

Creating new value and revitalizing the community through research

Research Institute for Technological Science and Innovation (RITI)

技術科学イノベーション研究機構

Research Institute for Technological Science and Innovation (RITI)

戦略研究部門
Dep. for Strategic Research

• TUT-ISYS
(Institute for System Dynamics,
University of Stuttgart)
International Cooperative
Research Laboratory for
Advanced Systems
Engineering

エレクトロニクス
先端融合研究所

Electronics-Inspired
Interdisciplinary
Research Institute



Greetings

The Research Institute for Technological Science and Innovation (RITI) was established on April 1, 2016 to enhance our university's research capabilities by promoting collaborative research with leading companies and top research institutions both domestically and abroad. The RITI is an umbrella organization for research at TUT consisting of the Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), which is an existing research institute; four Research Centers; three new Strategic Research divisions; and the Advanced Research Collaborative Laboratory.

The EIIRIS is TUT's flagship research base for the advancement of interdisciplinary research which combines research on innovative electronic technologies, such as smart sensing, with advanced application fields, including robotics, artificial intelligence, information and communication technology, life science, agricultural engineering, the environment, disaster prevention, design, and chemistry/materials.

The Strategic Research Department adopts an open application system for selecting research themes and a matching fund system to the maximum extent possible. The department consists of various projects integrating state-of-the-art ICT, such as sensor/device technology, AI and IT technology, and robot technology, as well as CPS technologies, all of which are our strengths, with cutting-edge application fields. In addition, the Strategic Research Department is made up of three divisions: the Emergent System Research Division which creates new values; the Social System Research Division which solves problems in collaboration with local communities and society; and the Advanced Research Division which has a strong collaboration system with the world's top research institutions and leading companies. In cooperation with the existing EIIRIS and four Research Centers, the department is advancing research aiming at making open innovation a reality.

TUT works as a research university which adopts large-scale projects relating to its research, such as the Research University Enhancement Promotion Program, the Program on Open Innovation Platform with Enterprises, Research Institute and Academia (OPERA), and the National University Management Reform Promotion Program. By simultaneously promoting basic research and applied research for practical use, TUT makes an effort to accelerate social implementation and commercialization, and aims to become a university that shines brightly in the world.



Kazuhiko Terashima
President
Toyohashi University of Technology

I was appointed as the second Head of the Research Institute for Technological Science and Innovation (RITI) on April 1, 2020.

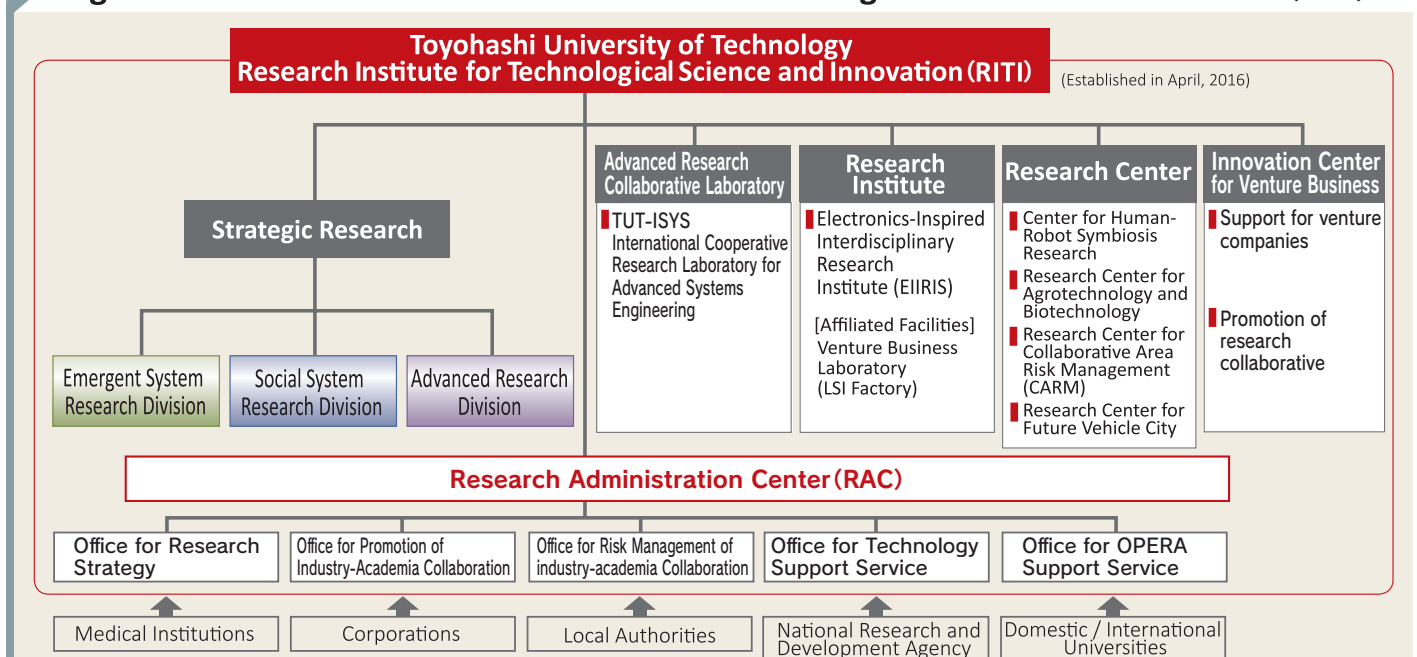
The RITI was established on April 1, 2016 with the objective of strategically planning, promoting, managing and publicizing the Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), the Research Center, the Advanced Research Collaborative Laboratory, and the Cooperative Project for Innovative Research. In particular, the Advanced Research Collaborative Laboratory, which was newly established in the academic year 2015, is advancing globally cutting-edge research by combining the outstanding science and technology of both prestigious foreign universities' laboratories and leading Japanese research institutes/ companies. In addition, the Cooperative Project for Innovative Research is a new initiative that aims to create innovation using a large-scale matching fund system between universities and companies and is beginning to produce results. The Research Administration Center (RAC) is responsible for the smooth operation of the RITI, providing research support in project planning, contracts, legal affairs and intellectual property creation/management.

Since its incorporation, TUT has been designated as a university to participate in the large projects carried out by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), including the Research University Enhancement Promotion Program, "Research Promotion Administration Center (RAC); the Program for Leading Graduate Schools, "Fostering Brain Information Architects with Advanced Technology for Ultra Large Scale Brain Information"; and the Top Global University Project. Only a handful of universities in Japan have been selected for these three MEXT projects. In the future, we aim to vigorously promote cutting-edge research and produce various outstanding research to develop new creative industries centering on innovation. To this end, we will take an open-application approach placing electronics technology at its core, and proactively incorporate different fields, such as robotics, information and communication technology including artificial intelligence and IoT, life sciences such as medical welfare and biotechnology, chemistry and new materials, agriculture, earthquake-resistance and disaster prevention, and environment and urban engineering.



Shinichi Yamamoto
Executive Trustee, Vice President
(Research, International Affairs, SDGs,
Internal Control)
Director of Research Institute for
Technological Science and Innovation
Toyohashi University of Technology

Organization Chart of Research Institute for Technological Science and Innovation (RITI)



Creating new value and Revitalizing the community Through research



Outline of the Research Institute for Technological Science and Innovation (RITI)

Toyohashi University of Technology was built on the philosophy that it will contribute to the development of mankind by discovering scientific principles that support the evolution of technology, the production of modern and innovative technology, and the creation of new value that leads us to the solutions of today's challenges and further into the future.

To put this philosophy into practice at a high level, we especially focus on developing the following:

1. Promotion of Emergent System Research for the creation of new values, which is evolving at a rapid pace and which incorporates TUT's strengths such as sensing, artificial intelligence, and robotics research
2. Promotion of Social System Research for solving problems, which can contribute to local communities
3. Promotion of Advanced Interdisciplinary Research through strong collaboration with leading companies and top research institutions both domestically and abroad

Therefore, we chose to combine our existing Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) with the work of our four research centers, and established the Research Institute for Technological Science and Innovation (RITI) that aims towards achieving open innovation.

We have established three strategic research departments within the institute, and have also founded The Cooperative Project for Innovative Research which is composed of research topics that were selected by members of the school community.



Main Research Policies

- 1 Reinforcing the development of application and interdisciplinary research based on sensory, artificial intelligence and robotics research using the open application method*
- 2 The creation of new, top global research fields
- 3 Reinforcement of research abilities through the Research Administration Center
- 4 Improving the research ability of all members of the faculty at the university to reinforce overall research capability
- 5 Establishment as an international base for science and technology

*Open Application Method

This refers to pursuing interdisciplinary research aimed at actual application in society that makes maximum use of systems for open recruitment of research topics and open funding.

Strategic Research

Emergent System Research Division

Research that creates new value for social implementation

Social System Research Division

Research to solve the problems society and communities face

Advanced Research Division

Globally cutting-edge research in specialized areas

Cooperative Project for Innovative Research

The "Cooperative Project for Innovative Research" is a project to promote effective interdisciplinary research. The project will develop the frontiers of specific fields using a matching fund format with domestic and overseas research institutions and companies; and will strengthen the ability of participants to implement and advocate for the results of research in society.

In addition, the Research Institute for Technological Science and Innovation (RITI) will be used as a learning space for graduate students in the five-year integrated doctoral program through the "Fostering Brain Information Architects with Advanced Technology for Ultra Large-Scale Brain Information" succeeding the Program for Leading Graduate Schools.

Advanced Research Collaborative Laboratory

The lecturers at Toyohashi University of Technology collaborated with researchers from domestic and international research organizations that boast a high standard of research to establish the Advanced Research Collaborative Laboratory. The goal of this was to allow us to pursue research in a specific research field for a fixed period as well as improve the sophistication and variety of research here at our university.

TUT-ISYS(Institute for System Dynamics, University of Stuttgart) International Cooperative Research Laboratory for Advanced Systems Engineering

Directors

○University of Stuttgart
Oliver Sawodny

○Toyohashi University of Technology
Naoki Uchiyama



Research Institute

Electronics-Inspired Interdisciplinary Research Institute(EIIRIS)



Kazuaki Sawada
Director

Determined to become a world leader in development and interdisciplinary research

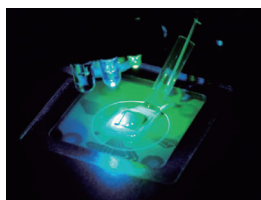
The Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) was established in October 2010 as Toyohashi University of Technology's first research institute to explore the technological sciences and their applications. More specifically, EIIRIS's objectives are to develop interdisciplinary research of smart sensing, photonics information devices, and other innovative electronics technology and their advanced application in fields such as robotics, telecommunications, the life sciences, agricultural engineering, environmental science, and disaster prevention.

In April 2019, EIIRIS expanded its research structure from the existing two research disciplines to five, signaling the start of research and development in new interdisciplinary.



Innovative Sensor Technology

We have realized various devices utilizing accumulated design and fabrication technologies for sensors, MEMS and LSI that have been highly regarded worldwide. We will promote the creation and demonstration of innovative sensors and MEMS devices while collaborating this strength with materials research institutes and applied research institutes.

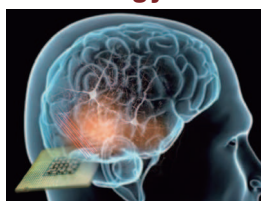


measurement etc.) for agricultural production under environmental control such as intelligent greenhouse and plant factory.



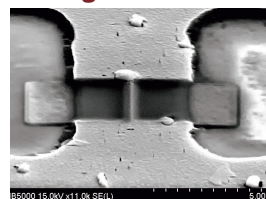
Innovative Applied Sensing Technology

Our research interests include human cognitive functions and mechanisms behind the interpersonal communication and human-robot interaction by utilizing multidimensional information, e.g. human behavior or brain activities, acquired by multimodal advanced sensors.



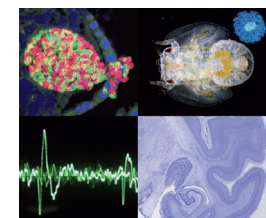
Advanced Environmental Sensing

Our group is developing low-noise Josephson junctions and highly sensitive SQUID magnetometers for application of nondestructive inspection and ultra-low field MRI. We are also studying optimization of terahertz-wave sensor arrays such as microwave kinetic inductance detectors.



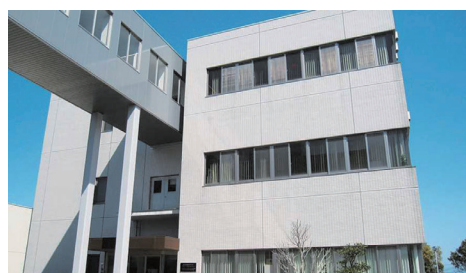
Advanced Life Sciences

Our research focuses on understanding cellular and molecular basis that underlies inter- and intraspecies interactions, behavior, and neuronal function of organisms, along with developing innovative electronic devices.



Advanced Agricultural Engineering

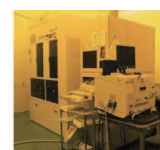
Focusing on the development of sensor-based plant diagnosis techniques (Chlorophyll fluorescence imaging, volatile organic compound measurement, photosynthesis and transpiration



Venture Business Laboratory (LSI Factory)

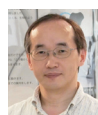
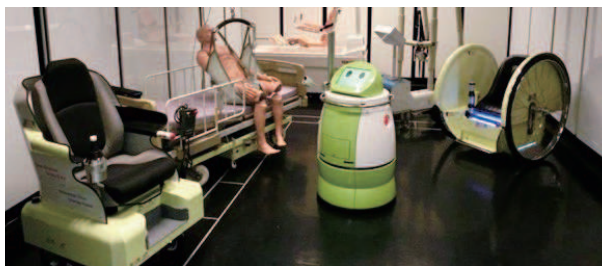
Our LSI Factory, where you can learn everything there is to know about semiconductor integrated circuits

Our LSI Factory, where we do everything from design to the production and evaluation of semiconductor integrated circuits, has some of the world's best equipment. We are pursuing research and education into the development of integrated, intelligent devices, which combine semiconductor integrated circuits (IC, LSI) with sensor technology and nanotechnology.

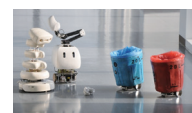


Research Center

Center for Human-Robot Symbiosis Research



Michio Okada
Director



Toward a society where people and robots can coexist at high level and fruitful lives, we are developing various type of service robots such as welfare robots that perform walk training and physical support, harvest support robots, intelligent lighting systems, etc. And we are conducting researches on human-robot symbiosis technologies based on the weak-robots concept, socially assistive robot technologies, and novel actuators using ultrasonic motor.

Research Center for Agrotechnology and Biotechnology



Sensing technology



A plant farm that uses artificial light



Toshihiko Eki
Director



This center was established for applying a range of our engineering technologies to agriculture. The center members, full-time specifically appointed professors as well as researchers in different departments, are collaborating and conducting research into agriculture, sensing systems, biotechnology, the environment, and smart agri-tech city systems.

We are also developing human resources for agriculture by conducting the following training courses: the Advanced Course for Managing Plant Factory, the Advanced Course for IT-based Land-utilizing Farming, and the Training Course for the Sixth Sector Industrialization, the Practical Course for Chrysanthemum and Tomato Cultivations, and the New Farmer Support Course (only in 2021), respectively.

Research Center for Collaborative Area Risk Management (CARM)



Taiki Saito
Director



At our center, we conduct research into disaster prevention in the community and risk reduction in local areas by looking not just at natural disasters, but also at risks on a broader scale in the environment and everyday living. For this reason, we cooperate closely with local administrations, industries, and community groups, and through cross-collaboration with professors in related fields, we are endeavoring to develop technology and put our project aimed at reducing risk into practice. We are also striving to ensure the results of our research continue to benefit the community, and to establish a base for general academic research to contribute to creating a safe community full of vitality.

Research Center for Future Vehicle City

Wireless electric vehicle



Takashi Ohira
Director



We are taking on the following research topics to create the sustainable vehicles of the future with a reduced carbon footprint:

- 1) Research into a city where low-carbon electric cars are the main form of transport
- 2) Research into a city which is safe and secure for vulnerable road users
- 3) Energy-saving technology and new systems that would support a low-carbon society



Wearable sensing for safe driving



Visualization of traffic big-data



Car detection for vulnerable road users



Innovation Center for Venture Business



It has been established for the purpose of utilizing the research results and human resources to support the start-up of a venture company, the research and development of commercialization after the start-up, and the promotion of joint research.

We are waiting for the use of everyone, such as companies.



RESEARCH ADMINISTRATION CENTER



Saburo Tanaka
Vice President
(Research Enhancement)

Deputy Director of
Research Institute for
Technological Science and Innovation
Director of Research
Administration Center

In December 2013, after we became part of the Ministry of Education, Culture, Sports, Science and Technology's Program for Promoting the Enhancement of Research Universities, we established the Research Administration Center (RAC) at Toyohashi University of Technology. It oversees the strategic planning and management of all of our research that will serve to produce research results that will change the world.

At the RAC, URAs who are well versed in education, research, and development conducted at our university, and also have sufficient knowledge of what is required by society, are responsible for the following jobs: 1) Basic research topics that should be covered and the course of action required for collaboration between our university, various companies, and government organizations, 2) Research strategies and proposals to expand our

university's research facilities to achieve the above, 3) The planning and proposal of large research projects that involve university lecturers, 4) Office support for managing industry-academia collaborative research and acquisition of competitive funding, 5) Management of intellectual property creation, 6) International promotion of research results and outreaching activities including the planning of consortiums, 7) Tasks including the management of all contracts and the risk management for industry-academia collaboration, 8) Promoting the effective use of shared equipment throughout the school.

In this way, the RAC supports the research activities pursued by the Research Institute for Technological Science and Innovation (RITI). Especially regarding Strategic Research, the RAC will strongly support the activities by building bridges with companies from the initial topic recruitment stages and maximizing the output of post-written theses, intellectual property, and licensing.

Research Administration Center (RAC)

Office for Research Strategy

- Analyses trends in academic research, scientific policies, society's needs, university potential in Japan and overseas, determines an overall research strategy and presents these ideas to the Strategic Planning Committee.
- Determines and implements programs for the continuous development of URAs (University Research Administrators).

Office for Promotion of Industry-Academia Collaboration

- Proposes policies for the further pursuit of interdisciplinary research to create new value with industry-academia-government at its core.
- Supports acquisition of competitive funding for projects with a large impact.
- Offers overall support from the creation to the acquisition of rights and applications of intellectual property, and supports collaborative activities involving intellectual property.
- Employs experts in international patents and international law to meet the global requirements concerning patents and contracts.

Office for Risk Management of Industry-Academia Collaboration

- Manages issues such as conflicts of interest, confidential information management and security export control in order to facilitate industry-academia collaboration.

Office for Technology Support Service

- Manages the university's shared equipment and provides support for interdisciplinary research by employing experts and lecturers with highly-specialized skills.

Office for OPERA Support Service

- Support the research program on OPERA (Open Innovation Platform with Enterprises, Research Institute and Academia) promoted by Japan Science and Technology Agency.

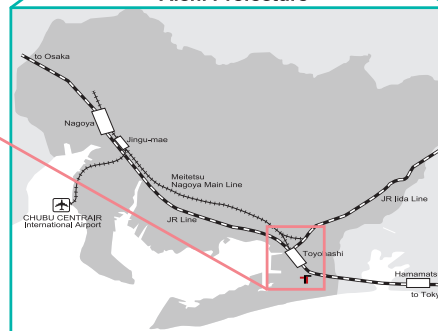


Research Administration Center (RAC) Office (Building D-101)

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Email: office@rac.tut.ac.jp
Website: <http://www.rac.tut.ac.jp>



Aichi Prefecture



Main Research Topics of the Cooperative Project for Innovative Research 2019

Emergent System Research Division

1-1	Department of Computer Science and Engineering Michio Okada	Research Project for Social Implementation of Weak-robots Concept
1-2	Department of Electrical and Electronic Information Engineering Hirofumi Takikawa	Advanced tool Coating Technological Laboratory, OSG-TUT Collaboration (ACTO), 2nd stage
1-3	Department of Architecture and Civil Engineering Taiki Saito	Development of technology to improve earthquake resistance of buildings using dynamic pulley damper mechanism
1-4	Department of Electrical and Electronic Information Engineering Kazuaki Sawada	Development of multimodal sensing technologies for visualization of physical / chemical information in micro-meter scale
1-5	Department of Computer Science and Engineering Michiteru Kitazaki	Estimation and control for human status by using physical care robot
1-6	Electronics-Inspired Interdisciplinary Research Institute Toshihiko Noda	Development of multimodal gas sensing technology for environment measurement
1-7	Department of Computer Science and Engineering Jun Miura	Next-generation Robotic Farming in Greenhouse Horticulture
1-8	Electronics-Inspired Interdisciplinary Research Institute/Department of Applied Chemistry and Life Science Saburo Tanaka	Development of Ultra-Sensitive Contaminant Detection System for Li-ion Battery Components
1-9	Research Center for Future Vehicle City Takashi Ohira	Wireless Power Transfer Serendipity That Enables Automatic Drone Charging Stations to Come True

Social System Research Division

2-1	Department of Architecture and Civil Engineering Kojiro Matsuo	Community-based Road and Traffic Management that Make Use of Big-Data: Toyohashi Model
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Main Research Topics of the Cooperative Project for Innovative Research 2020

Emergent System Research Division

1-1	Department of Mechanical Engineering Takayuki Shibata	Microfluidic-based Genetic Diagnostic and Improving Technologies for Enhancing Food Safety
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Emergent System Research Division

1-2	Research Center for Future Vehicle City Shinji Abe	Wireless power-transfer system for small vehicles
1-3	Department of Applied Chemistry and Life Science Yuu Hirose	Production of the Functional Foods from Algal Cells
1-4	Department of Mechanical Engineering Tomoaki Mashimo	Capsule Endoscope Robot Technology using Micro Ultrasonic Motor
1-5	Department of Electrical and Electronic Information Engineering Kazuhiro Takahashi	Development of biomarker inspection system using MEMS biosensor
1-6	Department of Electrical and Electronic Information Engineering Toru Harigai	Prediction of photovoltaic generation and weather sensing network
1-7	Research Center for Agrotechnology and Biotechnology Takahiro Yamauchi	Development of rooting in the direct planting of a cutting cultivation of the chrysanthemum and the root taking promotion technique

Social System Research Division

2-1	Student Support Center Hiroyuki Daimon	Enhancement of Compact Biogas Power Generation System to the Entire Country
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Advanced Research Division

3-1	Information and Media Center Hitoshi Goto	Development of automatic optimal control technology for market-linked AI vegetable factories
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Main Research Topics of the Cooperative Project for Innovative Research 2021

Emergent System Research Division

1-1	Department of Applied chemistry and Life Science Rika Numano	Elucidation of disease onset mechanism and functional recovery by long-term neuronal activity and behavioral analysis of disease model mice
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