

- Editor's Note

We hope that you enjoy this issue on "Research and Matching" and our special feature on graduation research and design. This time around, we included many photos and Illustrations in all the articles to help visually convey what goes on in the laboratories and the details of graduation research and design. Our goal for this issue of Ttime! is to provide hints on how to realize a fulfilling research life for everyone who picks it up.

This will also be the last issue designed and produced by this year's team. Despite the production period being a busy time for the team members with their schoolwork and job-hunting activities, they did their best to deliver this very interesting issue. We would like to thank all who were involved in preparing this issue. Starting with the next issue, we will be producing the Ttime! PR brochure under a new structure. We will continue to do our best to promote the benefits of the Faculty of Engineering, and we look forward to your continued support of Ttime!







Research and Matching



Research and Matching

Under the theme "Research and Matching," this issue covers the research themes and the atmosphere of the laboratories related to engineering.

Each department of the Faculty of Engineering has numerous laboratories, and each student is assigned to a lab to work on research activities.

In the third and fourth years of undergraduate school and when preparing for the graduate school entrance examination, students are given the opportunity to select the laboratory of their choice, and following a selection process, they are assigned to a laboratory.

When choosing a laboratory, the deciding factors are the research theme and atmosphere of the laboratory.

Students can check out the research themes to some extent by looking at each lab's website, but the atmosphere is something that can only be determined by actually visiting the lab.

Therefore, we talked to several professors who run labs and students who belong to labs, without being partial to a particular field of study, focusing not only on their research activities but also on research life at the labs, such as what the labs are like and how the research themes are decided. We also included a special feature on graduation research and graduation design in the Faculty of Engineering.

Basically, in most departments, the students work on one theme as their graduation research, but some departments require both graduation research and graduation design, and some departments require students to conduct experiments and projects in addition to their graduation research. We briefly summarized which type each department adopts, and interviewed two students. We hope that this issue helps you choose a university, advance to a higher education, and select a lab.

Written by Mizuki Noguchi





Solar system exploration toward utilization of space resources / Miyamoto Laboratory Professor Hideaki Miyamoto

Creating a Framework for Analyzing Words / Yanaka Laboratory Lecturer Hitomi Yanaka



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Seigo Kikura



So close, yet so far! Neighboring labs - Gel as a new material Takashi Yasuda, Itaru Tomikawa





Graduation Research and Design!

Karin Oshima



Graduation Design (Department of Aeronautics and Astronautics) Kazuki Toma

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Solar system exploration toward utilization of space resources

Hideaki Miyamoto





Tell us about your research!

My research focuses on the surface conditions of planets, satellites, and asteroids, and how mankind can make use of these celestial bodies. I am particularly interested in understanding the surface environment of these celestial bodies and the various processes working on the surfaces, with the hope of directly utilizing these extraterrestrial resources (space resources).

For this reason, I was involved in the Hayabusa 2 asteroid mission and the Kaguya lunar mission as a member of their science teams. I am presently participating in several space exploration programs run by JAXA, NASA, and ESA, as well as by private companies. I lead the surface science and geology science team for JAXA's Martian Moons eXploration (MMX^{*1}) mission, where I am working on preparations for mission operations.

I also belong to the Lunar Polar Exploration Mission (LUPEX^{*2}), where I am a member of the team developing a subsurface radar to study the subsurface conditions. In addition, I am the leader



of the science team for the TSUKIMI Lunar Terahertz Surveyor for Kilometer-scale Mapping sponsored by the Ministry of Internal Affairs and Communications of Japan. In fact, the name "TSUKIMI" was named by a student from my lab.

Science and engineering both play a crucial role in space exploration, which is why we work with space science and engineering professors from all over the world, including those at JAXA and NASA. My lab especially focuses on research based on Earth and planetary science; for example, we create simulants*3 of surface materials such as for the moon and asteroids, and we conduct field observations using Mt. Fuji as a simulated celestial body.

We are also involved in the operation of the TeNQ Space Museum in Tokyo Dome City. Please come and visit us.

*1 : Project to send a probe to a Mars satellite to observe and collect samples *2 : Project to obtain data on water resources in the lunar polar regio *3 : Rock reproducing the surface material of a celestial body using material from Earth.



Ground radar prototype

How is systems innovation science applied to space exploration?

The Department of Systems Innovation offers various fields of research with diverse backgrounds, such as ocean engineering, nuclear engineering, and natural resource development. All of these share one thing in common: they have clear objectives and aim to address problems by combining a multitude of technologies into a functioning, complex system. Space exploration is in the same way; it has a scientific goal, skillfully combines robust*4 technologies, and functions as a large system as a whole to reach goals. Hence, the knowledge about systems handling, programming, and data analysis that students acquired during their undergraduate studies can be applied to the field of space exploration after they are assigned to our laboratory.

Of course, the Department of Systems Innovation itself does not specialize in planetary science, and our students come from a variety of backgrounds, including science department. So, our laboratory encourages them to attend meetings of a reading circle and participate in various study groups. We also have two short debriefing sessions and one seminar every week, as well as discussions when necessary.



How do you pick your research themes?

Student interests and areas of expertise are very important to us. We usually spend a considerable amount of time deciding on a theme, testing out one or two things and depending on the progress, switching to a different theme or revising our course if we come across a theme that looks interesting. In other words, the

Please give a message for Komaba Campus students and junior/senior high school students who are interested in research!

I believe that we can best demonstrate our abilities when we are enjoying ourselves. Those who know what they like or have something that interests them should give it a try without worrying about whether or not it is right for them. I find it fascinating for people with diverse backgrounds to gather together in the space field, including in my laboratory. I think their output could be applied to many things, even if they are not directly related to space at first glance. A strong desire to conduct research on making use of celestial bodies is what is important, so having a clear idea of what interests you is very helpful.

Japan has been the focus of worldwide attention in the field of astronomical exploration with the early successes of Hayabusa, Hayabusa 2, and Kaguya. Moreover, Japan ranks second in the world in the number of meteorites it possesses. We also have a competitive edge in meteorite research. In other words, Japan enjoys considerable resources for space resource development, making us one of the most fortunate

- The meetings are often attended by international participants from abroad, and the discussions are conducted in English.
- Many students look a little lost at first, but everyone gets used to it after a while. This experience helps students to become more confident at international conferences.

*4 : Technologies are established and stable results can be expected.



Laboratories in TeNO

themes are not decided in a top-down manner solely because they have to be done in the laboratory.

This is to avoid imposing a theme on students based on my own preferences; I do not want to ruin the opportunity for students to innovate and do amazing things on their own.

countries in the world in this field. The world is currently investing trillions of yen in the utilization of space resources, and while development by private companies is flourishing, there are almost no such companies in Japan. People around the world ask why this is so, given that Japan is supposed to be a world leader in space development. The reason is that the Japanese are too cautious. Being cautious is a good thing, but it would be nice to see young people who are willing to take a leap of faith.



Written by Atsushi Narita



Creating a Framework for Analyzing Words

Hitomi Yanaka





How can we make computers "understand" sentences?

Our research focuses on natural language processing, a technology that represents the meaning the words we use in our daily lives (natural language) as computable formats, and performs computational processing. Natural language processing is a common technology used in machine translation, information retrieval, dialogue AI, and other applications.

However, with the current mainstream methods, it is difficult to correctly understand meanings and information such as comparatives, negation, quantification, etc. Our laboratory aims to realize semantic analysis capable of truly understanding the meaning of words based on linguistics and logic.

Premise sentence	The child is watching a cat running.	
(Hypothesis sentence)	The cat is running. Entailment	
Premise sentence	The child is watching a cat running.	
(Hypothesis sentence)	The child is running. Non entailme	nt

How did you start your current research?

a job because I was interested in systems and IT, and I wanted to

get to know more about society. While working on search system

development, I discovered the field of natural language processing,

and as I started researching it, I became more and more interested

in this area, so I started working at a laboratory in this field as a working doctoral researcher*1. After receiving my doctorate,

By having the language model judge whether the premise sentence entails the hypothesis sentence, it is determined whether the language model really understands the language. In some cases, if the language mode is inappropriate, it will determine that it is the child, not the cat, that is "running" in this premise sentence

Japanese Adversarial Reasoning Dataset From JaNI I (Yanaka&Mineshima2021)



When I was an undergraduate/master's student, I was actually I continued my research at RIKEN, where I began working on majoring in chemical systems engineering, but I decided to get

evaluating whether general-purpose language models using deep learning, which was becoming popular at the time, really understood language. This research brought me to what I am doing today.

*1 : While working for a company, aim at obtaining a doctoral degree by conducting research at a graduate school



What is your laboratory like?

Our laboratory was established in April 2021. As an information science laboratory, we have no special machines or devices. The servers we use for research are rented from inside and outside the university, so our room is almost like a living room. Since we can work from anywhere with just one computer, we basically conduct our research remotely, but we have face-to-face meetings and study groups once a week.

Students in the Department of Information Science in the Faculty of Science, to which I belong, are assigned to laboratories to work on their graduation thesis in the fall of their fourth year of undergraduate study. Considering that they have to finish their graduation thesis in six months, we have them choose a theme of their interest out of several themes presented to them and proceed with their graduation research. From the master's course onwards, students are basically asked to work on a new theme related to their graduation study. Since most of our research is done remotely, we always ask the students to report on their progress at each weekly face-to-face meeting so that we can check the situation and keep them motivated to "work hard" by hearing the other students' reports.



What do you place importance on in order to continue your research?

Music is my way of relaxing. I especially like jazz and love playing and listening to the piano. These days I rarely have time to play the piano, so I enjoy creating music on my computer instead. I also watch a lot of movies and TV dramas.

When I get hooked on something, I won't stop until I get to the bottom of it, and there are times when I realize that a whole day has zoomed by just doing that (laughs). Research in the information field can be done anytime and anywhere, which makes it difficult to separate work from play, so I try to follow a plan for eating right, getting a good night's sleep, and exercising every day. When I'm at a dead end in my research, it's usually because I am either sleepdeprived, hungry, or suffering from very stiff shoulders, so adhering to my plan often solves the problem (laughs). I also like to write and I often write down what happened that day. Sometimes I find that writing down what is not working helps me sort out things from an objective viewpoint and make it work.

Please give a message for Komaba Campus students and junior/senior high school students who are interested in research!

I myself have a very different research interest now versus when I was a master's student, although my interests and concerns do change from time to time. Some people have a clear idea of what they want to do, others are not sure what they want to do just yet. We are all very different, but I think

Research and Matching



Scene from laboratory



Lecturer Yanaka playing the piano

it is a good idea to stick to what you are intuitively interested in and work on it as hard as you can. When interests change, you can work on the new interest. I believe that by giving it your all, things will come into view.

Vritten by Yuki Tsuji





Student interview

Chika Okuda

School of Engineering Department of Electrical Engineering Someya-Yokota Laboratory Master's Course 1st Year

Tell us about your research and your research goals!

I build thin, flexible transistors. Transistors form an integral part of electronic circuits and play a role in amplifying and switching signals in electronic (analog and digital) circuits. Most of the electronic circuits around us are thick and hard because they are made of metals and silicon. Transistors made from organic materials, however, can be used to make thin and soft circuits. With such flexible circuits, it will be possible to easily attach them to the skin or body. They are expected to be useful in the medical and healthcare fields, for example, for long-term monitoring of biological signals.

We are currently working on optimizing the fabrication process and materials to improve the softness of the transistor. Our transistors are about 0.5×0.5 mm in size and less than 1/1000 mm in thickness.

Although it may seem like exhausting work, it is surprisingly enjoyable as it involves a lot of handicraft work. After making the transistors, we apply a voltage between the electrodes to measure the current flowing through them and evaluate the performance. This measurement does require a lot of patience, but I enjoy it because this is a time when I can quietly immerse myself in the experiment. Whenever I make a transistor with a structure that has never been made before and it shows excellent characteristics, I am ecstatic and I can't help but shout, "This is it!"

In the future, I hope to be able to use soft device technology as a leverage to advance into fields allowing more real-world use and application.



Can you describe the atmosphere of your lab and how you spend your day?

Our lab consists of about three members in each grade plus a technical staff. We also have a lab at RIKEN and many joint research partners. Materials play an important role in soft circuits, so our lab is not limited to people with an electrical background, but also includes people with a background in materials, chemistry, and mechanical engineering. Our lab members each work on individual research themes, rather than several of us working on a single theme. Although we work on different themes, we share many of the same experimental equipment and processes, and seniors and the technical staff guide the students in their research. Once a week we discuss our research with our professors, and every month we report on our progress in the laboratory and receive advice from everyone. A typical day's schedule for me includes a one-hour lab meeting in the morning, and then I spend the rest of the day doing experiments or attending lectures. For lunch, I sometimes get a take-out seafood bowl and eat with everyone else in the lab. I usually finish my experiments around 6:00 p.m. and go home. In my laboratory, we are not allowed to conduct experiments when the staff and professors are not around, so there are no experiments late at night or on weekends. I think we lead quite a healthy lifestyle compared to most labs that involve a lot of experiments.



View of our common area

How was your matching with your lab?

The ratio of male to female students at our lab is almost 1:1, with international students making up half the student body. In my undergraduate days, most of my classmates were Japanese male students. However, in my laboratory, I am not treated differently just because I am a girl, so I feel very comfortable. Our lab meetings also have a very open atmosphere where we can frankly express our opinions regardless of our grade. I feel that this lab really suits me. When choosing a lab, I gave importance not only to the research achievements and whether or not the research themes were interesting, but also to the environment, so I looked into the percentage of international students and female students in each



Vacuum deposition equipment used everyday

lab. Actually, I did not know about my current lab until the second semester of my junior year. The main deciding factor was the high percentage of international students and female students, not to mention the fact that I was impressed by the soft electronic circuits. No matter what type of research you do, you may find something that is surprisingly interesting once you start working on it. On the other hand, if the environment doesn't suit you and you don't feel comfortable, not only will you be unable to demonstrate your true potential, you and those around you will not be happy. Listen to your instincts about what interests you and find a place where you can do your research freely and spontaneously.

Written by Eriko Yamada



Researching Cities, Transportation, and Human Behavior

Giancarlos Parady



Laboratory Urban Transportation Research Unit



Lecturer, School of Engineering, Department of Urban Engineering



Tell us about your research!

The research conducted at the Urban Transportation Research Unit is based on three pillars.

The first pillar is the pursuit of the ideal form of cities and transportation. We evaluate how new public transportation systems such as automated driving and the sharing economy^{*1} can be introduced into society, as well as the optimal structure of the cities themselves, from various perspectives, including economic, environmental, and social.

The second pillar is understanding the human behavior that underlies this. We use mathematical models to explain behavior and then study ways to get people to behave in socially desirable ways. As an example, we are researching ways to persuade people to bicycle, walk, and use public transportation as a measure against climate change. For emergencies such as tsunamis, we aim to understand underlying behavioral mechanisms to formulate evacuation plans. Other than that, in the early days of the COVID pandemic, unlike now, people didn't go out at all when the government imposed restrictions on moving around, right? Based on this change, we are also researching why people refrain from going out even though it is no longer a mandatory policy, and how to encourage people to cooperate.

The third pillar is research on urban transportation planning and the ideal ways to put it into practice. We use case studies of systems, policies and plans to study why successful cases worked and what we can learn from them. We study not only Japanese cases, but also those from overseas.

Recently, we have been focusing on research on social networks and travel behavior. Traditional travel behavior surveys and models

target individuals, but most activities are actually carried out not by one person alone, but as part of a coordinated effort with the group they belong to. We would like to clarify the mechanism of the decision-making process of these groups.

*1 : Sharing economy: Social structure in which goods, services, places, etc. are shared and exchanged with many people for use



Distribution of social networks among Tokyo metropolitan area residents



Simulated trends in use of shared automated vehicles in Numata City by time of day and vehicle status (source: Yo Kamijo, 3rd year doctoral student at the Urban Transportation Research Unit)

Tell us about the atmosphere of your lab!

We are committed to deepening exchanges between international and Japanese students. I am from the Dominican Republic, and when I first came to Japan to study for my master's degree, I felt that the Japanese students, especially those from the University of Tokyo, had already formed a community, which often resulted in a



What the lab is like



Tell us how you conduct your research and what you consider to be important in running your lab!

When students decide on a research theme, they may either find their own topic or participate in research that is already being conducted by the laboratory. At the Department of Urban Engineering, students are free to decide their own themes based on what they are interested in and what issues they want to address. Basically, after understanding the strengths and areas of expertise of the laboratory, the students set a specific theme, formulate a hypothesis, and then test it. The ultimate goal of any research is to contribute to policy development.

In running the lab, we are mindful of accommodating the needs and skills of our students. The Department of Urban Engineering has

Transportation is a fascinating and challenging field because of some very rapid technological advances in recent years. One of the roles of researchers is to harness the positive aspects of new technologies, identify the negative impacts, and devise countermeasures. For example, if you join the Urban Transportation Research Unit from a liberal arts background, you will probably have to learn to apply unfamiliar models and mathematics. You can learn these things after you join the department or lab. I was studying

divide in the activities of international and Japanese students. To ensure that all of my fellow lab members get along well with each other, we are increasing the opportunities for everyone to hang out together, such as by going to baseball games, in addition to the welcome parties and dinners.

many liberal arts students, and not everyone has the same skill sets. So, we focus on how we can best utilize the skills of these students. In addition, we look for appropriate teaching methods for different students and try to establish a systematic approach where seniors can take care of juniors. We also think it is crucial to create a network among the students, so we try to provide opportunities for students to interact with each other by holding study groups and joint camps with other universities and participating in academic conferences in Japan and abroad. Also, being a researcher myself, I try to make sure that I keep time for my own research as well as that of my students.

Please give a message for Komaba Campus students and junior/senior high school students who are interested in research!

architectural design as an undergraduate and knew nothing about models when I joined the Urban Transportation Research Unit, but my seniors at the time taught me the basics and helped me reach where I am now. Finally, having a variety of perspectives offers an advantage in this field. Anyone who is interested in cities and transportation, enjoys walking, or just wants to plan the future of their city is welcome to join us.

ritten by Shiho Sakuma



Applied Humanities: Promoting a New Fusion of the Humanities and Sciences with a Practical Perspective

Riina Toya



Associate Professor, Institute of Industrial Science Graduate School of Interfaculty Initiative in Information Studies, Emerging Design and Informatics Course



As a faculty member with a background in the humanities, which is a rare thing in the Institute of Industrial Science, I am working to promote the integration of humanities and sciences. In a society where science and technology are more deeply entrenched and complex, the fusion of humanities and sciences is ever more important; however, putting it into practice is a challenge. We must take a broad look at the whole picture, think about matching, and put it into practice. Without these three steps, this fusion of humanities and sciences is unlikely to progress in reality. Specifically, we believe it is important to design a "coordinator" role that connects different fields, and we are working with professionals who have completed the University of Tokyo Executive Management Program (Todai EMP*1). At the same time, we are thinking about and implementing new ways of integrating humanities and sciences. For example, since 2019, we have been holding "Culture x Engineering research group" about ten times a year for EMP graduates and all University of Tokyo faculty and staff. This is still an on-going effort,



Forum "The Potential of Music"

as we believe that it is important for faculty members to interact with experts and practitioners in various fields on a regular basis in order to promote the integration of humanities and sciences. We invite speakers from a variety of fields potentially related to engineering. Discussions that include the participants always expand in diverse directions, and this tickles my curiosity as the organizer of the meeting. In a music-themed session, we found that many of the participants had musical experience, such as playing musical instruments, and we realized the potential for the fusion of different disciplines starting from music. In addition, the institute launched the "Research Group on Culturally-Informed Engineering" in 2020 to explore new possibilities for engineering centered on the integration with humanities disciplines.

*1 : A course for working people with the aim of nurturing leaders who can identify issues on their own in this era of rapid change. The course offers many cutting-edge subjects that transcend the framework of humanities and sciences.



Associate Professor Toya speaking at the forum



What inspired you to begin your current research?

My background is in history, which I started researching earnestly in the master's program of the Graduate School of Arts and Sciences, aspiring to explore changes in human aesthetics over a period of 50 to 100 years. After that, I worked as a researcher at the Research Institute of Economy, Trade and Industry (RIETI) before launching my own business. When I had reached a point where my small company had settled down, I enrolled in the University of Tokyo EMP program. This was my first exposure to the science field, and I was fascinated by its cross-disciplinary nature. When I completed the EMP, the timing coincided with the start of a cross-disciplinary



Research were displayed at the exhibition "Potentialities: Exhibition for a Possible Euture - in Komaba" at the Institute of Industrial Science (two models on the left)



What is your laboratory like?

It was only last year that I started my concurrent position at the Interfaculty Initiative in Information Studies and the Graduate School of Interdisciplinary Information Studies, so our laboratory doesn't have any students yet. I tell my students in class that I want them to thoroughly understand their field of specialty before broadening their exposure to other fields. In terms of providing research guidance to students, I feel that it is the latter that I should be involved in.

Hi, Komaba campus students, The University of Tokyo is home to top researchers across a wide range of fields. The environment of the College of Arts and Sciences provides the perfect chance to experience the latest in cutting-edge research. Choosing the right course of study in higher education may be a daunting task, but I hope that you will treasure your curiosity and broaden your knowledge in a wide range of fields.

To all junior and senior high school students, what you are learning in school right now represents the very foundation for integrating humanities and sciences. It will serve you well in many ways after graduation. Do your best and find the joy in studying for your entrance exams. Keep up the good work!

program for graduate students at the Graduate School of Arts and Sciences, and I joined the program as a specially appointed faculty member. In 2019, I became a faculty member at the Institute of Industrial Science with the launch of the project "Toyoshima Endowed Chair for Life Style Research^{*2}," which brought me to my current theme of "Applied Humanities."

*2 : Project funded by Toyoshima & Co., Ltd., one of Japan's leading textile trading companies (as of September 2021). The project aimed to discover clues for developing the various seeds accumulated at the Institute of Industrial Science into the lifestyles of the future.



Books published by Associate Professor Toya to date. "The Birth of Underwear" (top right) is based on Associate Professor Toya's master's thesis

The Interfaculty Initiative in Information Studies and Graduate School of Interdisciplinary Information Studies offers a secondary advisor program*³. I hope that students will consider my laboratory as a candidate for secondary advisor to further their research in their field of specialty.

*3 : A system that allows students to receive formal research guidance from faculty members outside their own lab. In many cases, a secondary advisor is selected at the time of admission to both the master's and doctoral programs

Please give a message for Komaba Campus students and junior/senior high school students who are interested in research!



View from the Toya Lab

Written by Mizuki Yamada





Student interview

Seigo Kikura

School of Engineering Department of Applied Physics, Koashi Laboratory Master's Course 1st Year

Tell us about your research and your research goals!

My research focuses on quantum cryptography, which can realize fully secure cryptographic communications. The cryptography that is widely used today has not been solved because of the enormous time and money associated with using existing computers, but in principle, it is possible to solve it. Should faster algorithms or computers be developed, the cipher could be cracked efficiently and the information could be stolen by a third party. In other words, it is a safe, yet unsafe, encryption method.

In contrast, quantum cryptography is an encryption method that, in principle, cannot be solved by a third party. To begin with, in order to ensure a secure cryptographic transmission, the encryption key*1 must be shared only between the sender and the receiver, and it must not be revealed to a third party. A third party may try to eavesdrop on the encryption key, but applying the laws of

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Notebook used for research

quantum mechanics will make it possible to detect eavesdropping by a third party. By excluding the part that has been attacked by the eavesdropper and using only the part that has not been eavesdropped on as the encryption key, the encryption key that is unknown to the eavesdropper can be shared, thus ensuring secure information communication. Although the theory of quantum cryptography itself was proposed long ago, not many people in Japan are studying it yet, but studies are being conducted to promote its widespread use.

In quantum cryptography, information is transmitted using photon information. Currently, I am working on the theme of analyzing the amount of information transmitted according to the difference between the theoretical and actual behavior of photons. *1 : A sequence of numbers required to encrypt a message or to restore encrypted data.



Research tools

Tell us how you spend your day and what your lab is like!

My lab is a theory-based lab where no experiments are conducted. For this reason, I can do my research at home, but I prefer going to the lab because I can concentrate better there. Theory-based research means that I write my research in a notebook or write source code and think about it while running the program. In addition to conducting research, I also attend rotational lectures and classes, study what is necessary for my research, and attend



How do you match with your lab?

Upon entering graduate school, I felt that the research topics at my lab were not for me, so much so that I even thought about dropping out. However, after I consulted with my advisor, I was given a research theme and I started going to weekly meetings with him, which helped me find the direction of my research and continue my research life at the graduate school. Before deciding on a laboratory, you should read the research details listed on the website or brochures, as well as papers published by the laboratory of your choice, even if only a few papers. This will help prevent mismatches between the research being conducted and the research you want to do. That said, it is still a difficult decision because your interest in



meetings with my professors to learn more about my research theme.

Since many of the students work on their research from home, I don't have many opportunities to chat with my labmates. Instead, we go out for dinner after our weekly meetings or hold chat meetings. We also have recreational activities from time to time. In that sense, I think we all get along really well.

research may change, and there are some things that you cannot know until you actually join the lab. There is little we can do about that, so when it comes to choosing a laboratory, I think it is important to consider not only the research being conducted, but also the people in the lab and how you match with them. For me, my supervisor was very kind, which is one of the reasons why I continued my research. For those who are planning to visit laboratories in the future, I would highly recommend that you talk to the professors and students of the laboratories and consider how you match with them, which will help you choose the right laboratory for you.

Written by Shuichiro Koga



SO CLOSE, YET SO FAR!

NEIGHBORING

Brief description of research field Unveiling the Universal Law of **Osmotic Pressure in Gels**

Zhena Laboratory

School of Engineering Department of Bioengineering Doctoral course, 2nd year

Takashi Yasuda

which is not part of the three pillars. This is a field in which mechanisms are created from scratch using gel materials, rather than applying a gel to a living body part, as is done in artificial tendons. Professor Yoshida's research focuses on "Biomimetics." while Associate Professor Akimoto's research focuses on the surface properties of gels, the scope of which covers a wide range when viewed in the laboratory as a whole.

What is unique about your lab?

Tomikawa I think that we communicate a lot in my lab. Discussions are frequent, and students can casually walk into the classroom and chat with the professors. Also, about half the students in my lab are international students, but they can speak Japanese, so we chat with each other very normally. I myself enjoy chatting with people, and I placed importance on the atmosphere when I chose this laboratory, so I think I made the right choice.

Yasuda I think my lab can truly be summed up in one word: "liberal." We have a wide range of research themes, and there are no core hours^{*2}. On the flip side, it is also a carefree environment, so you are expected to take the initiative, and as long as you can do that, you can enjoy a free and relaxed research life.

*2 Core hours: Refers to the hours that students must be at the laboratory.

How do you conduct your research?

Tomikawa My laboratory also has no core hours, which allows us to do research at our own pace. However, we do not simply proceed on our own, but often form units with other students with similar research themes and we have many opportunities for discussion. Our daily research activities are paced by the

Yoshida-Akimoto Laboratory

School of Engineering Department of Materials Engineering Master's course, 1st year

Itaru Tomikawa

presentations that we give at conferences several times a year, and at times we rethink our direction and plans. I'm a night person, so I spend my days in the laboratory from early afternoon doing experiments, participating in discussions, and reading papers. When I have time-consuming experiments such as polymer synthesis, I sometimes work until 11:00 p.m. and return home on the last train.



Yasuda Our lab's overall policy is "20 hours a week for research." We have seminars every week and presentations three times a year; otherwise, students are free to pursue their research at their own pace. Our professors value an environment in which students can conduct research spontaneously. I am currently working on about ten concurrent themes, some of which I undertake on my own and the others I assign to my juniors. I hope to contribute to the development of the entire research field by simultaneously addressing issues of varying degrees of difficulty and scale.

Tell us about your research!

Yasuda Our laboratory conducts all kinds of research on gels*1. Based on three pillars, "Design Gel" to develop gels, "Gel Medicine" to apply gels to medicine, and "Understand Gel" to understand the gels themselves, we approach gels from various perspectives, such as chemistry, physics, biology, medicine, and mathematics. My own research is themed on the basic physical properties of gels from the perspective of "Understand Gel," but the unique aspect of the Zheng Laboratory is that we can switch back and forth between the three pillars without limiting ourselves to just one perspective.

*1 Gel: Colloidal solution (sol) that has lost its fluidity and become jelly-like.



Tomikawa The main theme of the Yoshida-Akimoto Laboratory, to which I belong, is the "creation of artificial life." Hearing these words makes us sound like mad scientists (laughs). It actually falls under the theme of "Biomimetics," so to speak,



What career paths do most students pursue?

Presentation at academic conferenc

Yasuda At my lab, 80% of the undergraduates go on to graduate school, and about 20% get a job. In the master's course, the percentage of those who find employment increases to 70%, and only about 30% go on to the doctoral course. Most students who complete their doctoral course will find a job, but there are also those who continue on to academia. Tomikawa The breakdown of undergraduate students at our lab is very similar to that of Yasuda's lab. I think the percentage of those who find employment after completing their master's course is somewhat higher at my lab. Those who go on to doctoral programs find that there are more international students, which broadens the range of friends they can make.

Thank you, Yasuda and Tomikawa!

Written by Anna Sasaki

Special Feature on Graduation Research and Design!

🕘 Schedule for 4th Year Undergraduates 🔍

graduation research, graduation design, and graduation production. Most departments require students to spend one year on graduation research, while the Department of Architecture and the Department of Aeronautics and Astronautics require students to Moreover, when students work on graduation research for a full year, the timing of their assignment to a laboratory differs depending on the department or course. Even within the same department, the schedule may differ slightly from laboratory to laboratory. As an example, this is the schedule of one of our Ttime! members (a graduate of the Department of Materials Engineering) during September

> August to beginning of September Graduate school entrance

Early July

Graduation thesis presentation (interim presentation); after the presentation, preparation period for graduate school entrance examinations (break)

All departments in the School of Engineering require students to complete graduation research^{*1} and graduation design/production for graduation.

In many departments, fourth year students spend a year working on their graduation research, graduation design, or graduation production, and compile the results into a graduation thesis or other deliverables to be presented at their graduation ceremony. Here, we spoke with two students working on their graduation research and design. What was their schedule like, what did they work on, and what difficulties did they face? What did they gain by completing the project?

In graduation research and design, students start out from the fundamentals they studied and cultivated in lectures and exercises in their respective departments, and are tasked with highly specialized issues and themes under the guidance of faculty members and senior students in their laboratories.

We hope that this special feature will help you think about and visualize the research, design, and production they you may be

working on in the near future!

graduation

Beginning of

January

Start writing graduation

Mid-

Announcement of graduate

acceptance

school entrance exa results and

Second week of February Graduation research presentation **Beainning of** February Submission of araduation thesis End of January Submission of thesis abstract

Research, Production, and Design

After completing their graduation research, graduation production, and graduation design, their research and present their research, production, and design in front of the department's faculty. The table on the right shows what fourth year students in each department work on*2

examination, graduation research resumes

start of graduation

Early

April

Assignment to a laboratory

End of March Graduation

Late March

Presentation at outside research meetinas



epartment of Civil Engineering		
epartment of Urban Engineering		
epartment of Mechanical Engineering		
epartment of Mechano-Informatics		
epartment of Precision Engineering		
epartment of Information and ommunication Engineering		
epartment of Electrical and Electronic ngineering	Graduation research	
epartment of Mathematical Engineering nd Information Physics (Mathematical ıformation Engineering Course)		
epartment of Materials Engineering		
epartment of Applied Chemistry		
epartment of Chemical System Engineering		
epartment of Chemistry and Biotechnology		
epartment of Architecture	Graduation research + Graduation production	
epartment of Aeronautics and Astronautics	Graduation research + Graduation design	
epartment of Mathematical Engineering nd Information Physics System Information Engineering Course) lepartment of Systems Innovation	Graduation research + a (experiments, exercises, etc. unique to the department/ course)	
	/	

Written by Yuki Tsuj



Karin Oshima

School of Information Science and Technology Department of Mechano-Informatics, Master's course, 1st year



Tell us about your graduation research! •-

Expanding on a previous study showing that studied whether rats bond with each other when they are played music that matches the beat. This may sound far-fetched, but it is well known that in humans, when everyone performs the same movement to the music, mutual bonding grows pairs of rats were allowed to interact in one of three sound environments: music that encourages movement to the beat, music that discourages movement, and silence. We then placed one of the paired rats in the middle chamber and the and right chambers with transparent walls. We used image analysis to determine whether the rat in the middle chamber made longer contact with the rats in both chambers, and to measure their relative friendliness. The results of the experiment

the beat got "closer" the longer they listened to









-• What were the challenges •you faced in your research?

The hard part was managing my motivation and schedule. I found it difficult to balance my research and my own time. For example, in lectures, you only need to attend the class at the scheduled time, but in research, you must manage your own schedule. In not work at all. I wish I could better balance my time between my research and the rest of my time. I felt stressed whenever I spent too much time on either one.



Lastly, what are your • thoughts on the graduation research?

experiments, and so on, all the while maintaining a sense of independence. I also found that it is more enjoyable when I can do this in a field that I like. Actually, when I started my graduation research, I hypothesized that the pair of rats exposed to music that matched the beat in the three conditions would get along the best after listening to the music, but the results showed that this was not the case. Nevertheless, I noticed that there were individual differences among the rats, and that each pair initially got along to change my viewpoints, and I decided that I needed to look the changes before and after the music was played, and found that the pairs that got along the best were the pairs that were played music to the beat. I think this proved to be a good experience for the participants in that they now knew that even when the results differed from their hypothesis, they could come up with a new hypothesis based on a different point of view and conduct the experiment once more.

20 Research and Matching

🖕 What have you gained 🔍 through your research?

don't know the field, you can make it if you dive into it. Before joining the lab, I had zero experience touching rats or even neuroscience, which I was knowledge of the research field started to grow as I learned more about it by searching for and reading papers on my own. I didn't like to touch animals, so I was guite afraid of the rats at first, but when I touched them, they were surprisingly gentle. I became attached to the rats as I let them play on my lap to get them used to humans. The lab rats were white and had red eyes, and I began to think they looked like bunnies. But I am still terrified of rats in the wild (laughs).



Graph showing experimental results

Red represents music that is easy to move to the beat, yellow is music that is hard to move to and blue represents the change in how close they became compared to the first measurement after being allowed to interact in a silent environment.

Written by Ayako Masuno



Kazuki Toma

School of Engineering Department of Aeronautics and Astronautics. Master's course. 1st year

-• Tell us about your annual schedule for your •fourth year of undergraduate studies!

I decided on my lab at the beginning of April and was assigned to the Nakasuka-Funase Laboratory. Immediately after the assignment, I selected my group⁺¹ and participated in the laboratory's satellite development project. At the beginning of May, I gave a presentation on the theme of my graduation research, and after that, I began working hard on both the project and my research. In June, I designed the test equipment to be used to develop the satellite, and at the end of the month, I gave a mid-term presentation of my graduation research. July through mid-September was a break period for my graduate school entrance examinations. October was busy with projects, and I had to travel for one week to graduation research before the deadline for submitting my graduation thesis at the end of November. Immediately after completing the graduation research, students begin their graduation design. I chose spaceship^{*2} and proceeded with the project based on the feedback I received at the weekly progress report meetings. At the end of February, I gave the final presentation, completed the graduation design, and then graduated from the undergraduate course. I completed both the graduation research and the graduation design, but the graduation design was more striking.

Tell us about your graduation design!

We designed the "Space Music Hall," a module for playing music on the space station. Envisioning a future in which technology advances and many people visit the space station, a relaxing space would be essential. The idea also came from imagining what it would be like to "nurture culture in space." Spacecraft design is carried out in pairs. In designing the spacecraft, I asked my partner to consider designing a space for a "space music hall" because of his extensive knowledge of VR and movies. conditions, people and the Earth were placed inside and outside the module. Meanwhile, I was in charge of handling many aspects of the space environment, such as structural and thermal calculations, and consideration of countermeasures for life support systems and space debris, and I was able to create a design that was both entertaining and feasible.







What is most appealing about the "Space Music Hall"?

we worked on the form of the performance and the method of viewing the performance. Unlike on the ground, there is no concept of verticality in zero-gravity conditions, so we designed the audience seats to surround the performers at 360° Furthermore, the audience can see Earth through the window at the rear of the stage. We believe that the beautiful view of Earth and the performance can be linked to create a moving artistic experience. In terms of feasibility, there are still challenges ahead. Through this design, we were able to envision, although vaguely, what it would be like to realize the project, and since we would not be able to identify specific issues until we design it. in that sense. I think it was our first milestone.

What did you work extra hard on in the design process?

Imaging and shaping the "Space Music Hall." I tried to come up with various ideas by watching SF movies and videos of astronauts in space, moving my arms and legs on the bed as if I were in space, and visiting the JAXA Tsukuba Space Center to see a full-scale model of "Kibo." It turned out to be harder than I thought to piece it together into a shape that I wanted to design. I also spent a lot of time doing calculations. Envisioning people living in the harsh environment of space, a rigorous design is required to ensure safety. Therefore, we decided to refer to the designs of manned space modules module that JAXA provides to the ISS, kindly shared related materials. I also researched various design documents of the graduation designs of my seniors. As a matter of fact, astronaut Naoko Yamazaki, a graduate of my laboratory, designed a space hotel for her graduation design. When I asked her about it, she kindly gave me all her design documents and detailed drawings. The design documents have been really helpful as they examine life support systems, methods of transportation to space, and economics.

-• Lastly, what did you think of your graduation design? 🕒

My dream has always been to go to space and play my favorite music in space, and it proved to be a wonderful experience for me to be able to give shape to this ambiguous dream. If I had designed something more realistic, such as a satellite, I might have been able to develop technology that I can apply now, but I am confident that the investment I made for the distant future, regardless of the sacrifices I had to make, will one day be worth it. If I can face my true feelings and reaffirm what I genuinely want to do during this opportunity to create the culmination of my life in the form of my work on my graduation thesis and graduation design, I should be







Written by Mizuki Noguchi