TUS

Building a Better Future with Science

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TOKYO UNIVERSITY OF SCIENCE

Building a Better Future with Science

Innovative TOKYO

Tokyo: a city on the leading edge of business, technology and fashion. As the capital of Japan and heart of the largest conurbation in the world, Tokyo leads in a wide range of fields, including politics, business and culture. Its multi-talented people and rich heritage constantly generate fresh cultural expressions. In this place of constant dialogue between tradition and innovation, students and researchers alike can find the intellectual stimulation that will open their eyes to a broad and multifaceted range of horizons. The diversity of options and plethora of unique experiences that can be encountered here make Tokyo a wellspring of innovation.

@TUS

As Japan's only private comprehensive university of science and technology, Tokyo University of Science (TUS) leads the way on the cutting edge of research. While grappling with global issues in the search for a sustainable society, TUS continually generates breakthrough technologies and showcases them to Japan and the world.

Mission

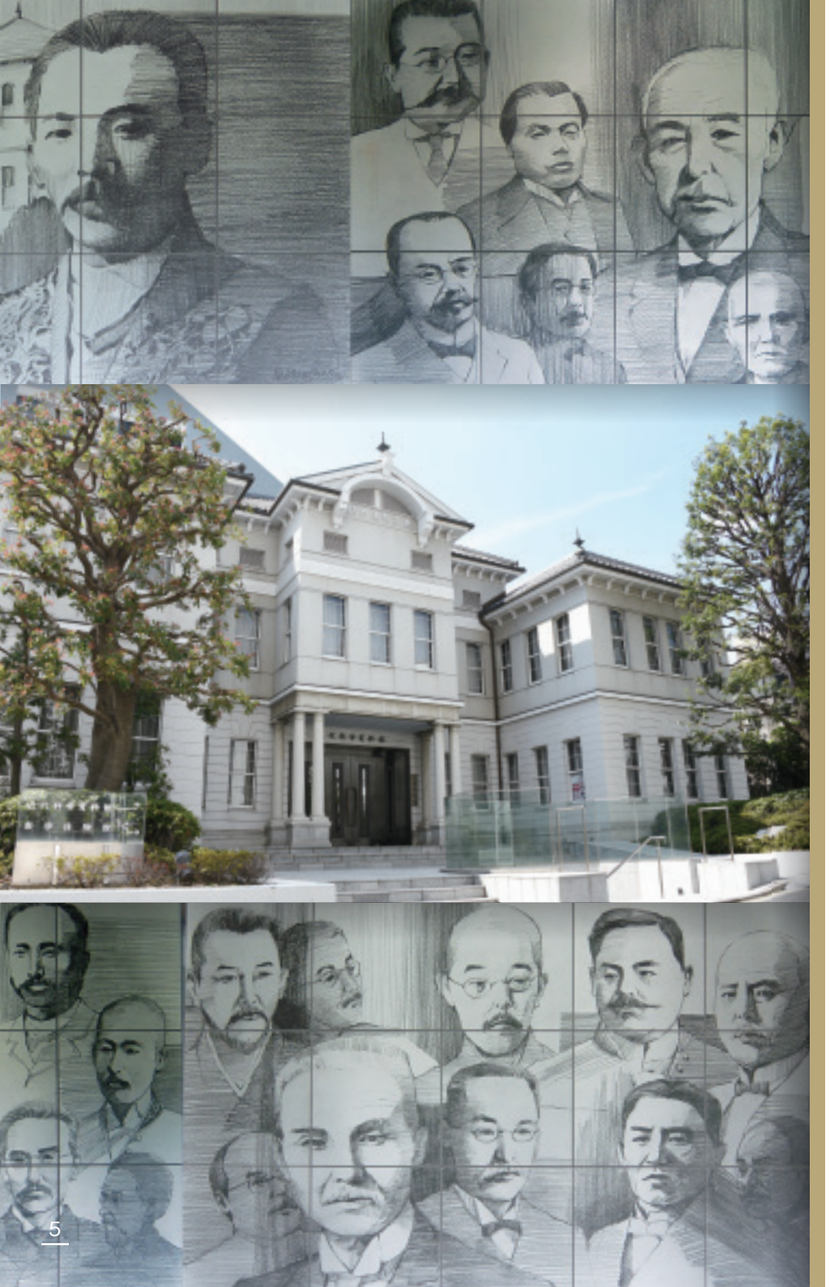
Building a Better Future with Science

The Founding Spirit of TUS is "Building a Better Future with Science." The educational and research philosophy of TUS, which aims to create science and technology for nature, people, society, and the harmonious development of all three, dovetails with the spirit of the sustainable development goals (SDGs), whose aim is the achievement of a sustainable world.

Vision

The State of TUS on Its 150th Anniversary in 2031 From Japan's TUS to the World's

- Training large numbers of people to leverage Japan's advanced technology in the drive for innovation
- Contributing people who can serve as world-class leaders in the fields of science and technology, business management and education
- An environment that cultivates people who can tirelessly seek solutions that contribute to humanity, with outstanding practical skills and perseverance
- A research hub that leads the world, covering the spectrum from basic to applied research
- A magnet for people from around the world seeking free, open and versatile dialogue in an interdisciplinary community
- The nucleus of a robust network of alumni who contribute to society wherever they are in the world



About TUS

In its nealy 140 years of history, TUS has carved out a solid position among Japan's educational institutions as the nation's only private comprehensive university of science and technology. A distinguishing feature of TUS is that, while specializing in science and technology, TUS pours its efforts into holistic education and offers education and research that traverse multiple academic fields. Since its foundation, TUS has stressed its educational policy of *meritocracy*, a commitment to supplying society with graduates of real and valuable capability. At the same time, TUS is committed to elucidating unknown principles of nature and sparking revolutions in technology.

The Founding Spirit

The founders of the institution now known as TUS were a group of 21 young scientists who had graduated with bachelor's degrees from the Imperial University (now the University of Tokyo), Japan's only university at that time. Moved to repay their debt to the nation for the education they had received, in 1881, the young scientists established Tokyo Butsurigaku Koshujo ("the Tokyo Academy of Physics"), the forerunner of today's Tokyo University of Science. Lacking money at first, the founders worked without pay, borrowing school buildings from other schools to teach lectures at night. The noble spirit of the founders, in their selfless devotion to the future of Japan is bequeathed to TUS today as the founders' spirit: "Building a Better Future with Science."

TUS at a Glance

Undergraduate
7-32
Faculties Departments

Graduate
7-30
Graduate Schools Departments

International Students 613

Partner Universities
82

Faculty Members
1,722

Students
18,948

Specialist course
Doctoral course
Master's course
Undergraduate

Student Nationalities
20
Countries

Research Institutes 37

Laboratories
380

TUS × SDGs

Achieving a Sustainable World through the Creation of Science and Technology

The Sustainable Development Goals (SDGs) are a set of international objectives for the period from 2016 to 2030 adopted at the United Nations Sustainable Development Summit in September 2015. Consisting of 17 goals and 169 targets for the achievement of a sustainable world, the SDGs exhort member nations to “leave no one behind” anywhere on Earth. The SDGs are *universal*, meaning they are intended for adoption by developing and developed nations alike.

TUS’s educational and research philosophy, which is to “Creating science and technology for nature, people and society and the harmonious development of all three—Building a Better Future with Science,” matches perfectly with the spirit of the SDGs. Now and in the future, TUS is committed to educating people, advancing research and giving back to society with the fruits of its research, aiming to achieve a sustainable world through the creation of science and technology.

SUSTAINABLE DEVELOPMENT GOALS

Contributing to World Health Through Science

3 GOOD HEALTH AND WELL-BEING

Approach 1 The Age of Curing Diseases with DNA Has Arrived

NISHIKAWA, Makiya
Professor
Department of Pharmacy
Faculty of Pharmaceutical Sciences

KEYWORDS
#Biopharmaceutics
#Drug Delivery System

One field in which researchers and pharmaceutical manufacturers around the world are investing significant resources is the development of ***nucleic-acid pharmaceuticals***: drugs that derive their medical efficacy from the manipulation of DNA and RNA. Highly effective yet easy to produce, nucleic-acid pharmaceuticals are expected to yield efficacy against previously intractable illnesses. These characteristics hold out the prospect of developing revolutionary wonder drugs and producing them in bulk for sale at low prices. A couple of such drugs have already been approved in Japan, and their number is expected to grow going forward.

My laboratory conducts research on drug delivery systems, to deliver these nucleic-acid pharmaceuticals to their targeted sites with pinpoint timing. Drawing on the properties of DNA, we have developed a “drug-carrier” DNA sequence that contains several sites for carrying nucleic-acid pharmaceuticals. By loading each of these sites with nucleic-acid pharmaceuticals, we devised a method of efficiently delivering multiple types of drugs to immune cells. We also succeeded in creating a “self-gelling nucleic acid” that fixes the nucleic-acid pharmaceuticals at the intended sites for long-lasting effect. By leveraging these technologies while using natural nucleic acids, we are paving the way for the development of further nucleic-acid pharmaceuticals while maintaining excellent levels of safety.

Approach 2 Improving Medical Treatment with Statistical Models

I research medical statistics, which applies statistics and machine learning to the medical field. Recently I’ve been focusing on the construction of models for patient prognostics. An example of such a model would be one that predicts the time until a patient’s cancer recurs through the analysis of big data gathered from multiple cancer patients’ clinical records, MRIs, CT scans, and so forth. I believe that these kind of statistical models will prove highly valuable in establishing more effective medical treatments.

SHIMOKAWA, Asanao
Junior Associate Professor
Department of Mathematics
Faculty of Science Division II

KEYWORDS
#Biostatistics #Machine Learning

Approach 3 Big Data Analysis for Long-term Care in Japan

I am working on economic analysis of long-term care for the elderly. Using big data of long-term care admission records, I conduct evaluations of Japanese long-term care systems to obtain implications for evidence-based policy making. What kind of long-term care system can be feasible under the constrained resources of Japan? Based on a rigid statistical background, I analyze actual data from the real world to find the sustainable long-term care mechanisms. Working on.

SUGAWARA, Shinya
Junior Associate Professor
Department of Business Economics
School of Management

KEYWORDS
#Economic analysis of elderly care

Unlocking the Mysteries of Plants to Solve Food Problems

2 ZERO HUNGER

Approach 1

Simply Planting Mint Nearby Can Protect Numerous Crops from Pests

When growing crops, damage from pests causes enormous losses. Reducing this damage could relieve food shortages in countries suffering from famine.
In my laboratory, we are developing a method of eliminating pests using mint. Simply planting mint near crops can protect leafy crops from a wide range of pests. The advantage of this method is that it can be applied simply and easily anywhere in the world. It is also effective in plant factories, which have been called "the future of agriculture."
The pungent fragrance of mint does more than just drive away pests. It also encourages the surrounding plants that "smell" it to protect themselves. Chemical components in the fragrance of mint trigger properties native to plants that protect them from enemies, communicating to these surrounding plants the need to take defensive action. In this way, mint protects all of the crops that surround it.
Plants use fragrance to converse constantly with surrounding plants. The fragrance of mint is like an alarm that says, "Pests!," putting other plants on alert.

ARIMURA, Gen-ichiro
Professor
Department of Biological Science and Technology
Faculty of Industrial Science and Technology

KEYWORDS
#Genetic Engineering
#Ecology #Biology

Approach 2

Elucidating How Plants "Live" to Develop "Plant Supplements"

My research involves the questions of how plants recognize their external environments – how they distinguish friends from enemies, how they process and transmit that information, and how they respond to it. My lab has elucidated the positive roles of reactive oxygen species and autophagy (a phenomenon in which plants consume themselves within their cells) in plants. We are continuing our research, in the hope of developing technologies that utilize plants to contribute solutions to problems of food, the environment and energy. For example, we are working to develop a "plant supplement" that enhances plants' immunity, making them resistant to disease and pests.

KUCHITSU, Kazuyuki
Professor
Director, Interdisciplinary Agricultural Science & Technology Course
Department of Applied Biological Science
Faculty of Science and Technology

KEYWORDS
#Plant Immunity
#Environmental Response
#Biological Information Processing

As an "Earhtuquake-Prone Country" Japan Leads the World in the Field of Disaster Preparedness

11 SUSTAINABLE CITIES AND COMMUNITIES

Approach 1

Buildings in Japan Have Become Highly Resistant to Earthquakes, But They Must Be More Resilient

Although a huge number of wooden houses were severely damaged during the 2016 Kumamoto earthquake, most houses built after the revision of the Japanese Building Standards Law in 2000 survived. Today's aseismic performance of Japanese buildings has become sturdier, dramatically reducing the incidence of building collapse along with rapid advances in earthquake-resistant technologies such as base isolation and vibration control.
Even so, current technologies of earthquake resistance do not provide perfect protection against special kinds of shaking. Long-period ground motions of long duration can possively damage high-rise buildings during massive inter-plate earthquakes. Pulse-type ground motions from inland earthquakes are short in duration but potentially devastating to buildings in highly urbanized areas.
My laboratory is prompting research from occurrence of seismic waves from fault rupturing to the strong motion evaluation and the shaking that occurs in buildings. In addition to analyzing earthquake records, we conduct simulation analysis and on-site structural damage assessment. Our ultimate goal is zero building damage from earthquakes. As residents who live in an earthquake-prone country, the people of Japan have a duty to lead the field of research for seismic resilience and share our findings with the world.

NAGANO, Masayuki
Professor
Department of Architecture
Faculty of Science and Technology

KEYWORDS
#Earthquake Engineering
#Structural Dynamics

Approach 2

"Intellectual House" Using IoT for Recognition of Building States

Our research concerns the development of IoT (Internet of Things) for buildings. We call this technology "intellectual house." Our goal is to create a building that can detect and assess its own safety after it is damaged by an earthquake, to protect the people inside the building and notify them whether the building is safe or dangerous as necessary. Buildings incorporating IoT can be used to protect children and the elderly, prevent solitary death and respond to needs for nursing care, among other applications. We believe that developing this technology is essential in Japan, where earthquake disasters are all too common.

ITO, Takumi
Professor
Department of Architecture
Faculty of Engineering

KEYWORDS
#Steel structure
#Earthquake-resistant engineering
#Composite structures

Toward the Establishment of New Energy Technologies

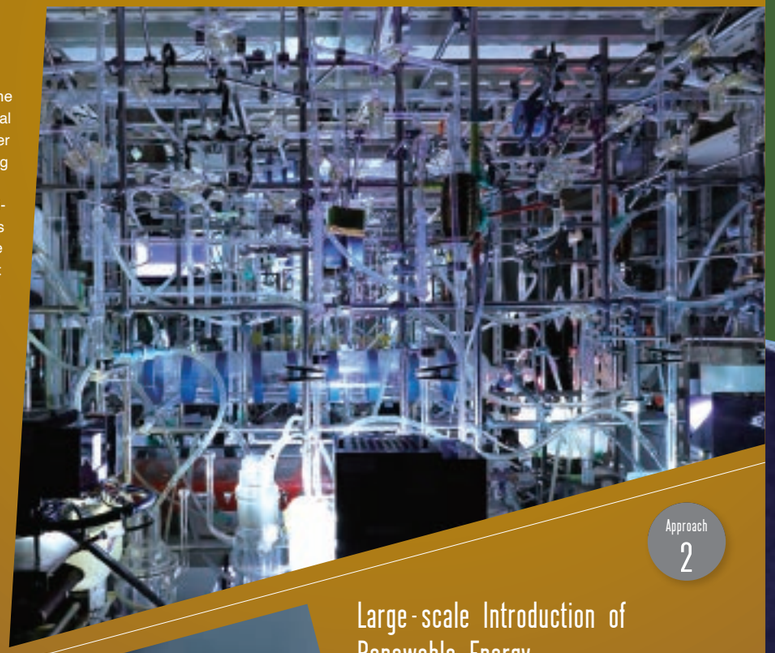
7 AFFORDABLE AND CLEAN ENERGY

Approach 1 Establishing the Ultimate Technology for Generating Hydrogen from Water using Solar Energy

My research topic is artificial photosynthesis using photocatalysts. The artificial photosynthesis has been recognized as “the ultimate chemical reaction.” If technology that securely generates hydrogen by water splitting is established, we can make a huge contribution to solving resources, energy, food supply and environmental issues.
The principle of the artificial photosynthesis, so called "the Honda-Fujishima effect", was firstly discovered by Akira Fujishima, a Professor Emeritus and previous president of this university, and Kenichi Honda in the late 1960's. Researchers around the world had struggled to develop efficient photocatalysts since the report of the Honda-Fujishima effect. However, the practical application to the water splitting has not yet been achieved. Now my laboratory is on a quest for new photocatalyst materials that can lead to the practical application of artificial photosynthesis.
The difficulty with this research is that, as we conduct repeated tests while tinkering with the element and the crystal structure, the tiniest differences completely change how the material works. But that’s the joy of catalytic chemistry. We are continuing to work on this research, aiming to solve some of modern society’s most pressing problems.

KUDO, Akihiko
Professor
Department of Applied Chemistry
Faculty of Science Division I

KEYWORDS
#Artificial Photosynthesis
#Photocatalysis

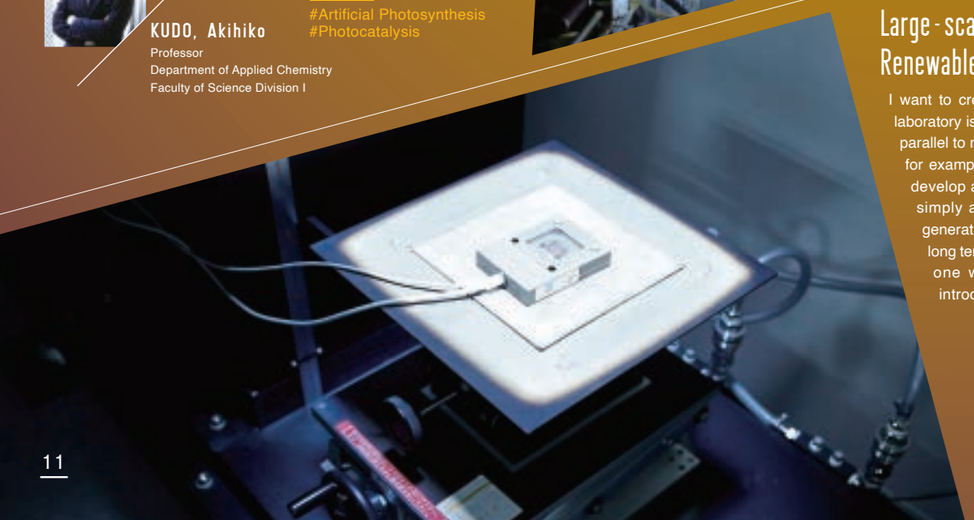


Approach 2 Large-scale Introduction of Renewable Energy

I want to create a sustainable energy system. Our laboratory is working on several research projects in parallel to make that dream a reality. In one project, for example, we are analyzing monitoring data to develop a technology that detects abnormalities simply and at low cost, enabling solar power generating systems to operate stably over the long term. Developing such technologies one by one will one day lead to the large-scale introduction of renewable energy.

UEDA, Yuzuru
Associate Professor
Department of Electrical Engineering
Faculty of Engineering

KEYWORDS
#Solar Power Generation
#Energy Management



Solving the Earth’s Environmental Problems

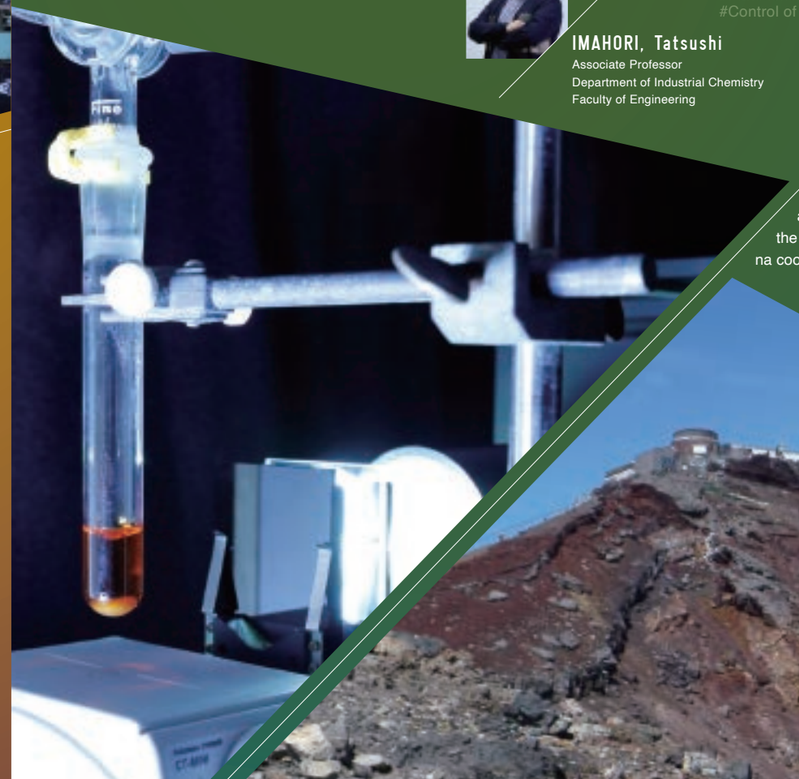
13 CLIMATE ACTION

Approach 1 Capturing Atmospheric CO_2 at Ambient Pressures and Temperatures with Non-Fossil Photo-Energy

Scientists around the world today are working on technologies for reduction of atmospheric CO_2 Among them, Direct Air Capture (DAC) technology that captures CO_2 from the atmosphere has recently attracted much attention as the promising technology, which can directly reduce atmospheric CO_2. This field is expected to contribute to solutions for the problem of global warming. Though technological development for DAC have been promoted, however, the practical application of DAC has not been achieved yet.
Our research group has developed a functional molecular material that can make DAC a practical reality. This functional material is a type of “molecular machine.” By manipulating its molecular structure with light energy, like a machine, it can be made to absorb or release CO_2 at ambient temperatures and pressures. This is the first example of DAC technology just with renewable energy. Since DAC technology with fossil fuel-based energy like common electricity indirectly exhaust CO_2, CO_2-free DAC technology has been accomplished by our system in principle. Joint research is currently moving forward toward practical implementation. In the future, we envision offshore plants that absorb CO_2 from the atmosphere.
It is said that, to solve the global-warming problem, the world’s advanced nations must slash their CO_2 output by 80% by 2050. Development of a practical DAC solution will provide one way of making that goal a reality.

IMAHORI, Tatsushi
Associate Professor
Department of Industrial Chemistry
Faculty of Engineering

KEYWORDS
#Molecular catalysis
#Functional molecules
#Control of chemical reactions



Approach 2 Cooling the Earth with Aerosols

CO_2 causes global warming, but substances that cool the Earth exist as well. A representative example of these is aerosols, fine particles that suspended in the atmosphere. Our research objective is to elucidate the mechanisms of new particle formation and the process of cloud formation, with a view to discovering effective measures against global warming. The best location for studying these phenomena is Mt. Fuji. We are currently in the midst of conducting repeated measurements at the summit of Mt. Fuji to examine the degree to which these phenomena cool the Earth.

MIURA, Kazuhiko
Professor
Department of Physics
Faculty of Science Division I

KEYWORDS
#Atmospheric physics
#Environmental science
#Aerosol science

Mt. Fuji Automated Weather Station, Japan Meteorological Agency

Undergraduate and Graduate Programs

As a comprehensive university of science and technology, TUC boasts academic departments of a unique scale for a private university, as well as graduate school offering a wide range of domains of inquiry and research facilities on the leading edge of science. Each of these aspects of TUC is linked to the others, expanding the University's range of study to generate powerful synergies. To hone their research capabilities in advanced fields, many students advance to graduate school. Using the specialized knowledge they gain there, after graduation these individuals find front-line positions as R&D professionals at companies and research facilities.

Undergraduate Programs

7 Faculties **32** Departments

The undergraduate program fosters students with a solid foundation in specific disciplines for future development and success.

Faculty of Science Division I
- Department of Mathematics
- Department of Physics
- Department of Chemistry
- Department of Applied Mathematics
- Department of Applied Physics
- Department of Applied Chemistry

Faculty of Engineering
- Department of Architecture
- Department of Industrial Chemistry
- Department of Electrical Engineering
- Department of Information and Computer Technology
- Department of Mechanical Engineering

Faculty of Pharmaceutical Sciences
- Department of Pharmacy (6-year system)
- Department of Medicinal and Life Sciences (4-year system)

Faculty of Advanced Engineering
- Department of Applied Electronics
- Department of Materials Science and Technology
- Department of Biological Science and Technology

Faculty of Science and Technology
- Department of Mathematics
- Department of Physics
- Department of Information Sciences
- Department of Applied Biological Science
- Department of Architecture
- Department of Pure and Applied Chemistry
- Department of Electrical Engineering
- Department of Industrial Administration
- Department of Mechanical Engineering
- Department of Civil Engineering

School of Management
- Department of Management
- Department of Business Economics
- Department of International Digital and Design Management

Faculty of Science Division II
- Department of Mathematics
- Department of Physics
- Department of Chemistry

Graduate Programs

7 Graduate Schools **30** Departments

Graduate school students hone their skills in an interdisciplinary environment. In the advanced stages of their studies, students conduct research interacting with accomplished professors, scholars and scientists.

Graduate School of Science
- Department of Mathematics
- Department of Physics
- Department of Chemistry
- Department of Applied Mathematics
- Department of Applied Physics
- Department of Mathematics and Science Education

Graduate School of Engineering
- Department of Architecture
- Department of Industrial Chemistry
- Department of Electrical Engineering
- Department of Management Science
- Department of Mechanical Engineering

Graduate School of Pharmaceutical Sciences
- Department of Pharmaceutical Sciences
- Department of Pharmacoscience

Graduate School of Advanced Engineering
- Department of Applied Electronics
- Department of Materials Science and Technology
- Department of Biological Science and Technology

Graduate School of Science and Technology
- Department of Mathematics
- Department of Physics
- Department of Information Sciences
- Department of Applied Biological Science
- Department of Architecture
- Department of Pure and Applied Chemistry
- Department of Electrical Engineering
- Department of Industrial Administration
- Department of Mechanical Engineering
- Department of Civil Engineering
- Department of Global Fire Science and Technology

Graduate School of Management
- Department of Management
- Department of Management of Technology (MOT)

Graduate School of Biological Sciences
- Department of Biological Sciences

Club Life & Activities

Student clubs and circles play an important role in the TUS student experience. There are literally hundreds of club and circle activities on each campus, reflecting the varied interests of TUS students.

Hokkaido・Oshamambe Campus

102-1 Tomino, Oshamambe-cho, Yamakoshi-gun, Hokkaido 049-3514

Kagurazaka Campus

1-3 Kagurazaka, Shinjuku-ku, Tokyo 162-8601

TUS Campuses

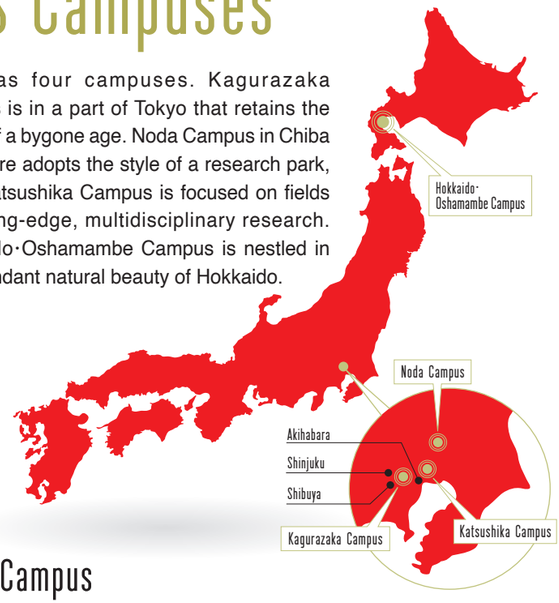
TUS has four campuses. Kagurazaka Campus is in a part of Tokyo that retains the charm of a bygone age. Noda Campus in Chiba Prefecture adopts the style of a research park, while Katsushika Campus is focused on fields of leading-edge, multidisciplinary research. Hokkaido・Oshamambe Campus is nestled in the abundant natural beauty of Hokkaido.

Noda Campus

2641 Yamazaki, Noda-shi, Chiba Prefecture 278-8510

Katsushika Campus

6-3-1 Niijuku, Katsushika-ku, Tokyo 125-8585



【North America】

United States of America
- University of Maryland
- University of California, Davis
- University of Connecticut
- Sleep and Circadian Neurobiology Laboratory, School of Medicine, Stanford University
- University of Southern California

Canada
- University of Saskatchewan
- University of Waterloo

【South America】

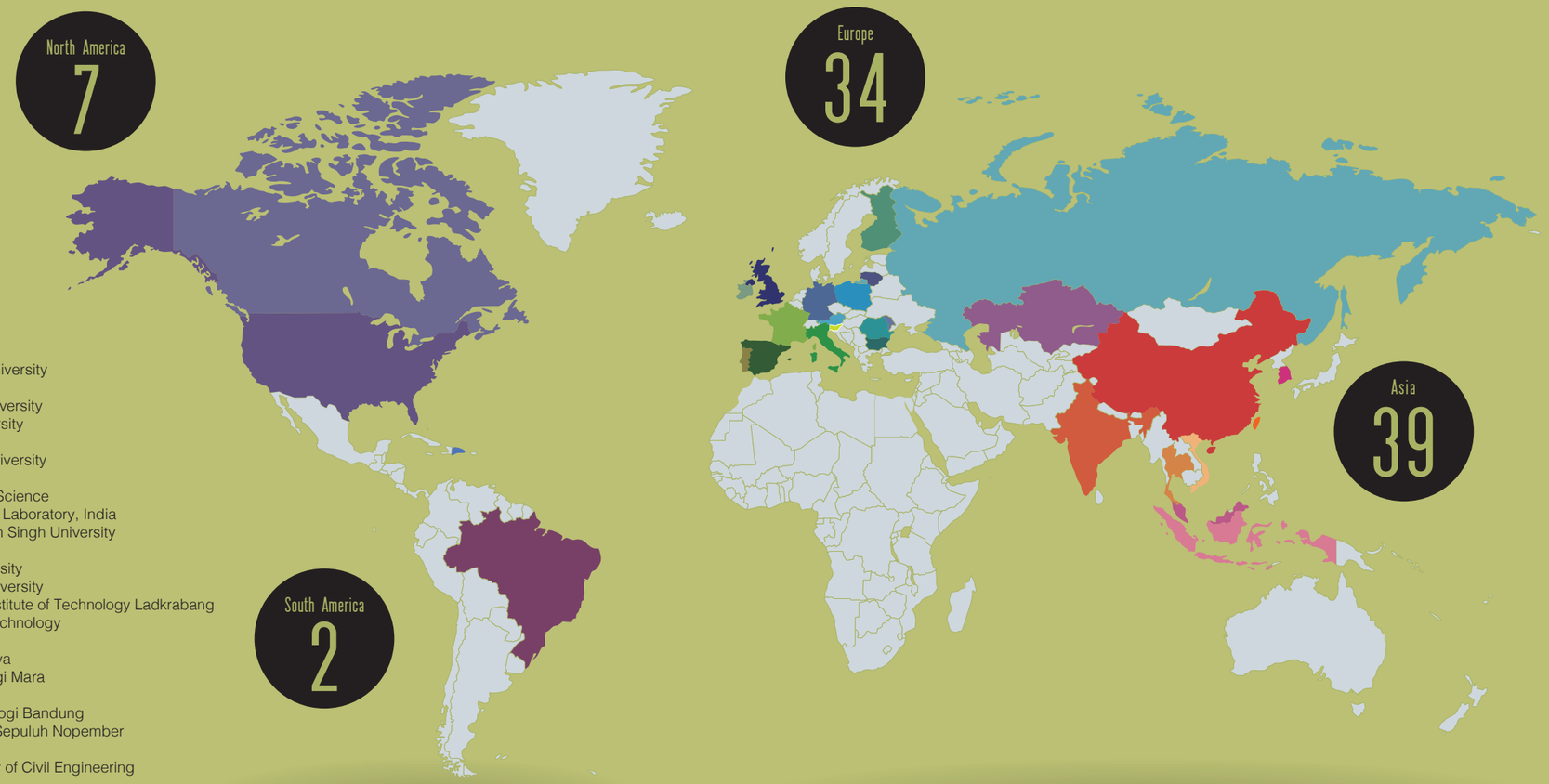
Dominica
- Pontificia Universidad Católica Madre y Maestra

Brazil
- Universidade of São Paulo

【Asia】

China
- Xinjiang University
- Tianjin University
- Northwestern Polytechnical University
- Shanghai Jian Tong University
- China University of Petroleum-Beijing
- Zhejiang University
- Nanjing University of Science and Technology
- Zhengzhou University
- Xi'an Jiaotong University
- University of Science and Technology Beijing
- Dalian University of Technology
- Qufu Normal University
- University of Chinese Academy of Sciences
- China University of Petroleum-East China
- Dalian Medical University
- Xiangtan University

Taiwan
- National Yang Ming Chiao Tung University
- National Chung Hsing University, Taiwan
- Taipei Medical University
- National Taipei University of Technology



South Korea
- Korea University
- Sungkyunkwan University
- Hoseo University
- Seoul National University
- Chung-Ang University
- Inje University
- Pusan National University

India
- Indian Institute of Science
- National Chemical Laboratory, India
- Chaudhary Charan Singh University

Thailand
- Chiang Mai University
- Chulalongkorn University
- King Mongkut's Institute of Technology Ladkrabang
- Asia Institute of Technology

Malaysia
- University of Malaya
- Universiti Teknologi Mara

Indonesia
- The Institut Teknologi Bandung
- Institut Teknologi Sepuluh Nopember

Vietnam
- National University of Civil Engineering

【Europe】

Italy
- University of Modena and Reggio Emilia

United Kingdom
- Brunel University London
- Kingston University

Austria
- TU Wien, Austria
- University of Applied Science Upper Austria

Spain
- University of Jaén
- Universitat Politecnica de Catalunya
- Universidad Politécnica de Madrid

Slovenia
- University of Ljubljana

Germany
- Hochschule Wismar, University of Technology, Business and Design
- University of Rostock
- Ostbayerische Technische Hochschule (OTH) Regensburg
- University of Applied Sciences Jena
- Federal Institute for Materials Research and Testing
- Leibniz Universitat Hannover

Finland
- University of Helsinki

France
- IAE de Paris (Institut d'Administration des Entreprises) Université Paris 1 Panthéon Sorbonne
- University of Lille
- Toulouse National School of Architecture
- École Nationale Superieure d'Architecture et de Paysage de Lille
- École Nationale Superieure d'Architecture de Paris-Belleville
- École Nationale Supérieure de Chimie de Lille
- École Nationale Supérieure d'Architecture de Nancy

Bulgaria
- The Bulgarian Academy of Science

Poland
- Adam Mickiewicz University

Portugal
- Instituto Superior Técnico

Moldova
- Technical University of Moldova

Lithuania
- Vilnius University

Romania
- University "Politehnica" of Bucharest
- The "Gheorghe Asachi" Technical University of Iasi
- "Alexandru Ioan Cuza" University of Iasi

Russia
- Moscow Power Engineering Institute (Technical University)

Ireland
- National University of Ireland Maynooth

Kazakhstan
- Al-Farabi Kazakh National University

As of February 1, 2021, TUC has cooperative agreements with 82 overseas partner universities and 3 cooperating organizations, supporting international exchange and research collaboration among students and researchers.

INTERNATIONAL CONNECTIONS