



TOHOKU
UNIVERSITY

Annual Report 2021



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) has also been striving to create new forms of activity, such as hosting events mostly online, and these efforts are beginning to bear fruit. Although there are various restrictions, the scope of our activities is steadily 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 have Junior Research Programs which provide young researchers with opportunities to develop their own future-oriented research fields. We also have “Future Society Design Programs,” starting in FY2022.

In FY2021, we were able to fully implement two Thematic Programs: “Environmental and Financial Risks in Market-oriented Societies” and “Constructing a Healthy Society: The Road From an Integrated Biobank to the Real World.” The other two Thematic Programs were partially implemented with the extension of their periods to FY2022, which are the programs entitled “POST 2011 Tohoku Triple Disaster: Lessons and Their Global Application on Multi-hazards and Cascading Disasters” and “Quantum-Annealing-Based High-Performance Computing - Optimizing Real-World Systems.” One Junior Research Program, “Dawn of Gravitational-wave Cosmology and Theory of Gravity” was also partially implemented with the extension of its period until FY2022. These programs and events were held online or in a hybrid form of face-to-face and online.

Established in November 2020, two new sections have engaged in new activities. The Design Hub for our Future Society supports social value creation in collaboration with diverse social actors and thereby envisions a better design for our future society. The Design Hub has managed two industry-collaboration programs. One is “Designing the Human-centric IoT Society -Cooperative Industry-academic Strategies for Creative Future Connection-,” in which TOKYO ELECTRON(TEL) and TFC have collaborated with each other to envisage future IoT societies. While this program was completed in FY2021, a new collaboration program with TEL started in FY2022. The other is “TFC×AXA Collaboration Program on Social Innovations in Insurance in the Digital Society,” which is now running.

The Research DX Support Center helps in promoting DX to create an information environment that facilitates creative research activities. Another part of its activities is “Data-Driven Science Webinars for Practice,” which are practice-oriented seminars that focus on the use of data in the field, and “Research DX Strategy Seminars,” which focus on the operation of research DX at universities.

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

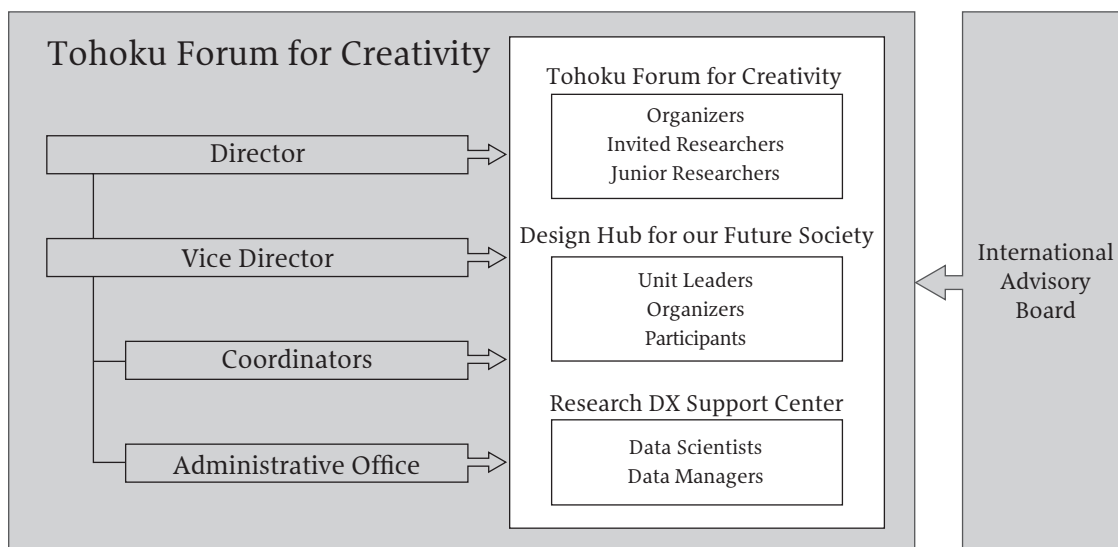
The TFC cultivates global and creative talent by promoting the participation of young researchers and students in our programs, and fostering an environment in which they can interact closely with world-class researchers.

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's Projects and Organizations

The "Forum for Creativity" Project

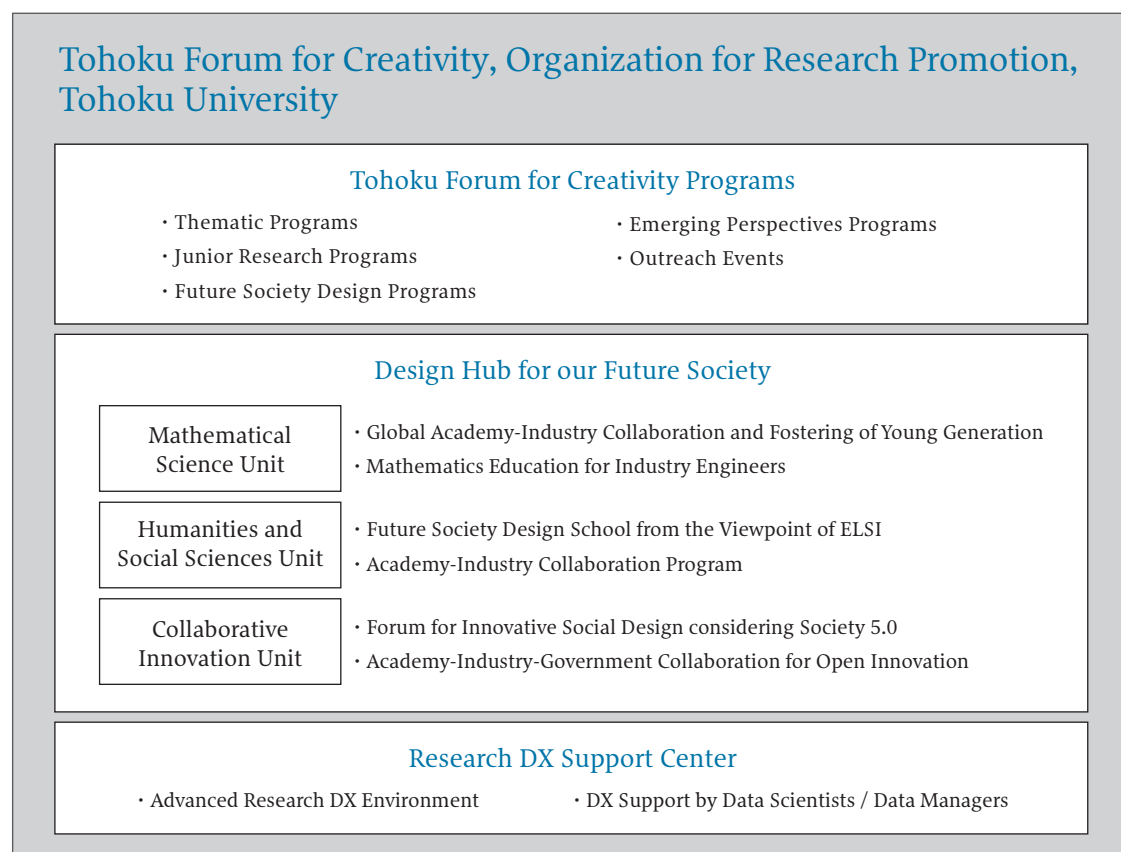
The TFC was established in 2013 as an organization equipped with Japan's first international visitor research center. Since then, it has run the "Forum for Creativity" project as its main task. Its objective is to contribute to solving the major issues faced by humanity and support the creation of new 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 humanities and social sciences to 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. Junior Research Programs, in which young researchers exercise their initiative for creating new research fields, are hosted every year. Additionally, Future Society Design Programs are scheduled to start in FY2022.

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.

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.



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
Hiroshi 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



Environmental and Financial Risks in Market-oriented Societies

Program Theme 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 identified 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 helps minimize costs incurred from such unexpected events in the private sector. In order to conduct comprehensive analyses, we provided the first platform for initiating research collaboration between environmental and financial economists and sharing of research experiences around the world.



Main Organizer
Jun Nagayasu (Tohoku University)

Events

- 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 Researchers Meeting on Social Risks
(January 20, 2021)
- Collaborative Online Program with the University of East Anglia, UK
Discussions and Workshop on Links Between European Economies
and the Rest of the World
(March 16, 2021 / April 27, 2021)
- Connect the World Project - Regional Impact of COVID-19
(April 8, 2021 / May 27, 2021)
- Researchers Meeting on Global Risks
(May 28, 2021)
- Young Researchers Meeting on Social Risks
(August 5, 2021)
- Researchers Meeting on Environmental Risks
(September 2, 2021)
- Researchers Meeting on Environmental and Social Risks
(November 2, 2021)
- The New Socialism: Designing Institutions for the Commons
(March 11, 2022)
- Researchers Meeting on Financial and Economic Risks
(March 24, 2022)

Program Organizers

Jun Nagayasu (Tohoku University)
Akira Hibiki (Tohoku University)

Principal Invited Researchers

Huey-Lin Lee (National Chengchi University)
Eric W. Welch (Arizona State University)
Nazmus Sadat Khan (World Bank)
Peter Martinsson (University of Gothenburg /
Technical University of Denmark)
Liliana Harding (University of East Anglia)
Joseph P. Byrne (University of Strathclyde)
Hitoshi Matsushima (The University of Tokyo)



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

Program Theme

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 is 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 discussed matters from a variety of viewpoints with guest speakers from a wide range of backgrounds including academia, industry, ethics, communication, and municipalities.



Main Organizer
Masayuki Yamamoto (Tohoku University)



Program Organizers

Masayuki Yamamoto (Tohoku University)
Atsushi Hozawa (Tohoku University)
Fuji Nagami (Tohoku University)

Principal Invited Researchers

Takis Benos (University of Pittsburgh)
Akira Sekikawa (University of Pittsburgh)
Rory Collins (UK Biobank)
Mark Divers (Karolinska Institute)

Events

- How To Utilize Metabolome Analysis in Cohort Studies?
(November 18, 2020)
- How To Analyze the Metabolome Information: Nutrition
(November 9, 2021 – November 10, 2021)
- Cohort, Biobank, and Metabolome for Personalized Medicine
(November 24, 2021)
- Difference of Lifestyles Between USA and Japan: Possibility of
Comparison Using Metabolomics Information.
(February 8, 2022 – February 9, 2022)
- Expanding the Potential of Large-scale Cohort Studies Through
UK-Japan Collaboration
(March 10, 2022)



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

This program discussed the post 2011 strategy as a memorial event of the 2011 Great East Japan triple disaster that pointed out the importance of mitigating major disasters through the perspectives of multi-hazards and their cascading effect. Following the Sendai Framework for Disaster Risk Reduction (SFDRR) and Sustainable Development Goals (SDGs), this program aims to systematically discuss the issues to minimize casualties, damages, and their cascading impacts from multi-hazards on a global scale based on lessons from the 2011 Tohoku triple disaster.

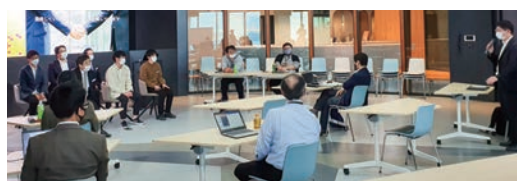


Events

- Student Workshop: Interdisciplinary Perspectives of Disaster Science (June 16, 2021 / June 23, 2021 / July 14, 2021)
- International Symposium and Workshop on POST 2011 Tohoku Triple Disaster: Lessons and Their Global Application on Multi-hazards and Cascading Disasters (June 30, 2021)
- International Symposium: The 30th International Tsunami Symposium (ITS2021) (July 1, 2021 – July 3, 2021)

Quantum–Annealing–Based High–Performance Computing – Optimizing Real–World Systems

Large-scale combinatorial optimization problems are becoming more important in various fields. Efficient methods to solve these large-scale problems are indispensable since they require a huge amount of computation power. Quantum Annealing (QA) is attracting attention as an efficient solver of these problems. With QA, solutions are searched for in a massively parallel manner, based on quantum phenomena. However, quantum methods must be combined with conventional supercomputers for application in real-world systems. This program brings together researchers and students to solve some of the world's most pressing problems through quantum and conventional computing.



Events

- Workshop and Tutorial on Solving Combinatorial Optimization Problems Utilizing Quantum Annealing (May 11, 2021 – June 30, 2021)
- Quantum Annealing Solution Contest (December 18, 2021)
- Quantum Computing Future Vision Forum (March 23, 2022)
- Quantum Annealing Day – Towards a New Era of Work Through Quantum Computing (March 25, 2022)

Dawn of Gravitational-wave Cosmology and Theory of Gravity

The discovery of gravitational waves implies a new “eye” to view our Universe, and it was the dawn of a new era, gravitational-wave cosmology. It advances our understanding of our Universe to observe various invisible objects, even the very moment right after the birth of the Cosmos. The nature of gravity is not so well understood observationally as electromagnetism, weak force, or strong force. Gravitational waves and their observations unveil missing pieces in understanding the law of gravity. Our program’s main theme is to initiate and proceed with the next generation of cosmology and gravitational theories, keywording gravitational wave observation.



Events

- Zao International Workshop “Dawn of Gravitational-wave Cosmology and Theory of Gravity” (February 28, 2022 – March 2, 2022)
- International Workshop “Dawn of Gravitational-wave Cosmology and Theory of Gravity” (March 2, 2022 – March 4, 2022)
- Special Lectures: Uncovering the Origins of the Universe With Gravitational Waves and Higgs Particles (March 5, 2022)

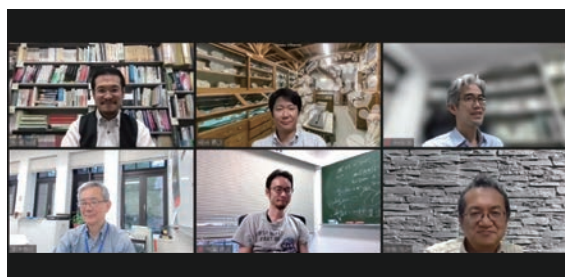


Data-Driven Science Webinar for Practice

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. The “new normal” has arrived due to the current spread of new coronavirus infections. The experimentalist research community has become active in searching for new experimental research methodologies focusing on data science. The seminar provided a place for interdisciplinary researchers to meet, including introducing the latest research tools and methods for beginners of information science and experts.

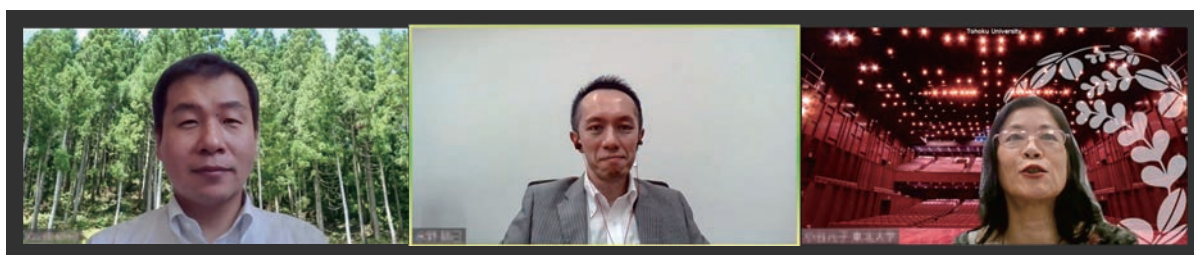
Events

- 8th Seminar: The Frontier of Data-driven Science: Complex Networks Analysis and Bayesian Statistics (July 30, 2021)
- 9th Seminar: Co-creation of Leading-edge Visualization Technology and AI: Towards the Social Implementation of Material Design (August 23, 2021)
- 10th Seminar: The Power of Mathematics in Data Science and AI (September 17, 2021)
- 11th Seminar: Opening up Possibilities of Diagnostic Technology Through Data Science (September 27, 2021)
- 12th Seminar: Data-science for Human and Society (October 21, 2021)
- 13th Seminar: Data-driven Science for Health and Medical Care (March 23, 2022)



The Second Seminar for the Core Research Clusters for Materials Science × The Third Seminar on Research DX Strategy

In this seminar, Toshiki Nagano, JST/CRDS Fellow, talked about “Government Strategies for Enhancing Material Innovation Power” in terms of the prospects for the promotion of DX in Japan. This is a joint seminar co-hosted by the Tohoku Forum for Creativity and Core Research Cluster for Materials Science, Tohoku University.



Design Hub for our Future Society | July 2021 – December 2021

TFC×AXA Collaboration Program on Social Innovations in Insurance in the Digital Society

We created a virtual and in-person plaza to formulate a “identification of social issues” program and the insurance industry’s role, centered on the motto “Digital Society and Insurance Innovation.” As part of this program, we encourage students’ interests in improving their data science and machine learning skills, and simultaneously increase their understanding of the social mechanism of insurance. We provided a suitable plaza for students, researchers, and industrial personnel to approach these social issues collaboratively.



Events

- Student Workshop: Interdisciplinary Perspectives of Disaster Science (July 14, 2021)
- Intensive Course on Risk Data Science and Insurance 2021 (December 6, 2021 – December 10, 2021)
- Kick-off Symposium: TFC×AXA Collaboration Program on Social Innovations in Insurance in the Digital Society (ONLINE) (September 14, 2021)
- Insurance Career Seminar 2021 (December 23, 2021 / December 27, 2021)

g-RIPS-Sendai 2021

The Research in Industrial Projects for Students (RIPS) program has been held at the Institute for Pure & Applied Mathematics (IPAM) of the University of California, Los Angeles. In 2018, the Advanced Institute for Materials Research (AIMR) at Tohoku University in Sendai launched the g-RIPS-Sendai program in collaboration with IPAM, targeting graduate-level students in mathematical science and related disciplines.

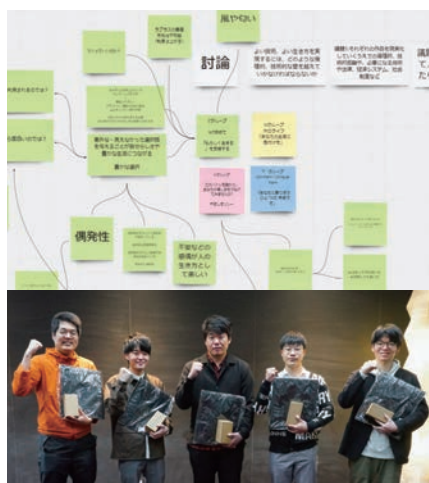
In the g-RIPS-Sendai program, participants from the U.S. and Japan work on cross-cultural teams on research projects designed by industrial partners. The projects are expected to be of great interest to the partners and offer stimulating challenges to students. Most projects involve both mathematical and computational work.

【Follow-up Program】 Designing the Human-centric IoT Society -Cooperative Industry-academic Strategies for Creative Future Connection-

The “human-centric IoT society” is realized as a social system where human beings and computers harmonize with each other. This program aims to discuss future human-centric IoT society issues for well-being through industry-academic collaborations. A salient feature of this program is the introduction of the technology assessment method, including cross-cutting discussions, which comprehensively cover liberal arts, technology, and science. The program created a knowledge base for IoT society development, which naturally fits the sustainable society’s goals. In addition, methodologies for designing the IoT society and practicing its optimal implementation were provided.

Events

- TEL & TFC Collaboration Workshop and Follow-up Workshops: Designing IoT Technology and Society To Realize My Way of Life (September 6, 2021 – September 8, 2021 / September 10, 2021)
- Nonlinear Science Workshop: Panel Discussion on Designing the Human-Centric IoT Society (December 8, 2021)
- Public Outreach Event: Café Philosophique “Will the IoT Bring Happiness?” (December 19, 2021)





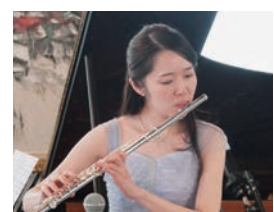
Design Hub for our Future Society | June 12, 2021

[Sendai City × Tohoku University] From the Campus to the City of the Future - A Symposium on the Super City Concept



Design Hub for our Future Society | February 5, 2022

Sendai Round-table Talk Japan's Future Starts From Sendai: Creating a Model City With Advanced Technology and Culture





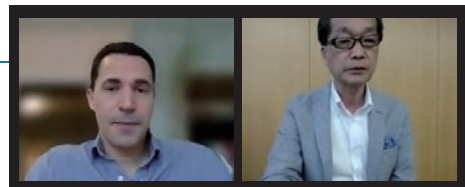
Emerging Perspectives Program | July 2021 – March 2022

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.

July 15, 2021

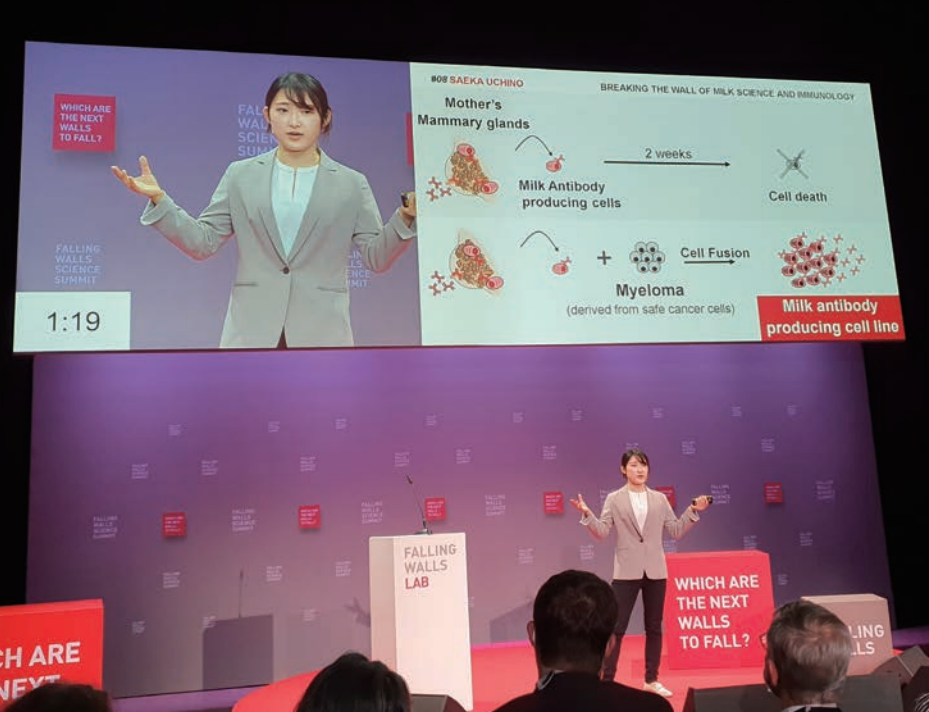
The 5th FRIS-TFC Collaboration Event: Departing the Ivory Tower: A Workshop on Entrepreneurial Research



March 26, 2022 – March 28, 2022

Contact Improvisation Workshop and Interdisciplinary Forum: Non-verbal Communication Through Body Movements

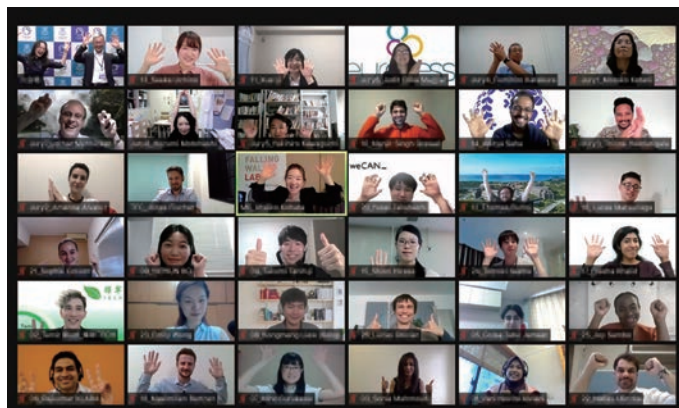




Other Activities | August 31, 2021

Falling Walls Lab Sendai 2021

Like every year, the Falling Walls Lab Sendai was held jointly with the Falling Walls Foundation of Germany on August 31, 2021. 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. A distinguished jury selected the best three presentations. The finalist from Falling Walls Lab Sendai, Ms. Sayaka Uchino was nominated to join the Falling Walls Finale in the Emerging Talents Category.



November 5, 2021

Tohoku University at Berlin Science Week 2021

The Future of Digital Health - What Needs To Be Done?



2021 JAPAN-TAIWAN Advanced Materials and Semiconductor Technology Workshop



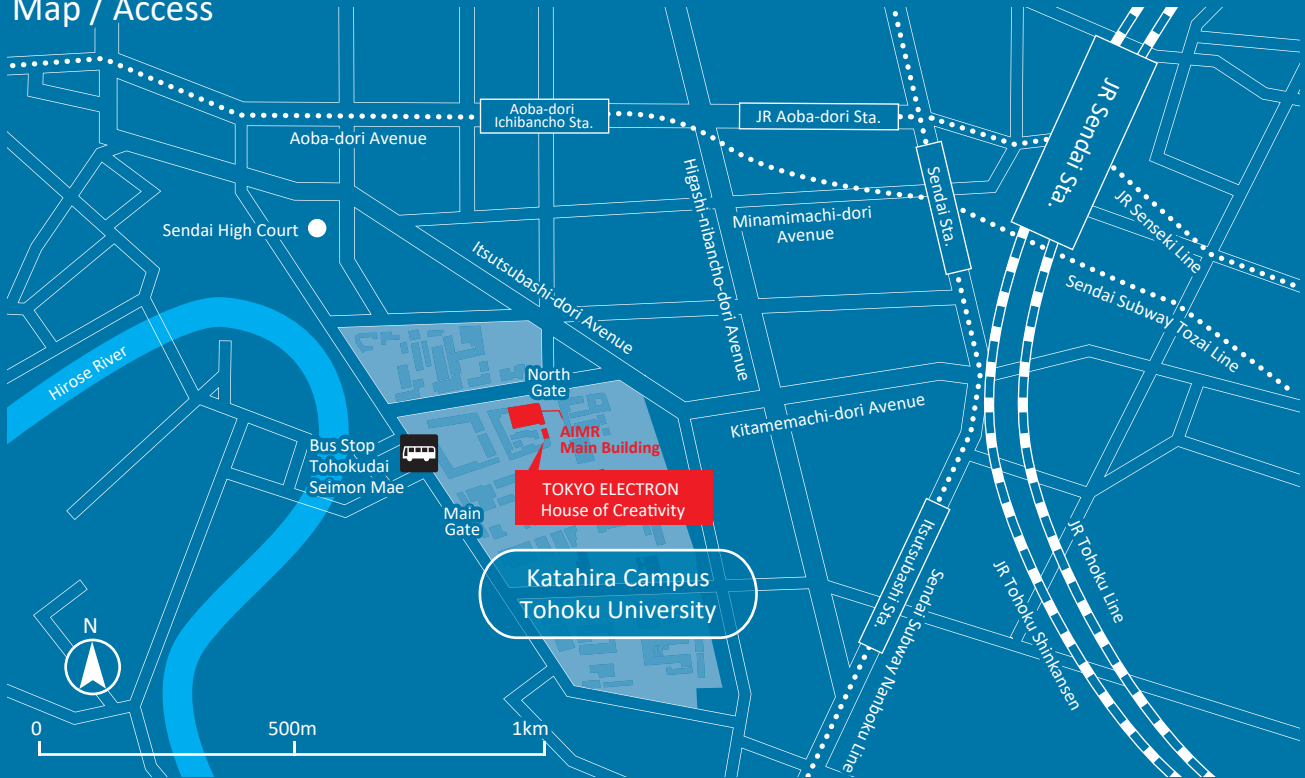
Science Day Award 2021 The Prize of TFC Commemorative Event



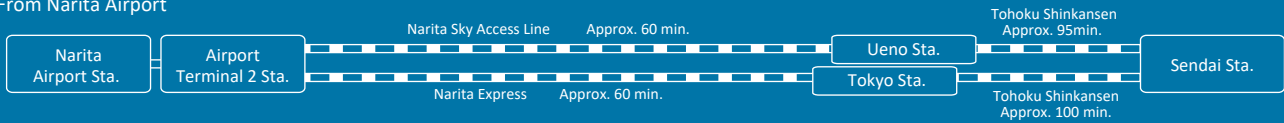
Tohoku University URA Association Special Seminar University-Collaborative CCRC: The Key Points and Ways to Success



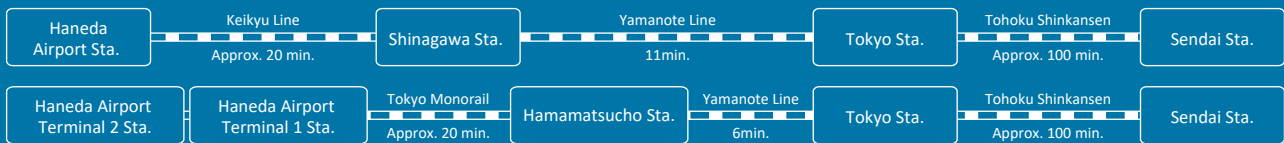
Map / Access



From Narita Airport



From Haneda Airport



From Sendai Airport



From Sendai Sta.

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 Sta.

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

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