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UTokyo Faculty of Engineering Homepage
https://www.t.u-tokyo.ac.jp/foe/index.html

狂ATE the FUTURE - Create the future with insanely great impulses
https://park.itc.u-tokyo.ac.jp/createthefuture

東京大学工学部
FACULTY OF ENGINEERING
THE UNIVERSITY OF TOKYO

Editor's Note

As was the case for the 2021 Summer Edition, most of the reporting for this Edition was also conducted online. In-person classes were featured in the Summer Edition with the expectation that students would actually be able to attend classes in-person. In this Winter Edition, with the expectation that students will actually be able to attend classes on campus, we introduce buildings where the engineering labs are located in order to remind engineering students how splendid their campuses are. In addition, in introducing buildings and research facilities, more photos have been used than in the past. Some of these photos were taken on site by our staff members who followed COVID-19 infection prevention and control protocols. 狂ATE (CREATE) the FUTURE is also featured. In addition to providing 狂ATE (CREATE) the FUTURE video links, we plan to follow up on these articles with Ttime! Web posts. Please don't miss either of them. Staff turnover will result in a new team to produce the next edition of this brochure. We will continue to work hard, and hope you will continue to check Ttime!.

Planning, Editing and Reporting:
Faculty of Engineering PR Office Student Assistants, School of Engineering, The University of Tokyo;
Atsushi Takada (Editor); Minaka Sugano (Associate Editor); Takashi Ankyu; (Student Representative); Aoi Watanabe (Web Editor); Akihiro Takeshita; Yukino Nanba; Chiaki Furusawa; Toru Kosugi; Sota Nagahara; Yuki Yamashita; Hinata Takeda; Yuki Tsuji; Koji Tokunaga; Atsushi Narita; Mizuki Noguchi; Ayako Masuno; Eriko Yamada; Takaaki Miyake

Cooperation:
Faculty of Engineering PR Office, School of Engineering, The University of Tokyo; Professor Kiyoshi Izumi (Director); Professor Kaori Fujita (Associate Director); Associate Professor Takahiro Morimoto; Lecturer Yoshiaki Narusue; Lecturer Ryuma Niiyama; Sumio Marukawa; Misuzu Kitahara; Katsuyo Nishi; Koko Kanezashi

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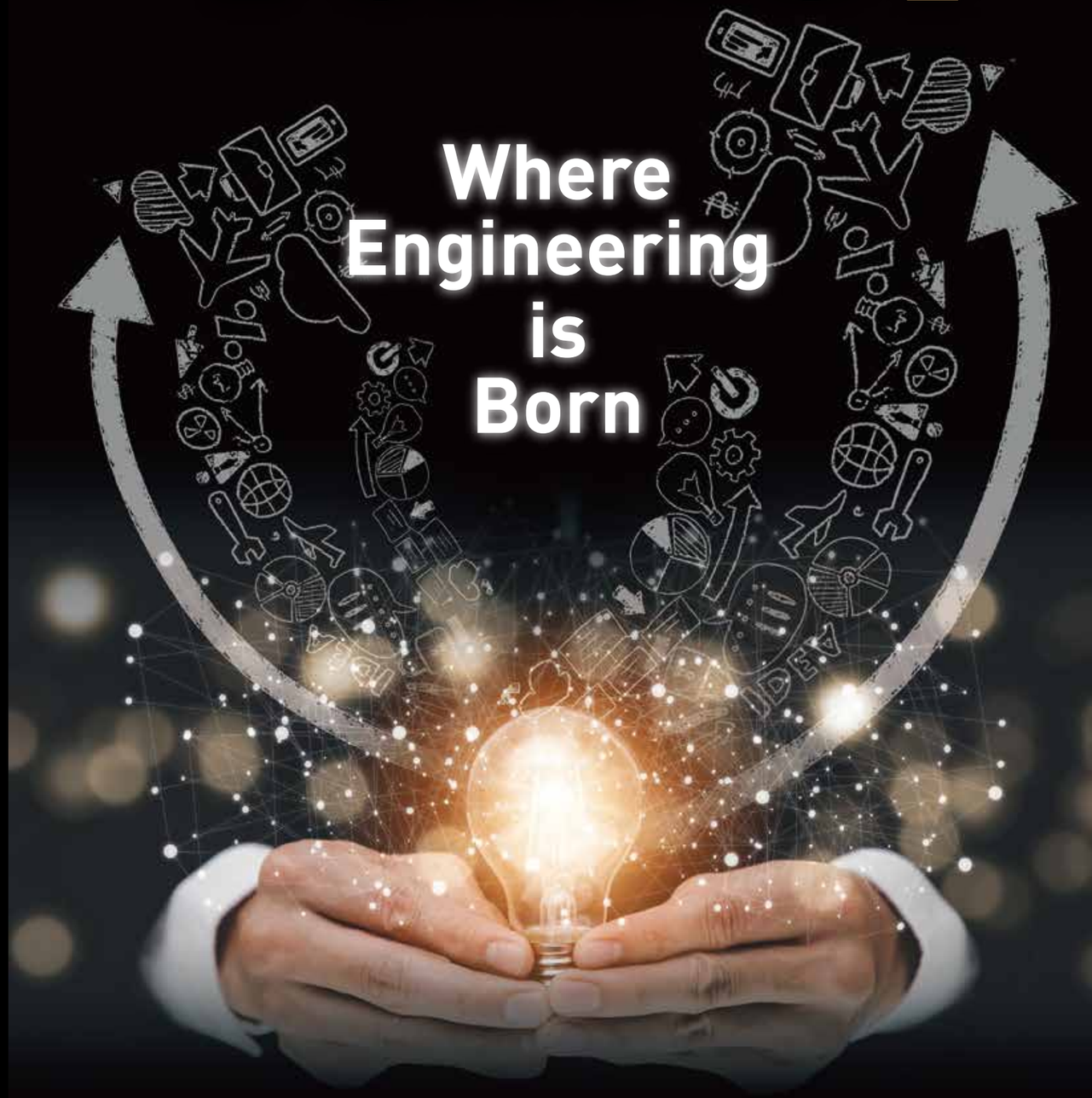
Student-edited UTokyo Faculty of Engineering PR Brochure

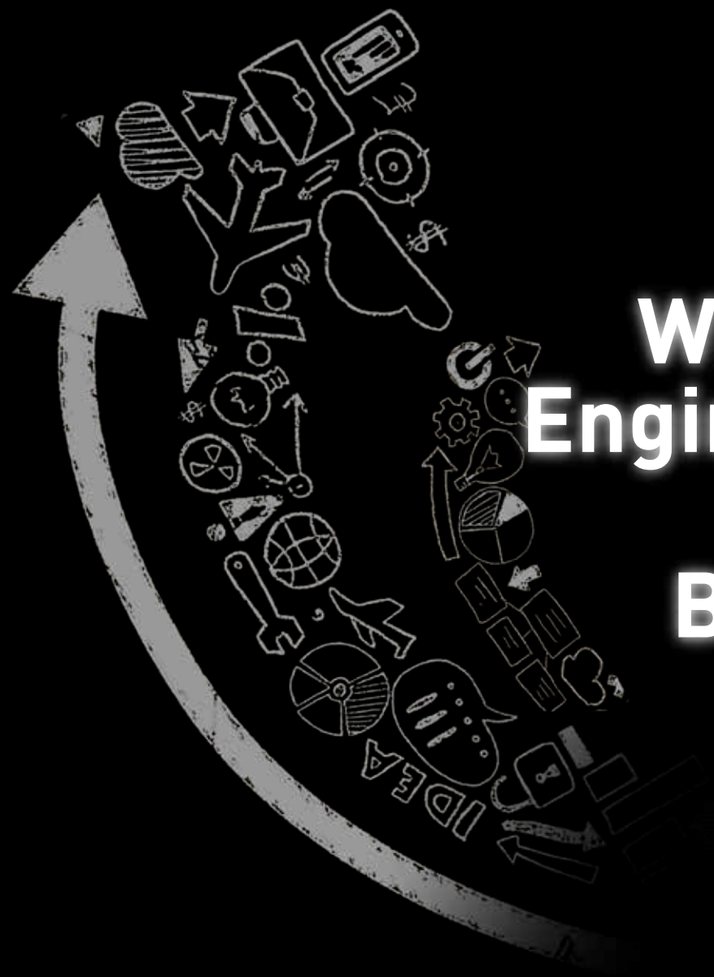
WINTER 2021

Ttime!

Where Engineering is Born



FACULTY OF ENGINEERING
THE UNIVERSITY OF TOKYO



Where Engineering is Born

The Winter Edition this year particularly features UTokyo campuses and FOE buildings. Among the numerous UTokyo campuses, this issue concentrates on the Hongo, Komaba, and Kashiwa Campuses, which are primarily used for FOE research. Old buildings such as on the Hongo Campus and relatively new buildings such as on the Kashiwa campus have differences and similarities as well as respective charms, which are shown in many images. We also interviewed professors who are in fact conducting research at these various campuses, and asked them to describe their research, research facilities, and campus spots they recommend. We hope you will take note of and see where professors, who have been conducting research for many years, have their special spots on campus. In addition, we also feature video content entitled 狂ATE (CREATE) the FUTURE that introduces people who are active in the FOE with on the “Create the future with insanely great impulses”. We hope that you will be able to sense each different campus atmosphere and the enthusiasm of people dynamically engaged in the FOE regardless of location.

HONGO CAMPUS

《Hongo Campus》

KOMABA CAMPUS

《Komaba II (Research) Campus Campus》

KASHIWA CAMPUS

《Kashiwa Campus》

CREATE the FUTURE
SCHOOL OF ENGINEERING, THE UNIVERSITY OF TOKYO

Student-edited UTokyo Faculty of Engineering PR Brochure

Ttime!

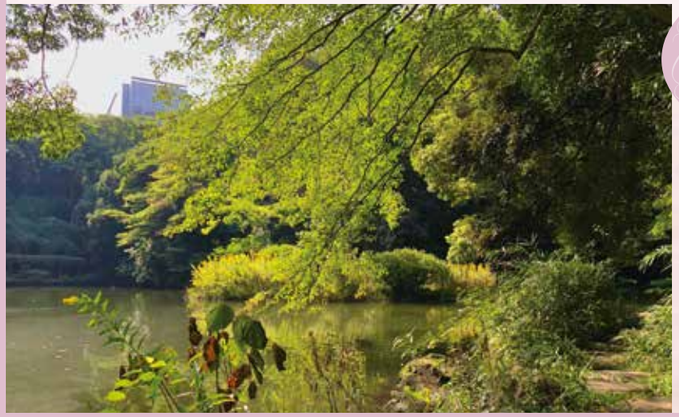
《Hongo Campus》

UTokyo symbols, such as the Akamon Gate and Yasuda Auditorium, are located on the Hongo Campus. Sanshiro Pond and the rows of ginkgo trees leading from the Main Gate to Yasuda Auditorium bring a sense of nature to the campus even though it is in the heart of the city. In addition to the many undergraduate faculty and graduate school buildings, many educational and research facilities, including the University Museum and the General Library, are located here. This campus has the longest history of all UTokyo campuses, and many of its buildings have been designated as important cultural properties or registered tangible cultural properties. We welcome you to visit Hongo Campus and sense its nature and history.

Engineering Bldg. 1

As were Yasuda Auditorium and the Head Administration Office of Engineering (Reppinkan), Engineering Bldg. 1 was designed by Yoshikazu Uchida in the 'Uchida Gothic' style, and it is registered as a national tangible cultural property. It is primarily used by the Department of Civil Engineering and the Department of Architecture, and houses drafting rooms for the respective departments. Students spend a lot of time in the drafting room when they are doing drafting and model making for their seminars. Bridge models and sculptures are on display in the building. There is also a plaza around a large gingko tree in front of Engineering Bldg. 1, where people can spend a relaxing time.

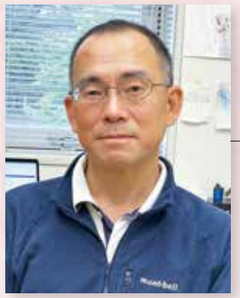
Professor Yu Nakai, who is conducting research in Engineering Bldg. 1, spoke about his research and recommended spot on campus!



Professor Nakai's Recommended Spot

The spot I recommend is Sanshiro Pond. I think Sanshiro by Natsume Soseki is one of the best coming-of-age novels of the modern era, because it skillfully depicts the mystery of women for a man faced with love. It is fun to take a walk and imagine whether this might be where Sanshiro met Mineko. I sometimes take walks with students and alumni at Sanshiro Pond and listen to them talk. I am very grateful to have such a place on campus.

◀Sanshiro Pond in early autumn



Department of Civil Engineering, School of Engineering

Professor **Yu Nakai**

Designing Cities

My specialty is the design of infrastructure which includes roads, bridges, and stations. Infrastructure design is deeply related to our daily lives. For example, building a road significantly changes the landscape, and the subsequent flow of people creates culture and economy. Concurrently with conducting research on the value that infrastructure design creates, I am also involved in urban development such as by providing design advice at local government sites. Although the only thing that infrastructure design can directly do is to create something tangible, I believe my role is to help local people think more deeply about issues their cities face. Cities are always fluid and changing, and there is no ideal form of completion. I would like to hold discussions with local people as I design for them, develop their environments through those designs, and watch over them.

In order to solve a problem in a city, we need to know what structure is creating that problem. And in order to understand that structure in the city, we need to know the origins of the city. In the same way, I believe that learning is a way of perceiving the truth and essence behind what we see right in front of us. I would like every student to cultivate their imagination by going out and walking around the city as much as possible, and being exposed to and sensing nature.

▲A snapshot of the reconstruction planning process in the town of Otsuchi. The plan was improved through dialogues and discussions with local residents on countless occasions to better understand the issues facing the community.

Design in the Town of Otsuchi

From September to December 2011, when involved in working on a reconstruction plan for their town of Otsuchi in Iwate Prefecture, I formulated a draft by holding close discussions with local residents. What I held important at the time was that I definitely did not want to abandon the town that they had lived in for a long time or want to build a new town on higher ground. The reason was because although Otsuchi has been hit by numerous tsunamis, I felt that there must be some basis for why local people continue to live in Otsuchi. I felt that there must be something extremely important that I, as an outsider, would not grasp, and that I must respect whatever that was.

▲What I first worked on in Otsuchi. I helped the owner of a Japanese style izakaya pub whose store had been swept away by the tsunami to build a plaza for food stands, and lit red lanterns in the rubble so that everyone could gather.

I designed a public space in the reconstruction plan for the local people to share. Modern cities are very functional spaces divided by different purposes, such as roads and sidewalks, places to work and places to live. However, the problem is that ideas, cultures, and the personalities of other individuals do not interact there. I believe that cities need to have various places where differing values and attributes can intermingle and new values can be created. I hope that this public space will be one of the reasons the local people live in Otsuchi. symbolic of reconstruction.

▲Oshachi Park in the Machikata district of Otsuchi. A spring-fed pond, which was a familiar local sight before being destroyed by the tsunami, has been restored to create a public space symbolic of reconstruction.

As a result of the reconstruction of Otsuchi a huge seawall to prevent tsunamis was constructed, the city was raised, and the landscape was drastically changed. As someone who specializes in landscapes, I felt extremely disappointed. However, as the reconstruction plan was being finalized, a local government official tearfully expressed his gratitude, saying, "Thanks to your guidance, the town has survived". His words left me feeling rather relieved. Since that time, I have been giving greater consideration to what the basis for continuing to live in an area encompasses.

Written by **Yukino Nanba**

Engineering Bldg. 4

This building houses Department of Materials Engineering laboratories, Library, and Student Room. Since most Materials Engineering classes are held in this building, third and fourth year undergraduate students are often in Bldg. 4 all day long, and we've heard that some students spend as much time there as they do at home. Near the front entrance, there are displays of samples made in Department of Materials Engineering laboratories, and you can observe materials that normally cannot be seen up close. Since the Library and Student Room are adjacent on the second floor, friends often chat in the Student Room after studying in the Library. In fact, Bldg. 4 has a freely accessed courtyard where people can eat while basking in the sun during breaks. Before the COVID-19 outbreak, some labs used to hold barbecues in the courtyard for social gatherings.

Professor Ryo Yoshida, who conducts research in Engineering Bldg. 4, spoke about his research and recommended spots on campus!

▲Street between Law & Letters Bldg. 2 and Law Bldg. 3

Rooftop of Engineering Bldg. 4 ▶

Professor Yoshida's Recommended Spots

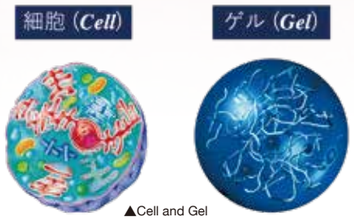
Every morning on my commute I walk from Hongo Sanchome Station to Engineering Bldg. 4, and the General Library and a plaza with a fountain in front of the Library are on the way. I really the street that goes from there, between Law & Letters Bldg. 2 and Law Bldg. 3 to Engineering Plaza. Although the trees lining the street stretching from Yasuda Auditorium to the Main Gate are nice, I like the street that intersects it at right angles because it is beautiful. Walking there alone in the morning gives me a fantastic feeling and relaxes me.
I become tense when I enter Bldg. 4, so it's not really a place where I feel at ease (laughs), but I like the rooftop of Bldg. 4. Unfortunately it's no longer accessible, but I used to go up there from time to time for a change of pace. Although my lab members didn't do it, some labs used to enjoy having barbecues there.

Department of Materials Engineering,
School of Engineering

Professor **Ryo Yoshida**

The Challenge of Bio Beyond Bio

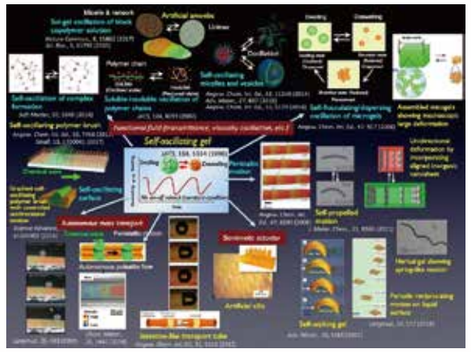
I conduct research on polymer gels. Opposed to metals, ceramics, and semiconductors which are hard, dry materials, polymer gels are soft, wet materials. Polymer gels have many analogies with living organisms, and as a biomaterial they have very intriguing properties. Developing their application is a very interesting field, and from the time I was a student, I have been pursuing this research for over 20 years.



▲Cell and Gel

Since the physicochemical properties of our living bodies, particularly our cells, are similar to those of gels, we believe that understanding gels will allow us to understand the phenomena and functions of life, or to create and construct such functions. In other words, I deal with gels from the standpoint of biomaterials and biomimetics※1. Since, in the sense that understanding gels leads to the quest for the principles of life, they can also be a tool for science, I think this is a field that will develop in both the engineering application aspect and the scientific aspect.
Within that, the main theme of my research is the development of self-oscillating gels. A self-oscillating gel is a gel that beats autonomously under certain conditions like a heart, and can be regarded as a biological model in which waves are spatiotemporally transmitted, or synchronized with the vibrations.

Since my first paper on self-oscillating gels was published in 1996, the various areas they have been applied to include soft robotics and microfluidic pumps, and I believe we will find many more applications for self-oscillating gels. My research has further expanded to include creating self-walking gels (artificial inchworms) and peristaltic actuators (artificial intestines); polymer brushes consisting of cyclically contracting tethered polymer chains (artificial cilia); and polymer solutions that move forward by autonomously and periodically undergoing sol-gel phase transition without external stimuli (artificial amoeba). However, since the driving force prerequisites are a bit challenging, we are striving to improve the system so that it operates at pH and temperature levels close to physiological conditions, and to make it more biocompatible. Ultimately, I would like to apply these smart materials to the biomedical field, including as DDS (drug delivery systems)※2.



▲Research development and application of self-oscillating gels

※1 To utilize ideas from the chemical and physical structure of living organisms and biological systems in manufacturing.
※2 Technology and systems that control the time and place of drug administration in the body in order to maximize pharmaceutical efficacy.

Fortunate to Have Equipment

Our laboratory is outfitted with most of the general-purpose equipment used in polymer synthesis experiments, structural property analysis, and chemical substance analysis. However, for experiments, such as structural analysis involving time series, for which general-purpose lab equipment specifications are not sufficient, we often visit specialist researchers to use their equipment. I often visit the Kashiwa Campus. Other environments where special equipment can be used include the measurement center on the Asano Campus, thus, I am able to carry out my research with the general-purpose synthesis and structural analysis equipment we have in our lab. In that sense, I think the UTokyo environment is admirable.

Message

Since its research areas are so broad, it may be difficult to imagine what the Department of Materials Engineering is like, but the broad spectrum of what can be learned includes a comprehensive range of important materials such as polymers, metals, and semiconductors. I don't think there is any other department where so much can be learned at the undergraduate level, so to the contrary, I think knowing such a wide range of things will be useful in the future in many areas. From now on, since integrated field research will increase and knowing a variety of things will be advantageous, when considering a career path I hope that your perspective will be long-term and broad, rather than getting caught up in a current trend.
There is a wide variety of biomaterial research and I think we approach research from a slightly different stance in comparison with the three chemistry departments, and since there is also biomaterial research that can only be conducted here, I hope you will consider the Department of Materials Engineering.

Written by **Sota Nagahara (Engineering Bldg. 4)・Atsushi Narita**

Engineering Bldg. 6

Engineering Bldg. 6, which is used by the Department of Applied Physics and the Department of Mathematical Engineering and Information Physics and when viewed from the main gate is located at the far end of the plaza in front of Engineering Bldg. 1, has a dignified, historical atmosphere. In addition to classrooms used for lectures, there is a Library on the first floor. Some of the student experiments conducted on the fourth floor are typical engineering experiments, such as using a soldering iron when building a circuit, while others, such as reproducing a two-dimensional Fourier transform with lasers, slits, and screens to understand image processing, tickle student curiosity.

Professor Kazushi Kanoda, who conducts research in Engineering Bldg. 6, spoke about his research and recommended spot on campus!

Professor Kanoda's Recommended Spot

When on my way back home from the Hongo Campus at night, I walk from Engineering Bldg. 6, past the Faculty of Law buildings towards the General Library and pass through Akamon Gate. I love the Law School building lights. While basking in those lights and walking I sometimes trample on gingko nuts (laughs). I hope you enjoy the Hongo lights while being careful of the ginkgo nuts.

◀Faculty of Law buildings at night

Department of Applied Physics,
School of Engineering

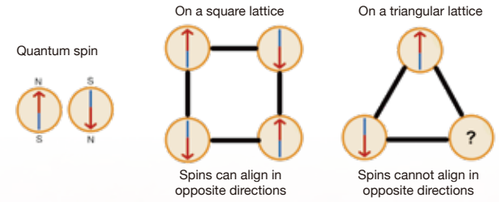
Professor **Kazushi Kanoda**

Professor Kazushi Kanoda's Career

I was born in Miyagi Prefecture, and after graduating from the Department of Nuclear Engineering in the School of Engineering at Tohoku University I went to graduate school at the Department of Nuclear Engineering at Kyoto University, where I became a member of a Nuclear Physics laboratory. Although I initially wanted to conduct research on nuclear physics or positrons, since I was attracted to the research on superconductivity that upperclassmen were conducting, I decided to do research on superconductivity. After that, I had a hard time deciding whether or not to continue on to a doctoral course, because at that time finding a corporate job after completing a doctoral degree was very difficult. In the end, a heads-or-tails coin flip decided that I would go on to the doctoral program (laughs). After earning my doctorate, I worked in the Faculty of Science at Gakushuin University, but because the research subjects and experimental methods differed entirely from what I had previously used, day after day was spent learning from scratch together with the students. I then worked at the Institute for Molecular Science in Okazaki, Aichi Prefecture, and in 1997 I came to work at the Department of Applied Physics at the UTokyo. Although as you can tell, I have moved around from place to place, I think I just flowed with the opportunities as they arose. That is true of when I began conducting superconductivity research, although I was not particularly attracted to the Institute for Molecular Science, where chemistry was the mainstream, I found it to be a really wonderful place. I have been at the Department of Applied Physics for a long time now, but if a new opportunity comes my way, I would like to take advantage of it. I digress, but as an undergraduate I was a baseball team coach at my alma mater, and I was fired after one year (laughs).

The Electronic Properties of Organic Materials are Full of Mysteries

I conduct research on the electronic properties of organic materials. For example, applying pressure to an insulator can turn it into a superconductor. Although this has not yet reached the stage of application, it is full of mystery and surprises even before that happens. And there is also something called quantum spin liquid. Electron spins, which are microscopic magnets, try to oppose each other in a substance. In a square lattice, they are aligned in opposite directions, but in a triangular lattice, they are not, and the spins become uncertain about which orientation they should take. The result is a liquid-like state in which the directions of the spins keep fluctuating and cannot be determined for any length of time. There are other phenomena such as electrons transforming into glass or the effective mass of an electron becoming zero. Taking peeks at organic material electrons is truly a series of surprises and mysteries.



▲Quantum spin liquid

Nuclear Magnetic Resonance Operates on the Same Mechanism as MRI

Our laboratory uses nuclear magnetic resonance (NMR) equipment to study the behavior of electrons. This is rather like an MRI, and its use allows us to study magnetic fields electrons create in a nucleus. For example, when investigating superconductivity and when electrical resistance falls to zero, there is usually nothing else we can know about it, however using nuclear magnetic resonance equipment allows us to observe electrons from the atomic nucleus standpoint to understand more. This is exceptional equipment for researching the function of electrons. The nuclear magnetic resonance equipment in our laboratory can produce a magnetic field as strong as 18 tesla and that can be cooled to near absolute zero.

▲Nuclear magnetic resonance equipment

What I want to tell students

If you have already decided what you want to do, I think you should pursue it. On the other hand, some people are still in the dark about what they are interested in, and I was one of those people. I'm sure those people will find something eventually, so stay optimistic now. And if you come across something that interests you even a little bit, dig into it with your own eyes and heart. I think having your own "way of thinking, way of feeling" is important in attaining individuality in this age of easy access to information. When you find something that makes you think this is it, for the time being go down that road and explore the possibilities with your head and heart.

Written by **Takaaki Miyake**

Engineering Bldg. 13

Built as a laboratory for the Tokyo Imperial University Faculty of Engineering, this building is still used as a laboratory today. Construction of Engineering Bldg. 13 was completed in 1930 just after the Great Kanto Earthquake; the structure is very sturdy and has few windows. The Great East Japan Earthquake caused no damage to the building at all, and the only damage was like one of the sake bottles on a student's desk in the lab fell off.

Professor Akiko Kumada, who directs the high voltage lab in Engineering Bldg. 13, spoke about her research and a recommended spot on campus!

Professor Kumada's Recommended Spot

I enjoy walking in the luxuriant green area near the Main Gate of the Earthquake Research Institute (ERI). On the field next to the trail, the women's lacrosse club often practices lacrosse with great enthusiasm. I was a member of the lacrosse club when I was a student several decades ago; it reminds me of the old days and makes me very nostalgic! Although I usually come through Nezu, I occasionally intentionally come via Sendagi and stroll through the area.

◀Path near the Main Gate of ERI

Electrical and Electronic Engineering Course
Department of Electrical Engineering and Information Systems, School of Engineering

Professor **Akiko Kumada**

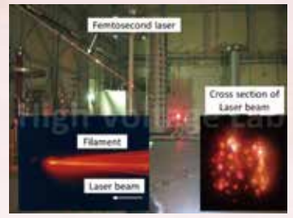
High voltage, electrical discharge, and insulation materials

Our laboratory is famous for its high-voltage experiments at the May Festival, and even though many people imagine it to be a 'lightning laboratory', we would like you to know that there is more to our laboratory than that.

Our research stems from 'how power systems can be built', and covers three topics: high voltage, electrical discharge, and insulation materials.

▲Lightning surge

▲Electrical discharge



▲Laser

In a power network transmitting high-voltage, high-current electricity from a power plant, being able to provide electricity only when and where you want it delivered, and to turn it on and off reliably without electrical discharge is essential. However, cutting off high-voltage, high-current electricity is very difficult. Particularly, how to cut off DC current has recently become a major problem, and reliable 'insulation' and 'interruption' is important. In order to physically understand and observe the mechanism generating and maintaining 'electrical discharge', we use optical sensing methods in research. The reason for this is that knowing the state of electrons, negative ions, and positive ions in the discharge path, requires a 'noncontact tool' that does not disturb the state of these particles because disturbing them causes observational problems. Measuring electron density and knowing the mechanism of electrical discharge allows us to more efficiently design insulation materials, circuit breakers, and other apparatus.

One of the Best High-voltage Facilities in Japanese Universities

Our laboratory hall has three different types of basic high voltage power supplies: 400kV DC, 500kV AC, and impulse※1 2.1MV. Among universities in Japan, ours is the only one with such a wide range of high-voltage power supplies. We also have a hall, so we are really proud of our facilities.

These power supplies were installed by previous professors in the 1960s, and have been used with great care ever since, so they have a long history.

※1 An impulse is an artificially created test waveform applied to see lightning surge voltage resistance, and is used to evaluate countermeasure products. Lightning surges are abnormal voltages, or currents, caused by lightning on metallic lines.

▲Laboratory hall

Research Facility Wishes

I would like to have a measurement system with lasers and a suitable environment for it, and a comfortable environment for people. We are conducting experiments using lasers, and since laser operation is also affected by room temperature changes, I would like to improve the environment to maintain a constant room temperature while a high-voltage power supply is being used. In addition, the hall is too large for air conditioning, and although in the summer we have spot coolers and air cooled clothing, it is too hot, so I would like a more comfortable environment for conducting experiments.

Also, although it is a three-story building, Engineering Bldg. 13 has no elevator, which is inconvenient.

The Real Thrill of Research Focused on Electrical Discharge

As a total application of physics and mathematics knowledge targeting the natural phenomenon of electrical discharge this research is close to science. The unknown phenomenon of electrical discharge can be said to be the realm of the gods, and I enjoy it very much.

Although when an accident occurs in an electric power system or some high-voltage apparatus, it presents an opportunity to investigate the cause of the accident and propose how to prevent it in the future, I am happy to think that the world is advancing because of this kind of technology. In addition, this research is sensitive to social situations because depending on renewable energies, specifications required for power devices making up power networks and power systems will change. Since a power system is the very foundation of society, I hope that students interested in going on to higher education will study not only physics and mathematics, but also society.

Written by **Hinata Takeda**

《Asano Campus》

The Asano Campus is located a few streets away from the Hongo Campus towards Ueno Station, or Nezu Station. Although when seen on a map it may appear to be a Hongo Campus annex, the campus houses not only Faculty of Science and Faculty of Engineering buildings, but the Takeda Advanced Knowledge Building, a research facility with the Takeda Clean Room in the basement and a 300-seat hall on the top floor, and the UTokyo Information Technology Center. The appeal of the Asano Campus is the quiet and calm atmosphere in which to conduct research. As the Asano Campus 'Yayoi 2-chome, Bunkyo-ku' address suggests, it is the historically significant spot where Yayoi pottery was discovered, and it has been designated as a National Historic Site as the Yayoi 2-chome Site.

Engineering Bldg. 9

Entering the Asano Campus, and walking along with the Takeda Advanced Knowledge Building to your left, you will see a white lattice-shaped building called the Engineering Bldg. 9. It contains many more laboratories than classrooms, and professors from various FOE departments use it as their research base. The UTokyo Advanced Characterization Nanotechnology Platform, in the basement, is equipped with the most advanced research equipment related to nanotechnology, and researchers from universities, public research institutions, and companies from all over Japan visit the building to use the latest analytical technology.

Professor Naoya Shibata, who conducts research in Engineering Bldg. 9, spoke about his research and recommended spot on campus!

Professor Shibata's Recommended Spot

Although it is not well known, there is a wonderful terrace called the Kumamoto Terrace on the fourth floor of Bldg. 9. It is a wooden deck made of wood from and donated by Kumamoto prefecture. The Institute of Engineering Innovation has a partnership with Kumamoto Prefecture, and for about 10 years has annually been inviting Kumamoto Prefecture high school students for lectures and facility tours. It has become a refreshing place to relax during research downtime and to have barbecues with Bldg. 9 professors.

◀Kumamoto Terrace

Institute of Engineering Innovation,
School of Engineering

Professor **Naoya Shibata**

Investigating the Nature of Materials

I have developed a new electron microscope and it is being used to study the nature of materials. Since I was a student I had been researching ceramics, but as my research continued, I realized that understanding the true nature of material properties, required going back to atomic and electron levels. My thinking was that directly observing the nanoscale world and subsequently deepening our understanding of materials would allow the creation of new materials. I thus realized that existing electron microscopes were limited in their ability to provide a deeper understanding of materials, and that electron microscopes needed to be further developed, so I am concurrently developing electron microscopes.

By developing high-performance electron microscopes, I hope my research clarifies principles that are important for creating new materials. With continued research, electron microscopes have become more developed. With conventional electron microscopes, although it was possible to observe the position of atoms, observing how electric and magnetic fields are generated around the atoms was very difficult, and that is important in understanding the function of materials. However, we are now able to observe electric and magnetic fields around atoms. In the future, I would like to make it possible to also directly observe the bonding of atoms by observing the fields around atoms with an electron microscope.

The Only Magnetic-field-free Atomic-resolution Electron Microscope in the World

In 2019, we developed a new electron microscope in collaboration with JEOL. This is the only electron microscope in the world that can observe materials in the absence of a magnetic field. The lens of an ordinary electron microscope is subjected to a very strong magnetic field. This is like putting a sample in a very strong magnet and observing it. Therefore, since placing a magnetic material under the lens, would cause the material to break down, magnetic materials could not be observed. We developed a new lens that overcomes this limitation, and created an electron microscope that is able to observe materials while maintaining a magnetic field-free environment. This allows us to observe the atomic world even in magnetic materials. In the future, this device will be used all around the world, but as of now, the only one is in the basement of Engineering Bldg. 9, which is being used for research on magnets and steel materials.

The basement of Bldg. 9 houses one of the world's largest electron microscope centers, called the UTokyo Advanced Characterization Nanotechnology Platform, and there is also a wide variety of other electron microscopes.

For example, the Atomic Resolution Ultrahigh Voltage Electron Microscope, which is an entire three-story high building, can accelerate electrons at more than six times the voltage of an ordinary electron microscope, allowing observation of even thick samples.

▲Magnetic-field-free Atomic-resolution Electron Microscope

▲Atomic Resolution Ultrahigh Voltage Electron Microscope

Written by **Ayako Masuno**

《Komaba Research (Komaba II) Campus》

The Komaba Research (Komaba II) Campus is a five-minute walk from the Komaba I Campus, where Junior Division classes are held. Home to the Institute of Industrial Science (IIS), the General Research Experiment Building, and the Center for Collaborative Research, among other facilities, this is a campus for conducting science and engineering research. As you enter the campus through the Main Gate, there is a building with a large Himalayan cedar and a clock tower, and behind it, flanking the square, are research buildings and the Research Center for Advanced Science and Technology. In addition to the Co-operative Store and Refectory, the campus also has a library, restaurants, and a nursery school, which provide a replete environment for carrying out research. Also, since a variety of trees are planted on campus, the changing seasons can be enjoyed such as cherry blossom viewing in the University Square in the spring and the autumn leaves of the ginkgo trees in the fall. Many students eat together for lunch in this Square, or play mini soccer during research breaks. Although most of the laboratories are only open to graduate students, and undergraduates may not have many opportunities to visit campus, since students enrolled in a Junior Division class called UROP※1 are also allowed to experience research at a Komaba Research (Komaba II) Campus laboratory, students eager to be involved in research as soon as possible have their eye on this campus.

※1 Abbreviation for the Undergraduate Research Opportunity Program, a Junior Division class. Students are allowed access to a Komaba II (Research) Campus laboratory for one semester to conduct research. This class was canceled for 2021. (http://www.oshimalab.iis.u-tokyo.ac.jp/UROP/index.html)

IIS, Research Buildings

These research buildings house IIS laboratories, where a variety of research, from biotechnology to architecture, is being conducted. Classes held in these buildings are related to research, such as the First Year Seminar for Natural Science Students and UROP. These research buildings were designed in the 1990s by architect Professor Hiroshi Hara when the IIS was relocated from Roppongi, and the fact that it is entirely made of concrete is impressive. Buildings A through F are connected with a wide covered area supported by a series of columns, so moving between buildings even on rainy days poses no difficulty.

Associate Professor Yukiko Matsunaga, who conducts research at the IIS, spoke about her research and a recommended spot on campus!

Associate Professor Matsunaga's Recommended Spot

▲The statue near the Main Gate

▲Peeking through the aquatic plants below the statue...

My favorite spot on the Komaba Research (Komaba II) Campus is the art object near the Main Gate! In fact, the lower part of this object is like an aquarium, and a variety of creatures live there. Since my specialty is life science, I enjoy observing the fish and shrimp swimming in this aquarium. Please quietly peek in when you come to campus!

Department of Mechanical and Biofunctional Systems, IIS (post); Department of Bioengineering, School of Engineering (concurrently)

Associate Professor **Yukiko Matsunaga**

▲A device that easily photographs capillaries

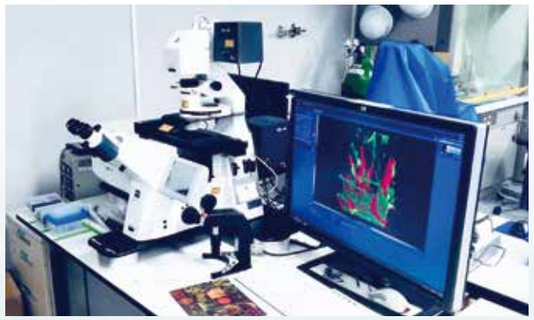
Building Organs from Cells

In our laboratory, we conduct research in the field of 'bottom-up tissue engineering', which is building organs from cells. If you think of the words 'building organs', you may wonder, "Can we make organs just by growing individual cells?" In reality, without satisfying a variety of conditions such providing a scaffold and a culture solution necessary for cell growth, organs cannot be built. The research started in the 1990s, and since this field incorporates new technologies one after another, it requires technical skills in various fields. In our laboratory, we have independently developed a microchip-type cell cultured blood vessel using microtechnology, and are culturing organs.

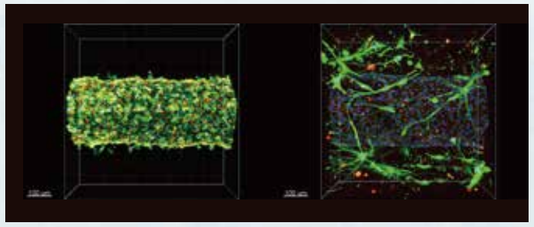
Our laboratory not only conducts specialized cell culture research, but we also actively take up the challenge of developing technologies that society needs. This is because, for me, engineering is based on the premise of 'being useful to people' and I think this academic discipline requires us to resolve problematic things in society. I recently collaborated with members of the DLX Design Lab to develop a device that allows anyone to easily photograph the blood vessels in their fingertips. The development of this device was initiated by the challenge of how to 'more easily be able see the blood vessels observed in experiments' common to researchers working on food-health relationships. We can also use this device for health status indicators because blood capillary shows our health conditions. If we daily use this device we can monitor our health status more easily.

Observing Cells in Three Dimensions

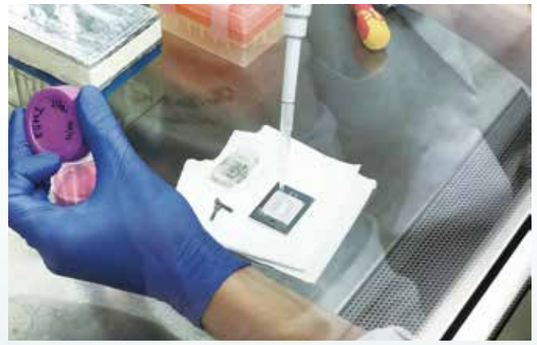
I am proud of two pieces of research equipment. The first is a confocal laser microscope! This microscope allows us to observe cultured cells in three dimensions, and we use it to check the structure of organs when we create them.



▲Confocal laser microscope



▲Observing cells in three dimensions with a confocal laser microscope



▲Using a cell culture chip

This device is also very useful because culturing cells under the laser microscope allows us to observe their growth.

The second is our original chip for culturing cells. This chip has innumerable micro-sized channels, and it is excellent for cultivating microscopic tissues in the chip. In the beginning, we made this chip by hand, we now have several thousand of these chips commercially produced per year and they have become an indispensable tool for our research. The use of this chip allows us to easily cultivate integrated cells, but creators must have a wealth of experimental skills in order to create high-quality artificial organs. Thus, to allow anyone to produce large quantities of artificial organs, we have recently taken on the challenge of using robots to automate the cell culture process with this chip!

Written by **Sota Nagahara**

《Kashiwa Campus》

The Kashiwa Campus, established in 1995 in Kashiwa City, Chiba Prefecture, is the third major campus after Hongo and Komaba. It upholds 'Adventures in Knowledge' that fundamentally reconfigures and integrates academic systems. Various research institutes and graduate schools, including the Institute for Cosmic Ray Research (ICRR), the Institute for Solid State Physics (ISSP), the Graduate School of Frontier Sciences (GSFS), the Atmosphere and Ocean Research Institute (AORI) , and the Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU), are located at the Kashiwa Campus for pursuing cross-disciplinary education and research.

The Kashiwa Campus is characterized by how vast the space is. It is an open space without gates or walls, with many natural campus features such as wooded areas and ponds. Kashiwa Campus is said to be home to a variety of creatures including rabbits, pheasants, and ducks. And since there are few high-rise buildings in the area, the expanse of sky is vast allowing views of Mount Fuji when the weather is good.

Please visit the Kashiwa Campus, where cutting-edge science and rich nature are woven together in harmony.

GSFS Environmental Studies Building

Among the buildings that line the Kashiwa Campus, the blue-green building giving a particularly refreshing impression is the Environmental Studies Building. This building, the base for the Environmental Studies Department of the GSFS, is where interdisciplinary research and education on human activity and the natural environment are conducted on a daily basis.

It was built in 2006. Since the building houses the Environmental Studies Department, its architecture includes many environmentally friendly features. One example is the louvers covering the entire building. Like shop entrance noren curtains, these louvers ensure air circulation while preventing sunlight from shining directly on the windows and exterior walls, which thus reduces the environmental impact of air conditioning. Other features including the overall S-shaped building, rooftop greenery, and the use of geothermal heating and cooling are unique even among the buildings on the Kashiwa Campus.

Associate Professor Misato Nihei and Professor Tetsuya Sakuma, who conduct research in the GSFS Environmental Studies Building, spoke about their research and recommended spots on campus!

Associate Professor Nihei's Recommended Spot 1

I like the wide square between the GSFS Environmental Studies Building and the GSFS Biosciences Building. Before the COVID-19 outbreak, we used to set up dozens of table-top gas canister burners in this square every spring and hold a welcome BBQ for 800 new students. I was the head of the BBQ committee once, and that was a tough job (laughs), but I think it is an event that can only be held at the spacious Kashiwa Campus, which neither Komaba nor Hongo can offer.

▲The square between the Transdisciplinary Sciences Building and the Biosciences Building

▲The narrow road behind the Environmental Studies Building

Associate Professor Nihei's Recommended Spot 2

A long, narrow road stretches east and west behind the Environmental Studies Building where my laboratory is located. It is just a mediocre, insignificant road, but when walking along this road from the Environmental Studies Building to another building that houses experimental facilities, I have seen wild rabbits and pheasants. I think that this extraordinary natural space existing within our daily campus life is one of the Kashiwa Campus charms.

Associate Professor Nihei's and Professor Sakuma's Recommended Spot

Just as the well-known 'Kashiwa has sushi' catchphrase goes, the Kashiwa Campus has a sushi restaurant. Its name is Osakana-club Hama. The restaurant, located on the first floor of the Atmosphere and Ocean Research Institute, serves many kinds of sushi and seafood bowls for lunch and dinner. One of the popular menu items is the Kaisen-don (seafood rice bowl) lunch-of-the-day featuring fish caught locally that day. Other unique items on the diverse menu include sashimi from unusual fish delivered directly from the harbor and, depending on the season, a hot pot for one. The Osakana-club Hama sushi restaurant has a long history with UTokyo. It was originally located on the Nakano Campus, and when the Atmosphere and Ocean Research Institute, which was also located on the Nakano Campus, moved to the Kashiwa Campus, Hama moved with it. When you visit the Kashiwa Campus, be sure to stop by the Osakana-club Hama to enjoy the fresh fish.

▲Hama Special

▲Various specimens lined up in the shop

▲The sky over the Kashiwa Campus

Professor Sakuma's Recommended Spot

As of 2021, I have a laboratory at the Hongo Campus, but until last year I was at the Kashiwa Campus. There aren't many tall buildings on the Kashiwa Campus, and the sky feels much bigger than on the Hongo Campus. Looking at the sky as I rode my bicycle from the station to the campus was a good way to refresh myself and cheer up.

Written by **Koji Tokunaga & Eriko Yamada**

Department of Human & Engineered Environmental Studies,
Graduate School of Frontier Sciences /
Department of Mechanical Engineering, FOE

Associate Professor **Misato Nihei**

Life with Technology

I conduct research in the field of assistive technology, based at the Graduate School of Frontier Sciences at the Kashiwa Campus. This field of research aims to develop devices and social systems that improve the quality of human life by analyzing how life changes in response to social change.

I am personally interested in the question, “How can we integrate human lives and machines?” Recently, I have been working on developing a variety of equipment and systems that support the lives of the elderly and disabled.

One specific area of research is the development of new mobility. One example is PeriPa, a ‘vehicle that supports an individual’s learning how to operate it’. In ordinary vehicles operation is determined by the vehicle, for example, when the stick is tilted to the left, the vehicle will turn to the left, and regardless of who drives the vehicle the same action produces the same outcome. On the other hand, with PeriPa, the vehicle learns different images for operation depending on the person, and allows the vehicle to be operated in a way that suits the individual. When wanting to make a turn in a vehicle, the actions someone wants to take vary from person to person. Some people want to lean their bodies, while others want to twist their bodies, or something like that. PeriPa is a vehicle that

▲PeriPa

uses multiple sensors to detect and learn a person’s intentions from his or her physical responses. It is a new type of mobility that allows the user to control the vehicle without having to learn how to operate it.

Additionally, by quantifying the degree of clutter in a living environment, we are conducting research on estimating the physical and cognitive functions of the elderly from the clutter of their room. By developing a communication tool for handwritten text and putting it into service, we are also conducting research on extracting information on changes in mental and physical functions from handwritten characters. We conduct research on a wide range of topics related to human life, including mobility, living environments, and communication.

In recent years, the rapid aging of Japanese society has become an issue. However, considering that 100 years ago the average life expectancy was about 50 years, that people can now live longer I think is great itself. By using engineering technology to solve social problems I would like to show the world how rich and wonderful an aging society can be.

Sensing People and Motion

Our laboratory has a shared motion measurement room facility for measuring and analyzing physical motions and bodies. We use multiple cameras and a floor reaction force sensor to record three-dimensional physical motions (motion capture system), and measure muscle tissue and brain wave activity to investigate movement and behavior mechanisms. This measurement room is used for conducting research on for example, evaluating wheelchair fall accidents, and studying the movements of wheelchair rugby, which became a hot topic at the Paralympics.


▲Motion measurement room


▲Living Lab

Also on the Kashiwa Campus is another experimental facility, which is a simulated house called the Living Lab that replicates an actual residence. The Living Lab includes a living room, toilet, bathroom, and bedroom, and sensors can be installed as required for given experiments. This facility allows us to sense daily life activities and evaluate developed assistive devices.

Since practical learning is important at our laboratory, the final evaluations of products we develop is always done where daily life takes place, and facilities such as the measurement room and Living Lab are indispensable in the research process leading up to on-site demonstrations.

Written by **Koji Tokunaga**

Department of Architecture,
School of Engineering

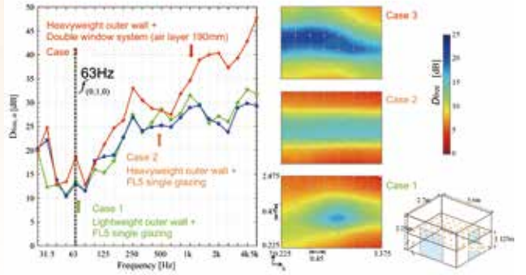
Professor **Tetsuya Sakuma**

Aiming Toward a Better Sound Environment

‘Sound’ is very close to you. For example, when you are talking with someone in a room, you not only listen to the sounds coming from the other person's mouth, but you also listen to the voice and sounds reflected on the floor and walls. While the reflected sounds make our voices louder and easier to hear, the longer the reverberation in the room, the more indistinct our voices become and the harder it is to hear them. As well, ambient noise masks voices and interferes with hearing. My research focuses on environments with such ambient sound, which is usually difficult to notice, but unconsciously affects us.

While sound has negative aspects, such as noise, it also has positive aspects, such as conversations with people around us and music that enrich our lives. How can we profit the most from necessary sounds and suppress those that are unnecessary? In my field of sound environments, it is not only the ‘quantity’ such as the loudness of sounds, but also the ‘quality’ of how people perceive sounds that is ultimately important.

Although I belong to the Department of Architecture, since while research on sound environments is related to various engineering fields such as mechanics, electricity, signal processing, and materials, it is also related to the humanities such as auditory psychology and sound culture, so it is



▲Measurement of façade sound insulation

very interdisciplinary. My laboratory also deals with diverse topics. We also conduct research on sound insulation and absorption materials used in buildings, such as for walls, floors, and windows; concert hall acoustics; outdoor noise propagation prediction methods; and architectural design guidelines for sound environments in houses, offices, schools, and public facilities. We hope that our research will lead to the spread of rational acoustic design and a better sound environment for society.

Simulations and Experiments

Of course, although investigating how sound is heard on site is important, conducting experiments in actual buildings is difficult because conditions may not be controlled, and checking out different acoustic designs may be impossible. Therefore, using numerical simulation and a multi-channel acoustic system allows us to reproduce the sound environment of an actual space in a laboratory and evaluate how it sounds. An anechoic room is used for this.

An anechoic room is a room with four sides made of sound-absorbing materials, which absorb over 99% of the sound. We conduct auditory experiments on music in concert halls; announcements at stations and airports; equipment and traffic noise; and measure the characteristics of acoustic materials, noise sources, and loudspeakers. Even if numerical simulation can predict the physical quantity of sound, it cannot be applied to an actual design unless we see how people feel when listening to it. Creating a better sound environment for the world requires not only conducting simulations but also audible experiments in anechoic rooms.

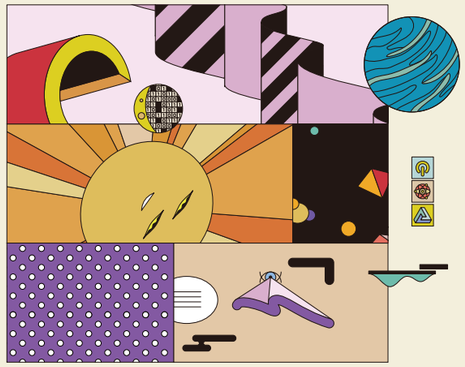

▲Acoustic test house

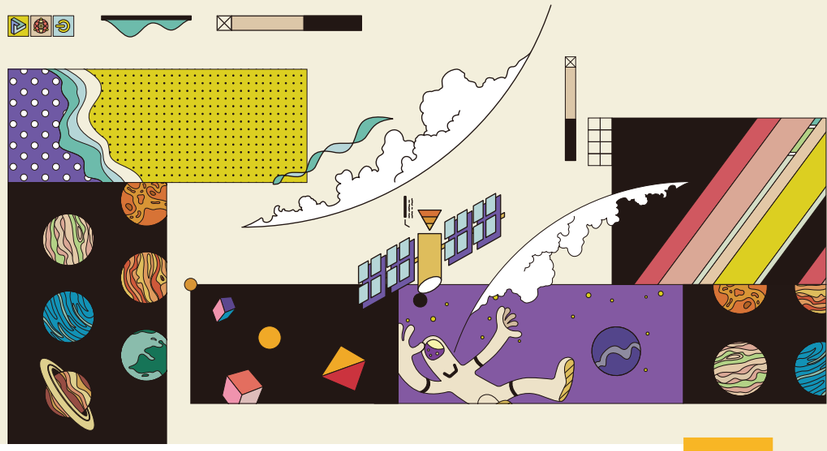

▲Anechoic room

Written by **Eriko Yamada**

狂ATE (CREATE) the FUTURE

SCHOOL OF ENGINEERING, THE UNIVERSITY OF TOKYO





狂ATE (CREATE) the FUTURE is video content streamed by the UTokyo FOE on YouTube, which was just launched in May 2021. To answer straightforwarded questions such as 'What happens at FOE?' and 'What kind of people are at FOE?' these five-minute videos introduce students working hard at UTokyo FOE under the concept of 'Create the future with insanely great impulses'.

For this edition, we talked with two students appearing in 狂ATE (CREATE) the FUTURE.

Mizuki Ishida

Second year doctoral student, Department of Systems Innovation, School of Engineering

After entering the UTokyo Humanities and Social Sciences III course of study, she continued through the FOE Department of Systems Innovation E&E course, and is currently enrolled in the SOE Department of Systems Innovation. Her current research is on the exploration of new gold deposits in Japan.

Kozue Okamura

First year doctoral student, Department of Chemical System Engineering, School of Engineering

After entering the UTokyo Natural Science II course of study, she studied at the FOE Department of Chemical Systems Engineering, and is currently enrolled in the SOE Department of Chemical Systems Engineering. Her research focuses on designing the entire pharmaceutical product process, from manufacturing through delivery to patients.

Did you know each another?

Mizuki Ishida (hereafter referred to as Ishida): I knew her because we happened to be together in a student-led project in the program called GSDM※1. I felt an affinity to the fact that she is also in engineering department.

Kozue Okamura (hereafter referred to as Okamura): I have known her for a while particularly through Toward Diversity and Lighthouse activities. They are both currently active student groups at UTokyo. The Toward Diversity initiative came out of the GSDM and we get UTokyo students in class years ahead of us to share their research and other information to provide younger generation female students with hints to pursue careers in academia. Lighthouse has a focus on SOE, with those who have enrolled in doctoral programs providing advice and encouragement to those who are considering going on to doctoral programs, regardless of their gender. And our first guest was Mizuki. Whenever there is a project, I call on her for help (laughs).

Ishida : Yes, anytime (laughs)! When interacting among doctoral students, I am always impressed by how many of them are taking spontaneous action to solve current social issues while conducting research to create a future society. I am glad that the doctoral program has fortunately enabled me to meet such people.

Okamura : Since some people only have a negative impression of doctoral programs, I hope to share what makes these programs appealing.

Did you notice or feel anything after having been interviewed?

Okamura : This interview led me to realize that I have always been interested in things that cannot be pursued merely numerically, such as what makes people feel happy, or in the case of the 'thickened ankake bouillon' research, what makes people feel something is delicious. Since my current research is based on the goal of delivering a product to people and making patients feel happy, it was good to realize the connection between the two.

Ishida : When you're in a doctoral program, you occasionally think, "If I don't produce great research results, your life is meaningless." However, after the release of this video, I received positive comments from various people; They said my passion cheered them up. I realized that this kind of outreach could inspire people around me. At the same time, I would like to emphasize that the video is interesting because it condenses several hours of filming into five minutes, and in reality I am just an ordinary person. Since I'm a kind of person who loses confidence when I see amazing people, I want to let people know that the hurdles to be of these videos are not so high.

※1 GSDM:An interdisciplinary doctoral program, called the Global Leader Program for Social Design and Management, to train top leaders to guide global society.

Would you like to add a message or something you failed to mention in your video?

Okamura : When I was offered this opportunity, I didn't want to give the impression that I had been thinking, "I'm going to do research on pharmaceutical manufacturing processes" since I was a child. When high school students see the video, I wanted to let them know that it's totally okay if you don't know what you want to do, so I emphatically made sure that message was included at the end. Even if you don't have a cool dream, that's nothing to be ashamed of, and just because you don't have one at the moment I don't think you need to worry about it. I would like them to come to the university with the mindset that this is a period of time to look for one, and that there is enough time to wander.

Ishida : In the video, you see a Sailor Moon wand; It's actually an official but "cheap" wand. Although there used to be more "expensive" wands for adults on the market, I didn't buy it, thinking that I wouldn't be able to use it for anything. But I should have bought one if this fil shooting was going to take place! I really regret that. When they sell a next "expensive" one, I'm definitely going to get it, even though no one is likely to make my video again (laughs) . Also, Kozue was so right when she said that you don't have to have a cool dream. I was nodding my head so hard that it almost fell off. This may not seem convincing, but I would really like to emphasize this point; We are ordinary people!

Mizuki and Kozue, thank you so much for your valuable interview!

This article delves into content not included in the videos, so if you're even the tiniest bit curious, please check out the actual videos!

Information on the academic career path choices of these two interviewees, which was not included in the brochure, is available on Ttime! Web. Please read on!

Access Ttime! Web here

Access Mizuki Ishida's video here

Access Kozue Okamura's video here

We plan to continue streaming 狂ATE (CREATE) the FUTURE videos. Please subscribe to our channel!

Access the 狂ATE (CREATE) the FUTURE video series index here

Written by **Yuki Tsuji & Akihiro Takeshita** (other than the interview)

Student-edited UTokyo Faculty of Engineering PR Brochure

Ttime!

Engineering students tell what's going on now at UTokyo FOE!

From start to finish the process is student-led!

Brochure content is decided in meetings

Interviewing/Writing Proofreading

Completed!

We also produce an English edition as well as manage our website!

We are official PR student assistants whose main job is to create and edit the FOE PR brochure entitled Ttime! which promotes FOE appeal.

The brochure published twice a year, with interviews introducing our cutting-edge research, is also available on our website.

Main Activities

① Producing the FOE PR Brochure, Ttime!

Ttime! is the FOE PR brochure published for high schools, prep schools throughout Japan, and UTokyo students. Student assistants do everything from planning, interviewing, writing articles through proofreading. Ttime! is available at each FOE departmental office on the Hongo Campus, as well as being uploaded to the FOE website. It is also distributed to students at various events.

② Writing Articles for Ttime Web!

In addition to the Ttime! brochure content, additional articles are posted online. Articles introducing each department and other content that could not be included in the brochure have been uploaded. We welcome staff members interested in website creation!

③ FOE Event Management

We are also involved in FOE public relations, and collaborate in carrying out the summer open campus and the techno-science café for elementary, junior high and high school students.
In addition to these activities, we come into contact with alumni and get to know each other better!

Access Ttime! Web here

New Staff Members Welcome

The Ttime! staff presently has members from various departments, from undergraduates to master's students. This allows us to make friends with people from other FOE departments who we wouldn't normally have much contact with! Something else attractive about being on the Ttime! staff is that we hear priceless information from UTokyo professors first-hand when conducting interviews. Anyone interested or wanting to know more about us, please get in touch with us through the Contact Us link on our website!

Ttime! Web
https://ut-ttime.net/

We also post information welcoming new members on Twitter!

Twitter
https://twitter.com/Uttime

Please feel free to contact us at the email address below if you have any questions!

email:ttime.todai@gmail.com

We all welcome you to join us!