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GRADUATE SCHOOL OF FRONTIER SCIENCES,
THE UNIVERSITY OF TOKYO

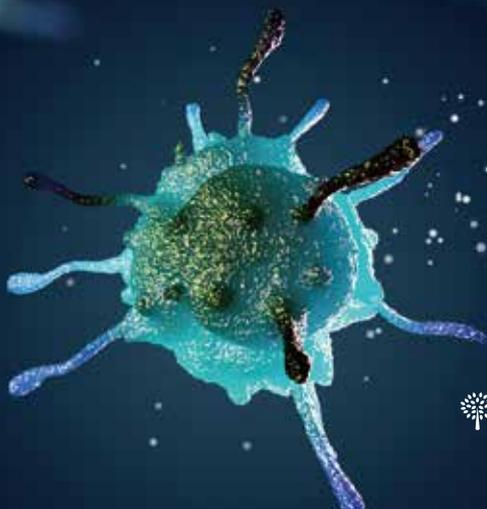
Feature
Article

Continue to evolve in response to the needs of society

Life Science Data Research Center

INDEX

FRONTIER SCIENCES
GSFS FRONTRUNNERS
Voices from International Students
ON CAMPUS × OFF CAMPUS
EVENTS & TOPICS
INFORMATION
Relay Essay

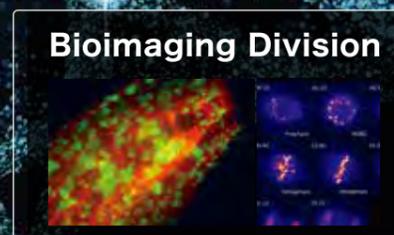
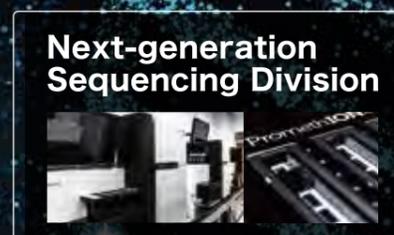


Continue to evolve in response to the needs of society

Life Science Data Research Center

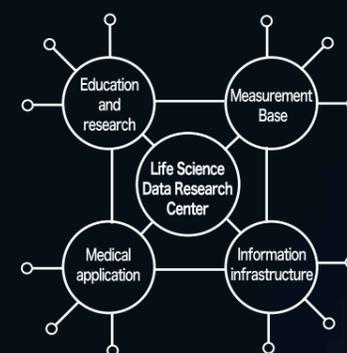
Along with Kashiwa II Campus, connecting society, industry, and regions with data science.

Life Science Data Research Center, affiliated facility of the a Graduate School of Frontier Sciences affiliated facility, was established in 2018 by integrating the Biomechanics Center, Omics Information Center, and the Functional Proteomics Center.



This center consists of a next-generation sequence department and a bioimaging department, and has a system in place to consistently perform calculations to analyze life data. Through next-generation sequence analysis and bioimaging, we aim to elucidate the diversity and evolution of life, drug discovery, and engineering applications.

The Kashiwa II Campus, where this center is located, is also characterized by industry-academia-government-private partnerships. It plays a role in connecting society, industry, and regions forming networks with various organizations in education and research, industrial applications, medical applications, information infrastructure, etc.



Kashiwa II Omics Campus Concept

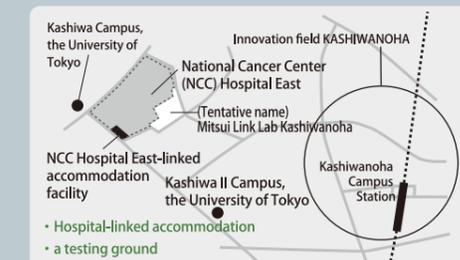
<https://lisdac.k.u-tokyo.ac.jp/>



Support the whole city with life science

As a base for genome analysis

The Life Data Science Center is located in the Kashiwanoha area, which is also the setting for the Mitsui Fudosan Co., Ltd. Kashiwa-no-ha Smart City concept. Kaori Nishibayashi of the Kashiwanoha Urban Planning and Development Department of the company said, "Kashiwa-no-ha Smart City is a city that creates a "future image of the world." Since there are many universities, research institutes, and the National Cancer Center Hospital East in this area, we would like to, for example, support cancer treatment in urban development."



A conceptual drawing of Mitsui Link Lab Kashiwanoha (Tentative name)

NISHIBAYASHI Kaori



Mitsui Fudosan Co., Ltd. Kashiwanoha Urban Planning and Development Department

KASHIWA-NO-HA SMART CITY "New model for hospital and Neighborhoods"

In addition, she also states that the genome analysis technology of Professor Yutaka Suzuki, who is the director of the Life Science Data Research Center, is the property of Kashiwanoha, and that by promoting urban development and collaboration with research institutes from the aspect of life science, this genome analysis is indispensable for the development of the Japanese medical and pharmaceutical industry.



SUZUKI Yutaka Professor

Computational biology and medical sciences / Life Science Data Research Center Director

Professor Suzuki also stated the importance of industry-government-academia-medicine collaboration as follows.

"Omics science for the 'species' of humans has matured as an academic discipline. In the future, it will shift to applications for individuals, such as genomic cancer medicine.

In addition, when conducting a total analysis from birth to death of an individual, such as gene expression in a healthy person, the stage is not the hospital but the entire city, which is the living environment. When promoting such a large project, I think it is better to collaborate with a general developer of a private company such as Mitsui Fudosan."

Collaboration with Kashiwa City "PCR test"

There is a PCR laboratory for COVID-19 infections in this center (temporarily opened on May 26, 2020), and it has a capacity of more than 400 tests per day. The person in charge of the Kashiwa City Health Center is grateful for the stable inspection system established in the city as it would usually take several days for the results to be obtained through inspection companies outside the city. In contrast, at this center, results are obtained the next day, and this speed is being highly evaluated. Dr. Jison Nagase, the chairman of the Kashiwa City Medical Association, said, "This industry-government-academia-medicine collaboration" will enable us to smoothly build an examination system if new infectious diseases occur in the future." Suzuki, Director of the center, also emphasized that he could respond to society's needs, saying, "We were able to contribute to the community as an unsung hero."



DATA SCIENCE

Research ∞ Education ∞ Social cooperation



Systematically learn life science data analysis Fostering human resources required by academia and companies.

DSTEP

In recent years, with the development of high-throughput equipment represented by next-generation sequencing technology, we have entered an era in which large-scale life science data can be obtained quickly and in large quantities. On the other hand, both academia and companies require data science personnel who understand the data obtained and can find meaningful interpretations. The "DSTEP (Data Scientist Training / Education Program)" is a life data science education program that meets the needs of such a society.



DSTEP Systematically learn practical data science with generous support

DSTEP is a program that provides systematic education in data science. Students study data science in parallel with their three year doctoral degree course.

By incorporating data science in the On-the-Job Training (OJT) format in dissertation research, you can experience practical data acquisition and information processing. For students, learning practical techniques appeals to their skill building efforts.

In addition, DSTEP is open to adult students. Even though pharmaceutical companies have a huge amount of data, they may not be able to utilize it because they do not

have the personnel to interpret the data.

By receiving systematic data science education at DSTEP, you can clarify useful information from your own data, such as differences in genomic mutations and disease risks related to whether drugs work or not in cancer cells. Having the knowledge and methods of data science can even lead to new businesses.

Data analysis such as genome can also be learned from technical books. However, Professor Yutaka Suzuki, Director of the Center for Life Data Science, and Associate Professor Ayako Suzuki, one of the faculty members in charge, say that **'by studying systematically with DSTEP, you can learn various analysis methods with generous support, and it, itself, is an opportunity to start data analysis.'**

Classes include lectures and exercises. In particular, the exercises include learning the characteristics and usage of programming languages, performing epigenome analysis and single-cell analysis. Study materials are carefully

prepared so that even people who have never written code can analyze the data. Ayako Suzuki, a specially appointed associate professor, said, "I didn't even know the word OS at the beginning. Still, I was able to learn how to analyze data". At first, you can copy and paste commands. What is important is to be able to experience this. She says, "it's an area where updates are fast, but we have prepared materials for the latest version". We are also taking care to prevent students from tripping over.

As of 2020, there were 15 participants, of which 6 were adult students. There are also many international students.



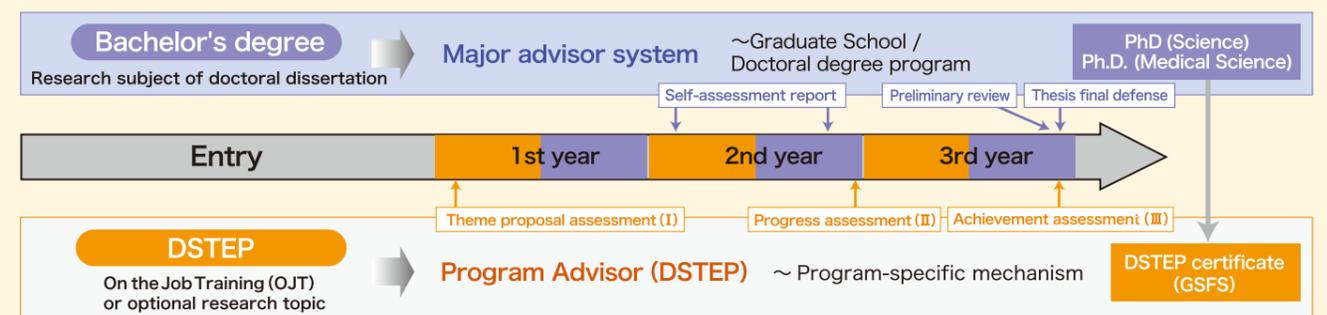
SUZUKI Yutaka, Professor
Department of Computational Biology and Medical Sciences / Life Science Data Research Center Director



SUZUKI Ayako, Specially Appointed Associate Professor
Department of Computational Biology and Medical Sciences / DSTEP

DSTEP program overview

Obtain a PhD in 3 Years ● Touch programming and large-scale data analysis ● Handle more practical data while acquiring knowledge ● Learn practical genomics



Finding and training human resources with advanced necessary scientific capabilities and data analysis capabilities that are directly linked to social needs, and aim to develop human resources to take on any challenge=Development of ready-to-work human resources.

In addition, several private companies are co-sponsoring as a consortium, aiming to respond to the needs of companies and give back to society.

Sponsored by one of Japan's leading bio-related companies and pharmaceutical companies.



Voice of students taking DSTEP

OKA Miho / Discovery Technology Research Laboratories
Ono Pharmaceutical Co., Ltd.



I decided to participate in this program because it would be a good opportunity to learn bioinformatics systematically while experiencing cutting-edge technology. I would like to utilize the valuable experience with many professors for drug discovery and searching biomarkers.

DU Junyan / 2nd year doctoral course, Department of Integrated Biosciences



I participated because the dry analysis is deeply involved in the content of my doctoral dissertation. DSTEP also has research funding and technical support, so students can proceed with their research with confidence. Students can also watch programming lectures on the dedicated website, which is very helpful for beginners.

YOKOYAMA Toshiyuki / 2nd year doctoral course,
Department of Computational Biology and Medical Sciences



It is very encouraging for doctoral students to have a mechanism to support students like DSTEP. I would like to apply what I learned at DSTEP to the development of software that supports cancer genome data analysis, which is my research theme.

SAKAMOTO Yoshitaka / 1st year doctoral course,
Department of Computational Biology and Medical Sciences



At DSTEP, I am working on the research theme of "Integrated elucidation of structural variations and DNA methylation states in the cancer genome using long-read sequencing technology." Practical exercises are very useful and directly connected to my research.

D-DRIVE aiming for industry-academia collaboration and human resource development in data science.

"D-DRIVE (Doctoral program for Data-Related InnoVation Expert)" is a data-related human resource development program that holds seminars and matching events as a place for industry-academia collaboration in data science. The network extends nationwide, promoting industry-academia collaborative projects and recurrent education for doctoral human resources for working adults, and building relationships of trust and cooperation with industry and the business community nationwide.

At the 2nd National Joint Interactive Matching held online in September 2020, students gave one-minute presentations on their research and career plans, and each company took 6 minutes to present their business content and internship programs. After the introduction, students interviewed with the company they were interested in. Among the 30 participating students, 20 ended up participating in the internship, which is a high matching success rate. Companies need more data science human resources,

not only in biotechnology but also for in the financial and material development fields.

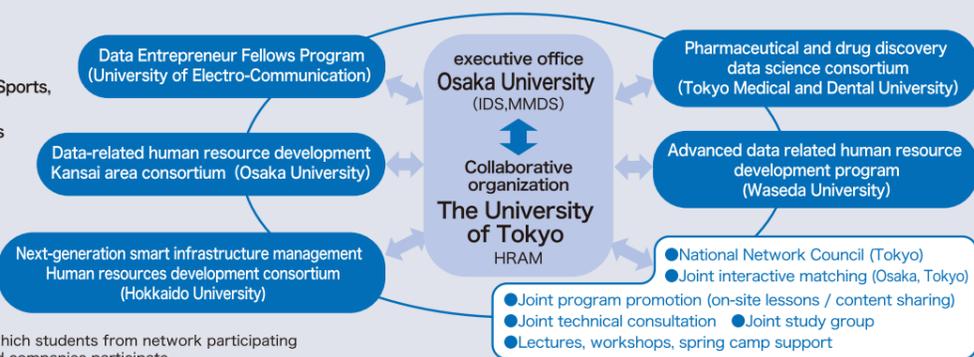
Furthermore, we aim to develop nationwide doctoral human resources that can encourage industry-academia collaboration and multiply data science beyond the efforts of specific industries and universities, such as technical consultation from companies and support for career development. The purpose is to revitalize the industry by increasing the number of data science human resources who can play active roles in diverse places in society.

D-DRIVE

Ministry of Education, Culture, Sports, Science and Technology
Data Science Human Resources Development Program



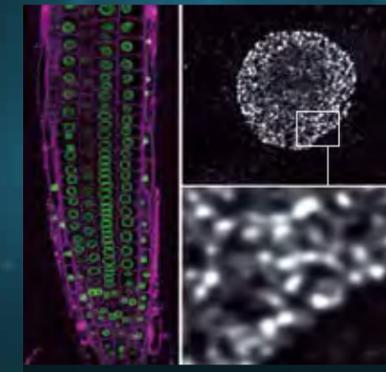
A matching event is also held in which students from network participating institutions nationwide and related companies participate.



Data science that aims to analyze life

DNA hangar is seen by bioimaging

DNA is folded and stored in the intracellular nucleus. The nucleus can take various shapes, such as flat, square, and rounded. In plants we found the nuclear envelope constituent protein CRWN that determines the shape of the nucleus. Observation by fluorescence bioimaging shows that CRWN is localized along the edge of the plant cell nucleus. CRWN creates a mesh-like structure and determines the nuclear shape from the backside of the nuclear envelope (photo). By designing the shape of the nucleus, which can be called a DNA hangar, we aim to create organisms with enhanced functions for living.



CRWN (green) is localized along the nuclear membrane of the root (magenta) (left), taking a mesh structure (upper right). The lower right is an enlarged view of the white frame on the upper panel.

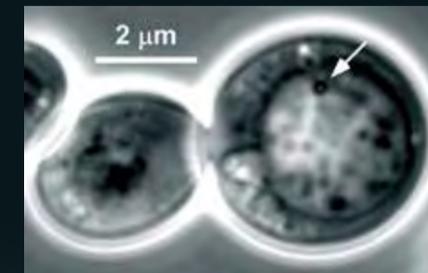


MATSUNAGA Sachihoro
Professor

Department of Integrated Biosciences /
Integrated Life Sciences /
Structural Life Sciences Course

Imaging data science of *Saccharomyces cerevisiae* autophagy

Autophagy is a system that transports cytoplasmic components to lytic organelles such as vacuoles and lysosomes, and degrades the components. When autophagy is induced, the cytoplasmic materials to be degraded are enclosed in membrane vesicles (like a garbage bag) called autophagosomes and transported to the vacuole (photo). Recently, it has become possible to trace the process of autophagosome formation under a fluorescence microscope, so we are conducting research to elucidate the molecular mechanism of autophagosome formation by morphometric analysis of images obtained by fluorescence microscopy.



Membrane vesicles appearing in the vacuole as autophagy progresses (arrow)

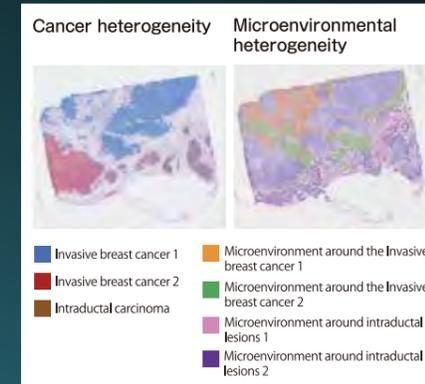


SUZUKI Kuninori
Associate Professor

Department of Integrated
Biosciences /
Life Science Data Research Center

Measure cancer multicellular society and challenge human history

At Suzuki Yutaka Laboratory, people from various backgrounds such as biology, information science, medicine, virology, and mathematics influence each other to conduct research. However, they all have a common interest in sequences represented by A, T, G, and C, and they are taking on the challenge of each theme every day by making full use of cutting-edge genome technology. "Cancer," which I specialize in, also constitutes a kind of society with diverse cells (photo). To know the survival strategy of this society is to know the history of human beings, and in a sense, it is something to be learned. However, the problem is that the existence of cancer is antisocial for humans.



Heterogeneity in cancer cell society. Spatial gene expression information for breast cancer. A variety of cells make up society.



NAGASAWA Sato
Project Researcher

Department of Computational
Biology and Medical Sciences/
Life System Observation Field

Exploration of diversity and universality exhibited by collective electrons in matter



Associate Professor
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Transdisciplinary
Sciences

FRONTIER
SCIENCES

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"By dividing matter into small pieces and understanding its minimum unit, we can unveil the original matter." Such a methodological reductionism constitutes the development of natural science.

On the other hand, condensed matter physics deals with various phenomena that often appear when a number of electrons (as many as 10^{23}) interact with each other in the matter. The emergent phenomena that often appear in such a many-body electronic system are "totally unpredictable from the nature of each electron".

P.W.Anderson, who won the Nobel Prize in Physics, simply expressed the difference between the properties of "individual electrons" and of "collective electrons" in a short term "More is different". "Sometimes they show the nature of a magnet, and sometimes they show the nature of superconductivity where the electrical resistance is zero." Electrons play an important role for all of these but their properties are completely different.

Our laboratory is conducting research to explore and unravel the "various" emergent phenomena exhibited by a large number of electrons in materials such as superconductors. In particular, in materials called "strongly correlated electron systems" in which a strong Coulomb repulsive force acts among electrons, the charge, spin, and orbital degrees of freedom of the electrons play a leading role, and the quantum mechanical effect is noticeable. We are interested in such "quantum phenomena". A typical example is high-temperature superconductivity. According to the standard model of superconductivity (BCS theory) for ordinary metallic materials, it has been thought that the superconducting transition temperature does not exceed 40 Kelvin. However, contrary to this expectation, "unconventional" high-temperature superconductivity was discovered in strongly correlated electron materials

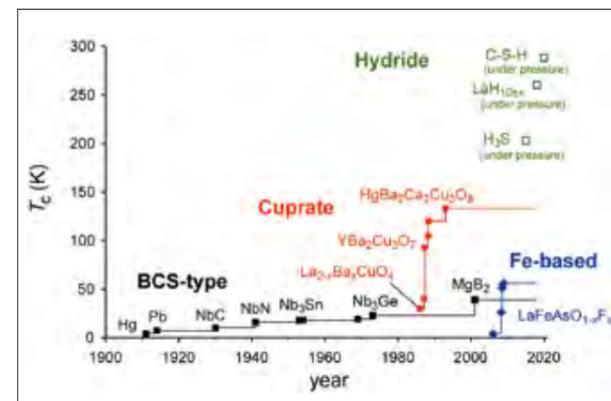


Fig1: Changes in superconducting transition temperature (Quoted from Chuo University Kittaka Laboratory website)



A container that stores liquid helium, which is an indispensable cryogen in low-temperature condensed matter physics.



such as copper oxide and iron-based compounds. The clarification of its mechanism is still being elucidated in modern physics and is an important research topic (Fig. 1).

While exploring "diversity" in condensed matter physics, it is also essential to understand "universality" hidden in diversity. For example, unconventional superconductors realized in strongly correlated electron materials share common features. In many unconventional superconductors, another ordered phase, such as an antiferromagnetic phase or an electronic nematic phase, often appears near the superconducting phase. When such an ordered phase is suppressed by external parameters other than temperatures such as pressure, chemical composition, and magnetic field, unconventional superconductivity appears (Fig. 2).

In our laboratory, to explore such "diversity" and "universality", we are conducting low-temperature experiments based on highly original experimental methods. For example, using the MHz tunnel diode oscillator and the GHz cavity resonator shown in Fig. 3, the magnetic penetration depth, which is one of the most fundamental physical quantities in a superconductor, was measured in

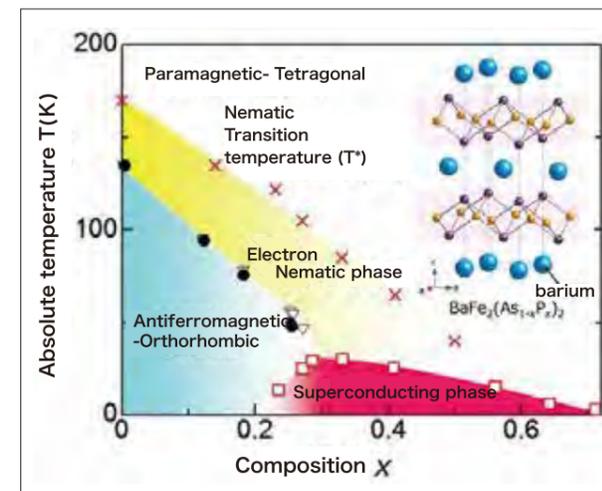


Fig2: Unconventional superconductivity and antiferromagnetic / electron nematic order in the iron-based superconductor $BaFe_2(As_{1-x}P_x)_2$

various unconventional superconductors. As a result, it has been clarified that unconventional superconductivity is realized by magnetic or orbital fluctuations in many superconductors such as copper oxide and iron-based superconductors, not by lattice fluctuations that play an important role in conventional superconductors.

The history of superconductivity goes back more than 100 years, but new superconductors such as topological superconductors and hydride room-temperature superconductors under ultra-high pressure are still being discovered. By pursuing "diversity", which is the real pleasure of condensed matter physics, and finding "universality", I hope that it will be possible to create new functions exhibited by collective electrons in matter.

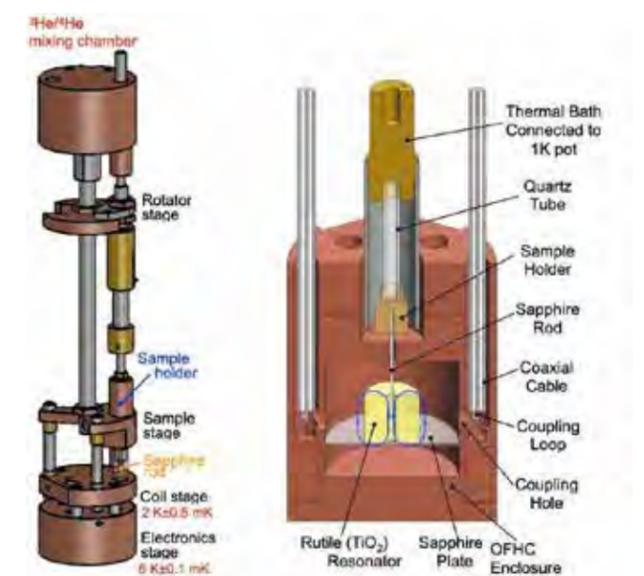


Fig3: Magnetic penetration depth measurement system equipped with a MHz oscillator (left) and microwave surface impedance measurement system equipped with a GHz cavity resonator (right)

Solve the mystery of "cancer stem cells"



Professor
GOYAMA Susumu

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Applied Physics

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When I began my research, back in the early 2000s, cancer stem cell research was all the rage.

The concept of "cancer stem cells", as advocated by Dr. John Dick's group in Toronto, that, "There are stem cells that are the basis of all cancer cells," was beautiful and attractive, and increased expectations for the development of radical therapies targeting stem cells.

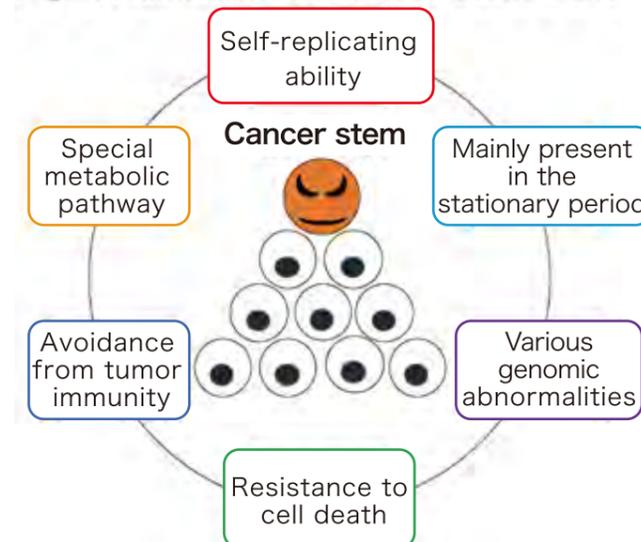
At that time, as a graduate student, I was working on the production of a conditional knockout mouse for transcription factor EVI1. EVI1 is highly expressed in types of leukemia that generally have a poor prognosis. Although now it is common to outsource the production of genetically modified mice, at that time, I had to make them by myself. With the help of my laboratory seniors and assistants and through trial and error, I finally generated the appropriate mice and interestingly, the number of hematopoietic stem cells were significantly reduced in these EVI1-deficient mice. This indicated that EVI1 is a key factor to maintain leukemia stem cells. Since then, I have become interested in the properties of cancer stem cells.

Later, I studied abroad in the laboratory of Dr. James C. Mulloy of Cincinnati Children's Hospital Medical Center in 2009, and started research using the Patient-derived Xenograft (PDX) Model. The PDX model, in which human cancer cells are transplanted into immunodeficient mice, is a central experimental approach in cancer stem cell research. However, from around this time, various problems in cancer stem cell research became clear. First, advances in the experimental model revealed that although initially believed to be extremely rare there are actually a surprisingly large number of cancer stem cells. This posed a big problem in the scientific community and triggered wavering confidence in cancer stem cell research in that experimental results changed depending on the experimental system. In addition, with the advent of next-generation sequencers, gene mutations in cancer have been identified one after another, and genome analysis has attracted more attention than cancer stem cell research. Furthermore, tumor immunology research started to become very popular after 2010, but cancer stem cell research was initially unable to catch up with this trend because it focuses on transplantation experiments using "immunodeficient" mice that lack immune cells against cancers. Recently, however, the fusion of stem cell science with genomics and immunology has progressed, and new cancer stem cell science, which incorporates



Laboratory scenery (1) Respect independence (2) Value Discussion (3) Produce results (thesis)
These three are what we always aim for.

Fig.1. Hallmarks of Cancer Stem Cells



the relationship between cancer clonal evolution and tumor immunity, is in the limelight again (Fig. 1). For example, we have shown that leukemic stem cells are refractory to treatment by avoiding an attack from tumor immunity (Fig. 2). We also found that the epigenome regulator ASXL1 promotes age-related pre-leukemic stem cell proliferation. Furthermore, with the advance of drug discovery technologies, it is now possible to design drugs targeting molecules involved in stem cell regulation. We are currently using the latest protein engineering and RNA interference technology to develop drugs targeting transcription factors that play important roles in the maintenance and proliferation of cancer stem cells.

In order to "cure" cancer, it is essential to study cancer stem cells, which are the source of the onset and recurrence of cancer. Many mysteries remain to be solved; what are the origins of cancer stem cells and why are they resistant to various treatments. I would like to promote new cancer stem cell science that is fused with genomics and immunology, and that can eventually cure cancer.

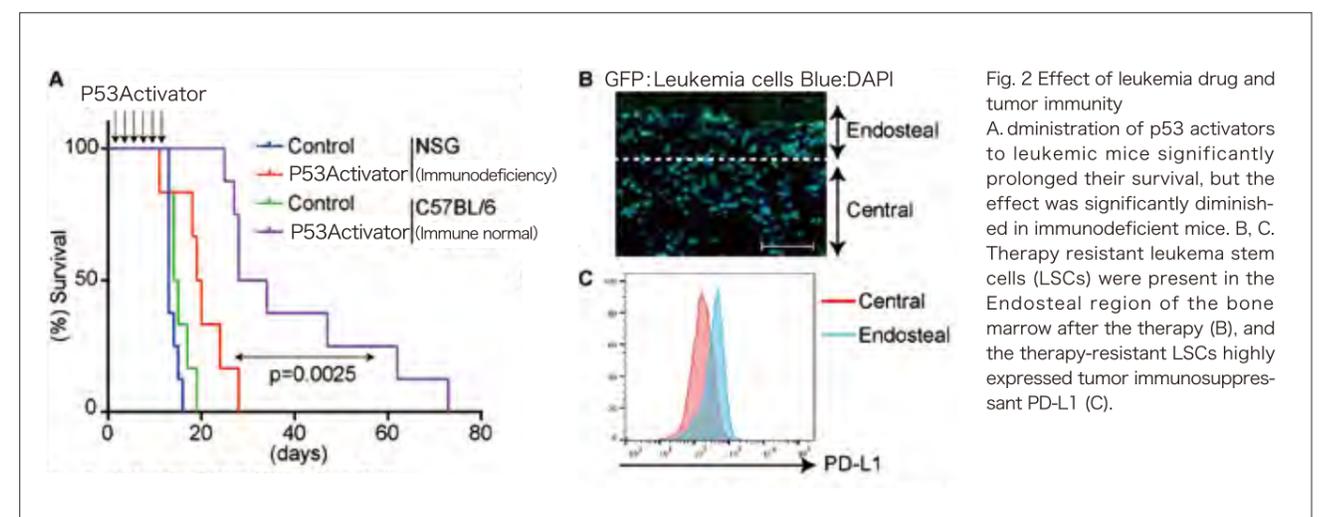


Fig. 2 Effect of leukemia drug and tumor immunity
A. Administration of p53 activators to leukemic mice significantly prolonged their survival, but the effect was significantly diminished in immunodeficient mice. B, C. Therapy resistant leukemia stem cells (LSCs) were present in the Endosteal region of the bone marrow after the therapy (B), and the therapy-resistant LSCs highly expressed tumor immunosuppressant PD-L1 (C).

Research on augmentation of human life functions based on robot technology



Visiting professor
MATSUMOTO Yoshio

Department of Human & Engineered Environmental Studies
Human Augmentation Laboratory

https://www.h.k.u-tokyo.ac.jp/research/hag/index_e.html



 Environmental Studies

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Augmentation of human life functions based on robot

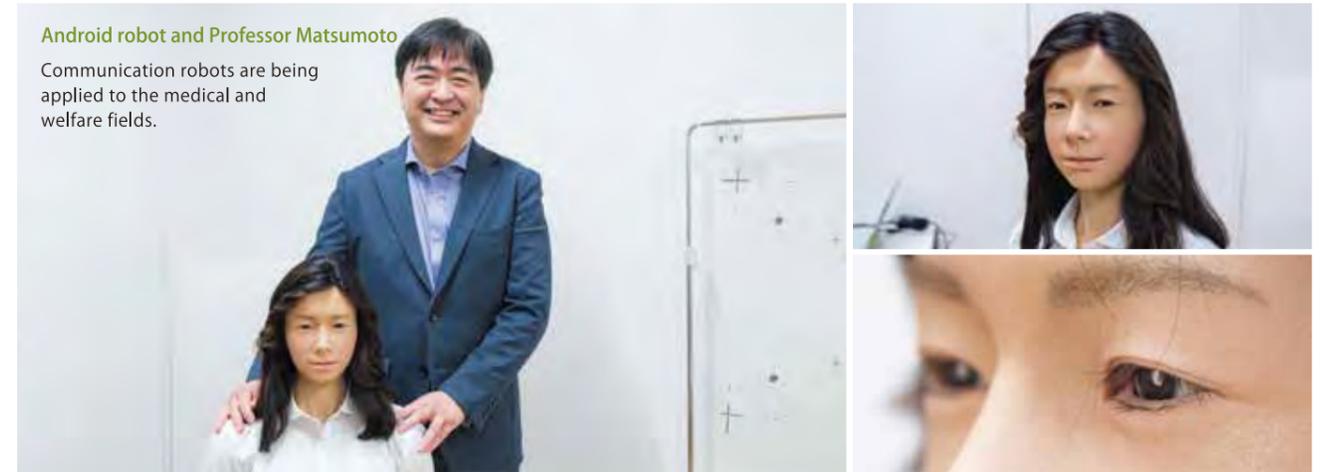
Launched in 2019 as a collaborative laboratory in the Department of Human Environmental Studies the Human Augmentation Laboratory is run by visiting professor Masaaki Mochimaru, associate professor Akihiko Murai and myself. The laboratory is located in the Kashiwa Center of the National Institute of Advanced Industrial Science and Technology (AIST) on the Kashiwa II Campus of the University of Tokyo.

The Human Augmentation Laboratory conducts research on systems to be attached to humans, in order to enhance and empower human functions. We conduct research on and develop systems that enhance human physical functions not only for people whose functions have deteriorated due to aging and disabilities, but also for people who are living normally. We think that people can be more active after they feel that their body function is enhanced. Through this research, we aim for improved healthcare and nursing care services, and for improved working opportunities. Systems that enhance human functions require technologies such as wearable sensors that measure human condition, feedback devices that work on humans, robots, and VR. For realizing such systems that augment human functions, both conducting basic research to deeply understand human sensation, dynamics, and psychological functions, and making representations with a human model are important. We will undertake basic researches to both understand human functions and to develop application systems in order to realize human augmentation. The lab has seven master's course students and 2 working doctoral course students who collaborate with more than



Robotic devices for elderly care developed and commercialized in the project

The walker in the foreground was certified as a rental device in the long-term care insurance.



Android robot and Professor Matsumoto

Communication robots are being applied to the medical and welfare fields.

The robot can express realistic and rich emotions in detail.

30 AIST researchers specializing in sensors, robots, psychology, service engineering, and design.

My research theme is an augmentation of human "life function." When I moved from university to AIST in 2009, I started to do research and development with the desire to disseminate "assistive robots" in society. Since 2013, we have been involved in the national project to develop robotic devices for nursing care (the "robot care project"). In the project, the companies have developed various robotic devices, and we worked on the development and standardization of safety and effectiveness assessment methods. The number of commercialized devices from the project has been increasing, and some are eligible for rental use under long-term care insurance.

However, developing robots that can support humans in a practical sense is not easy. In addition to improving the supporting functions to a "useful" level, we must consider if the care provided by the robot may provide "too much" support in that people may become less active and "unable" with excessive support (disuse syndrome). Therefore, we now also work on the introduction of IoT functions to robotic care devices to

A robotic bed that turns into a wheelchair

The transfer operation, which places a heavy burden on the caregiver / care recipient, becomes unnecessary.



collect data on how elderly people use welfare devices. By analyzing the nationwide long-term care insurance data of more than 10 million people for more than 10 years, it was found that the elderly who started using walkers in "care level 2" had better results than those who did not use any welfare devices. The rate of walker users maintaining the same care level even after 5 years was more than 10% higher, and the rate of living at home (not in care facilities) was more than 30% higher than for those who did not use any devices. My goal is not only to improve the convenience of living by assistive robots but also to maintain and improve "life functions" such as mental and physical functions to achieve more activities and participation. The augmentation of human life functions based on "robot technology" is what I am aiming for.

We are also working on training social skills for children with ASD (Autism Spectrum Disorders) using a human-like robot called an "android robot." This is collaborative research with Osaka University, the National Center of Neurology and Psychiatry, and a school offering special needs education. It has become clear that ASD children, who have a high affinity for robots, got involved with androids at school to conduct dialogue training such as job interview practice, and showed positive effects on communication with people.

We came to Kashiwanoha in 2019, and from 2020 we started our research activities with students in the laboratory at the University of Tokyo. I am excited to be able to have connections with researchers in the graduate school, local companies, nursing homes, and residents in the Kashiwa area. I look forward to furthering cooperation.

Supporting a safe life with cutting-edge research and development



HISAMATSU Rikito

Senior Researcher
Risk Assessment Section
Corporate Planning Department
MS&AD InterRisk Research & Consulting, Inc.
<https://www.irric.co.jp/>

In the non-life insurance industry, there is a keyword called Natural Catastrophe (Nat Cat) model

This is a model that predicts the amount of damage to insurance coverage for natural disasters, and the estimation results are used for determining insurance premium rates and managing insurance company risk. The Natural Catastrophe model is extremely important because the results are directly linked to management, and I have been involved in the development of this Natural Catastrophe model as my main job.

The Natural Catastrophe model has some requirements that need to be met. Typical examples are the ability to analyze infrequent risks and the ability to calculate the expected annual loss. In order to achieve these, hazards are estimated using engineering models based on a probabilistic approach, and the amount of damage to the insured is estimated from the hazard intensity (Fig.). To build such a model, "transdisciplinary approaches" of statistics, meteorology, civil engineering, architecture, etc. is indispensable. The group I belong to also has employees with advanced

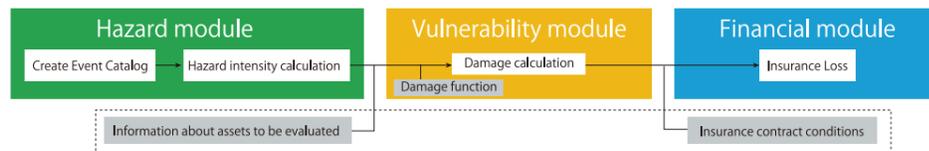
expertise in each field, and we all work together to develop models.

<To my juniors>

Firstly, I would like to tell newcomers that you have the opportunity to utilize your expertise in various industries, just as I utilize my knowledge of civil engineering and environmental studies in the insurance industry. Secondly, doctoral degrees can be important in private companies as well. After I obtained my master's degree, I often had the opportunity to collaborate with overseas companies at my work. Especially in international work, I fully realized that development would not proceed smoothly without discussions between doctors. Motivated by the feelings I felt at that time, I utilized my company's degree acquisition support system and received my PhD in 2020.

In the future, I will reflect on the knowledge gained in the doctoral course in the development of Natural Catastrophe model, aiming for risk assessment with less uncertainty. I hope that my work will lead to the sound management of the insurance industry and contribute to the safe life of everyone.

(Fig.) Components of Natural Catastrophe model



Picture of a meeting (1)



Picture of a meeting (2)

PROFILE

March	2010	Completed Master's Program in Department of Ocean Technology, Policy, and Environment.
April	2010	Joined a construction consulting company
October	2012	Joined MS&AD InterRisk Research & Consulting, Inc (up to the present)
April	2017	Enrolled Doctoral course, Department of Ocean Technology, Policy, and Environment.
June	2020	Completed doctoral course in Department of Ocean Technology, Policy, and Environment.



Photo taken on the top of Tō-no-dake in Kanagawa Prefecture.

With a history of over 100 years, the Cheung Chau Jiao Festival is held every year on Hong Kong's Cheung Chau island for five days from April 5th of the lunar calendar.

At the end of the 19th century, the islanders prayed to the god named Hokutei to ward off the epidemic of Cheung Chau island. They also fasted and roamed the island carrying the statue of Hokutei to show their sincerity. After the plague ended, the islanders started to hold the Cheung Chau Jiao Festival every year to thank the god.

The highlight of the festival is the "Bun Snatching" event that is held on the last day of the festival. It is broadcasted live on TV every year and I enjoyed watching it very much.

"Bun Snatching" is a race to climb the 15 meters high bun tower to take the bun at the top. Cancelled in 1978 due to the collapse of the bun tower, the race was revived in 2005, and new rules were set to make the race safer. All participants are now required to take special training before the race and also wear safety ropes during the race. Also, now, the winner is decided by the number of buns obtained within 3 minutes; whereas, in the past, the winner was the person who took the shortest time to take the bun from the top of the bun tower.

In the past, the buns hung on the bun tower were edible and all the buns were stamped with two Chinese characters,

A Quirky Festival in Hong Kong

Mack Yin Shan Isa

3rd year of doctoral program,
Department of Integrated Biosciences



"Heian", which indicates that you can live in peace every day if you eat it. The islanders ate the buns taken down from the bun tower after the festival in hopes of happy and peaceful lives. For hygienic reasons, the buns on the tower are now made of plastic and edible buns are sold at stores on Cheung Chau Island. The buns come in various flavours including ordinary bean paste, sesame paste, and lotus paste.

Can you feel the charm of the Cheung Chau Jiao Festival? Please come and visit if you have a chance.



The bun of the bun tower is stamped with "Heian" characters.

GSFS Students' Volunteer Team, the University of Tokyo

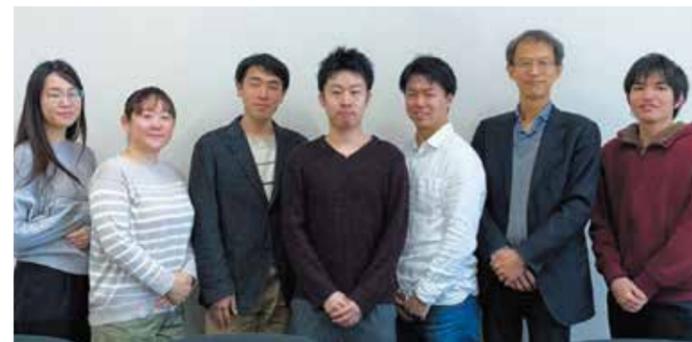
UT-OAK Minamisanriku Support Team

"Terakoya Activities in Minamisanriku Town"

<https://oakkyuen.jimdofree.com/>



UT-OAK Minamisanriku Support Team is a student volunteer organization established in April 2011 by volunteer students belonging to Department of International Studies.



Executive members of 2020 UT-OAK Minamisanriku Support Team and Professor Riki Honda, Advisor of the team

Immediately after the earthquake, we used to prepare meals and distribute supplies every weekend, but our current main activity is the Terakoya, which began in the summer of 2011 for elementary and junior high school students.

Every year, it is held at the community center and meeting place in the town for about one week each during the local summer vacation and winter vacation. In 2012, we received the University of Tokyo President's Award in the field of social activities. (The advisor at that time was emeritus professor Eiji Yamaji.)

ON CAMPUS X OFF CAMPUS

At Terakoya, we mainly help elementary and junior high school students with their homework and provide guidance to exam candidates. As you can see in the picture, during their study time the children focus well on studying and ask the volunteer students what they don't understand. Although the children are very quiet during study time, they begin to play tag during breaks.

Although Terakoya is not a school or



A picture of study time at Terakoya



The scenery of Minamisanriku Town (photographed in autumn 2019)

a tutoring school, making the clear distinction between study time and playtime is the feature of UT-OAK's Terakoya.

In addition to doing school homework, Terakoya also conducts science experiments with different themes each time. At the Terakoya, which we visited last time, we experimented to investigate the liquid properties of substances around us using black tea called butterfly pea, which changes color depending on pH. In this science experiment, the members plan everything from scratch. It is hard to prepare for the experiment because we think about a theme, conduct a preliminary experiment, and confirm the safety of the experiment.

I felt glad when children who participate in the Terakoya are looking forward to the experiment, and they ask, "What



Science experiments are very popular among children (winter 2019)

kind of experiment are you going to do this time?" and enjoyed experimenting when it started. The Terakoya activity is held in August and December every year. We have been sending volunteer recruitment emails to students at the Graduate school of Frontier science about a month ago. If you are interested in the activity, why don't you go to Minamisanriku with us?

Representative Yuma Iwasaki

(2nd year master's course, Advanced Materials Science)

I started to get involved in this activity because I wanted to see the disaster area directly. The image of "elementary school students in the disaster area" tends to come first, but when I talked with them, I learned that Minamisanriku is the ordinary environment for the children. I realized that it is important to treat them normally without being confused by the image.



-GSFS is partially supporting this activity through "the Student-led Creation Project"-

EVENTS & TOPICS

Kashiwa Campus Open to the Public 2020 [online exhibition]

In fiscal 2020, numerous projects were carried out online on platforms including Zoom and YouTube

In an effort to remain open to the public and prevent infection from the new coronavirus, the Graduate School of Science has made a wide range of activities available online. Activities provided online from October 17th (Sat) to October 31st (Sat) included lectures, guided tours, and counseling rooms to discuss some of the cutting-edge research being conducted on a daily basis by GSFS members.

In addition to such online activities, an online campus tour was created to allow virtual visits to the campus. In what has become a fulfilling public release, many people took advantage of this opportunity to virtually experience the state of the Kashiwa campus.



Kashiwa Campus Virtual Tour

《 List of events held 》

Lecture		Special lecture	
10/23	Unravel the real-world complexity with a fusion of science and engineering. Introducing cutting-edge research conducted by the Department of Complex Science and Engineering including machine learning, deep space exploration, fusion plasma, brain biotechnology, and virtual reality.	10/28	Proactive Research Commons Symposium -An integrated education and research organization's approach to revitalizing human resource development - Introducing the features of this graduate school's educational initiative: "Proactive Research Commons".
	Learning Computer : Forefront of machine learning research Introducing the basic mechanisms and latest trends in machine learning which is the core technology of AI -artificial intelligence-.	10/24	To happily live in the era of the 100-year life Katsuya Ijma (Director, Aging Society Research Organization / Professor, Future Vision Research Center)
10/24	Material functions determined by nano space Understanding quantum mechanics, statistical mechanics, thermoelectric power generation, and physics -from solid-state physics to quasicrystal physics- (for high school students).		Society coexisting with the new coronavirus. Ryosuke Shibasaki (Professor, Center for Spatial Information Science)
	The mystery of plasma and the forefront of fusion research An easy-to-understand omnibus lecture by experts explaining cutting-edge aspects of nuclear fusion and plasma. (for high school and undergraduate student)		"Online nature:" Its appeal for people and healing potential? Kaoru Saito (Professor, Graduate school Department of Natural Environmental Studies)
	Regional energy governance -For securing renewable energy- Considering future directions for renewable energy by listening as various domestic Japanese initiatives are presented by members representing different positions.	Video screening	
	Medaka in biodiversity A talk show where researchers discuss diversity and the importance of preserving diversity as explained through the wild medaka (Japanese Killifish) maintained on the Kashiwa campus.	10/17 ~31	Thermoelectric materials: key technologies for addressing energy and environmental problems Demonstration video of thermoelectric power generation and thermoelectric cooling/heating (For elementary and junior high school students)
10/23 10/24	Kashiwa style ☆ Deep space exploration Slide show and talk on zoom with members of the Deep Space Exploration Education Program	10/23 10/24	Let's draw and take close-up looks with advanced technology! Using laser and plasma technologies to make mysterious drawings and experimental observations of shining microorganisms
	Environmental Studies Introductory Content Online educational content on the environment that can be enjoyed by children and adults, including lectures, card games, and photo contests	Other	
		10/23 10/24	Radiation and medaka questions and answers Dr. Shoji Oda answers all your questions related to radiation and medaka on Zoom
		10/23 ~29	Forest experience in the online era How to listen to the voice of nature in the comfort of your own home "Cyber Forest" Exhibition and Guided Tour

"Look into the future!" a Science Course Selection Supporting Event for Junior/Senior High School Girls [Held on October 25]



On October 25th (Sun), a science course selection support event for Junior and High school female students was held by GSFS, Institute for Solid State Physics, and Atmosphere and Ocean Research Institute. Under the slogan "What is the new generation Rikejo (Girls/women majoring in science) with Corona era?" online lectures and panel discussions were held, and about 90 people from all over the country participated in the event. Participants sent messages such as "I learned that even if I choose science major, my career path and employment opportunity would not be narrowed." "I wanted to make use of the scientific way of thinking in my life." (Misato Ohtani, Associate Professor, Department of Integrated Biosciences)

EVENTS & TOPICS

GSFS Video Production Project



<https://gakuyugo-comm.edu.k.u-tokyo.ac.jp/home>



Research introduction video production project created by students.

This project is a part of the "Education and Research Project to Promote Transdisciplinary Communication by Students" which is pursued by the Graduate School of Frontier Sciences since 2019. This aims to promote the fusion of disciplines in GSFS by students creating videos about researches in other laboratories, and 39 students thus far have participated.



I want to broaden my knowledge horizons and contribute to academic fusion research.

CAO Vu Quynh Anh / Student Coordinator
Graduate Program in Sustainability Science-Global Leadership Initiative

Not only produced videos in collaboration with professors and students from different academic fields, but I also had the opportunity to play a role as one of student coordinators. In the future, I would like to promote a participatory approach where students are actively involved in the project management process.



I realized how different our idea on "sustainability" could be.

KAWASAKI Kei
Department of Environment Systems

Through collaboration with a Filipino student majoring in sustainability science, I learned new ideas and perspectives about "sustainability". The process of making a video while exchanging opinions in English was exciting, and my understanding of sustainability science has deepened.



A great chance to see how research develops, from its motivation to outlook

SUE Ayumi / Student Deputy Coordinator
Department of Natural Environmental Studies

This project offered me a chance to know the diverse people and research conducted in our graduate school. While creating original videos, I also worked a lot on translation to make Japanese subtitles. I enjoyed this work very much although I am not particularly good at English.



I think this approach "made by student for students," is excellent.

Vazquez Santiago Jairo
Department of Environment Systems

This is a chance to introduce the different research topics in the university in a relaxed way to prospective students, with fewer formalisms but considering quality standards. This program allowed me to learn the basics of video production from a professional and made me realize how good are videos for science communication when trying to reach a specific audience.

Video introduction



Meet Anh Cao-What if the water level keeps rising?

Producer
CAO Vu Quynh Anh, WANG Yutong
(Graduate Program in Sustainability Science-Global Leadership Initiative)



Released May 2020



Future of Assistive Technologies in Automobiles and Human Welfare

Producer
HAMADA Kiho (Dept. of Human environmental Studies),
Shoab Sengal (Dept. of Integrated Biosciences),
KOMIYA Miko (Dept. of computational biology and medical sciences)



Released November 2020



Short-Term Rentals and Urban Sustainability

Producer
ILIOPOULOS Nikolaos (Graduate Program in Sustainability Science-Global Leadership Initiative)



Released September 2020

We welcome both of new student members who are interested in video production, and production requests from faculty members. Please contact the project secretariat from the above HP

INFORMATION

The year 2020 Autumn Commencement Ceremony



The event was held on Friday, September 18, 2020 at the Large Auditorium (Yasuda Auditorium) on a reduced scale to prevent the spread of COVID-19 infection. The representatives from GSFS were Mr. Shunji Igarashi from the master's programs, and Mr. Yuki Yoshida from the doctoral programs. The number of graduates of GSFS was 112 people in total, 78 for the master's programs and 34 for the doctoral programs.

The year 2020 Autumn Entrance Ceremony



The event was held on Thursday, September 24, 2020 at the Large Auditorium (Yasuda Auditorium) on a reduced scale to prevent the spread of COVID-19 infection. There was a total of 151 students enrolled in GSFS, 90 for the master's programs and 61 for the doctoral programs.

(Photo by YUJI OZEKI)

Graduate School of Frontier Sciences

<https://www.k.u-tokyo.ac.jp/index.html>



Entrance Examination Information

https://www.k.u-tokyo.ac.jp/exam_e/



Souiki-kai

Graduate school of Frontier science Alumni Association
The "Souiki-kai" supports exchanges between graduates and current students.

<https://souiki-kai.net/>



UTokyo FOCUS

UTokyo FOCUS is the official news site of the University of Tokyo, which summarizes the research and education activities of the University of Tokyo in one place.

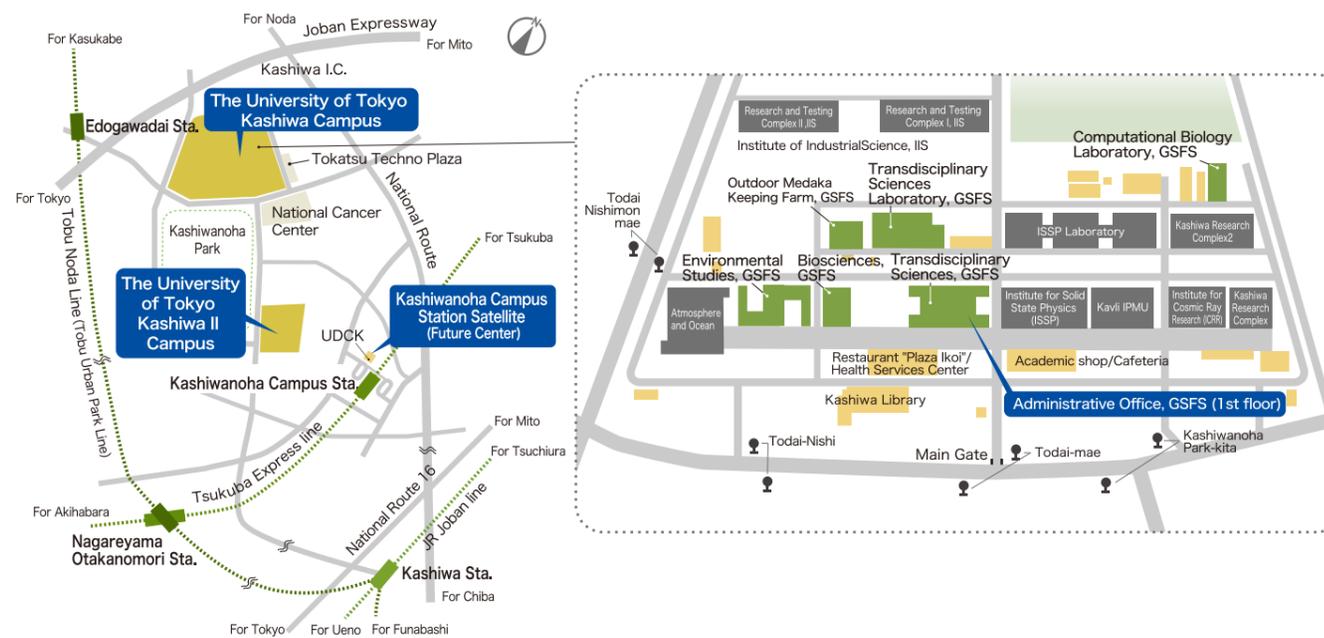
<https://www.u-tokyo.ac.jp/en/index.html>



Please also subscribe to our newsletter. <https://www.u-tokyo.ac.jp/focus/en/newsletter.html>



CAMPUS MAP



Rohan Mehra

Production instructor
Project Senior Specialist, Division for Strategic Public Relations, the University of Tokyo

This project gave me the chance to share skills I have acquired throughout my career with students eager and willing to use them. It makes me proud to see their productions and their enthusiasm for communication. By working with GSFS I am uniquely interested in sheer range of academic fields explored. That fact is great for public communication, where variety and novelty are valuable traits.



ITO Koichi

Research and Education Improvement Office Director, Professor

I am sure that as the student teams were creating the videos, they noticed novel aspects commonly underlying the surrounding academic fields and our society, which are also hints for promoting academic fusion. Their video works also tell us, (their audience), about such situations. This project will surely be a lubricant for the Graduate School of Frontier Sciences.

Editor's Notes

SUZUKI Kojiro, Chairperson of the Public Relations Committee

How was "SOSEI" volume 37? Regular "SOSEI" readers may have noticed that we have renewed the magazine's composition style. We are trying to change from a satisfying public relations magazine to a public relations magazine that everyone, in and outside GSFS, can enjoy. Our public relations will pursue the same "Broader and more international" motto of GSFS, so from now on, we will be making an English version as well. In the featured article and the new corner "ON CAMPUS x OFF CAMPUS", I hope our readers will feel that the faculty members and students at GSFS are taking on new challenges that connect with society in their own special ways. Please keep your expectation high for an ever-evolving "SOSEI" magazine.

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People not touching things and working place with softness.

Studying tactile sensation, I tend to see things from the perspective of "touching". From this perspective, I would like to write about how the COVID-19 has changed our world.

For example, a scene captures the moment that the president quickly pulls his hand away before mistakenly shaking a supporter's hand in front



of world news. The traditional form of "communication by touching" is changing.

Even things that are designed to be touched, such as handrails, doorknobs, and elevator buttons, are becoming untouchable. As a tactile researcher, I had to think about how to make people feel the value of touching in this "world where the hurdles of touching have become higher".

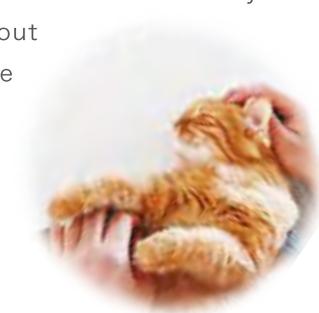


The shift in people's workplaces from offices to their homes can also be seen from a tactile perspective because the things we touch in public spaces are often rigid and cold, whereas the things we touch in private spaces tend to become softer and warmer.

For example, the straps and handrails of trains and buses are hard and cold, but in our private spaces such as our cars, the higher the quality of vehicles, the fluffier the seats become and the softer the handrails become. It is a shift to a space filled with smooth things.

Some of us may even have worked in the ultimate warm and soft environment, such as working with a cat on your lap.

As a tactile researcher, I am very concerned about how this "environmental change in softness and warmth" affects work efficiency. And, I have been thinking about this in a world where we live with the COVID-19.



Department of Complexity Science and Engineering

Associate Professor

MAKINO Yasutoshi