2017／2018

Creating new value and revitalizing the community through research

Research Institute for Technological Science and Innovation (RITI)

Master technology, create technology

TOYOHASHI UNIVERSITY OF TECHNOLOGY

Greetings

The Research Institute for Technological Science and Innovation (RITI) was established on April 1,2016 as an initiative to improve our university's research abilities and achieve results in our research topics by working together with leading domestic and foreign companies and first-class research organizations.The institute is made up of three research divisions: the Emergent System Research Division, the Social System Research Division, and the Advanced Research Division These were established to further develop research activities based on our existing Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) and four research centers, while also focusing on cooperation between our university, various companies, and the larger community. The topics researched in this institute were chosen by members of the school community, forming the Cooperative Project for Innovative Research. We are developing transparent collaborative research activities within the university by adopting 16 different collaborative research projects including three research topics that commenced in 2015 at our Advanced Research Collaborative Laboratory. At the same time, we are striving to train the researchers of tomorrow through collaborative research. These collaborative research projects are an important element in helping us to strengthen our university's role, which is one of the goals of our Third Medium-Term Objective/Medium-Term Plan launched in 2016. With the support of our university's office management and Research Administration Center as the basis, we are pushing forward with meaningful research.

Based on our university's basic philosophy – to conduct research and education in technological science, and to develop new technologies through scientific inquiry – we have always encouraged the formation of a base from which we can support industry-academia cooperation, and have developed research in educational practices to meet the demands of society and the economy. In October 2016, we celebrated the 40th anniversary of our founding and we wish to further enhance our research and development activities and continue pursue research that benefits the community, with the Research Institute for Technological Science and Innovation (RITI) at the center of our activities.

I hope that this collaborative research project initiative, which aims to promote industry-academia cooperation, will strengthen the ties between our university and the industrial world and lead to further integration of both talent and technology.

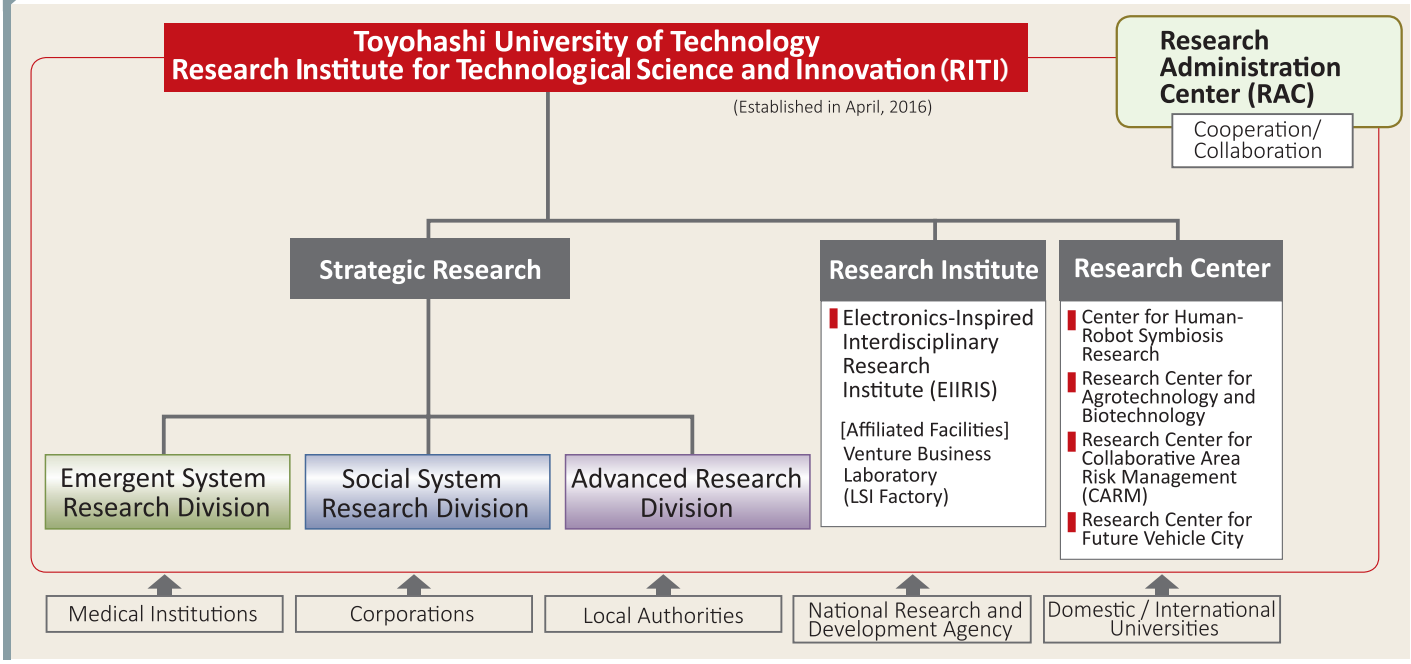
Takashi Onishi
President
Toyohashi University of Technology

I was appointed to serve as the head of the Research Institute for Technological Science and Innovation (RITI) when it was founded on April 1, 2016. This institute was established for the strategical planning, promotion, management, and presentation of the Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), research centers, Advanced Research Collaborative Laboratory, and the Cooperative Project for Innovative Research. The Advanced Research Collaborative Laboratory,which was newly established in 2015,combines scientific technology gathered from prestigious overseas universities, domestic research institutes and leading companies to pursue globally cutting-edge research. The Cooperative Project for Innovative Research is also a new endeavor aimed at producing innovative research funded equally by the universities and companies involved. The project is run by the Research Administration Center which is responsible for the planning, contracts, legal issues, and management of intellectual property as well as support for research activities.

Since this university was incorporated, it has been utilized for the Ministry of Education, Culture, Sports, Science and Technology's The 21st Century Centre of Excellence Program (Intelligent Human Sensing), the Global Centre of Excellence Program (Frontier in Intelligent Sensing), the Program for Promoting the Enhancement of Research Universities' Research Administration Centre, and the doctoral education leading program Training Brain Information Architects. In the future, we aim to produce prominent research by actively incorporating different fields such as robotics, artificial intelligence and IoT, life sciences such as medicine and biotechnology, chemistry and new materials, earthquake and natural disaster prevention, and the environment and infrastructure, all using the open application method with electronics at the core.

Kazuhiko Terashima
Vice President (Research Affairs)
Director of Research Institute for Science and Technology 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. Research into emerging systems to create new value that incorporates artificial intelligence, an area of research showing rapid development
2. Problem-solving research into social systems
3. State-of-the-art research through close cooperation with leading foreign and domestic companies and research institutes

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.

Strategic Research

Emergent System Research Division	Social System Research Division	Advanced Research Division
Research that creates new value for social implementation	Research to solve the problems society and communities face	Globally cutting-edge research in specialized areas

Cooperative Project for Innovative Research
(Research Collaborative Project, Advanced Research Collaborative Laboratory)

The Cooperative Project for Innovation Research is composed of the Research Collaborative Project, which promotes effectively interdisciplinary research, and the Advanced Research Collaborative Laboratory, a project that pursues specific cutting-edge research utilizing facilities from domestic and overseas research institutions. It is funded equally by domestic and international research organizations and corporations, and is designed to develop the forefront of specialized fields and reinforce the application of research results in society.

The Research Institute for Technological Science and Innovation (RITI) also acts as a research space for graduate school students studying under the 5-year Leading Program Training Brain Information Architects.

Main Research Policies

1. **Reinforcing the development of application and interdisciplinary research based on sensory 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.

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.

Prof. Shimojo (Caltech) - TUT International Collaborative Research Laboratory

Mind & Brain Laboratory for Perceptual and Cognitive Processing

Director

- California Institute of Technology
  Shinsuke Shimojo
- Toyohashi University of Technology
  Shigeki Nakauchi

AIST-TUT Advanced Sensor Collaborative Research Laboratory

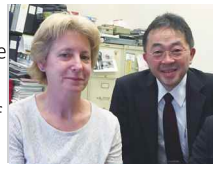
Director

- National Institute of Advanced Industrial Science and Technology
  Shiro Hara
- Toyohashi University of Technology
  Kazuaki Sawada

Prof. Ross (MIT) - TUT Collaborative Multiferroics Research Laboratory

Director

- Massachusetts Institute of Technology
  Caroline A. Ross
- Toyohashi University of Technology
  Atsunori Matsuda



Research Institute

Electronics-Inspired Interdisciplinary Research Institute(EIIRIS)

Kazuaki Sawada
Director

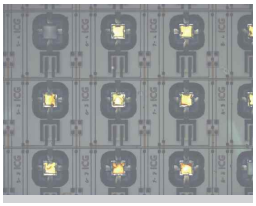
Determined to become a world leader in development and interdisciplinary research

The Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) was established in October 2010 as this university's first research institute. It is a base for conducting interdisciplinary research, combining our university's strengths of electronics infrastructure technology (sensors, LSI, photonic devices) and advanced fields of application (life sciences, agricultural science, environment, information transmission, robotics, etc.) into a new field of research and development.

Examples of Research Conducted at the EIIRIS

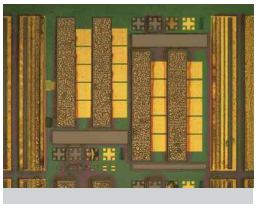
Integrated Ferroelectric Micro Sensors

At our LSI factory, we do everything from researching materials and structures, to integrated circuits, device production and system design. We are conducting research on micro sensors that combine ferroelectric material, which makes ultrasonic waves and infrared rays visible, as well as integrated circuits. We are aiming to apply this technology to medical examinations and security systems.



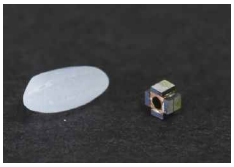
Development of High Power Electronic Devices Using Nitride Semiconductors

High power electronic devices using Nitride Semiconductors (GaN) have been receiving a lot of attention for their ability to effectively convert and control various types of electricity such as solar power and large-capacity batteries. We are working to develop and evaluate devices that use technology involving the formation of reliable insulator films and ion implantation for practical application.



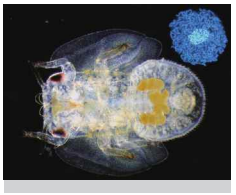
Micromotors and Microrobots

We are conducting research involving 1mm micro ultrasonic motors. Recently, we even succeeded in creating practical torque (several grams of force at the tip of the motor). Torque for a motor of this size has perhaps never been seen anywhere else in the world, and we are working to apply this technology to micro-robots.



Platform Analysis of Integrated Coexistence Between Insects and Bacteria

Some insects absorb bacteria into their own cells and the two become codependent on each other. We are conducting a platform analysis into this codependence to develop eco-friendly insect repellent that only works on pests, acquire useful materials such as seed compounds, and revolutionize biotechnology by controlling the biological interface.

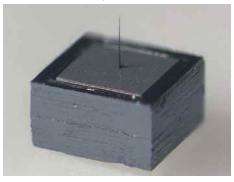


Human Neuro-sensing

We are conducting research to learn more about the nervous network that relates to cognitive processing by measuring cognitive behavior and controlling biological signals, mainly brain activity. The knowledge we obtain from this research will be applied to brain machine interfaces (BMI) and neuromarketing.

Interdisciplinary Research into the Development of Nerve Electrodes and Neuroscience

We are conducting experiments on animals (mice, monkeys) in our Life Sciences Laboratory to try to understand the neural platform for our sensory cognitive behavior. We are also conducting verification experiments using the Toyohashi Probe and electrodes necessary to measure brain activity.



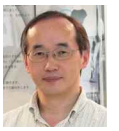
Venture Business Laboratory (LSI Factory)

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



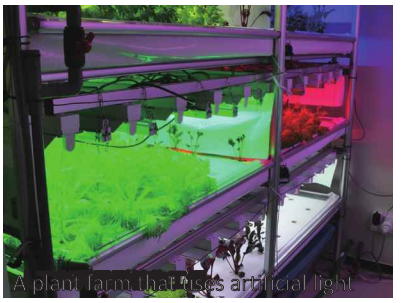
Michio Okada
Director

We are conducting research into care robots, service robots, and assistance and communication technology to achieve a society that creates fulfilling lifestyles where humans and robots can cooperate at a sophisticated level.

We are currently working on collaborative projects involving the futuristic Next Generation Care Station, which carries out basic care, nursing, and rehabilitation; Terapio, a robot that performs hospital rounds, Toyokki, a robot that guides visitors around Toyohashi City, and a robot that supports agricultural activities. We are also exploring new ways for humans and robots to coexist with such projects as Yowai Robot, a robot who brings out the helpful side of people.

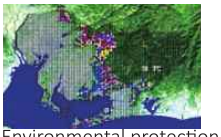
Research Center for Agrotechnology and Biotechnology

Sensing technology



A plant farm that uses artificial light

Takanobu Inoue
Director



Environmental protection system

This university, which has a range of technology including sensing and other engineering technology, established this center as a base for our application and development activities, and currently conducts general research in agriculture, sensors, biotechnology, and the environment. The center boasts full-time specially appointed professors, as well as lecturers who belong to different departments and fields who work to conduct research, as well as different training courses aimed at people already in the workforce such as the Frontier Plant Factory Manager, Frontier Course in IT for Land-utilizing Farming, and Training Program for Sixth Sector Industrialization.

Research Center for Collaborative Area Risk Management (CARM)

Taiki Saito
Director

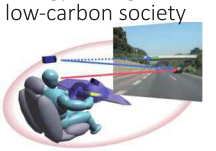
At our center, we conduct research into disaster prevention in the community and risk reduction in local areas by looking not just at natural disasters, but also at risks on a broader scale in the environment and everyday living. For this reason, we cooperate closely with local administrations, industries, 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

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



RESEARCH ADMINISTRATION CENTER

Kunihiko Hara
Vice President
(Research Enhancement)
Deputy Director of
Research Institute for Science
and Technology 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, our University Research Administrators (URA), who are well-versed in our university's education and research development and have sufficient knowledge of the community's needs, and Science and Technology Coordinators for the collaboration between universities, industry and government 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 export of safety guarantees, 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.

■ Office for Intellectual Property Management

- 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 Technology Support Service

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

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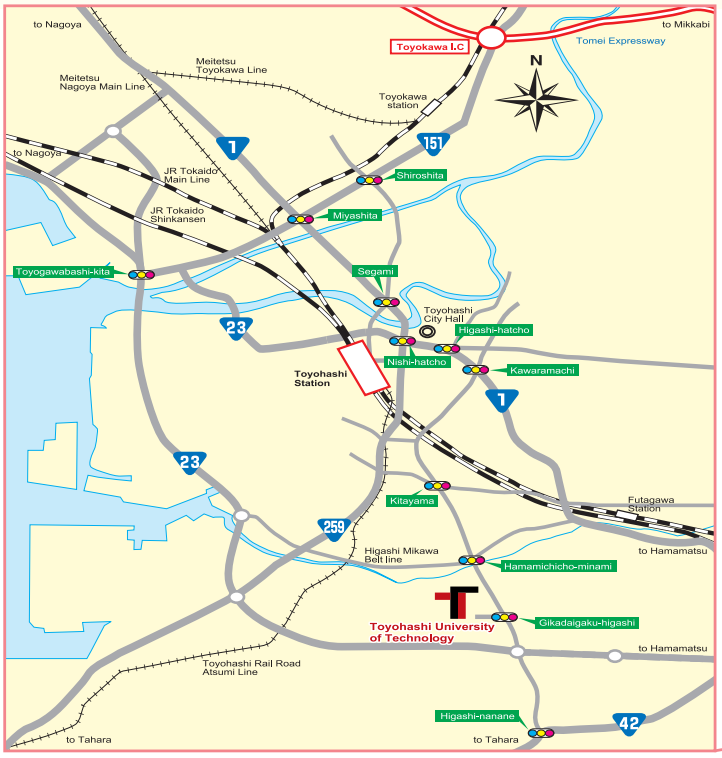

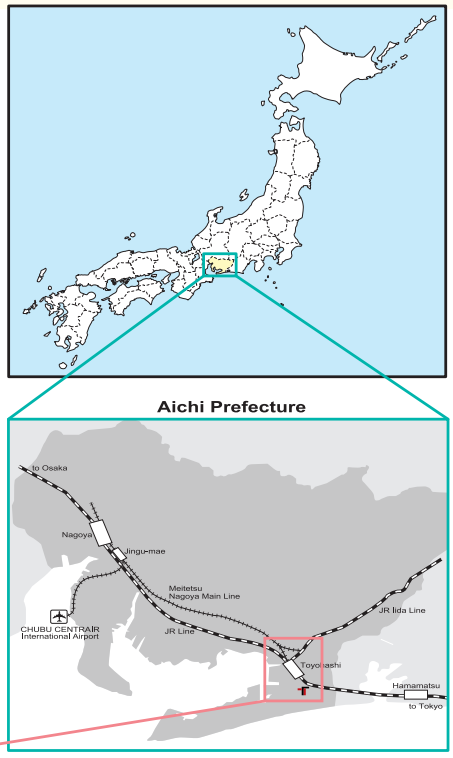

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