Other Activities | October 2, 2020 • November 5, 2020

Events

Seminar Series by Tohoku University WISE Programs
"Create the New Normal"

- The 23rd Seminar: The Green New Deal and The Green Recovery of East Asia in the Post pandemic of COVID-19 (October 2, 2020)
- The 24th Seminar: Infection and its Impacts on Society –Past, Present and Future– (November 5, 2020)

Quattro Seminars





Design Hub for our Future Society | February 2021 – March 2021

Design Hub for our Future Society

At the Design Hub for our Future Society, outstanding researchers from around the world and from Tohoku University work together to create visions for the future including collaborations between academia and industry. The hub aims to solve common societal issues and to achieve research results intended for swift implementation into society.



February 18, 2021

Regional DX Implementation in a Post-Coronavirus Society

March 26, 2021

Contributing to the World and to our Communities –International Co-operative Strategies and the Power of Moonshots–



March 29, 2021

Realizing the next-generation Revolution in Manufacturing Technology through DX





Research DX Support Center | March 3, 2021 · March 11, 2021

Research DX Support Center



The Research DX Support Center was newly established within the Tohoku Forum for Creativity in November 2020 to support the research community in responding to the ongoing digital transformation (DX). The Center has two tasks: one is to survey the situation of DX in Japan and the world, and the other is to share information on DX with the research community. For the latter task, two seminars on the "Tohoku University Research DX Strategy" were held.

March 3, 2021

First Seminar on Tohoku University Research DX Strategy



March 11, 2021

Second Seminar on Tohoku University Research DX Strategy



Emerging Perspectives Program | November 2020 – February 2021

Emerging Perspectives Program

The TFC has carried out the Emerging Perspectives Program (EPP) since 2017 to provide the seeds for future Thematic and Junior Research Programs through workshops or lectures given by invited researchers in various research fields. In FY2020, TFC co-hosted two workshops on Marine Science together with the Okinawa Institute of Science and Technology Graduate University (OIST).

November 11, 2020 – November 12, 2020

OIST-TOHOKU Joint Workshop on Marine Science

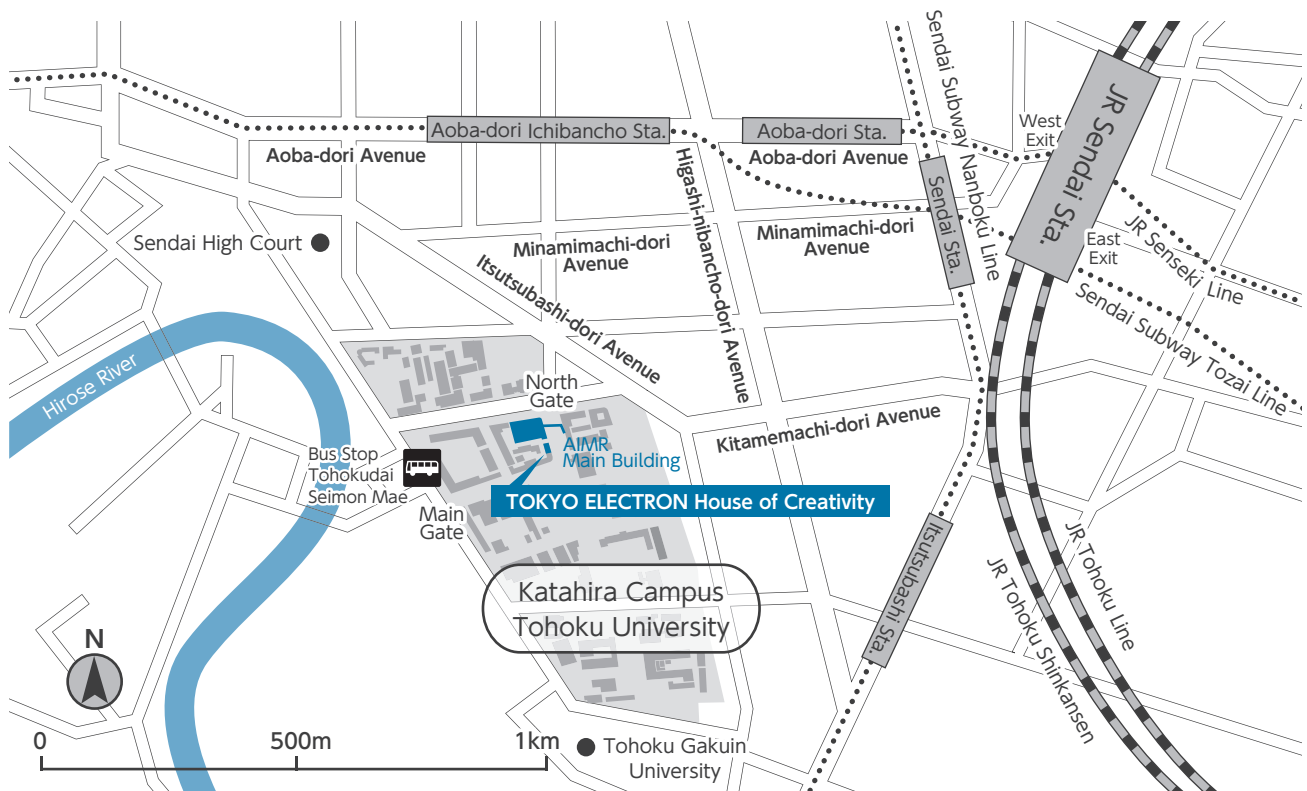


Photo by OIST

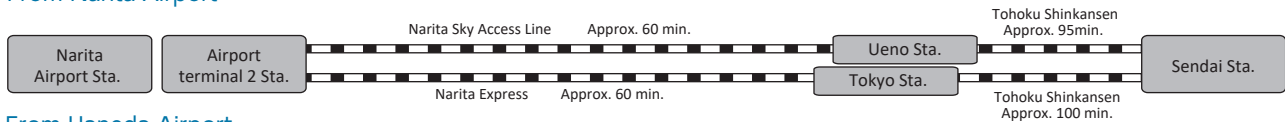
February 17, 2021

OIST-TOHOKU Joint Workshop on Marine Science: Ocean – Collapse and Regeneration

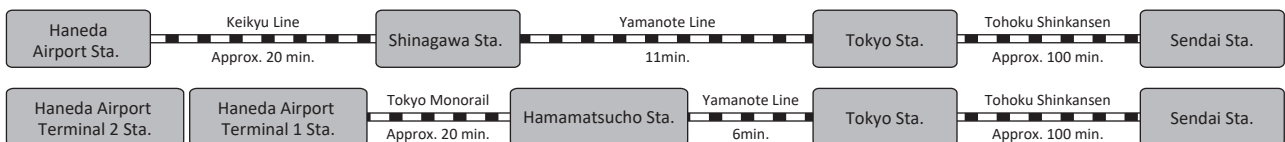
Access and Contact



From Narita Airport



From Haneda Airport



From Sendai Airport



From Sendai Station

By taxi : Approx. 10 min. by taxi from the West Exit on the first floor of Sendai Station

By foot : Approx. 15 min. walk from the West Exit of Sendai Station

From Aoba-dori Ichibancho Station

By foot : Approx. 10 min. walk from the South-1 Exit of Aoba-dori Ichibancho Station

Contact

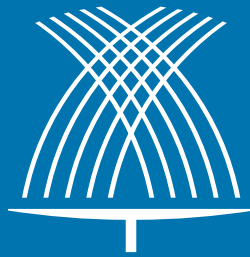
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