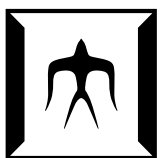


# Invitation to Life Science and Technology



Tokyo Institute of Technology  
School of Life Science and Technology



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# Greeting

Professor KAJIWARA, Susumu, Dean



In the 21st century, our society has moved from an era of only economic growth to an era in which people are pursuing the realization of a healthy, prosperous, and sustainable society. In addition, in recent years, we have been confronted with global societal issues such as climate change, the UN sustainable development goals (SDGs), and pandemics of infectious diseases. As such, life science and technology has become an indispensable discipline in solving these large-scale problems.

In 1990, Tokyo Institute of Technology (Tokyo Tech) added the "School of Bioscience and Biotechnology" to the School of Science and the School of Engineering, both of which led in the development of science and technology in the 20th century, in order to optimally enhance the essential "life" element for the 21st century. In 1992, the Graduate School of Bioscience and Biotechnology was established, and in 2016, the reform of the education system at Tokyo Tech generated the School of Life Science and Technology by combining the undergraduate and graduate schools for Bioscience and Biotechnology. Thus, the year 2022 marks the 30th anniversary of the founding of the graduate school of this faculty, which has already produced more than 5,000 graduates, many of whom are now working at domestic or international companies, research institutes, universities, government agencies, or international organizations.

The School of Life Science and Technology promotes a variety of research and development in the field by using the school's shared state-of-the-art equipment for bio-seamless image analysis, etc. The school also promotes joint research within the school, within the university, and with other universities and companies in Japan and overseas, and conducts interdisciplinary research and industry-academia collaboration to solve global societal issues.

In addition to the more than 100 affiliated faculty members, faculty members from the Laboratory for Chemistry and Life Science, the Cell Biology Center, and the Earth and Life Science Institute of the Institute of Innovative Research are also involved in providing specialized education.

The undergraduate curriculum allows students to systematically acquire knowledge in a wide range of specialized fields related to life science and technology, and to acquire specialized knowledge in interdisciplinary fields by taking a multidisciplinary course offered by a consortium of four universities: Tokyo Tech, Tokyo Medical and Dental University, Hitotsubashi University, and Tokyo University of Foreign Studies. In addition, Tokyo Tech offers a variety of study-abroad programs, allowing students to experience studying abroad at the undergraduate level.

The Graduate Major in Life Science and Technology is where students acquire knowledge and skills in highly specialized areas of the field and are trained to become global experts through a combination of special lectures, provided by invited world-class professors, and practical career development in Europe and the United States. The Graduate Major in Human Centered Science and Biomedical Engineering is a multidisciplinary course jointly administered by the departments of Mechanical Engineering, Electrical and Electronic Engineering, Information and Communication Engineering, Information Technology, Materials Science, and Applied Chemistry. The course fosters bright, creative minds and promotes cross-disciplinary research and development that integrate with other specialized fields. The Graduate Major in Earth-Life Science is launched from this year. It also provides the entrepreneurship education necessary to create new industries and develop new businesses. The School of Life Science and Technology aims to produce global leaders who can improve the well-being of people around the world by conducting research with a strong sense of curiosity and inquisitiveness, applying their flexible thinking to respond to the needs of a diversifying society, and utilizing their wealth of knowledge.

## Associate Deans

### Planning

Prof. YAMAGUCHI, Yuki

### Education

Prof. HONGO, Yuichi

### Research

Prof. KUME, Shoen

### Social Cooperation

Prof. KAMACHI, Toshiaki

## Councilor

Prof. HIROTA, Junji



# Blending Life Science and Technology to Create Infinite Possibilities

Can you imagine how our society will change in the coming years?

We can foresee the future as life science and technology progress together.

Extensive research is being conducted at the School of Life Science and Technology, from exploring the principles of life to technological applications.

Collective knowledge and skills in life science and technology offer infinite possibilities for our future society.

## History of the School



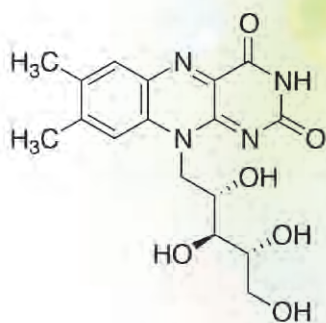
1929	Foundation of the Tokyo Institute of Technology
June 1990	Foundation of the School of Bioscience and Biotechnology
April 1992	Foundation of the Graduate School of Bioscience and Biotechnology
Autumn 1993	Establishment of the Gene Research Center
March 1997	Establishment of the Research Center for Experimental Biology
1999	Reorganization of the Graduate School Three new departments were opened in the graduate school: Department of Life Science, Department of Biological Information, and Department of Biomolecular Engineering. The undergraduate school was restructured into two departments: Department of Bioscience and Department of Biotechnology.
2000	The Department of Bioscience and the Department of Biotechnology in the graduate school were reorganized and renamed as the Department of Biological Sciences and the Department of Bioengineering, respectively.
2001	Construction of the Radioisotope Research Center
2003	Three research centers were merged to create the Center for Biological Resources and Informatics.
2016	Reorganization of the undergraduate and graduate schools as the School of Life Science and Technology

## Roots of the School

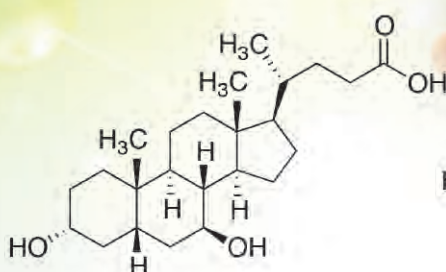


Tokyo Tech successfully created vitamin B2 by hand for the first time, thereby making industrial production possible. In addition, a drug for improving liver function, Urso, and an antiviral drug, Aracena, were also synthesized at Tokyo Tech.

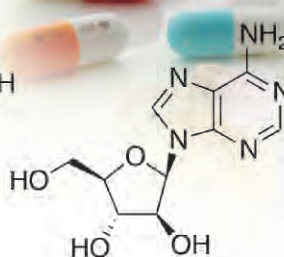
Furthermore, a group of Tokyo Tech researchers discovered alkaline enzymes, which led to the development of enzyme-containing detergents. Based on this pioneering research, Tokyo Tech established the School of Bioscience and Biotechnology, which was Japan's first interdisciplinary school of life science and technology.



Vitamin B2



Urso



Aracena

**The School of Life Science and Technology is advancing world-class research, developing various fields related to the life sciences, and delivering excellent results.**

### A Message from OHSUMI, Yoshinori Honorary Professor and 2016 Nobel Laureate in Physiology or Medicine

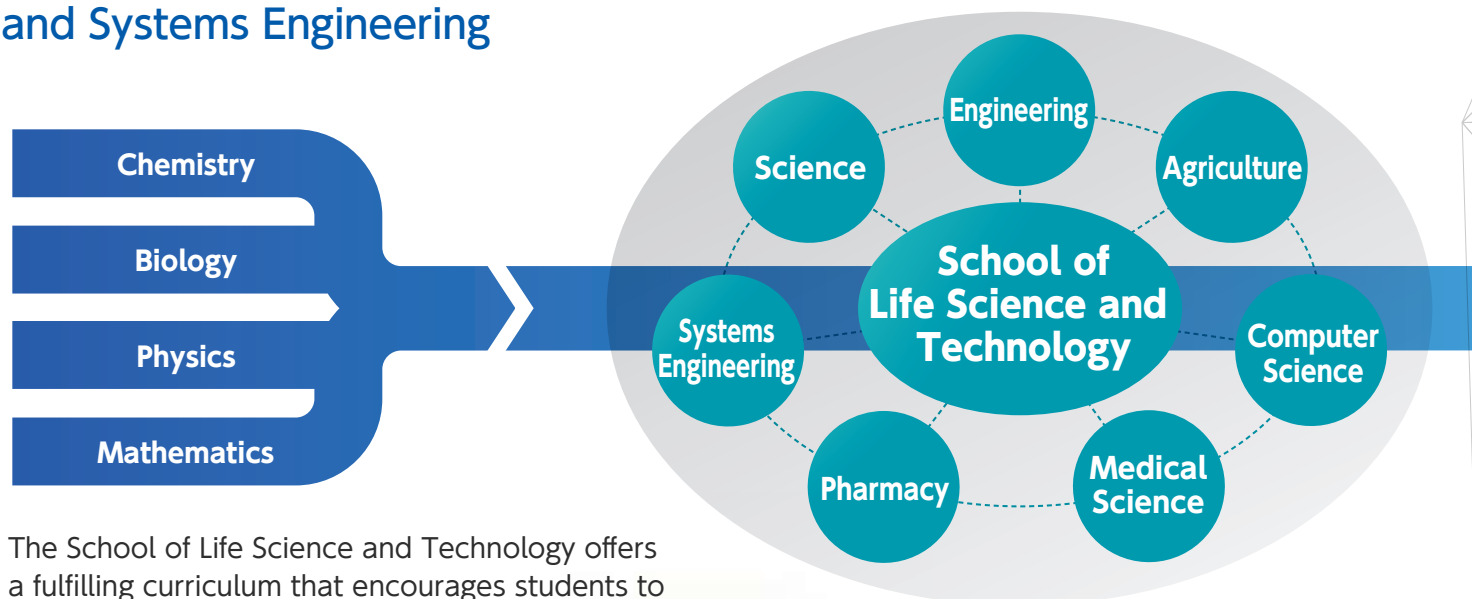
Science is a human activity that is built on a body of knowledge obtained over many generations. Therefore, it is impossible to separate scientists from the age in which they live. I am an example of this, having drawn inspiration from the scientific developments of my time and my own personal experiences to undertake my work on autophagy in yeast. While our understanding of the natural world continues to expand at a rapid pace, many mysteries remain unsolved. Many answers are in fact only the start of new questions. Rather than being captivated by the products of science and technology, I believe that the philosophy and broad perspective of science are more important than ever for the future of humanity.

My message for today's young people is to always keep an eye on the future. To perceive great authority before you merely indicates academic stagnation. Progress is realized by preparing young people to challenge accepted norms and surpass their predecessors. Do not be intimidated by others, and have the courage to embrace and develop your interests without being distracted by the relentless volume of information that is characteristic of our age. Make sure you live a life you are happy with, and find your own way with passion and resilience.



# Fostering Global Leaders

Interdisciplinary Interactions Encompassing Science, Engineering, Pharmacology, Agriculture, Medical Science, Computer Science, and Systems Engineering



The School of Life Science and Technology offers a fulfilling curriculum that encourages students to become leaders in a variety of fields. The curriculum enables students to systematically acquire the foundational knowledge and expertise in life science and technology. Furthermore, students can obtain an advanced education in a cutting-edge research environment. Our variety of international programs and internships is also emphasized.

## Undergraduate study

### The largest education and research organization for life science and technology in Japan

The School of Life Science and Technology is one of the largest undergraduate life science programs in Japan. Students can study the life sciences from polyphenic perspectives, including science, engineering, pharmacology, medicine, and agriculture.

### Creative experiences from the first year

In their first year, students take part in a challenging active learning program in which they create educational materials related to the life sciences. Critical thinking and problem-solving skills are developed through collaborative work.

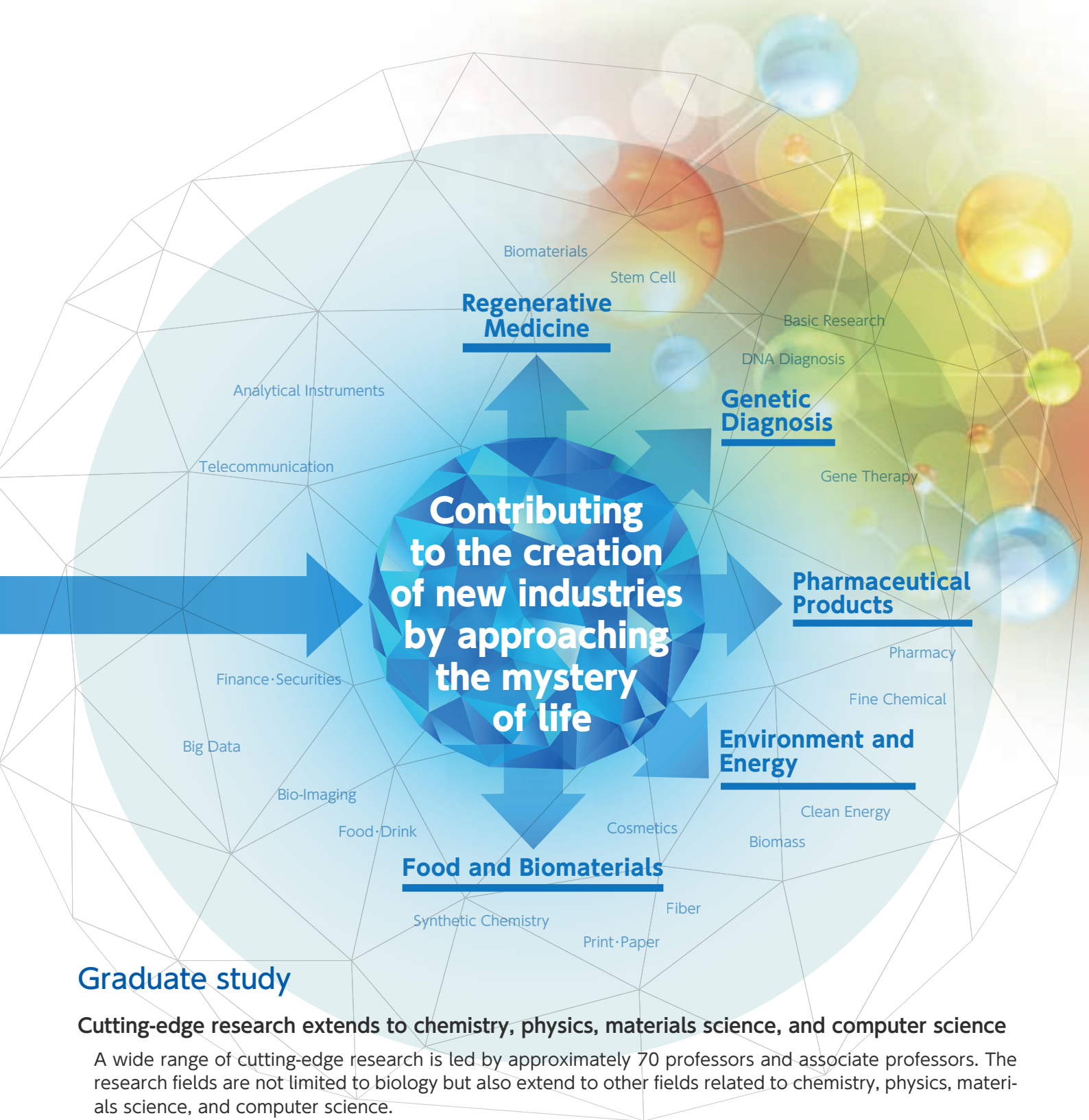
### Study abroad and internship opportunities

A set of well-established international exchange programs and short-term study programs are available, and undergraduate students are encouraged to use these programs to study overseas. Internships at companies are also encouraged, and credit is given for these activities.

### Early enrollment in graduate-level classes

Because most students continue their studies at the graduate level, the School allows students to take graduate-level classes while they are undergraduates. Talented eligible students can also graduate early.





## Graduate study

### Cutting-edge research extends to chemistry, physics, materials science, and computer science

A wide range of cutting-edge research is led by approximately 70 professors and associate professors. The research fields are not limited to biology but also extend to other fields related to chemistry, physics, materials science, and computer science.

### Research in an international environment

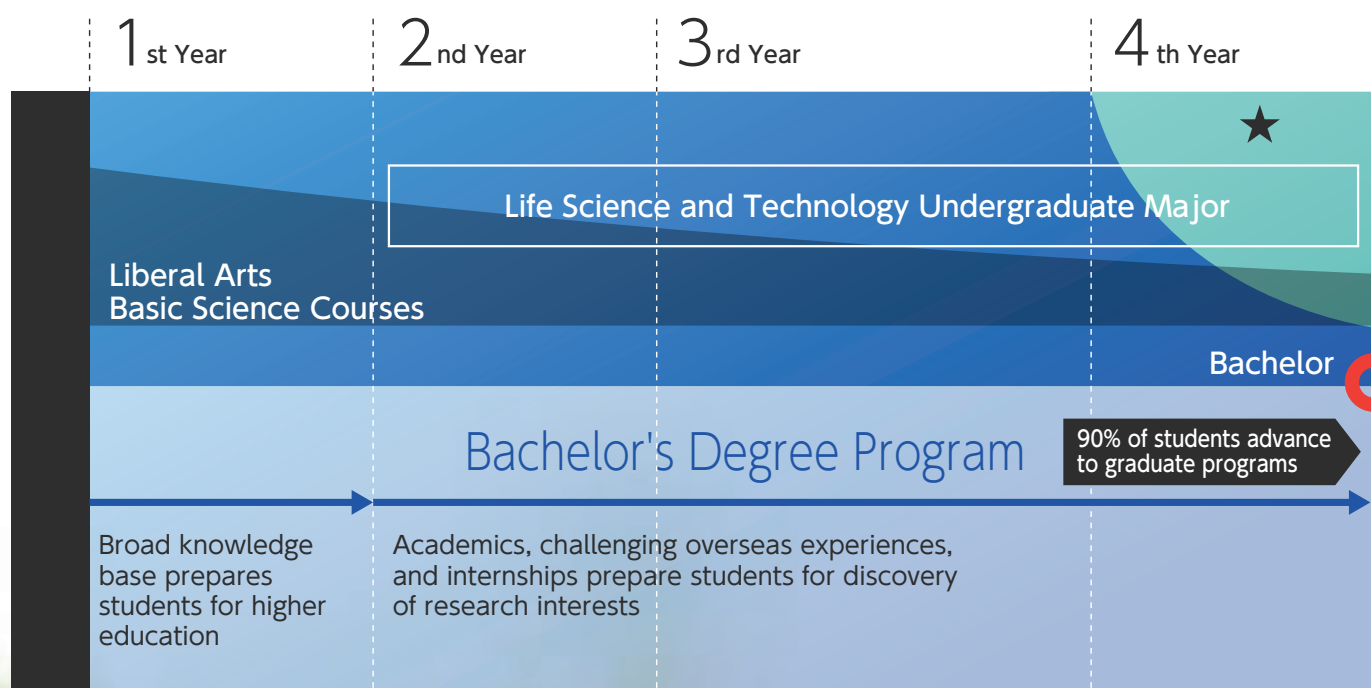
We welcome many outstanding researchers from abroad to visit and participate in research initiatives and seminars. Many of our laboratories have international students. There is an international atmosphere across the campus. Students are encouraged to attend conferences and internships abroad using the school's study abroad programs. Credit is also given for these activities.

### Broad and diverse studies lead to employment in a variety of fields

Studies at the School of Life Science and Technology are related not only to scientific fields such as biology, chemistry, and physics but also engineering fields such as applied chemistry, materials, mechanical engineering, and computer science. Our alumni work in a variety of companies in different fields.

# Pursuing New Forms of

Our new curriculum allows smooth transitions between degree programs. At the undergraduate level, students acquire basic knowledge in life science and technology by their third year and prepare themselves to participate in cutting-edge research by conducting the Independent Research Project (graduation research) in their final year.



## Bachelor's Degree Program

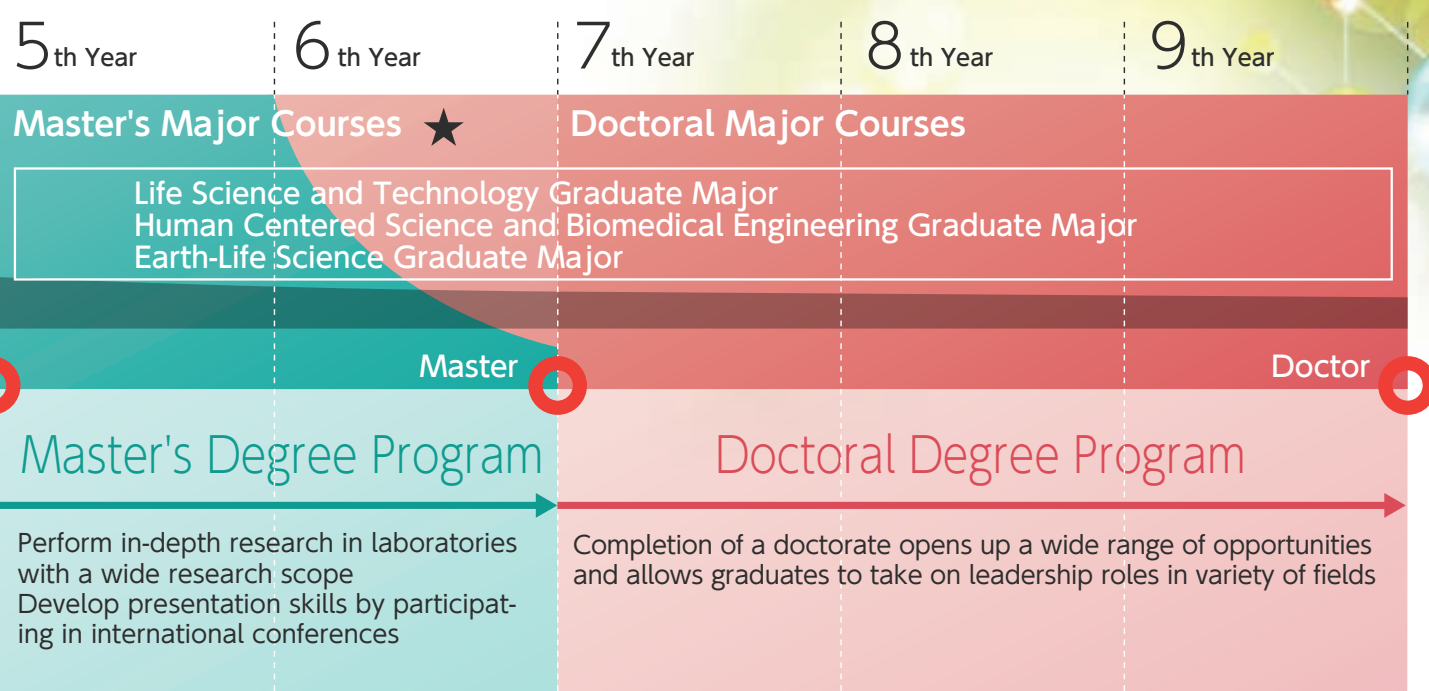
1st Year	2nd Year	3rd ~ 4th Year	
Fundamental Life Science Basic Chemical Thermodynamics Basic Quantum Chemistry Basic Organic Chemistry Basic Inorganic Chemistry Linear Algebra /Recitation Calculus /Recitation Fundamentals of Mechanics Fundamental Life Science Laboratory Introduction to Bio-Frontier Research Processes for Creation in Science and Technology School of Life Science and Technology Literacy International Bio-Creative Design	Physical Chemistry Organic Chemistry Biochemistry Molecular Biology Basic bioinorganic chemistry Molecular Genetics Biochemical Engineering Bioinformatics Biostatistics Instrumental Analysis in Bioscience Developmental Biology Basic Laboratory and Exercise Advanced Bio-Creative Design	Biophysical Chemistry Structural Biology Genome Informatics Bioorganic Chemistry Biomaterials Science Polymer Science (LST) Advanced biological inorganic chemistry Pharmaceutical Chemistry Plant Physiology Photosynthesis and photobiology Animal Physiology Evolutionary Biology	Microbiology Cell Engineering Environmental Bioengineering Genetic Engineering Basic Neuroscience Enzyme Engineering Synthetic Biology Cell Biology Bioethics and Law Biochemistry discussions in English LST Seminar Graduation Thesis Internship Overseas Training List of lectures (partial list)



# Learning

## ■ Quarter system

Our curriculum uses a quarter system in which each year is divided into quarters. The system allows flexible course planning and makes it easier for students to study abroad and complete internships.



★ Progress is measured by the student's level of achievement. Those who have attained a sufficiently high level may take more-advanced courses.

## Master's Degree Program

### Learn by engaging in cutting-edge research

By joining a laboratory and conducting cutting-edge research, students gain a deeper understanding of their field and develop scientific skills.



## Doctoral Degree Program

### Make an impact in the future of the life sciences

Advanced doctoral research provides opportunities for students to take an active part in the fields of life science and technology both inside and outside of Japan.



For additional details of the support options available to students at Tokyo Tech (tuition fee exemptions, scholarships, dormitory options, employment opportunities, etc.), please visit our website at <https://www.titech.ac.jp/english/student-support/prospective-students/support>

# Student Work and Activities

The fast-growing fields of life science and biotechnology seek internationally active individuals who are able to open up a new era. By creating an independent study environment, the School of Life Science and Technology supports a variety of activities in which students take initiative and proactively communicate with other students and researchers around the world.

**Learn by yourself, think actively, and materialize the idea with originality and ingenuity**



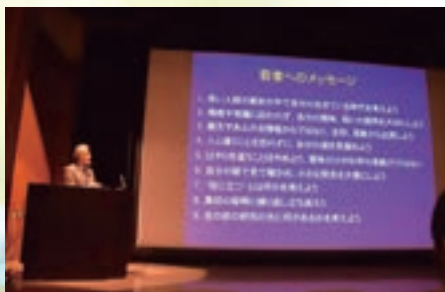
Students at School of Life Science and Technology are trained to materialize the idea with originality and ingenuity from the first year of the bachelor's degree program in courses such as Processes for Creation in Science and Technology, International Bio-Creative Design, and Advanced Bio-Creative Design. There are also opportunities to participate in presentation contests and give a speech on their achievements.

**Tokyo Tech Team wins another gold medal at iGEM**



Approximately 200 teams of students from around the world participate in International Genetically Engineered Machine (iGEM), an international competition in synthesis biology. Tokyo Tech Team, which mainly consisted of students from the School of Life Science and Technology, is famous for its record by winning the 11th consecutive gold medal.

**Looking to the future of life science with world-famous researchers**



With the hope of becoming world-class investigators, undergraduate and graduate students as well as young researchers can enrich their perspectives through participation in Bioscience and Biotechnology International Symposia and Top Leaders Forums where they can meet superb academics from home and abroad.

**Join workshops and training seminars abroad**



Tokyo Tech offers students the opportunity to attend overseas workshops and training seminars in order to foster global leadership.



## Exposure to cross-cultural environments while studying abroad

International internships are among the many ways in which students have the opportunity to visit universities and research institutes abroad. These programs aim to develop human resources in the field of life science and individuals capable of playing an active role in the world.



Massachusetts  
Institute of  
Technology



Heinrich-Heine-  
Universität  
Düsseldorf



University of  
Connecticut Health  
Center

## Study abroad experiences

### KAWAURA, Hinata

The three months I spent at the Gilestro Laboratory at Imperial College London was a hugely valuable experience. In the long-established academic culture of the UK, I observed that anything essential to the pursuit of academic excellence was respected above everything else. This meant that, unlike in Japan where students seldom counter the opinions of faculty members, students in the UK did not hesitate to engage in a battle of logic with their instructors. I found this setting extremely powerful, as it enables discussions among groups of individuals to come up with answers that would otherwise not be possible. I learnt a lot from my internship and intend to build on this experience as I continue to pursue my research.

### IMADA, Takashi

I worked as an intern for five months at the Pamela Silver Laboratory at Harvard Medical School. During my stay, not only was I able to acquire new skills in imaging and analysis, but I was able to meet a diverse community of researchers and observe the different ways in which Japanese and American universities and laboratories are organized. This experience has impacted the way I view research as well. The pursuit of science should not be about following trends set by others. It should be about taking on unique and edgy research that explores new fields.

## Students talk about their life in the lab

### KAWAMURA, Riki

doctoral student

My research is on about pheromones in the urine of African tropical fish. School of Life Science and Technology let us study a wide variety of interesting research such as my research. They can offer us abundant funds, state-of-the-art facilities, and unique classes, which can lead us to become ingenious scientists. Why not you take the plunge into the fascinating world of science in this fantastic environment??



### ANNO, Takuto

master's student

I am engaged in research on the functional regulation of the protein called SNARE. I am able to enjoy my research every day with the kind supports of my colleagues though I sometimes have trouble with my research. Additionally, I have my fulfilling student life because I can adjust my time flexibly and do my club activities.



### NARA, Eriko

undergraduate student  
at the time of the interview

I belong to the Ogura Laboratory, where we are engaged in research for medical applications. At first, I didn't know what to expect, but my seniors were very kind to me, so I enjoy every day in the laboratory. Although sometimes things do not go well, I find it rewarding to feel that my research is directly useful to society.





## International Graduate Program (IGP)

<https://www.titech.ac.jp/english/admissions/prospective-students/international/international-graduate>

### International Graduate Program for Bioscience and Biotechnology

Since 2007, the School of Life Science and Technology (the former Graduate School of Bioscience and Biotechnology) has administered an international graduate course for foreign students from all over the world, especially excellent students from Asian countries.

In 2013, to further advance this graduate course, we launched new international education programs that include master's, doctoral, and integrated master's and doctoral education curricula designed to help students cultivate their creativity, learn practical working skills, and improve their English- and Japanese-language skills. In these International Graduate Programs, we foster international leaders who are able to develop leading-edge research and innovations in science and technology as a bridge between Japan and other countries.

Currently, our school has three Graduate Majors, Life Science and Technology, Human Centered Science and Bio-medical Engineering and Earth-Life Science. A student selects one of these majors after discussion with his or her supervisor.



## Tokyo Tech - Tsinghua University Joint Graduate Program

[http://www.ipo.titech.ac.jp/tsinghua/index\\_en.html](http://www.ipo.titech.ac.jp/tsinghua/index_en.html)

Tokyo Tech and Tsinghua University (China) jointly operate a double degree program for students at the master's and doctoral levels. In addition to cultivating students' specialized scientific knowledge and research experience, the program strategically develops students with linguistic proficiency in Japanese, Chinese and English, and familiarity with the culture and customs of both Japan and China. Of the program's three courses — Bioscience and Biotechnology, Nanotechnology, and Decision Science & Technology — the "bio course" has historically played a central role. Managed jointly by each country's leading university in science and technology fields, the program is a model for international academic collaboration at the highest level of education and research. Industry-academia collaborative research symposia are held twice a year in Beijing and Tokyo to foster development of human resources who can respond to a wide range of interdisciplinary issues and promote industrial development and cultural exchange based on international cooperation between Japan and China. Professors, students, and business people participate in these symposia, thereby deepening bilateral exchanges. The program is recognized for nurturing talented individuals with the ability to contribute to the international community.

Members of the 15<sup>th</sup> cohort from  
Tsinghua University

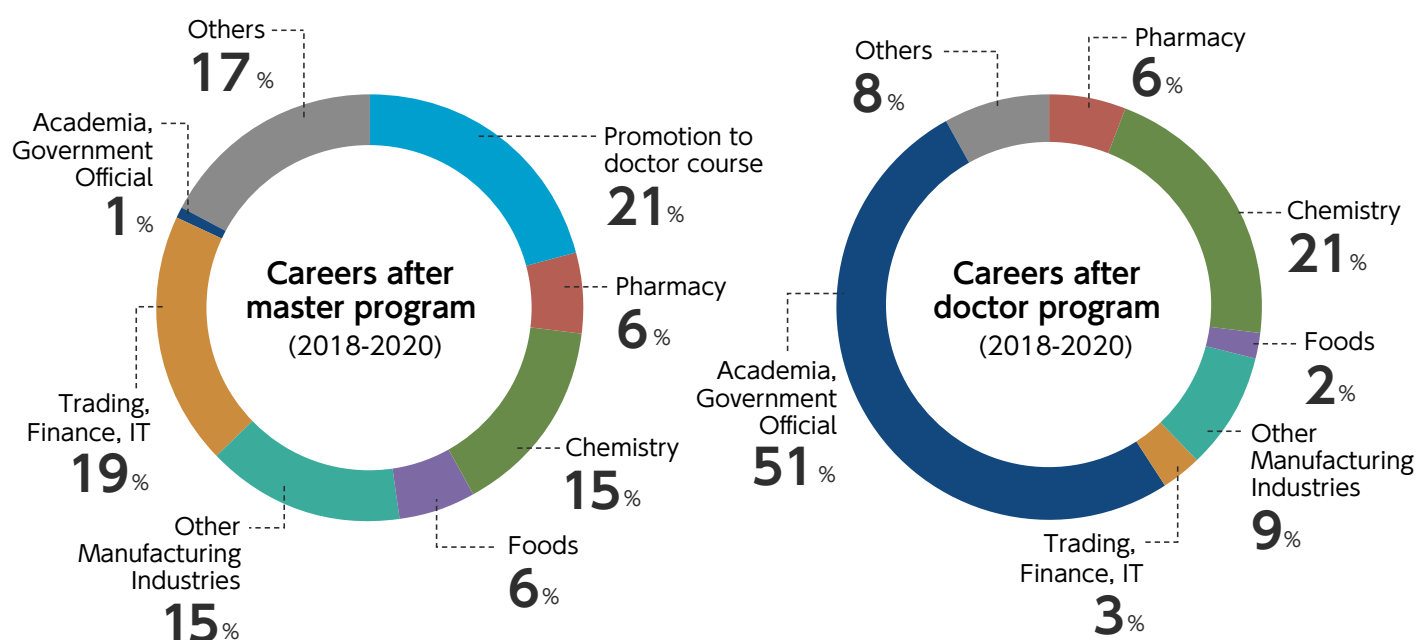
Member of the 14<sup>th</sup>  
cohort from Tokyo Tech



15<sup>th</sup> anniversary\_ceremony, October 21, 2019, Tokyo Tech

# Working Globally

90% of the undergraduate students will proceed to the graduate school of Tokyo Tech.



## Places of the employment

### Pharmacy

Astellas Pharma, Chugai Pharmaceutical, Daiichi Sankyo, Kowa, Kyowa Kirin, Medical & Biological Laboratories, Mitsubishi Tanabe Pharma, Mochida Pharmaceutical, Pfizer Japan, Shionogi, Takeda Pharmaceutical, etc.

### Chemistry

Asahi Kasei, Du Pont, Fujifilm, JSR, Kaneka, Kao, Lion, Mitsubishi Chemical, Mitsui Chemicals, Mitsubishi Materials, Nagase, P&G, Shiseido, Sumitomo Chemical, Teijin, Toray Industries, etc.

### Foods

Asahi Breweries, Ajinomoto, Kagome, Lotte, Morinaga Milk Industry, Nissin foods, Suntory Holdings, Yamasa, Yamazaki Baking, etc.

### Other Manufacturing Industries

Daikin Industries, Dai Nippon Printing, Fujitsu, Hitachi, JT, Konica Minolta, Mazda Motor, Micron Memory Japan, Nipro, Olympus, Panasonic, Shimadzu, Showa Denko, Sony, Toppan Printing, etc.

### Trading, Finance, IT

Itochu, Marubeni, Mizuho Bank, MUFG Bank, NS Solutions, NTT, NTT Date, SMBC Nikko Securities, Softbank, Sumitomo Mitsui Banking, Tokio Marine & Nichido Fire Insurance, Yahoo Japan, etc.

### Academia, Government Official

Tokyo Tech., Juntendo Univ., Kobe Univ., NAIST, OIST, Osaka Univ., AIST, PMDA, RIKEN, Ministry of Economy, Trade and Industry, Ministry of the Environment, etc.

### Others

Dentsu, Hakuhodo Consulting, NHK, JAL, McCann Erickson, etc.

# Faculty Members List

## <Life Science and Technology>

NAME	FIELD	Room No.	PAGE
Professor			
FUKUI, Toshiaki	C S	B1-913	19
HAYASHI, Nobuhiro	M M	M6-302C	15
HIROTA, Junji	T S	B-C-203	23
HONGO, Yuichi	T S	W3-706	23
ICHINOSE, Hiroshi	T S	B2-820	24
ISHII, Yoshitaka	M S	J3-814	15
ITOH, Takehiko	C M	M6-202C	19
IWASAKI, Hiroshi	C S	S2-303	20
KAMACHI, Toshiaki	C M	M6-301A	20
KAMIYA, Mako	M S	B1-902	15
KIMURA, Hiroshi	C S	S2-506	20
KINBARA, Kazushi	M S	B2-1120	15
KITAO, Akio	M M	M6-201C	15
KOBATAKE, Eiry	M S	G1-314	16
KOMADA, Masayuki	C S	S2-502	20
KUME, Shoen	T S	B1-812	24
MARUYAMA, Atsushi	M S	B2-1220	16
MIHARA, Hisakazu	M S	B1-801	16
MURAKAMI, Satoshi	M S	J2-904	16
OHTA, Hiroyuki	T S	B2-330	24
OSAKABE, Yuriko	T S	J2-1011	24
SEIO, Kohji	M S	J2-806	16
TAGUCHI, Hideki	M S	S2-602	17
TANAKA, Mikiko	T S	B1-715	24
TOKUNAGA, Makio	C S	B1-511	20
UENO, Takafumi	M S	B2-1034	17
URABE, Hirokazu	M S	B2-1131	17
WACHI, Masaaki	C S	J2-1003	21
YAMAGUCHI, Yuki	C S	B2-1231	21
YUASA, Hideya	M S	J2-803	17

## Associate Professor

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AIZAWA, Yasunori	C S	B1-501	21
ASAKURA, Noriyuki	M M	M6-301C	17
FUJIE, Toshinori	M S	B2-1022	18
FUJITA, Naonobu	C S	S2-2F	21
HATA, Takeshi	M S	B2-1127	18
HIRASAWA, Takashi	C S	J2-1109	21
HOSHINO, Ayuko	T S	B1-509	25
KAJIKAWA, Masaki	C S	B2-939	22
KANO, Fumi	C S	S2-609	22
KATO, Akira	C S	B2-522	22
KAWAKAMI, Atsushi	T S	B1-603	25
KONDOH, Toru	M M	M6-401	18
MASUDA, Shinji	T S	B-B-305	25
MATSUDA, Tomoko	M S	J3-913	18
MIE, Masayasu	M S	G1-316	18
NAKAMURA, Nobuhiro	C S	B2-720	22
NAKATOGAWA, Hitoshi	C S	B2-928	22
NIKAIDO, Masato	T S	W3-612	25
NONOMURA, Keiko	T S	B2-735	25
NOZAWA, Kayo	M S	B1-707	19
OHKUBO, Akihiro	M S	J3-815	19
OSADA, Toshiya	T S	B2-921	26
SHIMOJIMA, Mie	T S	B2-330	26
SHIRAKI, Nobuaki	C S	B1-810	23
SUZUKI, Takashi	T S	B2-534	26
TACHIBANA, Kazunori	T S	B2-835	26
TAGAWA, Yoh-ichi	T S	B2-1221	26
TSUTSUMI, Hiroshi	M S	B1-802	19
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## <Human Centered Science and Biomedical Engineering>

NAME	FIELD	Room No.	PAGE
Professor			
FUJII, Masaaki	M S	R1-312	27
HISABORI, Toru	C S	R1A-209	28
KAJIWARA, Susumu	C S	J3-1018	29
KONDOH, Shinae	T S	B2-521	30
KOSHIKAWA, Naohiko	T S	B1-612	30
NAKAMURA, Hiroyuki	M S	R1-914	27
NISHIYAMA, Nobuhiro	M S	R1-812	27
TANAKA, Kan	C S	R1-814	29
UEDA, Hiroshi	M S	R1-614	27
YAMAMOTO, Naoyuki	C S	J2-1110	29
Associate Professor			
AKAMA, Hiroyuki	T S	W9-614	30
KITAGUCHI, Tetsuya	C S	R1-616	29
MIURA, Yutaka	M S	R1-810	27
MIYASHITA, Eizo	T S	G3-1114	31
MORI, Toshiaki	M S	B2-1121	28
OGURA, Shun-ichiro	M S	B1-702	28
OKADA, Satoshi	M S	R1-913	28
ORIHARA, Kanami	C S	J3-1014	29
WAKABAYASHI, Ken-ichi	C S	R1A-215	30
YOSHIDA, Keisuke	C S	R1-816	30
Assistant Professor			
KADONOSONO, Tetsuya	M S	B2-421A	28

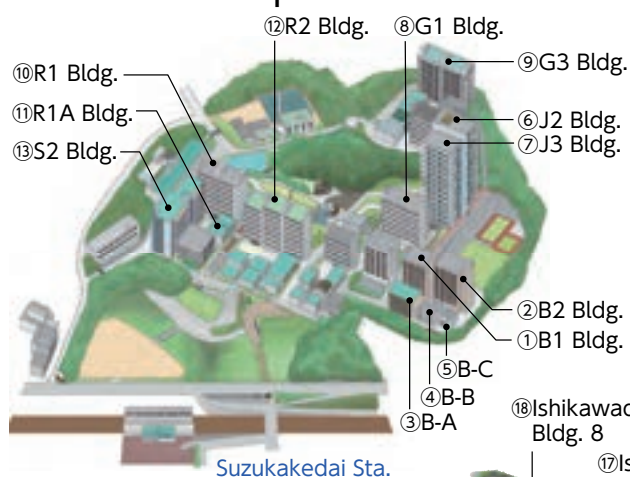
## <Earth-Life Science>

NAME	FIELD	Room No.	PAGE
Professor			
MATSUURA, Tomoaki	C S	7-307	31
Associate Professor			
FUJISHIMA, Kosuke	M S	8-318	31
MCGLYNN, Shawn	M S	7-318	31

## Research Field

M : Molecule C : Cell T : Tissue, Organism

## Suzukakedai Campus



## Facility Name

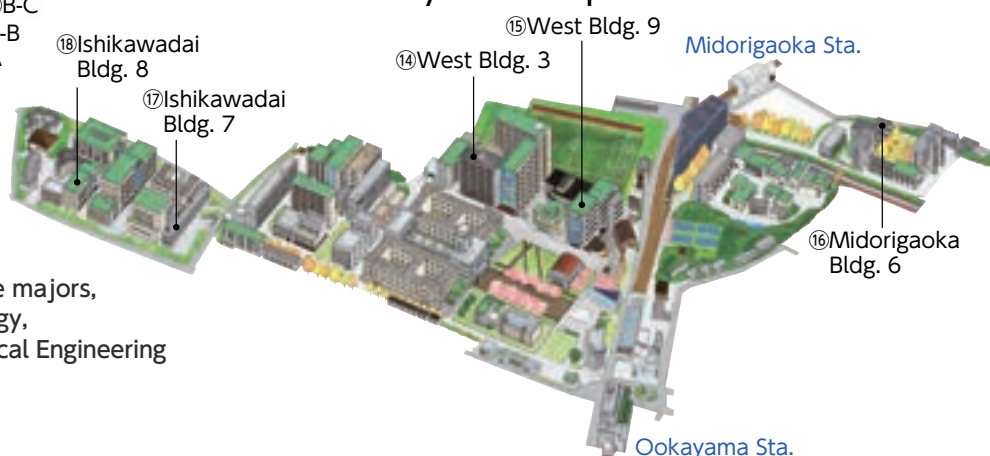
① Suzukakedai Campus

- ① B1 Bldg.
- ② B2 Bldg.
- ③ B-A (B1-B2 Annex A)
- ④ B-B (B1-B2 Annex B)
- ⑤ B-C (B1-B2 Annex C)
- ⑥ J2 Bldg.
- ⑦ J3 Bldg.
- ⑧ G1 Bldg.

④ Ookayama Campus

- ⑨ G3 Bldg.
- ⑩ R1 Bldg.
- ⑪ R1A Bldg.
- ⑫ R2 Bldg.
- ⑬ S2 Bldg.
- ⑭ West Bldg. 3
- ⑮ West Bldg. 9
- ⑯ Midorigaoka Area
- ⑰ Midorigaoka Bldg. 6
- ⑱ Ishikawadai Area
- ⑲ Ishikawadai Bldg. 7
- ⑳ Ishikawadai Bldg. 8

## Ookayama Campus



The School is composed of three majors,  
Life Science and Technology,  
Human Centered Science and Biomedical Engineering  
and Earth-Life Science.





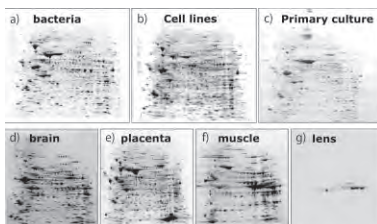
Professor  
**HAYASHI, Nobuhiro**

### Elucidation of something unknown of the life through high performance proteomics

Using AI proteomics technique developed by combination of original high-performance 2D-PAGE with AI, we are studying various subjects including basic, clinical and healthcare science.

**Keywords** healthcare science, clinical proteomics, artificial intelligence (AI)

#### 2D-PAGE of some tissues



#### Protein

Image of future healthcare society



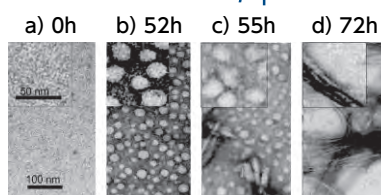
Professor  
**ISHII, Yoshitaka** Assistant Professor  
**KAMIHARA, Takayuki**

### Structural biology of amyloid and molecular mechanism of Alzheimer's

Our team is revealing functions and structures of misfolded amyloid proteins associated with Alzheimer's and other diseases by solid-state NMR (SSNMR). Our research scope also includes NMR-based analysis of advanced nanomaterials such as modified graphenes.

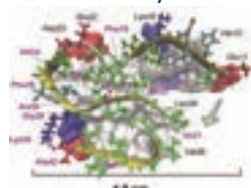
**Keywords** Amyloid, structural biology, solid-state NMR, carbon nanomaterials

#### Time-resolved electron micrograph of Alzheimer's A $\beta$ protein



#### Protein

First atomic model of A $\beta$ 42 fibril by SSNMR



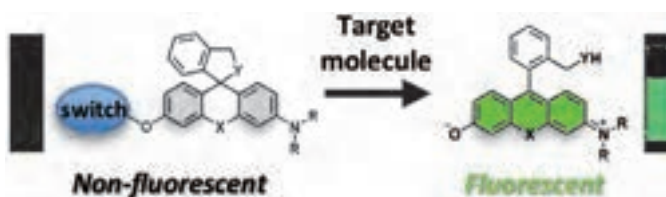
Professor  
**KAMIYA, Mako**

### Development and biological applications of original chemical probes

We are developing original chemical probes (fluorescent probes, Raman probes, photosensitizers, etc.) to visualize or control biological phenomena and disease.

**Keywords** Organic chemistry, photochemistry, fluorescent probes, bioimaging

#### Activatable fluorescent probes for bio-molecules



#### Chemical biology



Professor  
**KINBARA, Kazushi** Assistant Professor  
**SATO, Kohei**

### Developing functional molecules inspired by biological systems

Inspired by the sophisticated biological systems, we are developing synthetic functional molecules which mimic or control biomacromolecules.

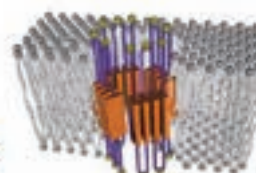
**Keywords** organic chemistry, molecular devices, self assembly, biomimetics

#### Biomaterials

##### Structured PEG



##### Ion channel



##### Photoactive protein



Professor  
**KITAO, Akio** Assistant Professor  
**TRAN, Phuoc Duy**

### Observing Biological Phenomena by Computer

We investigate molecular mechanisms of biological systems (proteins, nucleic acids, membrane, etc) by cutting-edge computer simulation.

**Keywords** Protein Dynamics, Computational Biology, Biophysics, Computational Chemistry

#### Membrane deformation simulation induced by I-BAR



#### Proton transfer through flagellar motor



#### Computational Biology



Professor  
**KOBATAKE, Eiry**

Assistant Professor  
**NISHIDA, Kei**

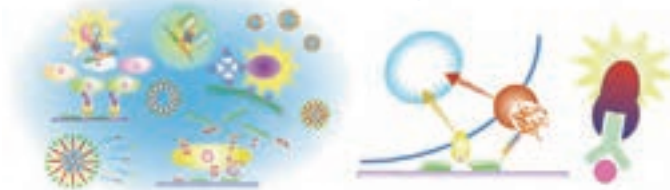
## Construction of super biofunctional protein materials

We have created various super biofunctional protein materials for controlling cellular functions and biosensing.

**Keywords** protein engineering, cellular and tissue engineering, biomaterial, biosensing

**Biomaterials**

### Construction and application of super biofunctional proteins



Professor  
**MARUYAMA, Atsushi**

Assistant Professor  
**SHIMADA, Naohiko**

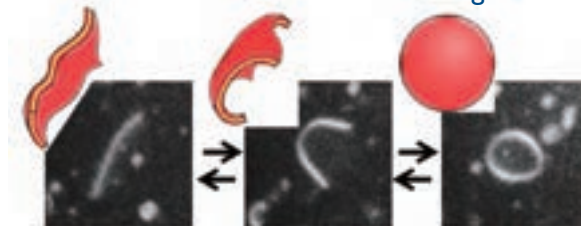
## Design of bio-functional and bio-conjugate materials

Our research interests involve design of biofunctional materials capable of enhancing function of biopolymers and cells for nanomedicines, tissue engineering and diagnosis.

**Keywords** drug delivery/ nucleic acids, proteins, lipids/ stimuli responsive polymers

**Biomaterials**

### Control of bio-membrane folding



Professor  
**MIHARA, Hisakazu**

Assistant Professor  
**MIKI, Takayuki**

## Peptide engineering and chemical biology

We design and construct supramolecular systems composed of peptides, glycosides and proteins using peptide engineering techniques for chemical biology research.

**Keywords** peptide, synthesis, phage-display library, cell analysis

**Biomaterials**

### Design of functional peptides

### Drug delivery by peptide-gold nanoparticle hybrids



Professor  
**MURAKAMI, Satoshi**

Assistant Professor  
**OKADA, Ui**

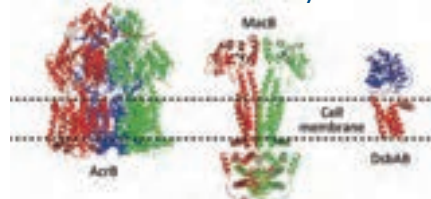
## Structure and molecular mechanism of membrane protein complex

We seek to understand the molecular mechanism of key biological processes on the cell membrane and membrane proteins at the level of protein structure, dynamics and molecular biology.

**Keywords** membrane protein, structural biology, protein crystallography, membrane transport

**Protein**

### Crystal structures of membrane protein solved in our laboratory



Professor  
**SEIO, Kohji**

Assistant Professor  
**MASAKI, Yoshiaki**

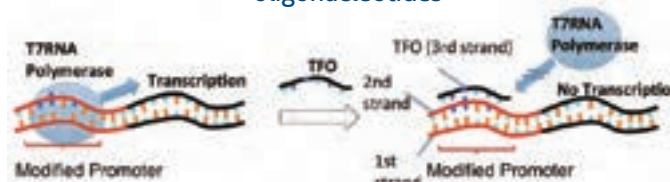
## Nucleic acids chemistry for regulation of genetic information

We are trying to establish novel methodologies to regulate nucleic acids related phenomenon, using organic chemistry, physical chemistry, biochemistry, and computational chemistry.

**Keywords** organic chemistry of nucleic acids, transcription regulation, nucleic acid drugs

**Nucleic acids**

### Transcription regulation by triplex forming oligonucleotides







Professor  
**TAGUCHI, Hideki**

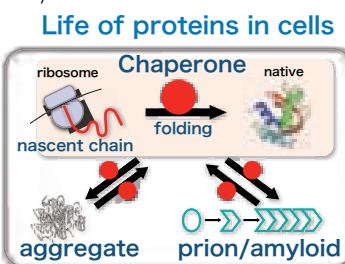
Assistant Professor  
**NIWA, Tatsuya**

### Life of proteins in cells: Translation, chaperone, prion

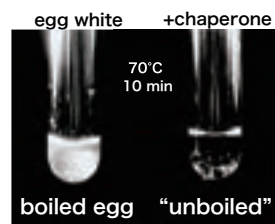
We are pursuing the expanding world of proteins in the cell, focusing on how proteins are synthesized and folded in cells (non-canonical ribosome dynamics, chaperones that assist protein folding, prions and so on).

**Keywords** Proteins, non-canonical ribosome dynamics, chaperone, prion, amyloid

### Protein



"unboiled" egg with chaperone



Professor  
**UENO, Takafumi**

Assistant Professor  
**ABE, Satoshi**

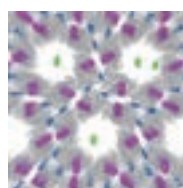
### Development of artificial enzymes and biosupramolecular materials

Our interests are chemistry of protein assembly based on synthetic chemistry and structural biology to elucidate chemical reactions in living cells and develop biomaterials.

**Keywords** protein engineering, bioinorganic chemistry, chemical biology

### Biomaterials

#### Functionalized protein crystal and artificial needle protein



Professor  
**URABE, Hirokazu**

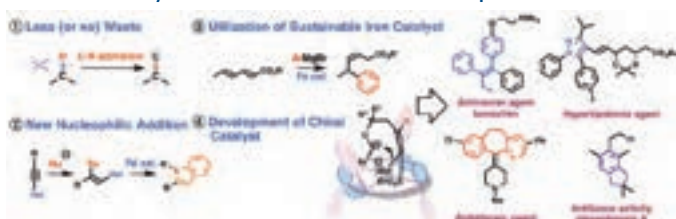
### Organic chemistry – The area leading biosciences

Our projects are the development of new, economical, or environmentally benign organic reactions and their applications to the synthesis of bioactive compounds and pharmaceuticals.

**Keywords** organic chemistry, synthetic chemistry, pharmaceutical chemistry, natural products chemistry

### Bioactive compounds

#### Chemical synthesis of biomolecules and pharmaceuticals



Professor  
**YUASA, Hideya**

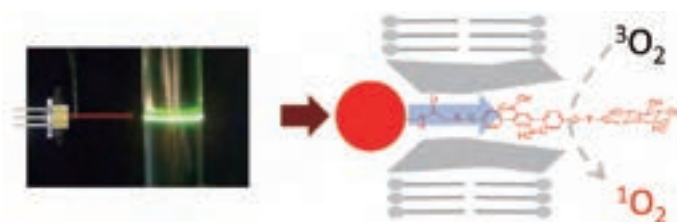
Assistant Professor  
**KANAMORI, Takashi**

### Photosensitizers and photodynamic therapy of cancer

We are studying photodynamic therapy of cancer using up-conversion nanoparticles and photosensitizers we developed on our own.

**Keywords** photodynamic therapy, photosensitizer, lanthanide nanoparticle

### Bioactive compounds



Associate Professor  
**ASAKURA, Noriyuki**

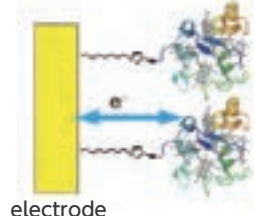
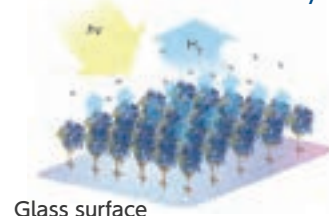
### Bioelectrochemistry of proteins and hydrogen generation by photoinduced biological electron transfer

We are interested in understanding details of the important biological electron transfer. This provides precise control over enzyme reactions in direct electrochemical and photochemical studies.

**Keywords** electrochemistry, photochemistry, biological electron transfer, redox proteins

### Protein

#### Photoinduced hydrogen evolution







Associate Professor  
**FUJIE, Toshinori**

## Nano-biodevice based on dimensional control for biomedical applications

We envision the smart biodevice with integrated nano, bio and electronic systems towards minimally invasive medicine, expected for human healthcare and biomedicine.

**Keywords** biomaterials, polymer, tissue engineering, bioelectronics

## Biomaterials

### Bio-integrated devices by nanosheet electronics



Associate Professor  
**HATA, Takeshi**

## Synthesis of bioactive compounds by sustainable molecular transformation

We are developing new sustainable synthetic methods for manipulation of organic molecules and also making natural products and pharmaceuticals by those methods.

**Keywords** organic chemistry, synthetic chemistry, pharmaceutical chemistry, natural products chemistry

## Bioactive compounds

### Sustainable synthesis of bioactive compounds



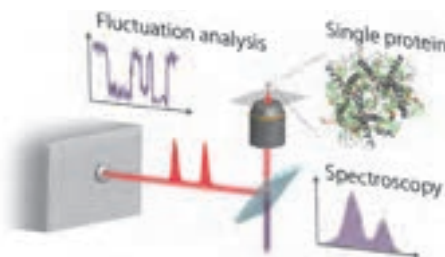
Associate Professor  
**KONDO, Toru**

## Nanoscale photophysics in biological system using advanced microspectroscopy

Photoreceptor protein achieves efficiency, multifunctionality, and robustness. We develop advanced microspectroscopy to understand photoreaction mechanism at the molecular level, leading to the design of bio-inspired materials.

**Keywords** ultrafast microscopy, single-protein, photosynthesis, biological quantum effect

## Biophotophysics



Single-protein spectroscopy by femto-second laser microscope



Associate Professor  
**MATSUDA, Tomoko**

## Organic synthesis by enzymes

We have been using enzymes as a catalyst and CO<sub>2</sub> as a solvent for organic synthesis to promote green chemistry.

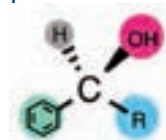
**Keywords** enzyme, organic synthesis, CO<sub>2</sub>, green chemistry

## Biocatalysis

### Microorganism with useful enzymes as catalysts



Optically pure compounds for intermediates of pharmaceuticals



Associate Professor  
**MIE, Masayasu**

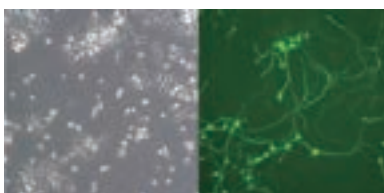
## Development of biomolecular tools

We are trying to develop molecular tools consist of biomolecules such as proteins and DNA for bioimaging, biosensing and regulation of cellular functions.

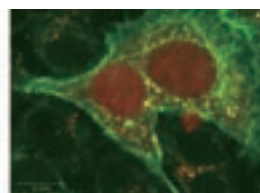
**Keywords** biomaterials, protein engineering, cellular engineering

## Biomaterials

### Induction of neural differentiation by protein transduction



### Bioimaging with engineered protein tag



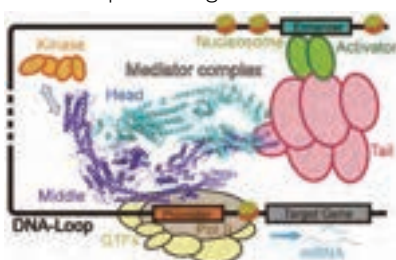


Associate Professor  
**NOZAWA, Kayo**

### Structural and biochemical analysis of gene regulation by 3D genome folding

To understand gene regulatory mechanism, we employ cryo-EM to visualize high-order genome architectures, and aim to design and characterize in-vitro reconstituted genomic architectures.

**Keywords** Structural biology, Cryo-EM, gene structure, transcriptional regulation



Chromatin, Gene expression



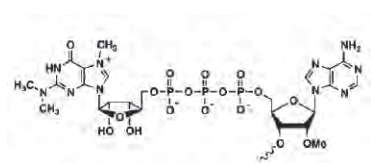
Associate Professor  
**OHKUBO, Akihiro**

### Development of new nucleic acid drugs for gene therapy

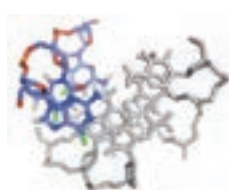
We develop new bioactive molecules including nucleic acids drugs for accurate regulation of biochemical reactions (transcription, splicing, translation) based on organic chemistry.

**Keywords** bioorganic chemistry, nucleic acid chemistry, nucleic acid drugs

### Nucleic acid drugs for accurate regulation of biochemical reactions



Bioactive compounds



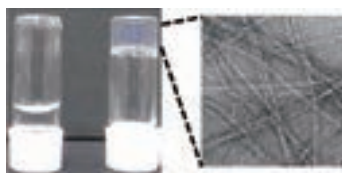
Associate Professor  
**TSUTSUMI, Hiroshi**

### Control and Analysis of Cell Environment based on Chemical Biology

We design and chemically synthesize supramolecular hydrogels and various fluorescent probes to control and analyze cellular function and cell environment.

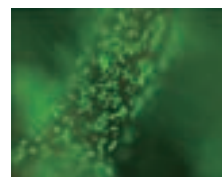
**Keywords** fluorescent probe, bioimaging, supramolecular chemistry, cell environment chemistry

### Supramolecular hydrogel



Biomaterials

### Cell culture using supramolecular hydrogels



Professor  
**FUKUI, Toshiaki**

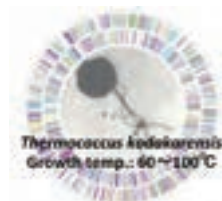
### Analyses and engineering of microbes for production of useful compounds

Our lab is studying on analyses and metabolic engineering of microbes (especially hyperthermophiles, bioplastic-producing bacteria, and methylotrophs) aiming efficient production of useful compounds.

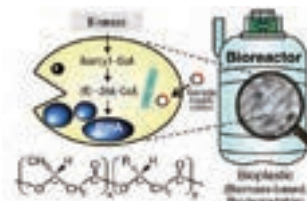
Assistant Professor  
**ORITA, Izumi**

**Keywords** bacteria/archaea, metabolic engineering, hyperthermophiles, bioplastic-producing bacteria

### Hyperthermophilic archaeon



### Bioplastic-producing bacterium



Microbiology



Professor  
**ITO, Takehiko**

### Elucidation of biological phenomenon using NGS and bioinformatics

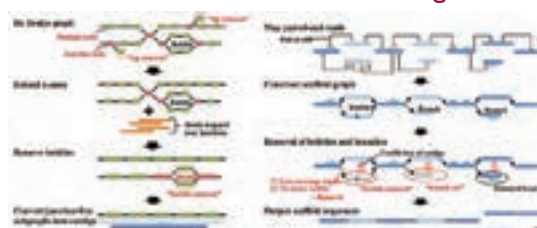
We are studying biological phenomenon, using next generation sequencer and various computational bioinformatics techniques.

Assistant Professor  
**KAJITANI, Rei**

**Keywords** genome informatics, chromosome dynamics

Bioinformatics

### Overview of Platanus assembler algorithm





Professor  
**IWASAKI, Hiroshi**

Assistant Professor  
TSUBOUCHI, Hideo  
KANAMARU, Shuji

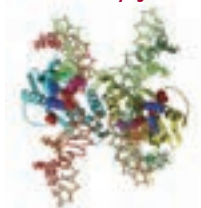
## Temporospatial regulation of chromosome dynamics

We are studying the molecular basis that underlies temporospatial regulation of chromosome dynamics through various techniques. In particular, we focus on the process of homologous recombination and mating type switching in fission yeast.

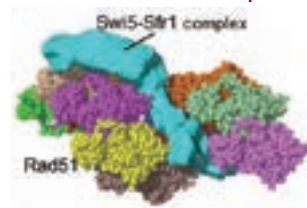
**Keywords** chromosome biology, homologous recombination, DNA repair, genome integrity

Chromatin,  
Gene expression

### A model for RuvC and Holliday junction



### A model for Rad51 filament and Swi5-Sfr1 complex



Professor  
**KAMACHI, Toshiaki**

Assistant Professor  
ITO, Hidehiro

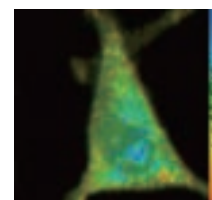
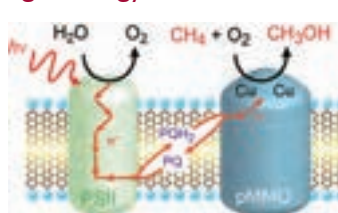
## Elucidation and application of metal ions in biological system

We are studying transduction of light energy into chemical energy by metalloenzyme and elucidation of oxygen dynamics inside a single cell.

**Keywords** metalloenzyme, oxygen imaging, energy transduction

Microbiology

### Light energy transduction and oxygen imaging of cell



Professor  
**KIMURA, Hiroshi**

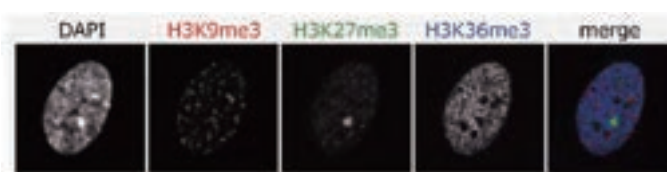
Assistant Professor  
NISHIHARA, Hidenori  
SATO, Yuko

## In vivo regulation of epigenetic dynamics

To understand the mechanism of gene expression, we are investigating histone modification dynamics in living cells and organisms.

**Keywords** epigenetics, cell nucleus, transcription, live cell imaging

Chromatin,  
Gene expression



Localization of various histone modifications



Professor  
**KOMADA, Masayuki**

Assistant Professor  
FUKUSHIMA, Toshiaki

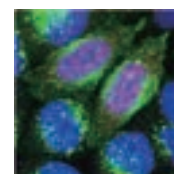
## Regulation of cell proliferation by growth factor receptor downregulation

We study how cell proliferation is regulated by growth factor receptor downregulation and how its impairment leads to tumorigenesis, with a focus on pituitary tumor causing Cushing's disease.

**Keywords** cancer, tumor, growth factor receptor, ubiquitin

Cellular function

### USP8 mutation in pituitary tumor in Cushing's disease



Professor  
**TOKUNAGA, Makio**

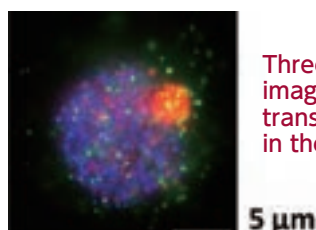
Assistant Professor  
ITO, Yuma

## Visualization and quantitation of cellular mechanisms

Our goal is the understanding of cellular spatio-temporal dynamics and mechanisms, based on development of techniques in molecular imaging and quantification.

**Keywords** single molecule, imaging and quantification, super-resolution, chromatin

Cellular function



Three-dimensional multi-color imaging of signaling and transcription factor molecules in the cell nucleus.





Professor  
**WACHI, Masaaki**

Assistant Professor  
IWAH, Noritaka

### Regulatory mechanism of bacterial cell growth and metabolism

We want to know how bacterial cells perform cellular metabolism, grow, and reproduce. Screening of new antibiotics is also carried out.

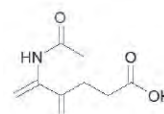
**Keywords** *E. coli*, cell division, metabolism, antibiotics, *Corynebacterium glutamicum*

### SEM image of *C. glutamicum* cells



### Microbiology

### Alaremycin and its producer strain



Alaremycin



*Streptomyces* sp. A012304



Professor  
**YAMAGUCHI, Yuki**

Assistant Professor  
SAKAMOTO, Satoshi  
YAMAMOTO, Junichi

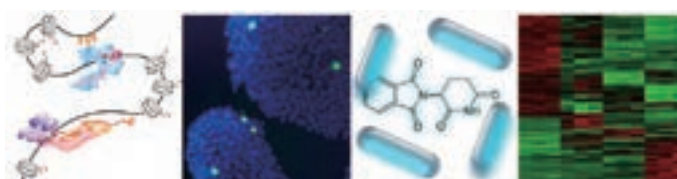
### Understanding and applying the machinery of life

We are promoting both basic and applied research, focusing on control mechanisms of genome expression and chemical biology using small molecules.

**Keywords** gene expression, genome, drug development, chemical biology

### Chromatin, Gene expression

Collage showing diverse research in the lab. From left, transcription, ES cells, drugs, genome-wide analysis.



Associate Professor  
**AIZAWA, Yasunori**

Assistant Professor  
KANEKO, Shinya

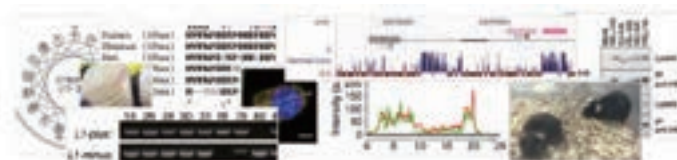
### Elucidation of sequence-function relationship in the human genome

We apply various approaches of molecular and synthetic biology to elucidate significance of (1) polycistronic translation of human mRNAs and (2) introns and retroelements in the human genomic functions.

**Keywords** gene, human genome, micro-protein, new proteome technologies

### Genomics

Multidisciplinary approaches to identify and understand new types of human genes



Associate Professor  
**FUJITA, Naonobu**

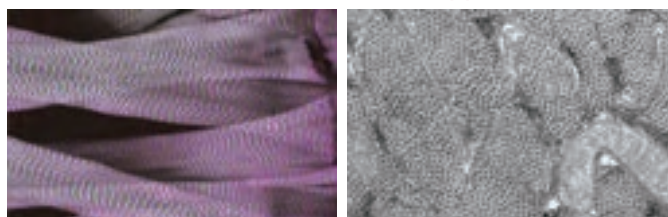
### Mechanisms of formation and remodeling of organelles in muscle cell

Muscle cells are multi-nucleated giant cells with highly organized organelles. Our study aims to elucidate the mechanisms to form and remodel the organelles in muscle cells.

**Keywords** muscle cell, organelles, T-tubule, fruit fly

### Cellular function

### Fluorescence and electron microscopy of muscle cells



Associate Professor  
**HIRASAWA, Takashi**

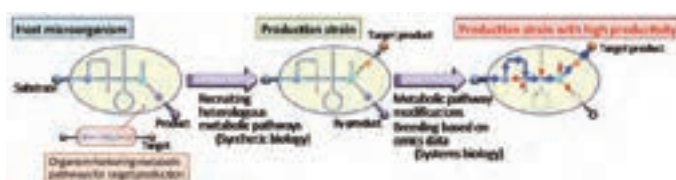
### Metabolic engineering toward bioproduction of useful materials

We are studying metabolic engineering of microorganisms for development of key technologies on rational design of microbial cell factories for production of useful materials.

**Keywords** applied microbiology, metabolic engineering, microbial cell factories, bioproduction

### Microbiology

### Metabolic engineering toward bioproduction





Associate Professor  
**KAJIKAWA, Masaki**

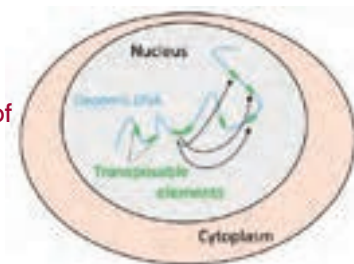
## Are transposable elements alive?

There are a huge number of transposable elements (TEs) in the genome of organisms. Our aim is to elucidate the amplification mechanism of TEs.

**Keywords** transposable element, retrotransposon, genome evolution, epigenetics

**Chromatin, Gene expression**

## Amplification of transposable elements



Associate Professor  
**KANO, Fumi**

Assistant Professor  
**NAKATSU, Daiki**

## Cell-editing technology based on cell-resealing technique

Kano lab is devoted to development of technologies for "Cell Editing and Cell Design". We use cell-resealing technique, a method for delivery of molecules into cells, combined with a novel analytical method for creating covariation networks based on features acquired from cell images.

**Keywords** cell-resealing technique/ cell editing/image analysis/human iPS cells

**Cellular function**



## Scheme of cell-resealing technique



Associate Professor  
**KATO, Akira**

Assistant Professor  
**NAGASHIMA, Ayumi**

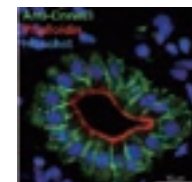
## Epithelial mechanisms responsible for environmental adaptation

We compare expressions and functions of transporters in various epithelial cell types (kidney, intestine, etc.) among freshwater fishes, seawater fishes, and terrestrial animals.

**Keywords** electrophysiology, molecular physiology, cell biology, comparative genomics

**Cellular function**

## Renal excretion of divalent ions in marine teleost



Associate Professor  
**NAKAMURA, Nobuhiro**

## Regulatory mechanism of cell and tissue shape and function

Our research is focusing on the signaling mediators, such as receptors, that regulate the cell and tissue architecture and function and the pathogenesis of related diseases.

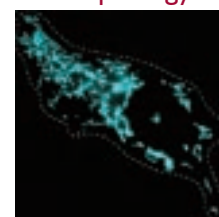
**Keywords** receptor, signal transduction, knockout mice, ubiquitin

**Cellular function**

## Abnormal lung morphology in knockout mice



## Mitochondrial morphology



Associate Professor  
**NAKATOGAWA, Hitoshi**

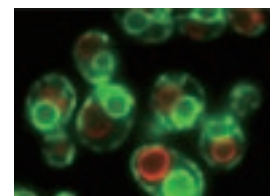
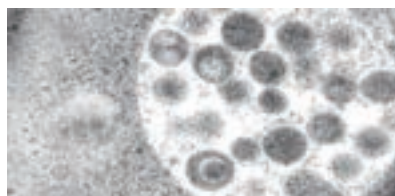
## Elucidation of molecular mechanisms and physiological roles of autophagy

We are studying molecular basis and physiological functions of autophagy (self-eating), an intracellular bulk degradation/recycling system, using various techniques.

**Keywords** yeast, organelles, membrane dynamics, starvation/stress response

**Cellular function**

## Electron and fluorescence microscopy of yeast cells





Associate Professor  
**SHIRAKI, Nobuaki**

### Elucidation of the role of amino acid metabolism in stem cell differentiation

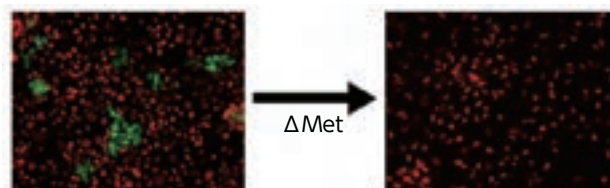
We are studying the role of amino acid metabolism in maintenance and differentiation of stem cells and its application for ES/iPS cell endoderm differentiation.

**Keywords** ES cells, iPS cells, amino acid metabolism, cell differentiation

Cellular function

### Methionine deprivation induced cell death only in undifferentiated cells

(Green : undifferentiated stem cells, Red ; endoderm cells)



Associate Professor  
**YAMADA, Takuji**

### Big data for human gut microbiome

We are studying molecular basis and metabolic functions of human gut or skin microbiome, using genomics, metagenomics and bioinformatics.

**Keywords** gut microbiome, metagenome, metabolic pathway, bioinformatics

Bioinformatics,  
Synthetic biology

### Data for human gut microbiomes



Associate Professor  
**YATSUNAMI, Rie**

### Extremophiles and extremozymes have limitless possibilities !

We are doing researches on protein engineering of extremozymes (enzymes produced by extremophiles) and metabolic engineering of extremophiles for production of useful materials.

**Keywords** protein engineering, metabolic engineering, extremophiles, extremozymes

Microbiology



AFM image of triangular disk-shaped halophilic archaeon



Professor  
**HIROTA, Junji**

### Molecular neuroscience of a sense of smell

Our laboratory studies on molecular mechanisms underlying the fate determination of olfactory sensory neurons, using mouse genetics and imaging techniques.

Assistant Professor  
**IWATA, Tetsuo**

**Keywords** olfaction, chemical sense, neuronal differentiation, genome engineering

Neuroscience

### Visualization of neurons in the main olfactory epithelium



### Artificial chromosome & genome editing



Professor  
**HONGO, Yuichi**

### Molecular ecology and genome evolution of symbiotic systems

We are aiming to decipher symbiotic mechanisms between microbes and animals such as termites, and among the microbes. We use interdisciplinary approaches: from field studies to single-cell genomics.

Assistant Professor  
**KUWAHARA, Hirokazu**

**Keywords** symbiosis, insect, gut microbes, single-cell genomics, metagenomics

Microbial Ecology

### Termite-gut protists and their symbiotic bacteria







Professor  
**ICHINOSE, Hiroshi**

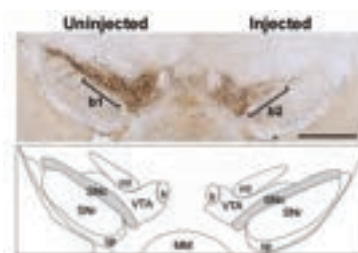
Assistant Professor  
**HARA, Satoshi**

## Patho-physiology of neuro-psychiatric disorders in relation to monoamines

We are studying the regulatory mechanism of brain function by monoamines and by tetrahydrobiopterin in order to develop novel drugs and diagnostic tools against neuro-psychiatric disorders.

**Keywords** dopamine, Parkinson's disease, biomarker

Neurochemistry



Conditional knock-out of the tyrosine hydroxylase gene by AAV-Cre



Professor  
**KUME, Shoen**

Assistant Professor  
**SAKANO, Daisuke**

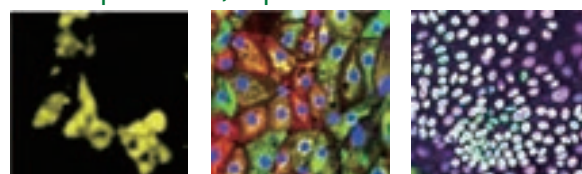
## Modeling organ development and homeostasis using human iPS cells

We are using human iPS cells to study the mechanism underlying organ development, differentiation, homeostasis, aiming for drug development and regenerative medicine.

**Keywords** stem cell, development & differentiation, drug development, regeneration

Development, Regeneration

### ES/iPS cell-derived differentiated cells of the pancreatic, hepatic and intestinal cells



Professor  
**OHTA, Hiroyuki**

Assistant Professor  
**HORI, Koichi**

## Stress responses and oil production in microalgae, Plant colonization of land

We are studying mechanism of stress responses of microalgae, particularly focusing on oil accumulation under nutrient starvation. We are also studying primary mechanisms for adaptation of plants on terrestrial condition, utilizing a charophytic alga, *Klebsormidium flaccidum* as a model organism.

**Keywords** microalgae, plants, stress response, oil, bioenergy

Plant, Microbiology

### Oleaginous alga *Nannochloropsis*



### Studies on colonization of land by plants

How plant colonized land?



Professor  
**OSAKABE, Yuriko**

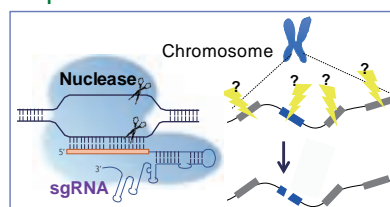
## Molecular basis of genome editing and genetic engineering of plants

We are studying molecular basis of genome editing technology and its application, and genetic engineering to improve plant environmental stress responses.

**Keywords** genome editing, genetic engineering, plant, stress response

Plant, Synthetic biology

### Genetic engineering and genome editing of plant stress responses



Professor  
**TANAKA, Mikiko**

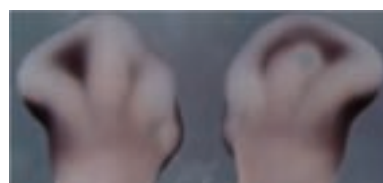
## Developmental basis of the evolution of vertebrate morphology

We are exploring the developmental and molecular mechanisms of how morphology of vertebrates have evolved.

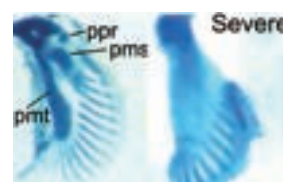
**Keywords** evolutionary developmental biology

Development

### *MafB* is controlled by BMP in limb bud



### Control and "posteriorized" shark fin





Associate Professor  
**HOSHINO, Ayuko**

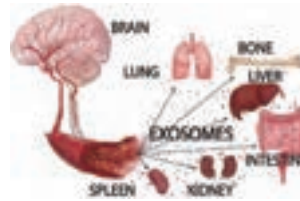
### Exosomes in Disease Etiology and Detection

Exosomes mediate cell-cell communication in physiology and disease. We aim to elucidate how exosomes drive disease pathology and target pathological exosome cargo and signaling to develop novel disease treatments.

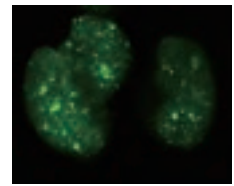
**Keywords** Molecular Biology of Disease, Cancer Metastasis, Neurological Disorder, Maternal-Infant Interaction

#### Exosomes

#### Exosomes as organ to organ communication tool



Cancer exosomes (green) uptaken by future site of metastasis (lung)



Associate Professor  
**KAWAKAMI, Atsushi**

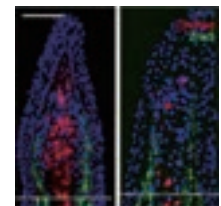
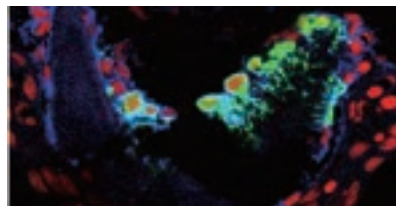
### Cellular and molecular mechanism of tissue regeneration

Multi-cellular organisms maintain their lives by regenerating damaged cells and tissues. In particular, fish retain high regeneration ability and regenerate fins, heart muscles, many internal organs, and even brain. We are tackling the mystery of tissues regeneration and homeostasis using zebrafish as a model.

**Keywords** regenerative biology, zebrafish, stem cell, tissue homeostasis

#### Development, Regeneration

#### Analyses by transgenic imaging, cell lineage tracing, manipulation of molecular signals



Associate Professor  
**MASUDA, Shinji**

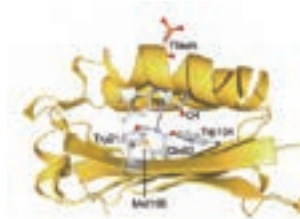
### Elucidation of regulatory mechanisms of photosynthesis, chloroplast, and photoreceptor functions

We are studying molecular mechanisms of how photosynthetic organisms sense and respond to light quality and quantity to control photosynthesis.

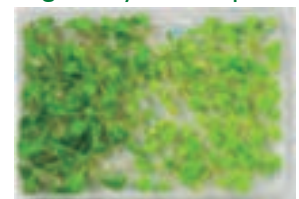
**Keywords** photoreceptor, chloroplast, photosynthesis, photo-oxidative stress

#### Photobiology

#### Photoreceptor protein BLUF



#### A photosynthesis regulatory mutant plant



Associate Professor  
**NIKAIIDO, Masato**

### Understanding the molecular mechanism of adaptive and parallel evolution

We are comparing the genomes of various animals to understand molecular mechanisms that generate biological diversity. We mainly focus on cichlids, ancient fish and hedgehogs.

**Keywords** evolutionary biology, pheromone, cichlids, mammals

#### Evolution, Ecology

#### Parallel evolution from hairs to spines (hedgehogs and tenrecs)



#### Enlarged lip (cichlids)



Associate Professor  
**NONOMURA, Keiko**

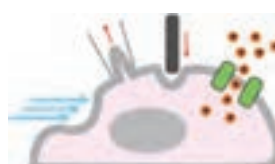
### Elucidation of roles of mechanosensation in tissue development/function/disease

We are studying physiological roles of mechanosensation mediated by PIEZO mechanically activated channel, awarded Nobel prize 2021, in tissues/cells including sensory neurons, brain tissue and lymphatic vessels.

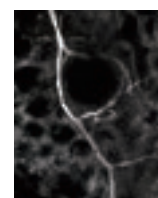
**Keywords** mechanosensing, PIEZO channel, live imaging, genetic engineering

#### Tissue function

#### PIEZO mechanically activated channel (green)



#### Sensory nerve fibers in the lung



#### Lymphatic valve





Associate Professor  
**OSADA, Toshiya**

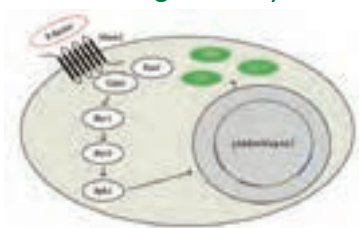
## Development of olfactory receptors based chemical sensor

We have developed a chemical sensor using olfactory receptors that are expressed in fission yeast through the endogenous GPCR pathway.

**Keywords** olfactory receptor, pheromone, fission yeast, sensor

Neuroscience

### The ligand assay



Associate Professor  
**SHIMOJIMA, Mie**

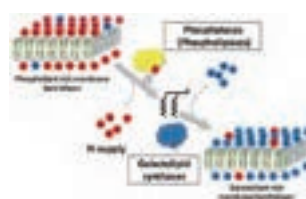
## Physiological role of lipid remodeling in plants

We are studying molecular mechanism and physiological function of plant lipid remodeling (membrane lipids, storage lipids, and surface lipids) in response to environmental stress.

**Keywords** plant, lipid, oil, stress response

Plant

### Lack of phosphate (Pi) starvation-induced lipid remodeling increases tolerance to drought stress



Wild type      Mutant



Associate Professor  
**SUZUKI, Takashi**

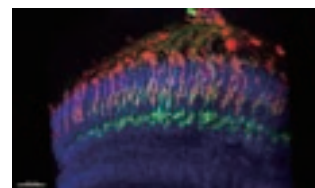
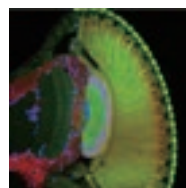
## Neuronal circuit formation and its plasticity

Our research goal is to elucidate the molecular mechanisms underlying neuronal circuit formation and function by means of molecular genetics.

**Keywords** brain, neuron, activity dependent plasticity, cell-cell communication

Neuroscience

### Fluorescence microscopy of the *Drosophila* visual system



Associate Professor  
**TACHIBANA, Kazunori**

## Elucidation of molecular mechanisms of spawning in jellyfish

We are studying molecular basis and physiological regulations of jellyfish spawning in laboratory and field.

**Keywords** jellyfish, spawning, photoperiodism

Chronobiology

### Jellyfish (*Cladonema pacificum*) and its polyp



Associate Professor  
**TAGAWA, Yoh-ichi**

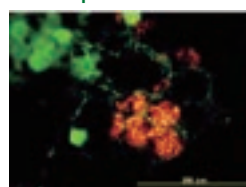
## *in vitro* living models for animal experiment alternatives and pre-clinical studies

We are developing culture systems of ES/iPS cell-derived tissues/organs on micro-fluidic devices closing livings (mouse or human).

**Keywords** *in vitro* living model, synthetic biology, developmental engineering, regenerative medicine

Development, Regeneration

### Mouse ES-derived hepatic tissue



### *In vitro* living system







Professor  
**FUJII, Masaaki**

### Structure and dynamics of molecules and clusters studied by advanced multicolor laser spectroscopy

We are developing new multi-color laser spectroscopy and studying molecular recognition mechanism of neurotransmitters and revealing chemical reaction mechanism in solvated clusters.

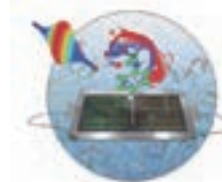
**Keywords** cluster, molecular recognition, solvation dynamics, proton / H atom transfer

#### ESI/Cold QIT laser spectrometer



#### Molecular Spectroscopy

Picosec. time-resolved IR spectroscopy and MD simulations



Professor  
**NAKAMURA, Hiroyuki**

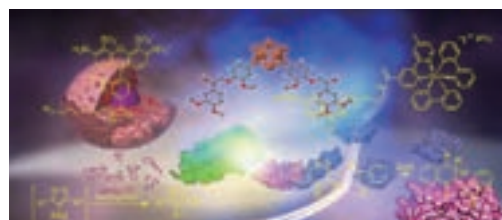
### Elucidation of biological functions and drug development by organic synthesis

We are developing new drugs for cancer therapy and new methodology for chemical biology based on synthetic organic chemistry.

Assistant Professor  
**MIURA, Kazuki**  
**MORITA, Taiki**

**Keywords** organic chemistry, medicinal chemistry, chemical biology, boron neutron capture therapy

#### Control of target protein functions by small molecules



#### Bioactive compounds



Professor  
**NISHIYAMA, Nobuhiro**

### Development of smart nanomedicine based on polymer nanotechnology

We are developing synthetic polymer-based nanomedicines towards realization of future medicine such as treatment of intractable diseases including cancers and diagnostic imaging.

Assistant Professor  
**HONDA, Yuto**  
**NOMOTO, Takahiro**

**Keywords** nanomedicine, DDS, polymer chemistry



From polymer synthesis to *in vitro* & *in vivo* evaluations

#### Biomaterials

MR imaging of small metastatic tumors in liver



Professor  
**UEDA, Hiroshi**

### Creation of novel biosystems by antibody/enzyme engineering

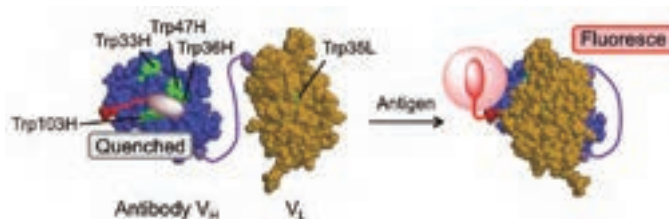
We are trying to create superior detection/diagnosis/therapy systems by transforming natural functional proteins to better ones for human beings.

Assistant Professor  
**ZHU, Bo**  
**YASUDA, Takanobu**

**Keywords** antibody engineering, enzyme engineering, biosensor

#### Protein

#### Novel immunosensor Quenchbody



Associate Professor  
**MIURA, Yutaka**

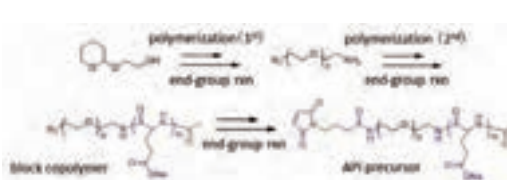
### Development of novel biomaterials by using well-defined macromolecules

Our spotlight areas of research include the development of functional polymers and biomaterials for medical applications such as drug delivery and imaging.

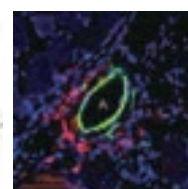
**Keywords** polymer, Nano-biotechnology, polymer-drug discovery, controlled release

#### Biomaterials

#### Typical polymerization/reaction



Accumulation of polymer-drug into limb ischemia (green:  $\alpha$ -SMA, red: polymer-drug, blue: nucleus)





Associate Professor  
**MORI, Toshiaki**

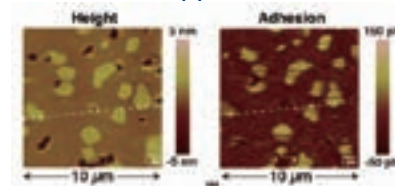
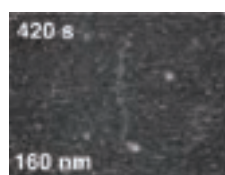
## Interaction analyses of glycoconjugate on cell surface and its application for medical engineering

We investigate the interaction analyses of glycoconjugates on cell surface at single molecule level and aim at the preparation of biomedical materials.

**Keywords** glycoconjugates, lectin, glycosyltransferase, single molecular analysis

**Biomaterials**

## Single molecular observation of glycoconjugates by atomic force microscopy



Associate Professor  
**OGURA, Shun-ichiro**

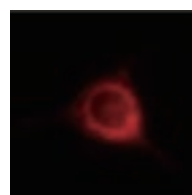
## Development of new biochemistry for medical applications

We develop the new biochemistry based on the analysis of metabolite from human and aim for the medical applications including cancer.

**Keywords** cancer diagnosis, cancer therapy, biomarker, cell physiological engineering

**Bioactive compounds**

## Visualized cancer cells



## Biomarker analytical system



Associate Professor  
**OKADA, Satoshi**

## Development of functional materials for imaging and controlling biological functions

Our aim is to develop organic-inorganic hybrid materials for observing and controlling biological functions in animal models.

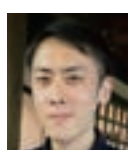
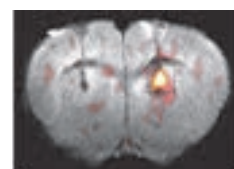
**Keywords** materials chemistry, chemical biology, molecular imaging

**Biomaterials**

## pH-responsive core-shell magnetic nanoparticle



## Brain Ca<sup>2+</sup> imaging by MRI probes



Assistant Professor  
**KADONOSONO, Tetsuya**

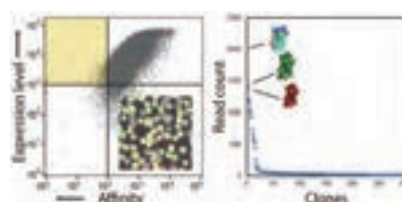
## Biopharmaceuticals developed by Smart Design technology

We are developing "smart design technology for molecules that mimic biological functions", by combining computational prediction and synthetic biological evaluation. Our aim is to create next-generation biopharmaceuticals.

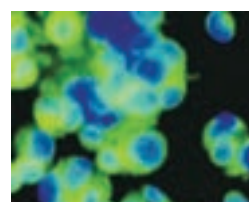
**Keywords** Smart design, biopharmaceuticals

**Protein**

## Cell-based library screening and NGS analysis



## Detection of breast cancer cells



Professor  
**HISABORI, Toru**

## Elucidation of energy conversion and redox regulation mechanisms of photosynthetic organisms

We are focusing on bioenergetics and redox-regulation mechanism of photosynthetic organisms, and the development of application using these basic knowledges.

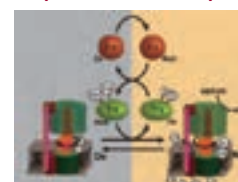
**Keywords** ATP synthesis, bioenergetics, redox regulation, photosynthetic micro-organism

**Protein function**

## Molecular structure of the ε subunit of ATP synthase



## Redox regulation of photosynthetic ATP synthesis





Professor  
**KAJIWARA, Susumu** Assistant Professor  
CHEN, Xinyue

**Molecular mechanisms of microbial infection, development of antimicrobial drugs & design of resource recycle system**

We study about applied biochemistry and molecular microbiology for medical care and environmental conservation (notably, infection, drug resistance, host response, renewal resources).

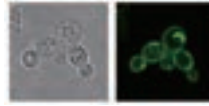
**Keywords** pathogen, immunity, drug discovery, renewal resources

**Applied Microbiology & Infection**

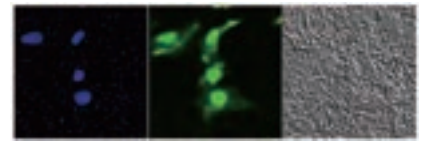


**Hemolysis of pathogenic fungus**

**Drug efflux pump expression**



**Apoptosis induction of human cell by pathogenic fungus**



Professor  
**TANAKA, Kan** Assistant Professor  
KOBAYASHI, Yuki  
MAEDA, Kaisei

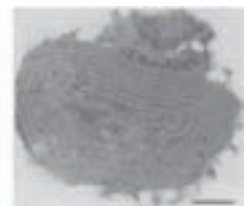
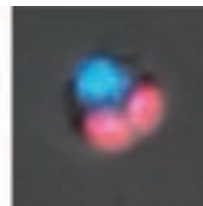
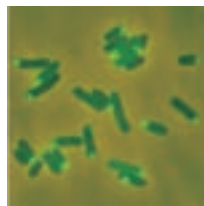
**From understanding to design of cell systems**

Our researches focus on fundamental architects of both prokaryotic and eukaryotic cells, destined for remodeling and design of cell systems.

**Keywords** photosynthesis, metabolism, gene expression, symbiosis/evolution

**Microbiology**

**Researches on unicellular model microorganisms**



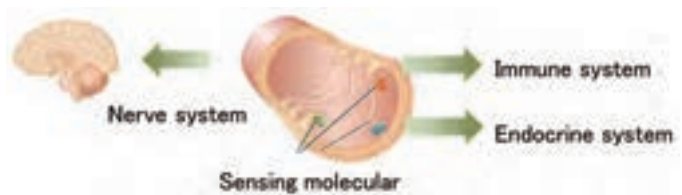
Professor  
**YAMAMOTO, Naoyuki**

**Sensing molecules and these roles in host-bacterial communications**

We are trying to find novel molecules displayed on gut surface which can sense to intestinal bacteria and elucidate the role in host response.

**Keywords** microflora, host-bacterial communication, host response, sensing

**Host-bacterial communication**



Associate Professor  
**KITAGUCHI, Tetsuya**

**Development of genetically-encoded biosensors**

We are developing tools for an optical microscope to visualize the dynamics of intracellular molecules in living cells, tissues and whole animal bodies.

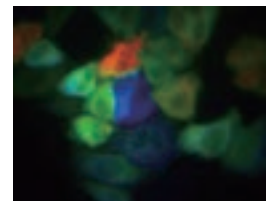
**Keywords** GFP, bioimaging, cell signaling

**Cellular function**

**Schematic diagram of genetically-encoded biosensor**



**Fluorescence microscopy by biosensor**



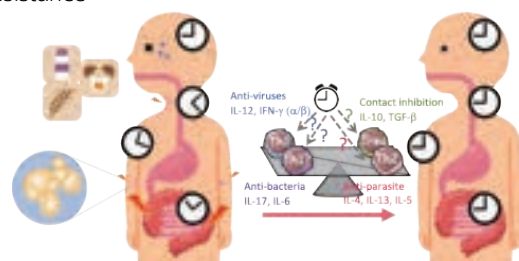
Assistant Professor  
**ORIHARA, Kanami**

**Preventing severe immune diseases by regulating peripheral clock**

We are studying about mechanisms of exacerbation of infectious / allergic diseases from the viewpoint of biological clocks. We are also trying to develop preventative methods for severe cases.

**Keywords** immunology, molecular biology, circadian rhythm, drug resistance

**Bioactive Molecules**







Associate Professor  
**WAKABAYASHI, Ken-ichi**

## Mechanisms of flagellar motility and photomovement of green algae

We are studying regulatory mechanisms of eukaryotic flagellar motility, through the analyses of photomovement of green algae (*Chlamydomonas* and *Volvox*).

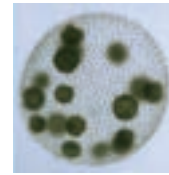
**Keywords** flagella, cilia, photomovement, green alga

Cellular function

*Chlamydomonas reinhardtii*



*Volvox carteri*



Cross-section of flagellum ("9+2" structure)



Associate Professor  
**YOSHIDA, Keisuke**

## Comprehensive analyses of regulatory mechanisms of plant organelle functions

How are plants living under environmental fluctuations? We are studying regulatory mechanisms of plant organelle functions using various techniques.

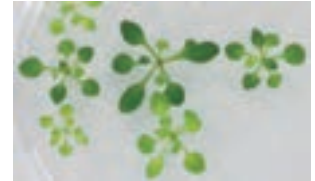
**Keywords** photosynthesis, environmental acclimation, redox regulation, organelle crosstalk

Plant

Molecular mechanisms



Physiological roles



Professor  
**KONDOH, Shinae**

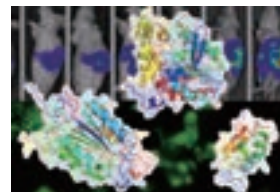
## Development of novel anti-cancer drugs and imaging probes. Novel technology for creating target-specific peptides.

We are aiming at developing novel drugs and diagnostic agents for hypoxic cancers. We are also establishing a novel technology for creating highly target-specific peptide drugs.

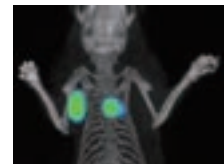
**Keywords** tumor hypoxia, HIF, *in vivo* optical imaging, drug development

Cancer treatment, Imaging

Innovative biopharmaceuticals development



Visualization of cancers with an optical imaging probe



Professor  
**KOSHIKAWA, Naohiko**

## Analysis of tumor progression by extracellular proteolysis and its clinical applications

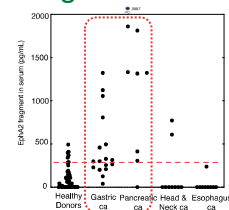
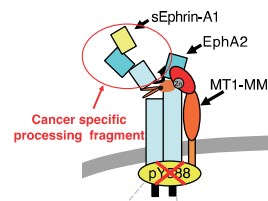
Aim of our study is to develop novel cancer diagnostics and therapeutics focusing on extracellular metalloproteases that act as a driving force of tumor malignant progression.

Assistant Professor  
**FUNAHASHI, Nobuaki**

**Keywords** Cancer, extracellular matrix, matrix metalloproteinase, diagnostics/therapeutics

Cancer biology

Cancer-specific proteolytic fragment can be a potent diagnostic biomarker for malignant cancers



Associate Professor  
**AKAMA, Hiroyuki**

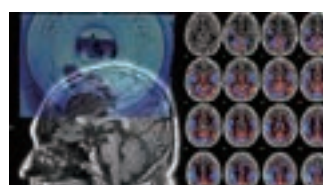
## Elucidation of the neural system of human brain by MRI

We are exploring the neural system of human brain by using techniques of fMRI with machine learning (Multi-voxel pattern analysis) and graph-theoretical analysis.

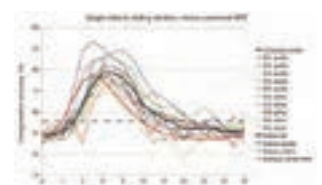
**Keywords** brain imaging (fMRI), machine learning (MVPA), complex networks

Neuroscience

Distributed neural patterns



MVPA Accuracy functions





Associate Professor  
**MIYASHITA, Eizo**

Explore the brain to understand adaptive control mechanisms of the arm

Repeating a verification experiment based on a working hypothesis, we are trying to understand the brain that is called the last frontier around us. Experimental data are collected in multiple levels from behavior to neurons.

**Keywords** brain science, neuroscience, motor learning, brain machine interface

Neuroscience

Measuring brain activity during task performance



BMI as a medical application



Professor  
**MATSUURA, Tomoaki**

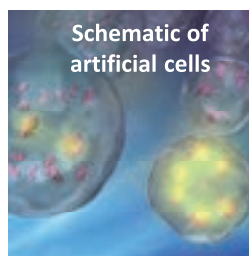
An artificial cell construction by design and evolution, and its application

We aim to clarify the nature of primitive cells that would have existed in the early stages of life, and construct molecules and molecular systems that can be put to practical use.

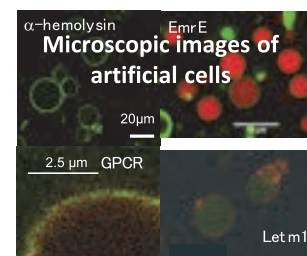
**Keywords** proteins, directed evolution, artificial cells, origins of life

Bioinformatics,  
Synthetic biology

Schematic of artificial cells



Microscopic images of artificial cells



Associate Professor  
**FUJISHIMA, Kosuke**

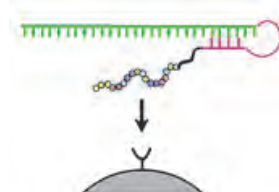
Study of RNA-peptide function for understanding the biological system

We are using synthetic biology methods to understand the functionality and evolvability of early RNA and peptides. We also design and explore de novo functional enzymes

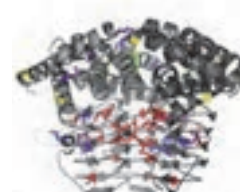
**Keywords** Origins of life, Directed evolution, RNA, Peptide, Astrobiology

Synthetic biology

mRNA display method to screen for functional peptides



Designing de novo functional enzymes



Associate Professor  
**MCGLYNN, Shawn**

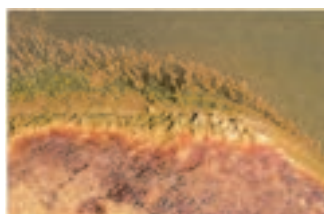
The origin and evolution of life

How did life begin, and how has it changed through time? To understand these questions, we use diverse tools and model systems: chemistry, microbiology, stable isotopes, and more.

**Keywords** onsen, phylogeny, iron-sulfide, enzyme

Geomicrobiology  
& Prebiotic Chemistry

Hot Spring Microbiology



A simulated hydrothermal vent



### (Other Professor)

YAMAMURA, Masayuki : Computational modeling collective function and morphogenesis

YANAGIDA, Yasuko : Device innovation by MEMS and biotechnology

SEKIJIMA, Masakazu : Machine Learning and Molecular Simulation for Drug Discovery and  
Elucidation of Biological Phenomena

TAKINOUE, Masahiro : DNA nanotechnology and artificial cell/nucleus engineering

### (Assistant Professors)

DENDA, Kimitoshi : Molecular physiology of cell growth and development during embryogenesis

FURUTA, Tadaomi : Biophysical elucidations of biomolecular functions

INOHAYA, Keiji : Bone formation and development

OKUMURA, Eiichi : Cell cycle control and signal transduction

SATO, Takao : Protein structure analysis and elucidation of mechanism

TAMORI, Masaki : Physiology and morphology of echinoderms

TANAKA, Toshiaki : Protein transport and cell proliferation

For details of the research themes, please see the website  
of each laboratory linked from the following URL.

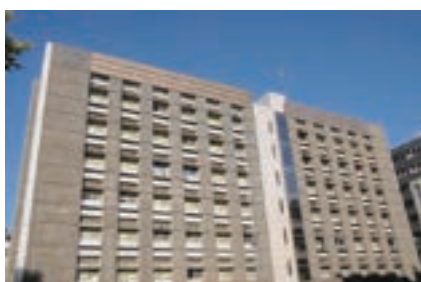
[https://educ.titech.ac.jp/bio/eng/faculty/research\\_lab/](https://educ.titech.ac.jp/bio/eng/faculty/research_lab/)



B1 • B2 Bldg.



J2 • J3 Bldg.



S2 Bldg.



R1 Bldg.

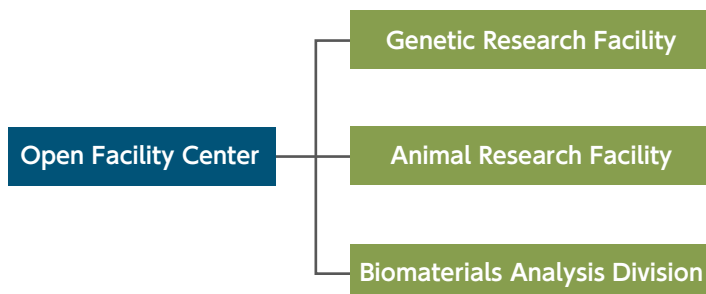


M6 Bldg.



## Open Facility Center

The Open Facility Center (OFC) was established in April 2020 as an organization that takes control of research support initiatives across the Institute. The OFC Genetic Research Facility and Animal Research Facility have taken over the operations of the Center for Biological Resources and Informatics, which was discontinued in March 2021. These research facilities mainly provide support services in the fields of "gene experiments" and "experimental biology" : 1) education, training, and safety management on recombinant DNA and experimental animals, 2) technical support for and maintenance of the core equipment, and 3) maintenance of the animal and plant facilities.

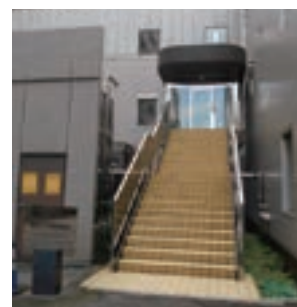
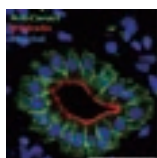
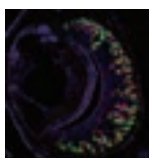


### Genetic Research Facility

- 1) Provides safety management and education for recombinant DNA experiments at the Tokyo Institute of Technology
- 2) Provides equipment for molecular biology experiments
- 3) Provides innovative technologies for genetic research
- 4) Provides research and education of proteins and genes

#### Core Equipment Service

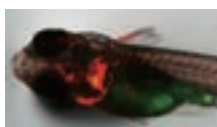
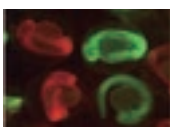
DNA sequencer, Transmission electron microscope, Scanning electron microscope, Inverted confocal microscope, Upright confocal microscope, Light microscope, Zoom microscope



### Animal Research Facility

- 1) Maintains and manages animal facilities
- 2) Provides equipment for animal experiments
- 3) Facilitates higher research and education

Mouse  
Freshwater organisms (zebrafish, medaka, Xenopus frog, etc.)  
Seawater organisms (puffer fish, starfish etc.)  
Services for mouse germ cell operations  
(in vitro fertilization, embryo/sperm freezing, transplantation)



### Biomaterials Analysis Division

- 1) Maintains the core equipment
- 2) Provides analytical services
- 3) Supports animal care and use
- 4) Supports education and research



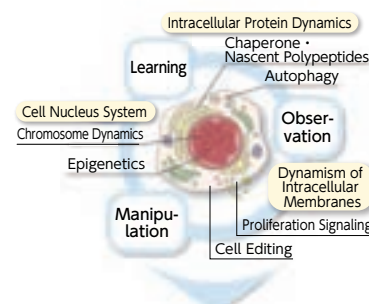
## Center for Cell Biology

<http://www.rcb.iir.titech.ac.jp/en/index.html>

Led by Honorary Professor Yoshinori Ohsumi, the 2016 Nobel Prize laureate in Physiology or Medicine, the Cell Biology Center is a new consortium that will unite a diverse range of investigators from basic to applied science backgrounds. This center aims to investigate the structure and function of cells—the basic units of life—by observing molecular mechanisms and by manipulating cells with cell editing and cytoarchitectural techniques. The findings will be used to create cells with unique functions. Through these interdependent investigations, the center will elucidate the fundamental principles of cells through world class research and state-of-the-art techniques and ultimately contribute to next generation of cell engineering, human health, and disease treatment.

Location: Suzukakedai Campus, S2 Building

Members: Honorary Professor and Unit Leader Yoshinori Ohsumi, and Prof. Hiroshi Iwasaki, Prof. Hiroshi Kimura, Prof. Masayuki Komada, Prof. Hideki Taguchi, Assoc. Prof. Fumi Kano, Assoc. Prof. Naonobu Fujita, Assist. Prof. Yuko Sato, Assist. Prof. Daiki Nakatsu, Assist. Prof. Tatsuya Niwa, Assist. Prof. Toshiaki Fukushima, Assist. Prof. Tomoko Horie, Assist. Prof. Hideo Tsubouchi of the School of Life Science and Technology.



Elucidating the phenomena underlying life on a cellular level  
Contribution to human health and the treatment of disease through interdependent investigations



Honorary Professor  
**OHSUMI, Yoshinori**

**Keywords** yeast, autophagy, vacuole, starvation, growth control

### Comprehensive studies of physiological roles of autophagy in yeast

We try to understand the induction mechanism and various modes of autophagy under various conditions. By biochemical analysis we have been studying degradation process of protein and RNA via autophagy and selective targets of autophagy.

Autophagosome by microscopy

### Cellular Function

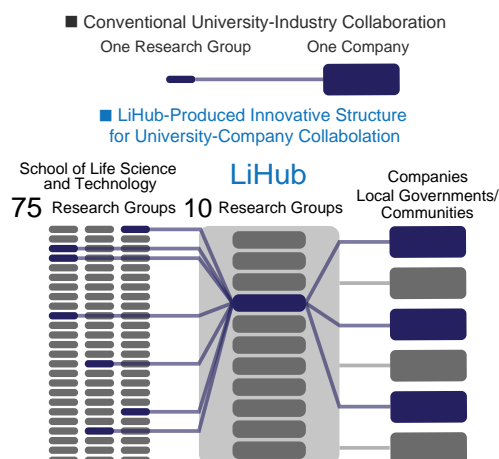


## Life Science and Technology Open Innovation Hub (LiHub)

The Life Science and Technology Open Innovation Hub (LiHub) was established in 2016 with the goal of building up a new academic style for Open Innovation by accelerating collaborations between our faculty members and industrial communities. Our School is one of the largest academic organizations in life science and technology field in Japan, including 75 research laboratories, which covers a wide range of bio-related disciplines.

By taking this strong advantage, LiHub serves as interfaces for companies and/or public sectors that need expertise of life science and biotechnology for their business and social activities. LiHub arranges communication, discussion and collaborations with faculty members who meet requests from companies and/or public sectors. In LiHub, there are 10 research groups that have already created communities for smooth academia-industry interactions, each of which is composed of 6-12 members of our faculties and specialized by one particular cutting-edge field such as healthcare industry, biomaterial, brain-environment interface, drug development, and synthetic biology. New more LiHub research groups will be created upon companies and/or public sectors' requests.

For more information, visit the LiHub website (or search with the keyword, "LiHub"): <http://www1.bio.titech.ac.jp/lihub/index.html>



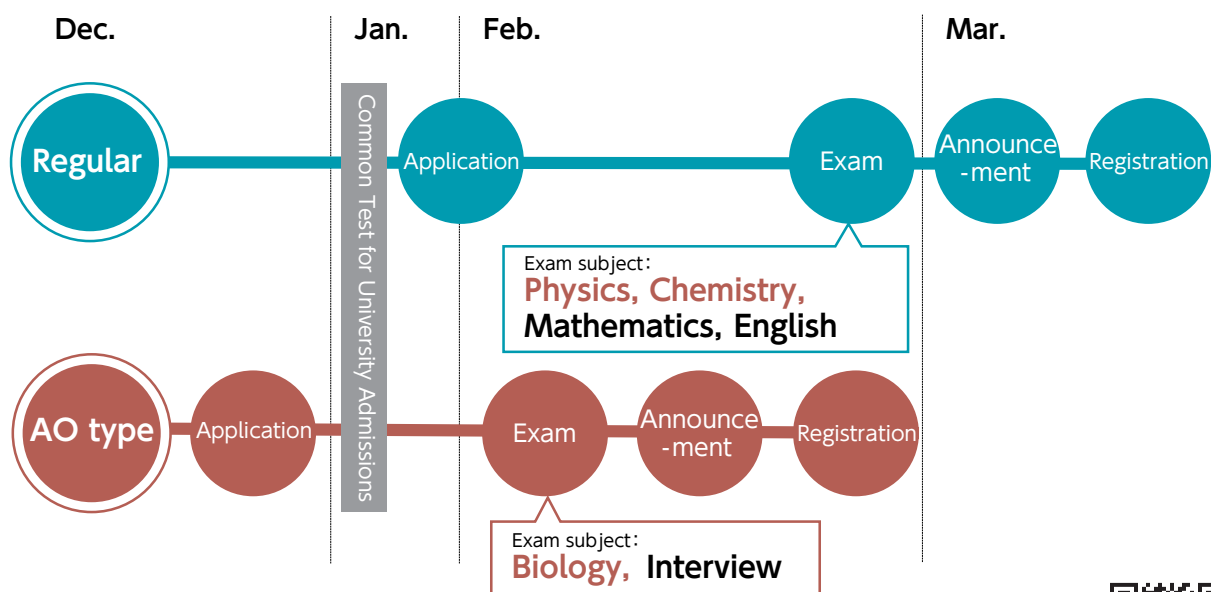
## Open Research Facilities for Life Science and Technology

Our school operates the Open Research Facilities for Life Science and Technology, which consists of the Shimadzu Corporation Precision Analytical Instruments Room, cell and protein analysis facility, ultracentrifuge facility, cold room, bioimaging facility, aquatic animal laboratory, biomolecular analysis facility, microbial culture room, and shared laboratory and office spaces. In 2021, synbio foundry and shared organic synthesis laboratory were launched, and we are promoting the enhancement of these open research facilities by installing new equipment. In addition, we have started the establishment of "Life Science and Technology Seamless Bioimaging Laboratory" that function as a platform for industry-academia joint research, and started the mouse optical imaging service. All these facilities and spaces are provided to support research and education in the life sciences and technology at Tokyo Tech. We envision that these facilities will provide opportunities for active collaboration among scientists, students, and technical staff members.

In a collaboration between Tokyo Tech and the Shimadzu Corporation, The Shimadzu Corporation Precision Analytical Instruments Room was established in 2017. This is a unique attempt to enhance research activities at Tokyo Tech by using the instruments and knowledge of the Shimadzu Corporation. This room contains advanced bioanalytical instruments, including mass spectrometry and microchip electrophoresis systems, that were donated by or purchased from the Shimadzu Corporation. We often hold orientation sessions for new users, as well as open workshops and demonstrations for new instruments.

# Schedule for Admission

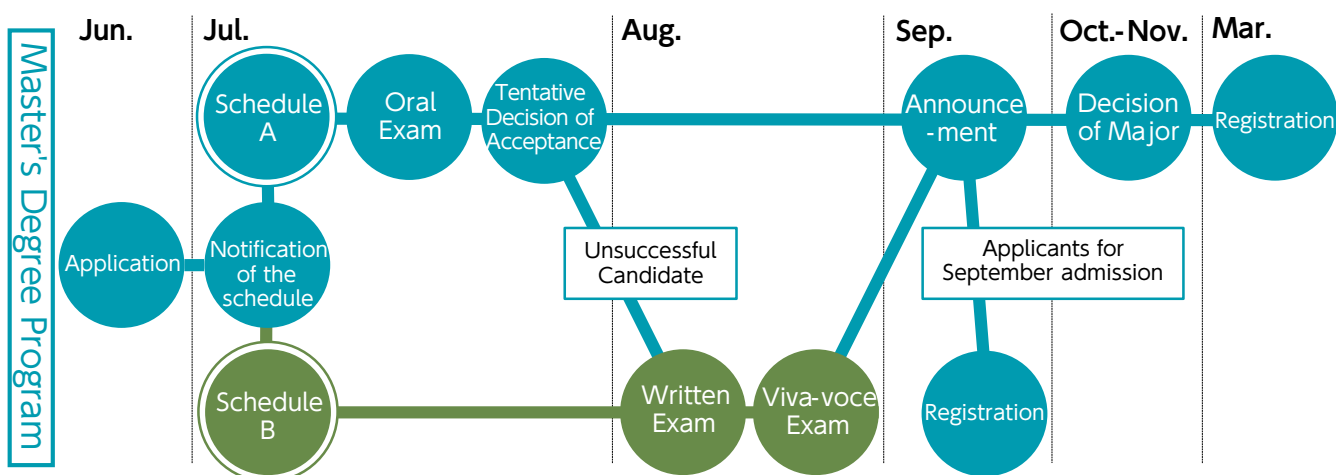
Undergraduate School	Capacity	Examination Category	
	150	Regular	AO type
		135	15



Examinations and programs are conducted in Japanese.  
For detailed information, please see <https://admissions.titech.ac.jp/admission>



Graduate School	Capacity
	Master : 168
	Doctor : 52



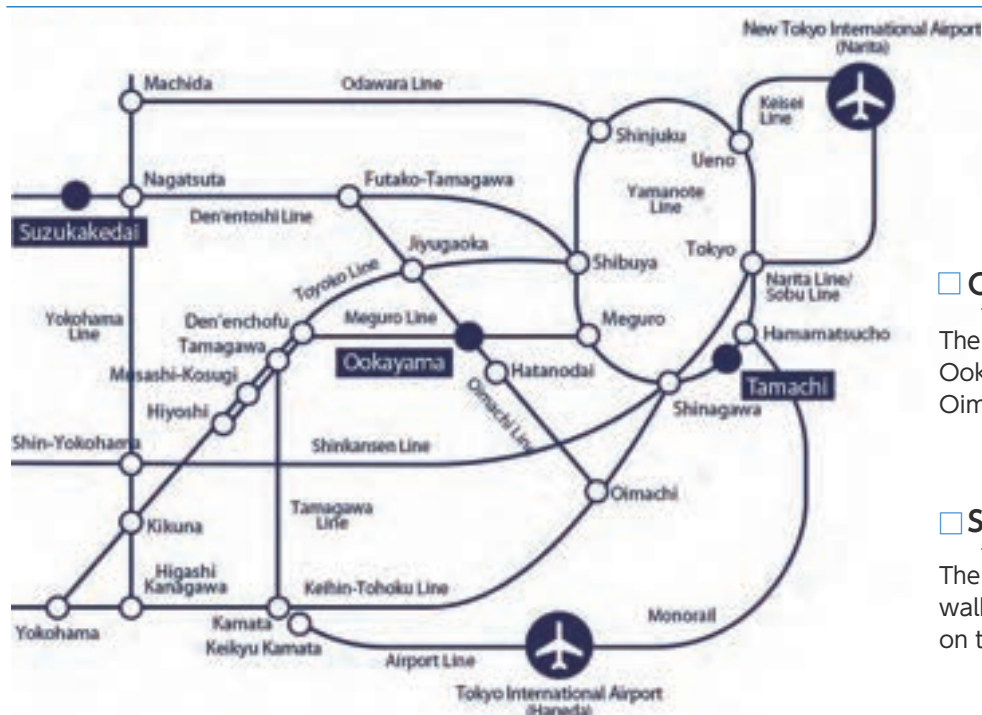
For detailed information, please see <https://www.titech.ac.jp/english/prospective-students/admissions>







## Access



☐ Ookayama Campus

The Main Gate is a 1-minute walk from  
Ookayama Station on the Tokyu  
Oimachi and Tokyu Meguro Lines.

☐ Suzukakedai Campus

The Suzukakedai Campus is a 5-minute walk from Suzukakedai Station on the Tokyu Den'entoshi Line.

## Latest Information

## Official site

<https://educ.titech.ac.jp/bio/eng/>



## Information for enrollment

## Undergraduate School

<https://admissions.titech.ac.jp/admission>

**Graduate School**

<https://www.titech.ac.jp/english/prospective-students>



## Inquiries

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Office, School of Life Science and Technology, Tokyo Tech.

**TEL** 045-924-5942 (9:00 - 17:15) **E-mail** bio.adm@jim.titech.ac.jp