TUS

Building a Better Future with Science

1-3 Kagurazaka, Shinjuku-ku, Tokyo 162-8601, Japan
Email：koho@admin.tus.ac.jp
https://www.tus.ac.jp/en/

"The information contained in this leaflet is current as of May 1, 2022"

Building a Better Future with Science

TOKYO UNIVERSITY OF 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.





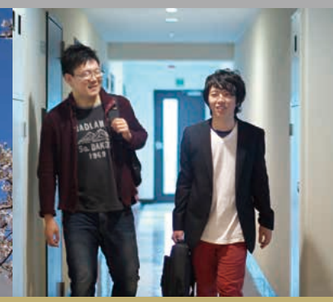

@TUS

As Japan's top 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.







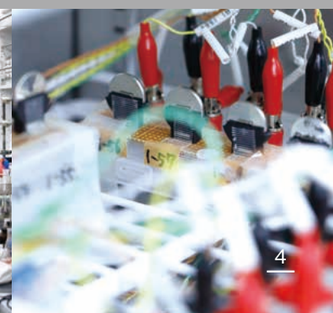










Mission

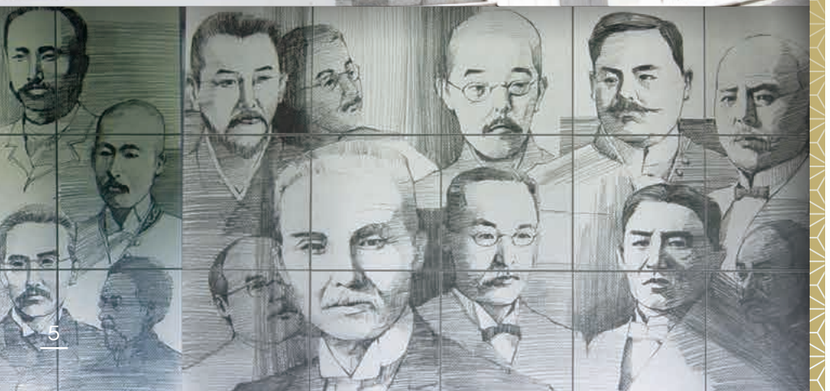
Building a Better Future with Science

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 fosters 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 over 140 years of history, TUS has carved out a solid position among Japan's educational institutions as the nation's top 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 *Achieving Excellence*, 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 Tokyo University, 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 ("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 give 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 782

Partner Universities
82

Faculty Members
1,752

Students
19,113

Student Nationalities
20
Countries

Research Institutes 27

Laboratories
394

As of May 2022

Building the Future

The Researchers of TUS

It is impossible to count the number of things in this world that we still do not understand. At the same time, there are countless technologies that need to be realized for humanity to live now and in the future. At TUS, we have 394 laboratories, where a wide variety of researchers are conducting diverse research. Their enthusiasm and talent are the driving force behind the laboratories and the development of our students. We introduce to you the cutting-edge research at TUS and the researchers involved along the following five themes.

Future Researchers and the SDGs

The Sustainable Development Goals (SDGs) are a set of international goals consisting of 17 goals and 169 targets that aim to end poverty, protect the global environment, and create a world of peace and prosperity for all by 2030. Much of the research being undertaken at TUS is contributing to the achievement of the SDGs.

EXPLORE the TUS

We provide a website where you can search for related departments based on your interests. Please use this information as a reference when choosing a faculty or department.

https://www.tus.ac.jp/explore/

Discovery of 6-Dimensional Periodic Structure Hypermaterials

Ordinary crystals have a structure in which atoms are arranged periodically. However, in 1984, an "impossible substance" was found. Its structure is unconnected in the 3-dimensional space that humans can perceive, but it has periodicity when described in 6-dimensional space. These materials are called quasicrystals. "Hypermaterials," a group of materials described in a unified manner in higher dimensional space, including quasicrystals, are my specialty. In 2021, we discovered the world's first "ferromagnetic quasicrystal". It is a discovery of great significance.

Hypermaterials have a wide range of potential applications. For example, pure gold is soft, but when mixed with hypermaterials, hard gold can be made without compromising purity. They can also be used as a coating material for frying pans and have been found to function well as a catalyst material. Ferromagnetic quasicrystals will likely be used in many products as the ultimate soft magnetic material.

The discovery of hypermaterials has changed the definition of crystals. Further research may prove the existence of substances in higher dimensional space. If we get there, we will surprise everyone around the world. Why don't you come and help us search for unknown substances? There is a distinct possibility that you will discover them.

Ryuji Tamura
Department of Materials Science and Technology, Faculty of Advanced Engineering
Professor

KEYWORD
#Materials & Physical Properties
#Functional Materials

SDG targets to which this research topic is related

What these two researchers have in common is that they are on a "quest to rewrite the textbooks! New scientific discoveries sometimes have the potential to turn common sense on its head.Science is a powerful weapon in our quest to explore the world.

Unraveling the Mechanisms of Vaccines and Allergies at the Cellular Level

It is already common knowledge in high school textbooks that helper T cells activate B cells to produce antibodies. However, more than a decade ago, TFH cells were discovered as specialized helper T cells for inducing antibody production, followed by TFR cells that inhibit B cell activation by TFH cells. The existence of these two cell populations revealed that we thought we knew how antibodies are produced, but in fact we did not.

The main theme of my research is how TFH and TFR cells function when the immune system makes antibodies in the body. Elucidating this mechanism could lead to the development of more effective vaccines and new drugs to treat allergic and autoimmune diseases.

The study of immunity is not easy. This is because immune cells perform their function by interacting with a variety of cells in the body. Therefore, focusing only on TFH and TFR cells does not give a complete picture of the function of these cells. Understanding this complex immune network is the best thing about immunology research and is the basis for developing new treatments for a variety of diseases.

Yohsuke Harada
Department of Medicinal and Life Sciences, Faculty of Pharmaceutical Sciences
Associate Professor

KEYWORD
#Immunology & Allergy
#Pharmaceuticals & Cosmetics

SDG targets to which this research topic is related

It is said that 'Society 5.0,' which highly integrates cyberspace and physical space, will arrive in the future. In order to realize Society 5.0, major changes are needed in telecommunications, transportation, and other infrastructure. This section presents research related to smart society.

Bringing about Innovation in Optical Communications through Advanced Coding, Multiplexing, and Optoelectronics

Optical communications, which support the Internet, have improved significantly in performance over the past 30 years and will continue to require higher speed and larger capacity. This is because it is clear that the data traffic will explode with 4K/8K broadcasting, metaverse, and video distribution, etc.

Breakthroughs (breaking through technical barriers) are needed to construct Exabit/s optical communication systems in the future. One of the themes we are working on is "advanced coding and multiplexing technologies". Until now, the data signal has been transmitted using the energy of light, but we are now trying to increase the transmission capacity dramatically by utilizing the properties of waves such as amplitude and phase.

We are also developing "optical signal processing devices" that process the data signal by an all-optical method, and have achieved high performance in experiments. We have also begun research on "advanced optoelectronic integrated circuits," which are a development of the all-optical technology and can process optical and electrical signals simultaneously. In joint research with companies and overseas universities, we aim to build a new generation of smart optical communication systems that can hold up to practical use.

If our research progresses, it will undoubtedly lead to breakthroughs in optical communications. Ten years later, it may be used commonly in our country and around the world. We encourage everyone to take on great technical challenges without fear of failure. Let us pursue the dreams together.

Yutaka Fukuchi
Department of Electrical Engineering, Faculty of Engineering
Associate Professor

KEYWORD
#Information and Communication
#Functional Materials

SDG targets to which this research topic is related

We humans have a responsibility to make the global environment and living conditions sustainable. There is an urgent need to develop technologies to prevent further damage to the environment. TUS is home to many researchers who are contributing to sustainability.

Environmentally-friendly Liquid Crystal Materials Created from Cellulose

Cellulose is the most abundant organic compound on the planet Earth. Cellulose is a component of plant cells. Therefore, wood, paper, dietary fiber, cotton, hemp, and so forth are made primarily of cellulose.

In our laboratory, we have created an environmentally-friendly full-color liquid crystal material from cellulose, a commonplace natural resource. A major feature of the material is that it can be created inexpensively by recycling and reusing unneeded paper and other related materials. Such novel materials could help us break away from our dependence on petroleum resources and contribute to carbon neutrality and sustainability from the perspective of the SDGs.

Moreover, the "cellulose liquid crystal elastomer (CLCE) films" we discovered exhibit the rubber-like property that enables mechanically responsive color changes upon stretching. We are now exploring their practical applications that take advantage of these characteristics. For example, such CLCE films coated on the walls of tunnels could provide early warning of a possible collapse or deterioration. This is because our CLCE films would change color before the walls collapse or deteriorate. In other words, it can be used to prevent tunnel collapse accidents without the aid of electric power.

Aging social infrastructures such as tunnels is one of the major problems facing society. Our laboratory is thus looking for ways to create and utilize novel materials to solve diverse social problems.

Seiichi Furumi
Department of Applied Chemistry, Faculty of Science Division I
Professor

KEYWORD
#Functional Materials
#Environmental Issues

SDG targets to which this research topic is related

Cellulose liquid crystal elastomer films change color when stretched with force.

What is creativity? How can we come up with groundbreaking creations? At TUS, we also offer classes in drawing, listening to music, and developing design thinking. Some researchers are pursuing the science of creativity in this way.

Entrepreneurship is like Art. So Start with a Sketch.

I am an art and design specialist and have recently been in contact with many entrepreneurs. Entrepreneurship and art are the same in the sense that we express our inner thoughts and feelings and transmit them to society. Entrepreneurs and artists are similar in that they first modify their ideas as they shape them and move them forward.

That is why I teach drawing and design as a basis for entrepreneurship and business creation. This makes sense.

What painting pictures reveals is how you see the world and what you value. You may notice contradictions you have, things you can't do anything about, or feelings you didn't expect to have. If you observe an object and trace your thoughts and awareness while moving your hands, you will see yourself in depth.

You will also experience the fun of things not going as expected and the significance of chance discoveries. Both entrepreneurship and art often work by adopting ideas that come to mind on the spot, and the fundamentals of this can be learned in drawing and design.

In a nutshell, I want students to know what it means to "think for themselves". And, I would very much like students to demonstrate profound Japanese-style innovation.

Masaki Yagisawa
Department of International Digital and Design Management,
School of Management
Associate Professor

KEYWORD
#Diversity

SDG targets to which this research topic is related

In order to solve the problem of global warming, it is essential to utilize clean energy, as an alternative to petroleum and other fossil fuels. TUS has several researchers in hydrogen energy, solar energy, and technologies related to biomass energy.

Developing Energy Management AI with Deep Reinforcement Learning

If you want to lower your environmental impact and power bills as much as possible in a home with solar power generation and storage facilities, you need to implement "energy management". However, energy management is complex and time-consuming because the amount of electricity consumed at different times of the day, the unit price of electricity, and the unit price of electricity sold from solar power generation change from time to time.

That is why my laboratory is now developing an "energy management AI". We are using deep reinforcement learning (deep learning) to create AI that automatically maximizes rewards such as reduced environmental impact and improved economic efficiency.

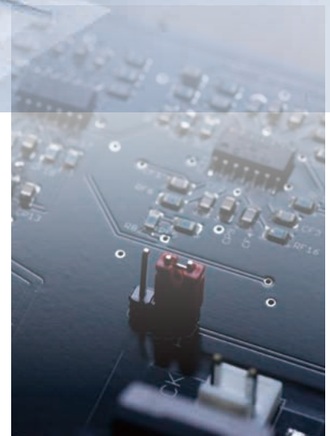
In some cases, making AI self-learn energy management requires hundreds of millions of days of trial-and-error data. Therefore, we have taken the approach of creating a simulation of the target energy system and having it learn by itself within the simulation.

Since 2021, actual equipment has been installed in the research facility and demonstration tests have begun. Once adjustments through demonstration testing are completed, the system can be put into practical use. Energy management AI is already at the stage of being utilized in the field in this way. We will keep trying to find optimal applications and develop them one after another.

Noboru Katayama
Department of Electrical Engineering,
Faculty of Science and Technology
Associate Professor

KEYWORD
#Infrastructure

SDG targets to which this research topic is related



Undergraduate and Graduate Programs

As a comprehensive university of science and technology, TUS boasts academic departments of a unique scale for a private university, as well as graduate school offering a wide range of domains of research facilities on the leading edge of science. Each of these aspects of TUS 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 Information and Computer Technology
- 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

Extracurricular Activities

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

Hokkaido・Oshamambe Campus

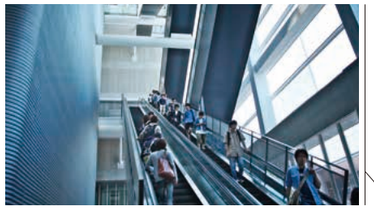
102-1 Tomino, Oshamambe-cho, Yamakoshi-gun, Hokkaido 049-3514

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 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.

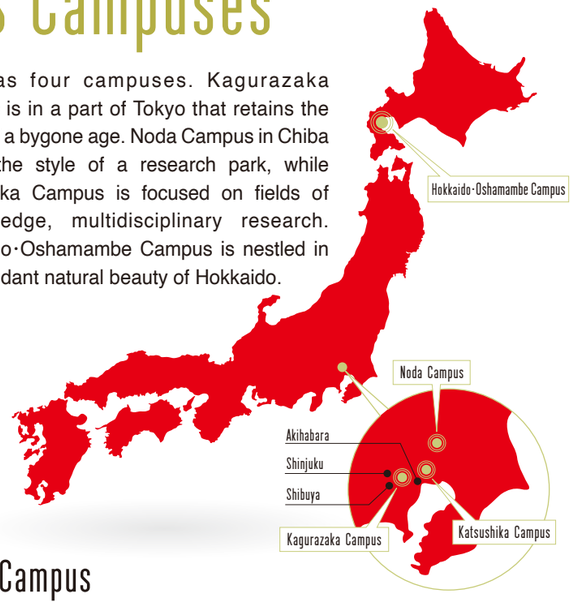


Noda Campus

2641 Yamazaki, Noda-shi, Chiba 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】

Costa Rica
- Universidad de Costa Rica

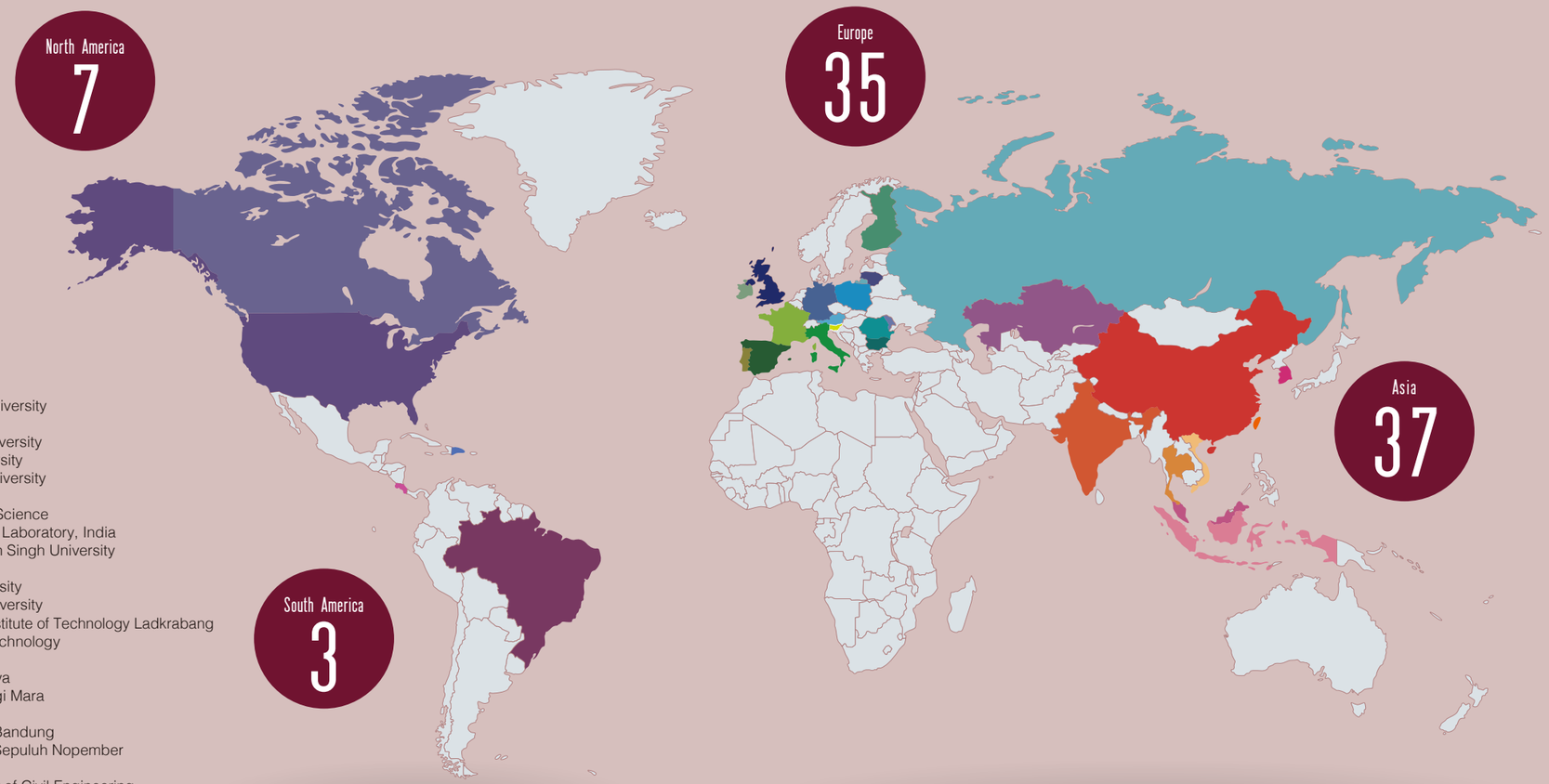
Dominica
- Pontificia Universidad Católica Madre y Maestra

Brazil
- Universidade of São Paulo

【Asia】

China
- Xinjiang University
- Tianjin 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
- 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
- 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 School of Architecture
- École Nationale Superieure d'Architecture de Paris-Belleville
- École Nationale Supérieure de Chimie de Lille
- École Nationale Supérieure d'Architecture de Nancy
- University of Strasbourg
- Institut Supérieur de l'Aéronautique et de l'Espace

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 May 1, 2022, TUS has cooperative agreements with 79 overseas partner universities and 3 cooperating organizations, supporting international exchange and research collaboration among students and researchers.

INTERNATIONAL CONNECTIONS