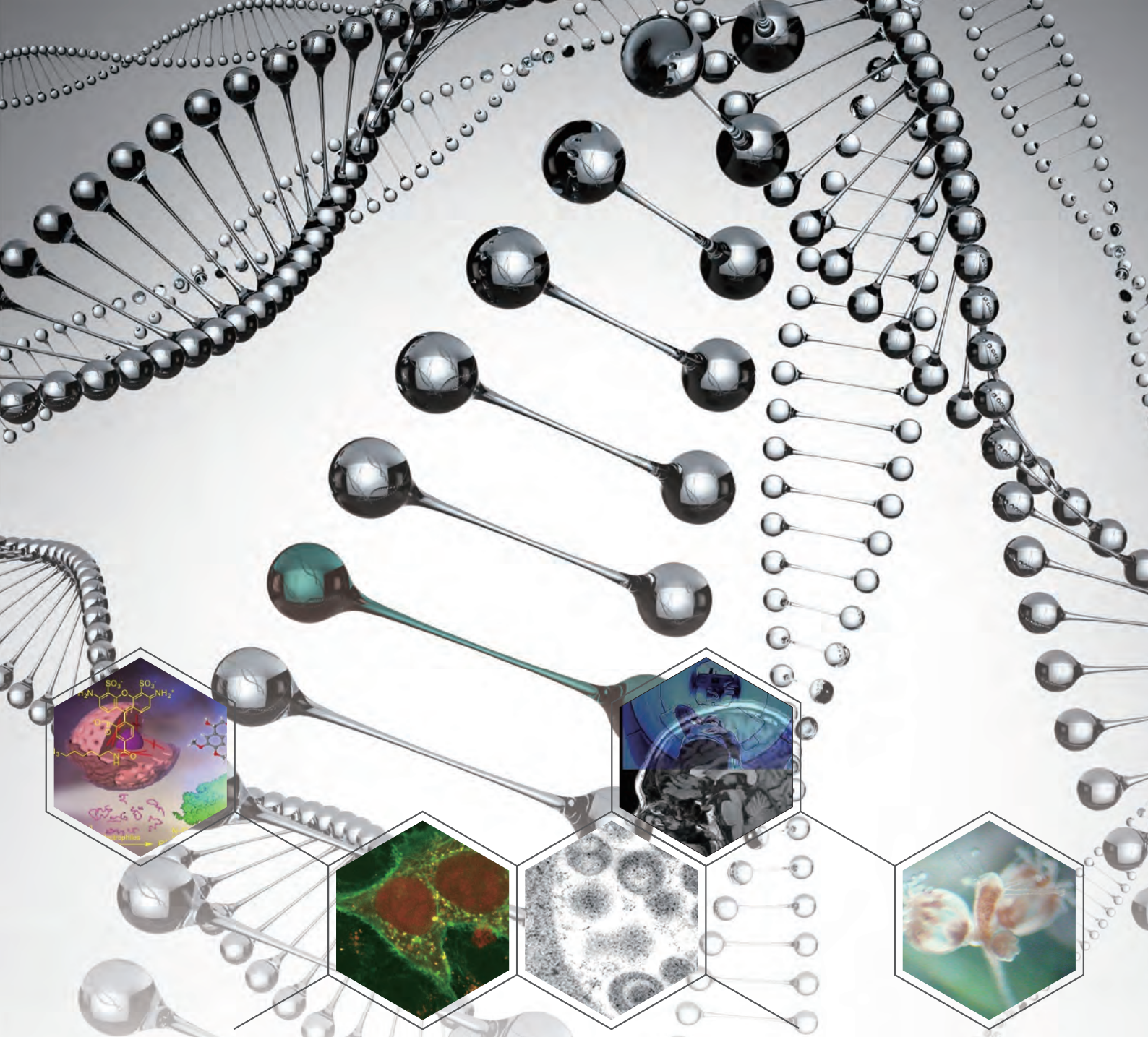

Invitation to Life Science and Technology

Tokyo Institute of Technology
School of Life Science and Technology

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Message from the Dean

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; or well-being, in other words. In addition, recent years, we have been confronted with global social issues – such as global warming, the UN Sustainable Development Goals (SDGs) and infectious disease pandemics –, and life science and technology has become an indispensable discipline in solving these large-scale problems.

In 1990, Tokyo Institute of Technology (Tokyo Tech) established the School of Bioscience and Biotechnology as the third undergraduate school, after the School of Science and the School of Engineering, to lead in the development of science and technology in the 20th century and to fully supplement the life element that is essential in the 21st century. The Graduate School of Bioscience and Biotechnology was established in 1992. In 2016, the reform of Tokyo Tech's education system generated the School of Life Science and Technology by connecting undergraduate and graduate schools for Bioscience and Biotechnology. Our faculty has already produced more than 5,000 graduates, and many of them are now working in domestic and international companies, research institutes, universities, government agencies, and international organizations.

The School of Life Science and Technology promotes a wide breadth of research and development in the field by using the School's shared state-of-the-art equipment for seamless bio-imaging platforms, etc. The School also promotes joint research among its own members, within the Institute, as well as with other universities and companies in Japan and overseas, and conducts interdisciplinary research and industry-academia collaboration to solve global social issues.

In addition to the more than 100 faculty members affiliated with this faculty, 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 from the undergraduate level.

The Graduate Major of Life Science and Technology of our graduate program gives students the opportunity to acquire knowledge and skills in highly specialized fields of Life Science and Technology and training needed to become global experts in the field through a combination of special lectures, by invited world-class professors, and practical career development in Europe and the United States. The Graduate Major of 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, and it fosters global leaders who can promote cross-disciplinary research and development that integrates with other specialized fields. Since 2022, we have started the Graduate Major of Earth-Life Science, which will tackle global issues humanity is facing, the origin of life, and extraterrestrial life. 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 leading experts who can promote the well-being of people around the world by conducting research with a strong sense of curiosity and inquisitiveness, with flexible thinking that can respond to the needs of a diversifying society, and by utilizing a wealth of knowledge.

Associate Deans

- Planning — Prof. YAMAGUCHI, Yuki
- Education — Prof. HONGOH, 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.

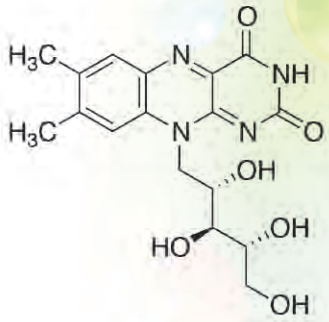
History of the School

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

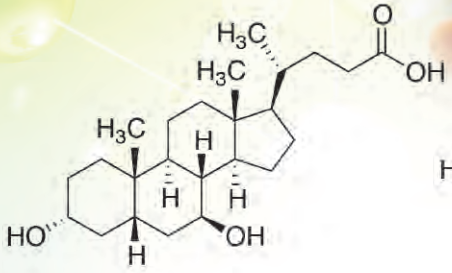
Roots of the School

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, Arasena, were also synthesized at Tokyo Tech.

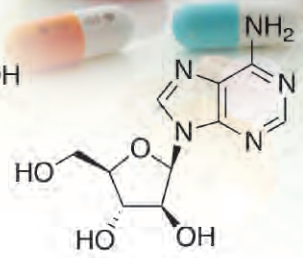
Furthermore, a group of Tokyo Tech researchers discovered alkaline enzymes, which led to the development of enzyme-containing detergents. Based on this pioneering research, Tokyo Tech established the School of Bioscience and Biotechnology, which was Japan's first interdisciplinary school of life science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

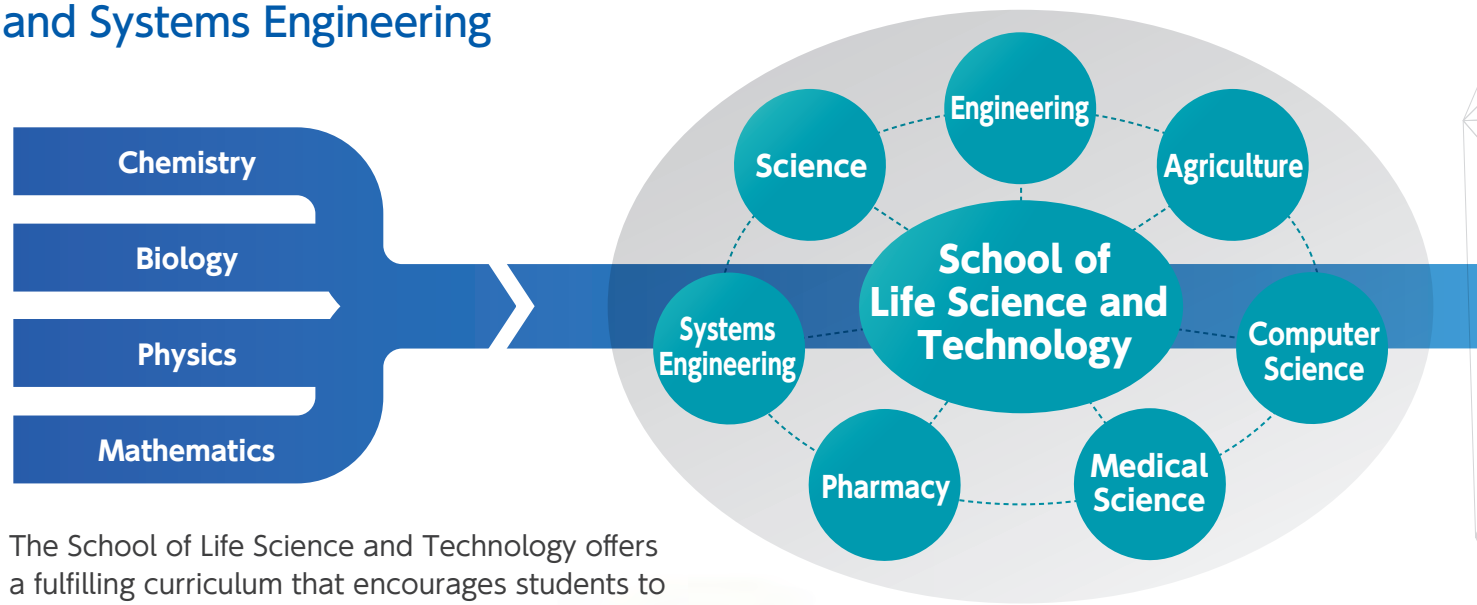
A Message from OHSUMI, Yoshinori Honorary Professor and 2016 Nobel Laureate in Physiology or Medicine

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

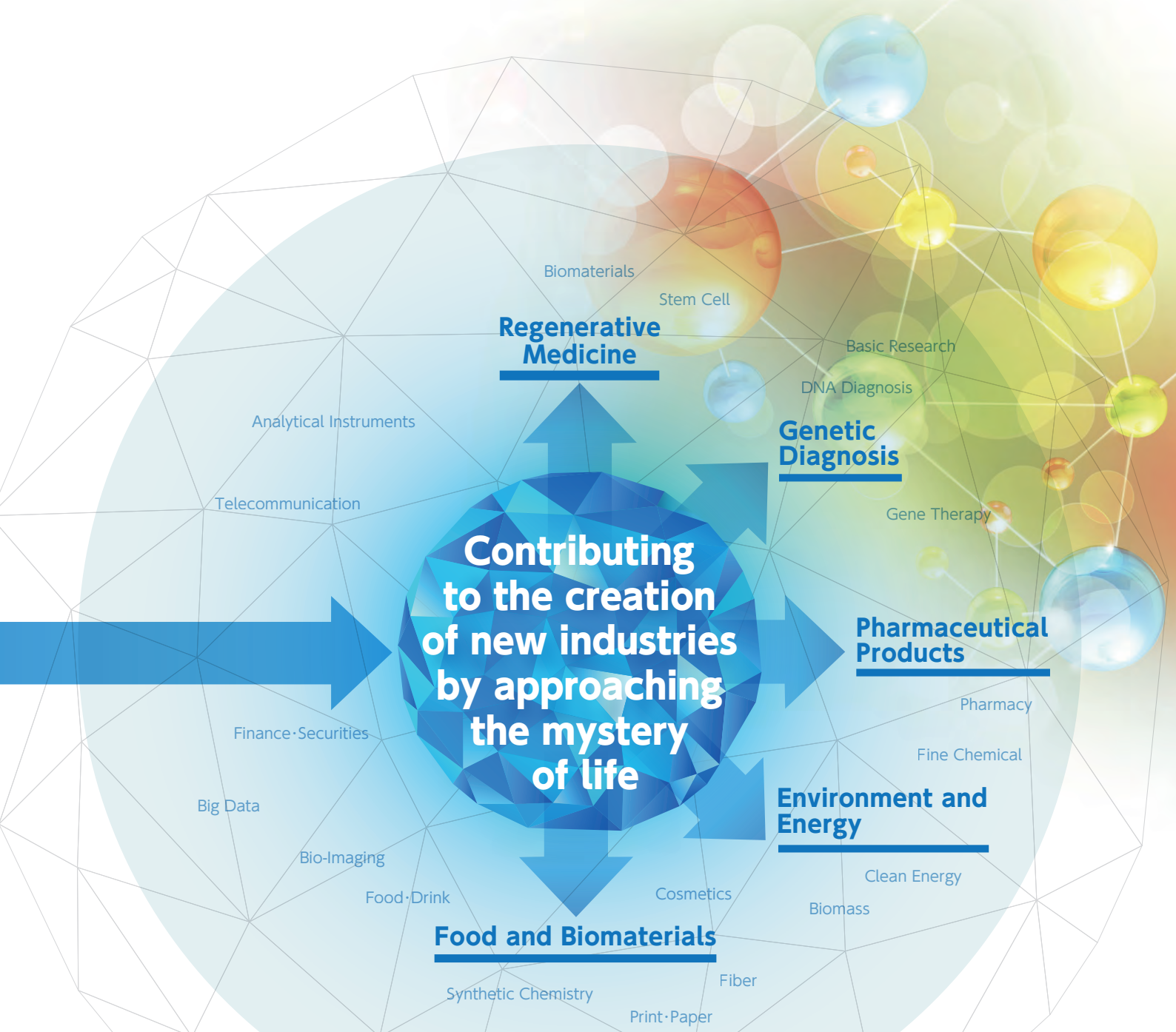
In their first year, students take part in a challenging active learning program in which they create educational materials related to the life sciences. Critical thinking and problem-solving skills are developed through collaborative work.

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 80 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

- Fundamental Life Science
- Basic Chemical Thermodynamics
- Basic Quantum Chemistry
- Basic Organic Chemistry
- Basic Inorganic Chemistry
- Linear Algebra /Recitation
- Calculus /Recitation
- Fundamentals of Mechanics
- Fundamentals of Electromagnetism
- 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

2nd Year

- 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

3rd ～ 4th Year

- 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

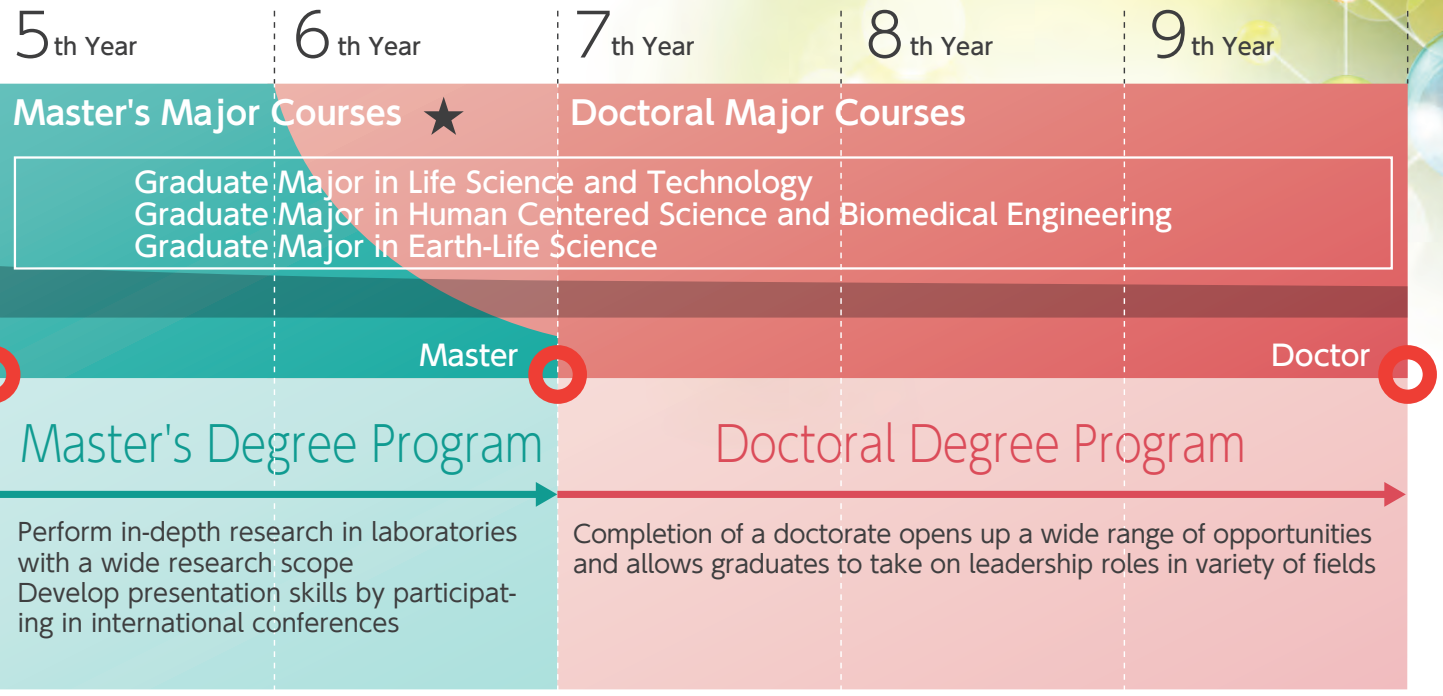
- Graduation Thesis
- Internship
- Overseas Training

List of lectures (partial list)

Learning

■ Academic 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.



Master's Degree Program

Perform in-depth research in laboratories with a wide research scope
Develop presentation skills by participating in international conferences

Doctoral Degree Program

Completion of a doctorate opens up a wide range of opportunities and allows graduates to take on leadership roles in variety of fields

★ 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/prospective-students

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.

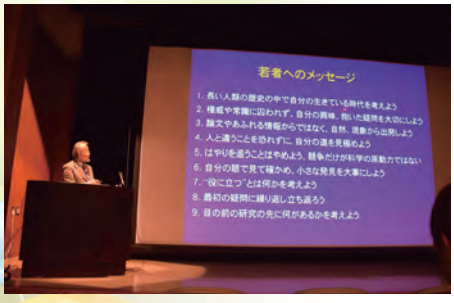
Learn by yourself, think actively, and materialize the idea with originality and ingenuity

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

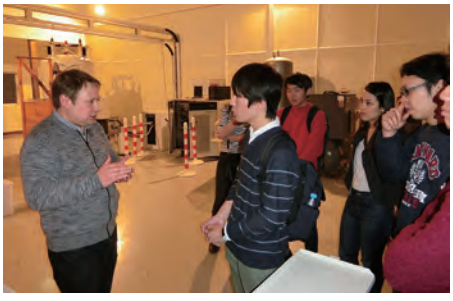
Approximately 200 teams of students from around the world participate in International Genetically Engineered Machine (iGEM), an international competition in synthesis biology. Tokyo Tech Team, which mainly consisted of students from the School of Life Science and Technology, is famous for its record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

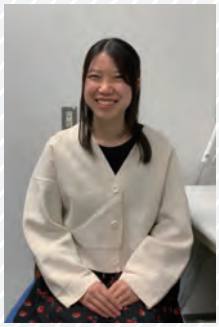
I worked as an intern for five months at the Pamela Silver Laboratory at Harvard Medical School. During my stay, not only was I able to acquire new skills in imaging and analysis, but I was able to meet a diverse community of researchers and observe the different ways in which Japanese and American universities 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

Mutawakil Al Muqadasi doctoral student

I am an Indonesian student at the School of Life Science and Technology. As a foreign student in Japan, the language barrier has been a great challenge. Even so, my fellow students here are very helpful thus making me enjoy every process of my research. Moreover, it is a blessing to have supervisors who are always there for me to give valuable insights and mental support, hence making my life as a student easier.
Overall, it is an excellent opportunity to study at Tokyo Tech. I hope I can implement my knowledge and experience that I earn to help society in the future.

KANESHITA, Minori master's student



I'm currently researching on the immune response function of an U1 snRNA. Although there are times my research does not go well, I enjoy with the guidance I receive from my professors and seniors. I'm able to conduct a wide range of experiments from organic synthesis to cell experiments, and I feel that I'm growing through my experiments.

TAKEDA, Yota undergraduate student

I am exploring the developmental mechanisms of the vertebrate limbs. At first, I did not to know what to expect, but thanks to the kindness of my colleagues in the laboratory, I am enjoying my research every day. I would like to make use of my experiences at Tokyo Tech, and be a person who is active in a variety of situations.

International Graduate Program (IGP)

https://www.titech.ac.jp/english/admissions/prospective-students/graduate-programs/igp

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

Tokyo Tech and Tsinghua University (China) jointly operate a double degree program for students at the master's 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.

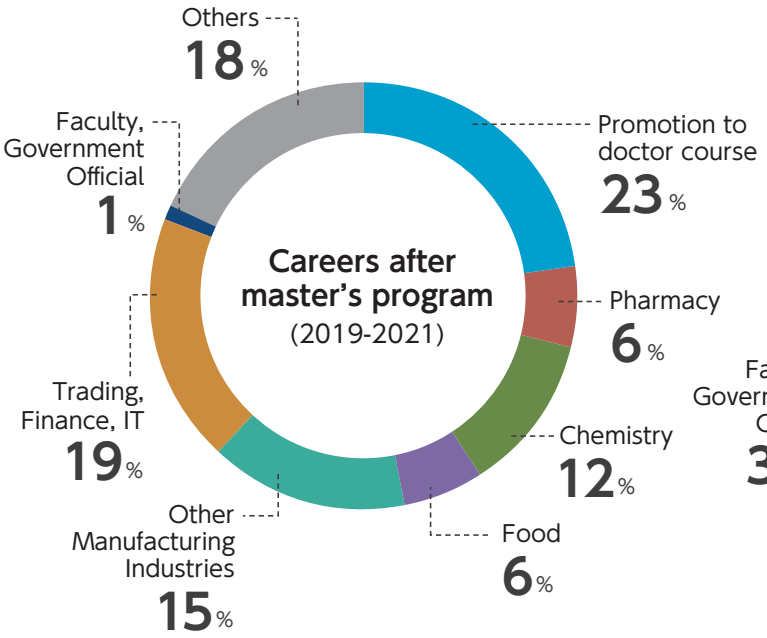
Members of the 15th cohort from Tsinghua University

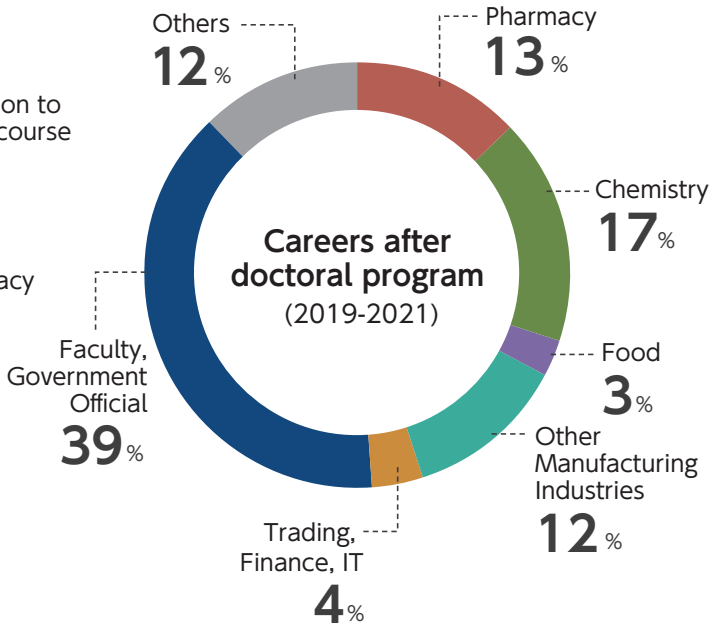
Member of the 14th cohort from Tokyo Tech

15th 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 employment

Pharmacy

Astellas Pharma, AstraZeneca, Chugai Pharmaceutical, Johnson & Johnson, Kowa, Kyowa Kirin, Mochida Pharmaceutical, Pfizer Japan, Shionogi, Takeda Pharmaceutical, etc.

Chemistry

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

Food

Asahi Breweries, Ajinomoto, Kagome, Kewpie, Kirin Holdings, Lotte, Morinaga Milk Industry, Mizkan, Nissin Foods Group, Yamasa, Yamazaki Baking, etc.

Other Manufacturing Industries

Dai Nippon Printing, Fujitsu, Hitachi, JT, Kioxia, Mazda Motor, Micron Memory Japan, Nippon Paper Group, Nipro, Shimadzu, Showa Denko, Terumo, Toppan Printing, etc.

Trading, Finance, IT

Itochu, Marubeni, Mizuho Bank, Microsoft Japan, MUFG Bank, NS Solutions, NTT, NTT Data, SoftBank, Sumitomo Mitsui Banking, Tokio Marine & Nichido Fire Insurance, Rakuten Group, etc.

Faculty, Government Official

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

Others

Accenture, Daiwa Institute of Research, Dentsu, Deloitte Tohmatsu Consulting, Japan Broadcasting Corporation, Japan Airlines, McCann Erickson Japan, The Japan Research Institute, Tokyo Gas, etc.

Faculty Members List

〈Life Science and Technology〉

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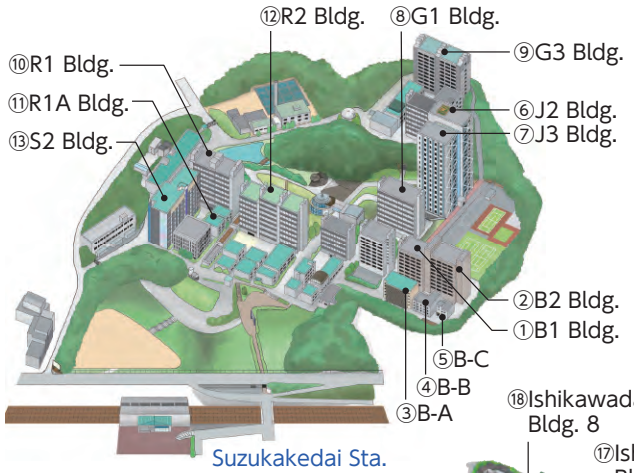
Research Field
M : Molecule C : Cell
T : Tissue, Organism

Suzukakedai Campus

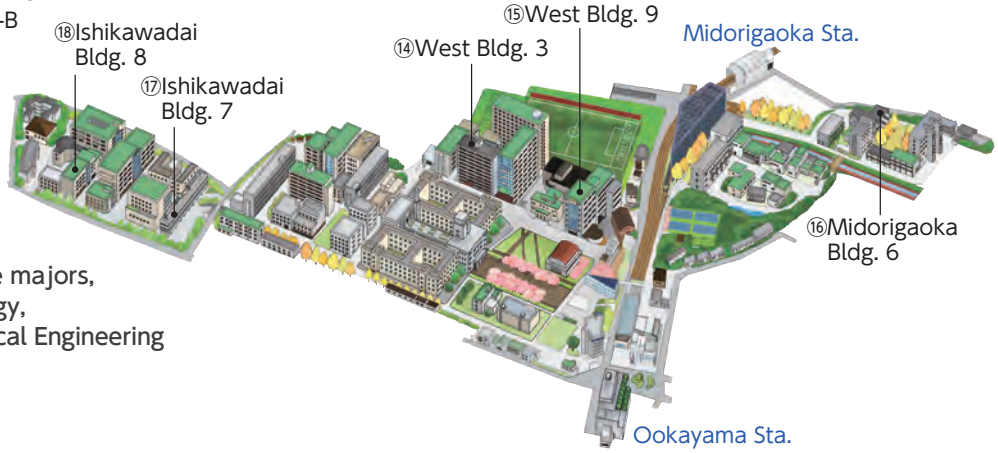


Facility Name

Ⓢ Suzukakedai Campus
① B1 Bldg.
② B2 Bldg.
③ B-A (B1B2 Annex A)
④ B-B (B1B2 Annex B)
⑤ B-C (B1B2 Annex C)
⑥ J2 Bldg.
⑦ J3 Bldg.
⑧ G1 Bldg.
⑨ G3 Bldg.
⑩ R1 Bldg.
⑪ R1A Bldg.
⑫ R2 Bldg.
⑬ S2 Bldg.

Ⓞ Ookayama Campus
⑭ West Bldg. 3
⑮ West Bldg. 9
Ⓜ Midorigaoka Area
⑯ Midorigaoka Bldg. 6
Ⓘ Ishikawadai Area
⑰ Ishikawadai Bldg. 7
⑱ 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 | Assistant Professor WONG, Sing Ying

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)

Protein

2D-PAGE of some tissues

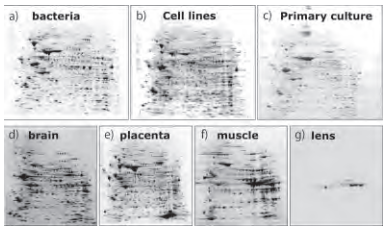


Image of future healthcare society

Professor
ISHII, Yoshitaka | Assistant Professor MATSUNAGA, Tatsuya

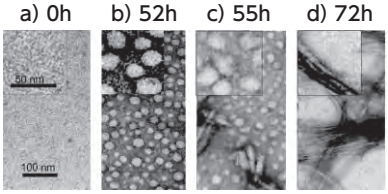
Structural biology of amyloid and molecular mechanism of Alzheimer's

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.

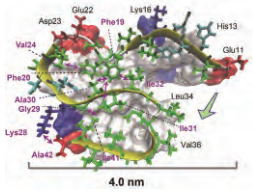
Keywords Amyloid, structural biology, solid-state NMR, carbon nanomaterials

Protein

Time-resolved electron micrograph of Alzheimer's Aβ protein



First atomic model of Aβ42 fibril by SSNMR



Professor
KAMIYA, Mako | Assistant Professor FUJIOKA, Hiroyoshi

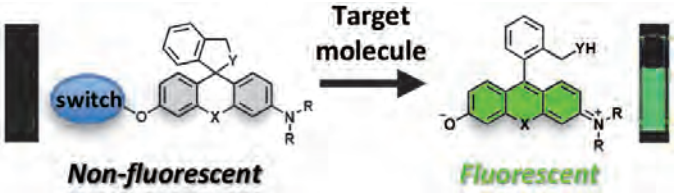
Development and biological applications of original chemical probes

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

Chemical biology

Activatable fluorescent probes for bio-molecules



Professor
KAWAI, Kiyohiko

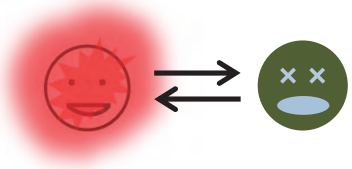
Detect a single molecule Learn from a single molecule

We use bioorganic chemistry to control photochemical reactions. Our research focuses on "dynamics" such as rate constants of chemical reactions and motions of biomolecules.

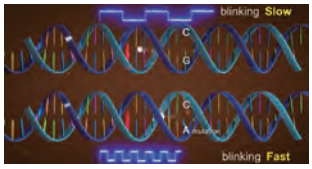
Keywords single molecule chemistry, bioorganic chemistry

Photochemistry

Fluorescence blinking



In situ mutation detection



Professor
KINBARA, Kazushi

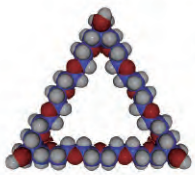
Developing functional molecules inspired by biological systems

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

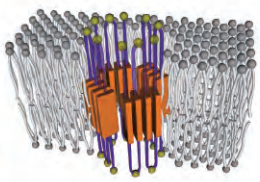
Keywords organic chemistry, molecular devices, self assembly, biomimetics

Biomaterials

Structured PEG



Ion channel



Photoactive protein

Professor
KITAO, Akio

Assistant Professor
TRAN, Phuoc Duy

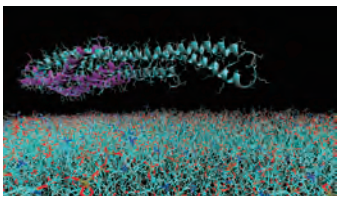
Observing Biological Phenomena by Computer

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

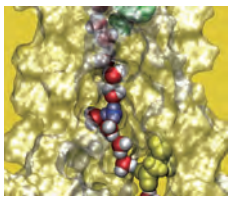
Keywords Protein Dynamics, Computational Biology, Biophysics, Computational Chemistry

Computational Biology

Membrane deformation simulation induced by I-BAR



Proton transfer through flagellar motor



Professor
KOBATAKE, Eiry

Assistant Professor
NISHIDA, Kei

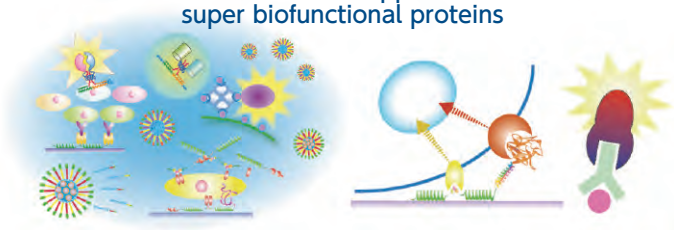
Construction of super biofunctional protein materials

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

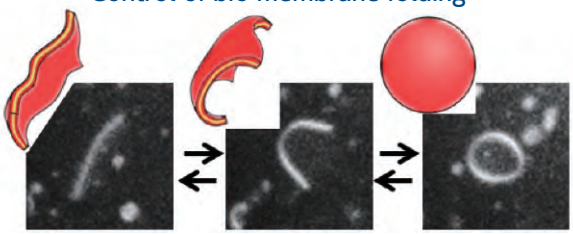
Design of bio-functional and bio-conjugate materials

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

Peptide engineering and chemical biology

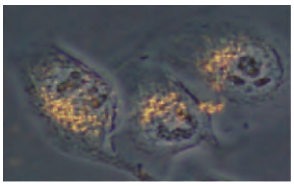
We design and construct supramolecular systems composed of peptides, glycosides and proteins using peptide engineering techniques for chemical biology research.

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

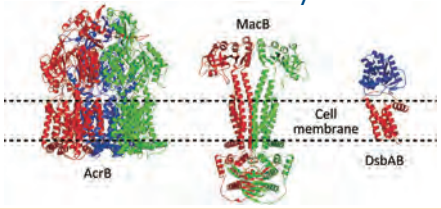
Structure and molecular mechanism of membrane protein complex

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

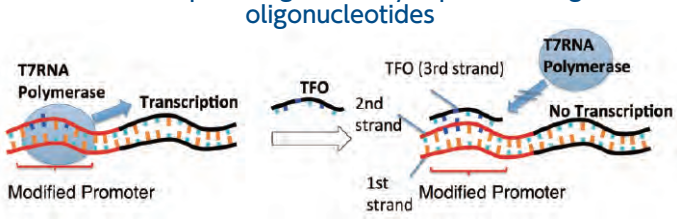
Nucleic acids chemistry for regulation of genetic information

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

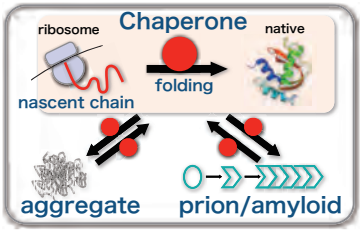
Life of proteins in cells: Translation, chaperone, prion

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).

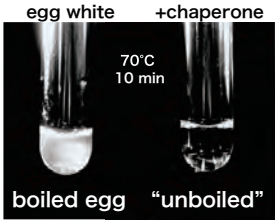
Keywords Proteins, non-canonical ribosome dynamics, chaperone, prion, amyloid

Protein

Life of proteins in cells



"unboiled" egg with chaperone



Professor
UENO, Takafumi

Assistant Professor
ABE, Satoshi

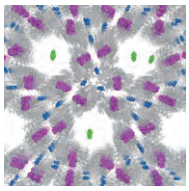
Development of artificial enzymes and biosupramolecular materials

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
YUASA, Hideya

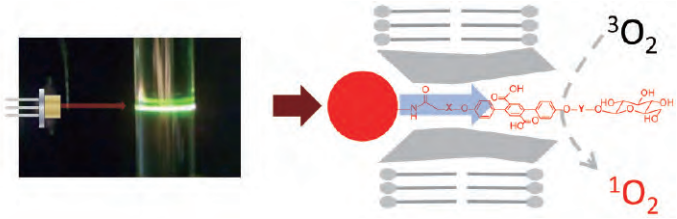
Assistant Professor
KANAMORI, Takashi

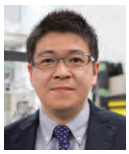
Phostosensitizers and photodynamic therapy of cancer

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

Keywords photodynamic therapy, photosensitizer, lanthanide nanoparticle

Bioactive compounds





Associate Professor
ASAKURA, Noriyuki

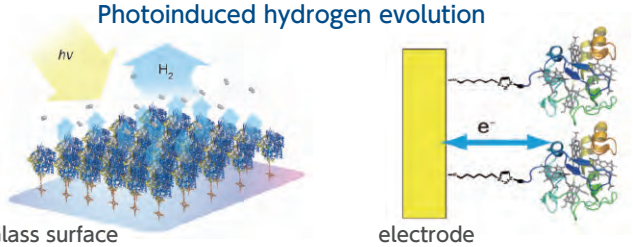
Bioelectrochemistry of proteins and hydrogen generation by photoinduced biological electron transfer

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

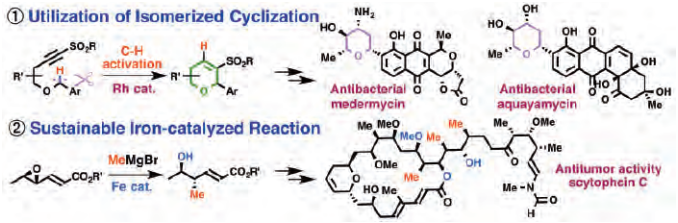
Synthesis of bioactive compounds by sustainable molecular transformation

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



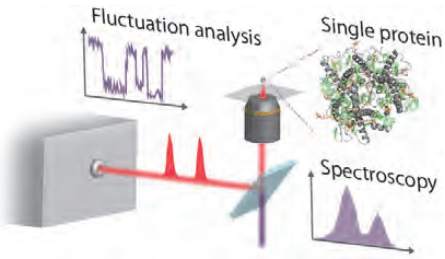
Associate Professor
KONDO, Toru

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

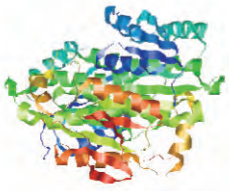
Organic synthesis by enzymes

We have been using enzymes as a catalyst and CO_2 as a solvent for organic synthesis to promote green chemistry.

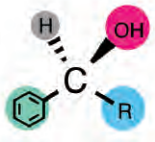
Keywords enzyme, organic synthesis, CO_2, green chemistry

Biocatalysis

Microorganism with useful enzymes as catalysts



Optically pure compounds for intermediates of pharmaceuticals



Associate Professor
MIE, Masayasu

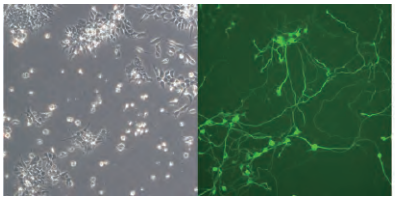
Development of biomolecular tools

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

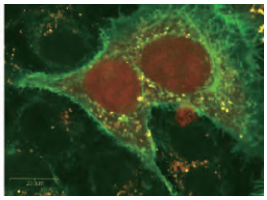
Keywords biomaterials, protein engineering, cellular engineering

Biomaterials

Induction of neural differentiation by protein transduction



Bioimaging with engineered protein tag



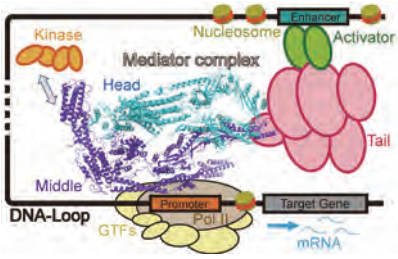
Associate Professor
NOZAWA, Kayo

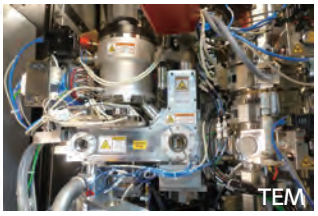
Structural and biochemical analysis of gene regulation by 3D genome folding

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

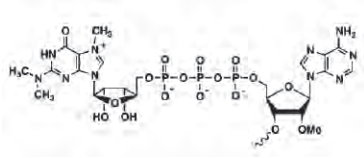
Development of new nucleic acid drugs for gene therapy

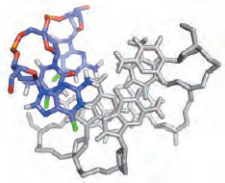
We develop new bioactive molecules including nucleic acids drugs for accurate regulation of biochemical reactions (transcription, splicing, translation) based on organic chemistry.

Keywords bioorganic chemistry, nucleic acid chemistry, nucleic acid drugs

Bioactive compounds

Nucleic acid drugs for accurate regulation of biochemical reactions





Associate Professor
TO, Taiko

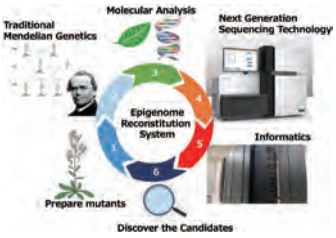
Elucidating the epigenome establishment mechanism in plants and its applications

Living organisms identify harmful sequences in their genomes and suppress them through epigenetic modifications. We are studying the mechanism how plants establish epigenomic patterns properly, as well as developing new applications.

Keywords plants, epigenomics, molecular genetics, synthetic biology

Chromatin, Gene expression

Epigenome reconstitution



Association of variability (epigenome / phenotype)

Associate Professor
TSUTSUMI, Hiroshi

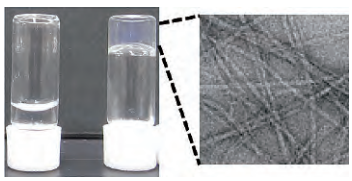
Control and Analysis of Cell Environment based on Chemical Biology

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

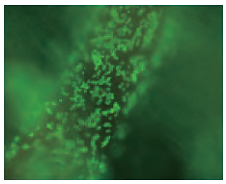
Keywords fluorescent probe, bioimaging, supramolecular chemistry, cell environment chemistry

Biomaterials

Supramolecular hydrogel



Cell culture using supramolecular hydrogels



Professor
FUKUI, Toshiaki

Assistant Professor
ORITA, Izumi

Analyses and engineering of microbes for production of useful compounds

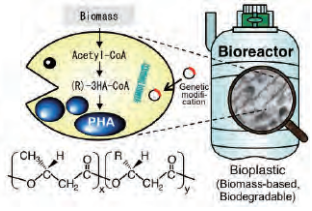
Our lab is studying on analyses and metabolic engineering of microbes (especially hyperthermophiles, bioplastic-producing bacteria, and methylotrophs) aiming efficient production of useful compounds.

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

Microbiology

Hyperthermophilic archaeon

Bioplastic-producing bacterium



Professor
ITOH, Takehiko
Assistant Professor
KAJITANI, Rei

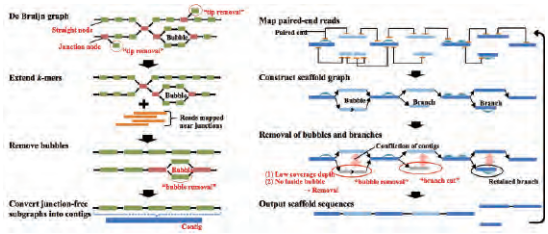
Elucidation of biological phenomenon using NGS and bioinformatics

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

Keywords genome informatics, chromosome dynamics

Bioinformatics

Overview of Platanus assembler algorithm



Professor
IWASAKI, Hiroshi
Assistant Professor
TSUBOUCHI, Hideo
KANAMARU, Shuji

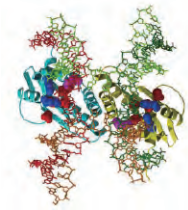
Temporospatial regulation of chromosome dynamics

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.

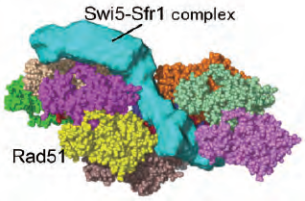
Keywords chromosome biology, homologous recombination, DNA repair, genome integrity

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

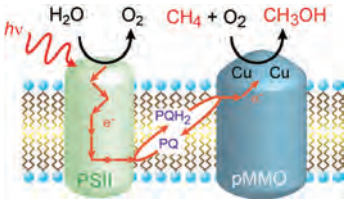
Elucidation and application of metal ions in biological system

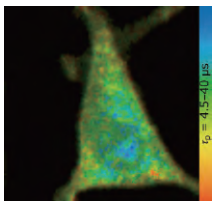
We are studying transduction of light energy into chemical energy by metalloenzyme and elucidation of oxygen dynamics inside a single cell.

Keywords metalloenzyme, oxygen imaging, energy transduction

Microbiology

Light energy transduction and oxygen imaging of cell





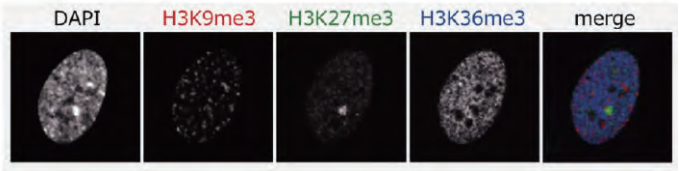
Professor
KIMURA, Hiroshi
Assistant Professor
SATO, Yuko

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

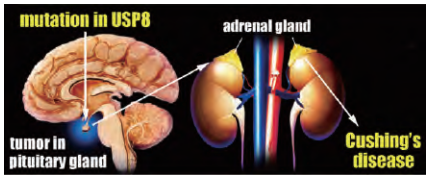
Regulation of diverse cellular functions by the ubiquitin system

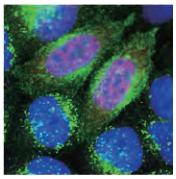
The ubiquitin system not only induces cellular protein degradation but also regulates their localization, complexation, and activation. We study molecular mechanisms underlying its diverse regulation and dysregulation in human diseases and senescence.

Keywords ubiquitin, proteostasis, tumor, senescence

Cellular function

USP8 mutation in pituitary tumor in Cushing' s disease





Professor
TOKUNAGA, Makio

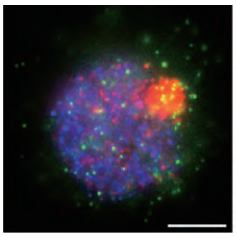
Assistant Professor
ITO, Yuma

Visualization and quantitation of cellular mechanisms

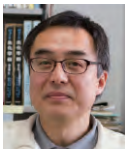
Our goal is the understanding of cellular spatio-temporal dynamics and mechanisms, based on development of techniques in molecular imaging and quantification.

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
IWAI, Noritaka

Regulatory mechanism of bacterial cell growth and metabolism

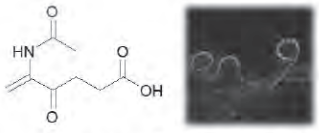
We want to know how bacterial cells perform cellular metabolism, grow, and reproduce. Screening of new antibiotics is also carried out.

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

Microbiology

SEM image of *C. glutamicum* cells

Alaremycin and its producer strain



Alaremycin　*Streptomyces* sp. A012304

Professor
YAMAGUCHI, Yuki

Assistant Professor
SAKAMOTO, Satoshi
YAMAMOTO, Junichi

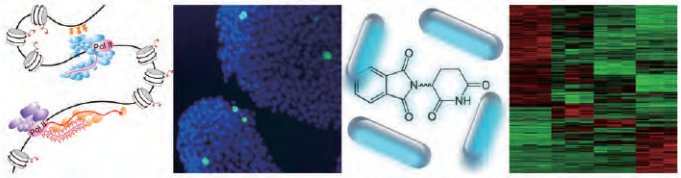
Understanding and applying the machinery of life

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

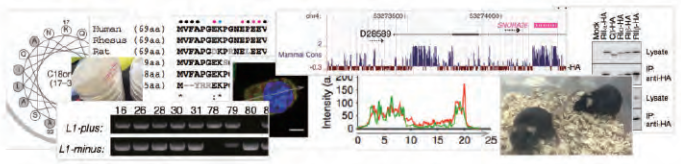
Elucidation of sequence-function relationship in the human genome

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

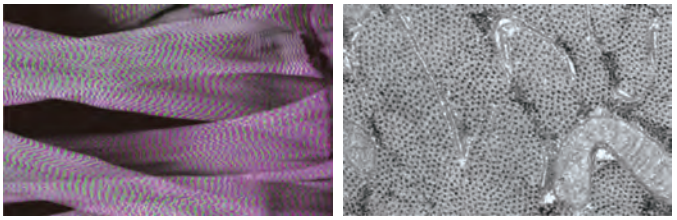
Mechanisms of formation and remodeling of organelles in muscle cell

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

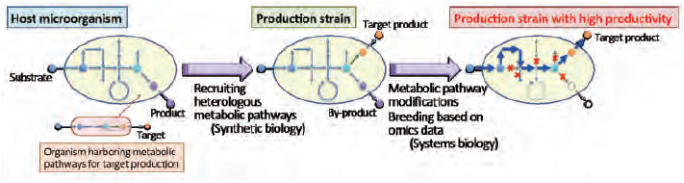
Metabolic engineering toward bioproduction of useful materials

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

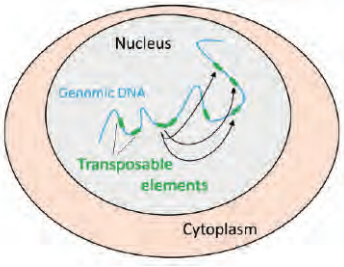
Are transposable elements alive?

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

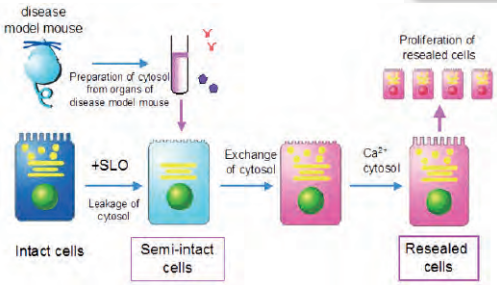
Assistant Professor
NAKATSU, Daiki

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 delivering molecules into cells, combined with a novel image-based analysis that creates covariation networks from immunostained 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

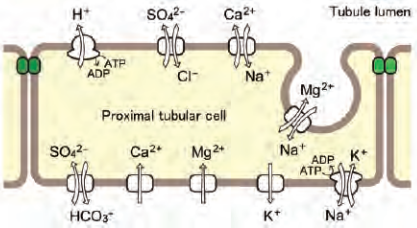
Epithelial mechanisms responsible for environmental adaptation

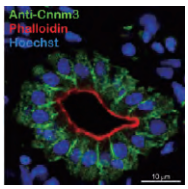
We compare expressions and functions of transporters in various epithelial cell types (kidney, intestine, etc.) among freshwater fishes, seawater fishes, and terrestrial animals.

Keywords electrophysiology, molecular physiology, cell biology, comparative genomics

Cellular function

Renal excretion of divalent ions in marine teleost





Associate Professor
NAKAMURA, Nobuhiro

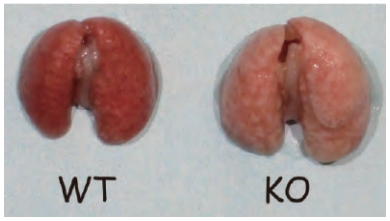
Regulatory mechanism of cell and tissue shape and function

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.

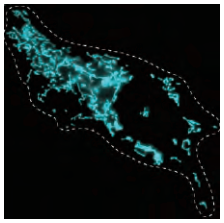
Keywords receptor, signal transduction, knockout mice, ubiquitin

Cellular function

Abnormal lung morphology in knockout mice



Mitochondrial morphology



Associate Professor
SHIRAKI, Nobuaki

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

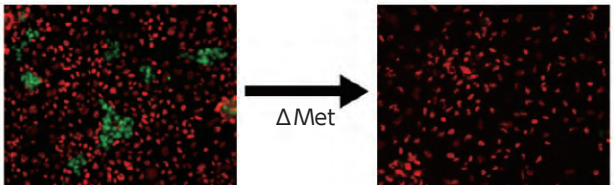
We are studying the role of amino acid metabolism in maintenance and differentiation of stem cells and its application for ES/iPS cell endoderm differentiation.

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

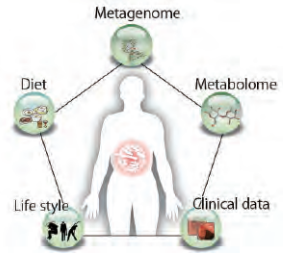
Big data for human gut microbiome

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



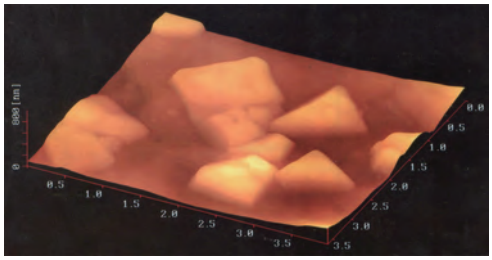
Associate Professor
YATSUNAMI, Rie

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

Assistant Professor
IWATA, Tetsuo

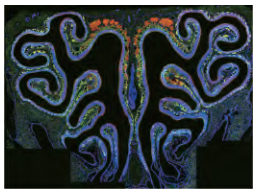
Molecular neuroscience of a sense of smell

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

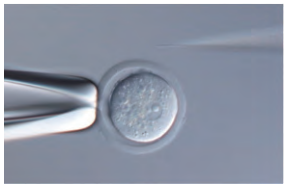
Keywords olfaction, chemical sense, neuronal differentiation, genome engineering

Neuroscience

Visualization of neurons in the main olfactory epithelium



Artificial chromosome & genome editing



Professor
HONGOH, Yuichi

Assistant Professor
KUWAHARA, Hirokazu

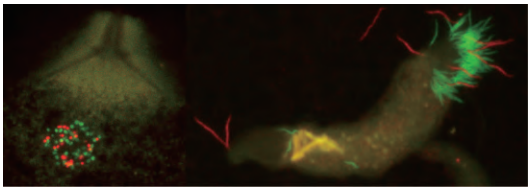
Molecular ecology and genome evolution of symbiotic systems

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

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

Microbial Ecology

Termite-gut protists and their symbiotic bacteria



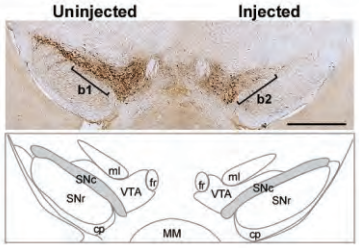
Professor
ICHINOSE, Hiroshi

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

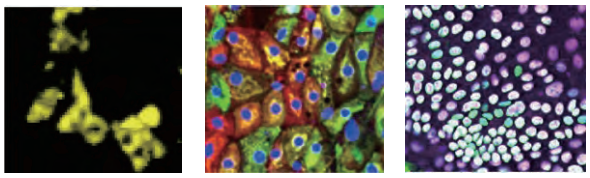
Modeling organ development and homeostasis using human iPS cells

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
OSAKABE, Yuriko

Assistant Professor
KIDOKORO, Satoshi

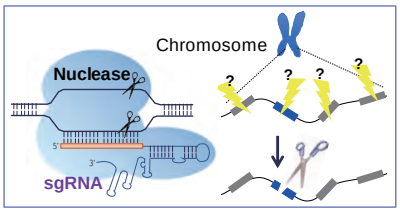
Molecular basis of genome editing and genetic engineering of plants

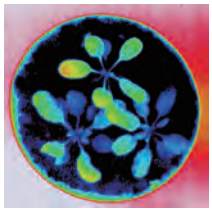
We are studying molecular basis of genome editing technology and its application, and genetic engineering to improve plant environmental stress responses.

Keywords genome editing, genetic engineering, plant, stress response

Plant, Synthetic biology

Genetic engineering and genome editing of plant stress responses





Professor
TANAKA, Mikiko

Assistant Professor
KAWANISHI, Toru

Developmental basis of the evolution of vertebrate morphology

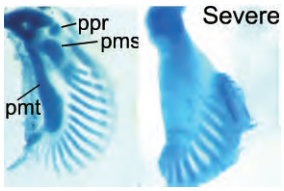
We are exploring the developmental and molecular mechanisms of how morphology of vertebrates have evolved.

Keywords evolutionary developmental biology

Development

MafB is controlled by BMP in limb bud

Control and "posteriorized" shark fin



Associate Professor
KAWAKAMI, Atsushi

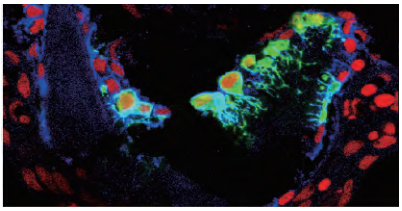
Cellular and molecular mechanism of tissue regeneration

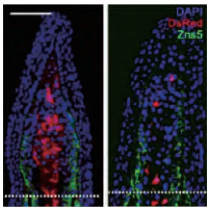
Multi-cellular organisms maintain their lives by regenerating damaged cells and tissues. In particular, fish retain high regeneration ability and regenerate fins, heart muscles, many internal organs, and even brain. We are tackling the mystery of tissues regeneration and homeostasis using zebrafish as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

Keywords regenerative biology, zebrafish, stem cell, tissue homeostasis

Development, Regeneration

Analyses by transgenic imaging, cell linage tracing, manipulation of molecular signals





Associate Professor
MASUDA, Shinji

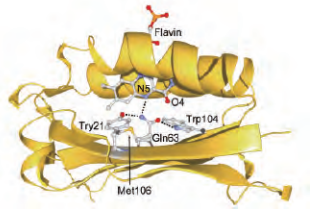
Elucidation of regulatory mechanisms of photosynthesis, chloroplast, and photoreceptor functions

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

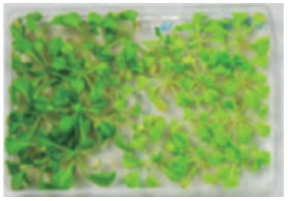
Keywords photoreceptor, chloroplast, photosynthesis, photo-oxidative stress

Photobiology

Photoreceptor protein BLUF



A photosynthesis regulatory mutant plant



Associate Professor
NIKAIDO, Masato
Assistant Professor NAGASAWA, Tatsuki

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

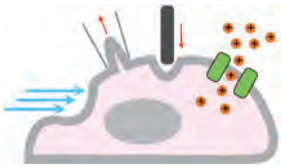
Elucidation of roles of mechanosensation in tissue development/function/disease

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.

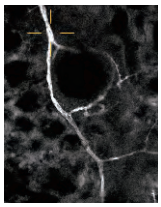
Keywords mechanosensing, PIEZO channel, live imaging, genetic engineering

Tissue function

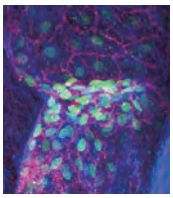
PIEZO mechanically activated channel (green)



Sensory nerve fibers in the lung



Lymphatic valve



Associate Professor
OSADA, Toshiya

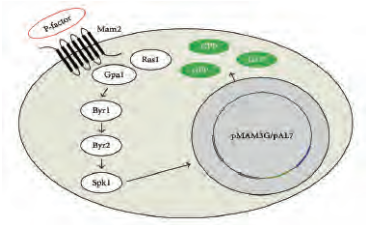
Development of olfactory receptors based chemical sensor

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
Assistant Professor HORI, Koichi

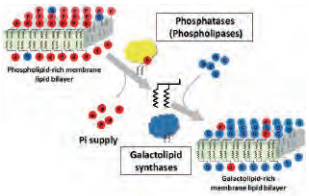
Physiological role of lipid remodeling in plants

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

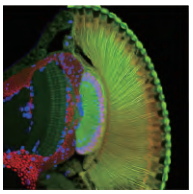
Neuronal circuit formation and its plasticity

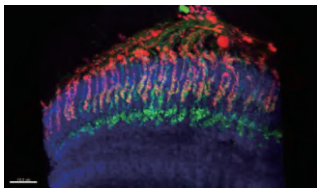
Our research goal is to elucidate the molecular mechanisms underlying neuronal circuit formation and function by means of molecular genetics.

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

Neuroscience

Fluorescence microscopy of the *Drosophila* visual system





Associate Professor
TACHIBANA, Kazunori

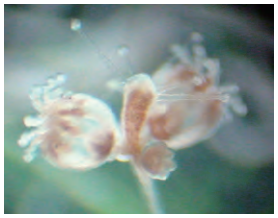
Elucidation of molecular mechanisms of spawning in jellyfish

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

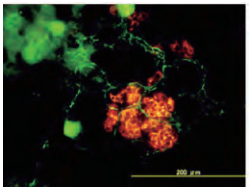
in vitro living models for animal experiment alternatives and pre-clinical studies

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

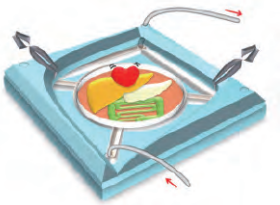
Keywords *in vitro* living model, synthetic biology, developmental engineering, regenerative medicine

Development, Regeneration

Mouse ES-derived hepatic tissue



In vitro living system



Professor
FUJII, Masaaki

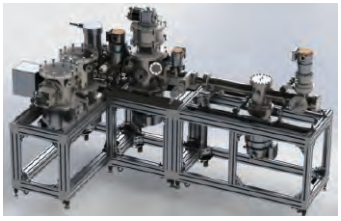
Structure and dynamics of molecules and clusters studied by advanced multicolor laser spectroscopy

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

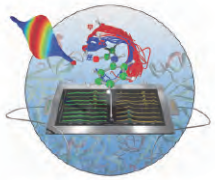
Keywords cluster, molecular recognition, solvation dynamics, proton / H atom transfer

Molecular Spectroscopy

ESI/Cold QIT laser spectrometer



Picosec. time-resolved IR spectroscopy and MD simulations



Professor
NAKAMURA, Hiroyuki

Assistant Professor
MIURA, Kazuki
MORITA, Taiki

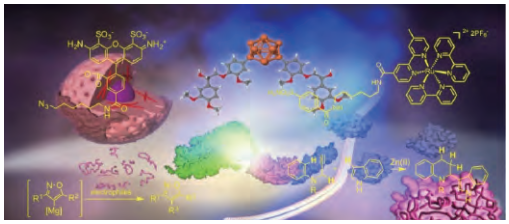
Elucidation of biological functions and drug development by organic synthesis

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

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

Bioactive compounds

Control of target protein functions by small molecules



Professor
NISHIYAMA, Nobuhiro

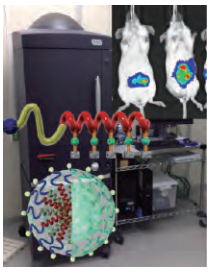
Assistant Professor
HONDA, Yuto

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.

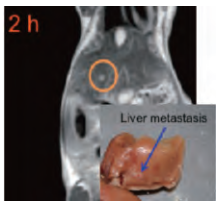
Keywords nanomedicine, DDS, polymer chemistry

Biomaterials



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

MR imaging of small metastatic tumors in liver



Associate Professor
KADONOSONO, Tetsuya

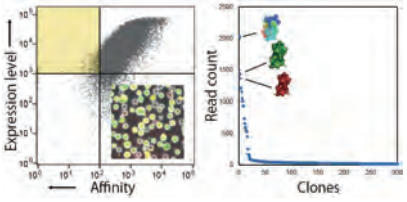
Biopharmaceuticals developed by Smart Design technology

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.

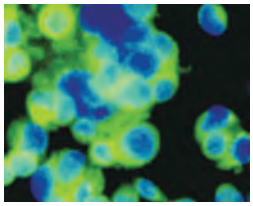
Keywords Smart design, biophramaceuticals

Protein

Cell-based library screening and NGS analysis



Detection of breast cancer cells



Associate Professor
MIURA, Yutaka

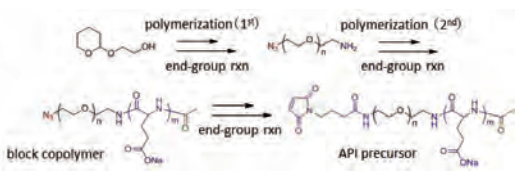
Development of novel biomaterials by using well-defined macromolecules

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

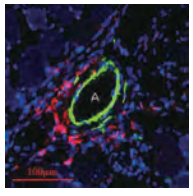
Keywords polymer, Nano-biotechnology, polymer-drug discovery, controlled release

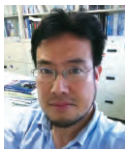
Biomaterials

Typical polymerization/reaction



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





Associate Professor
MORI, Toshiaki

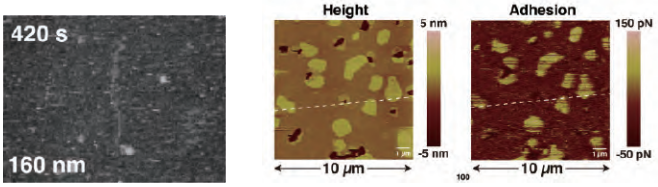
Interaction analyses of glycoconjugate on cell surface and its application for medical engineering

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

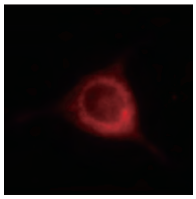
Development of new biochemistry for medical applications

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

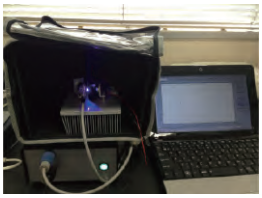
Keywords cancer diagnosis, cancer therapy, biomarker, cell physiological engineering

Bioactive compounds

Visualized cancer cells



Biomarker analytical system



Associate Professor
OKADA, Satoshi

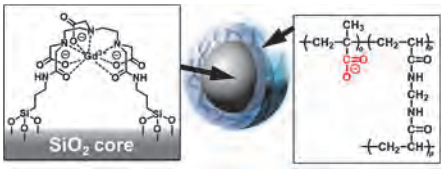
Development of functional materials for imaging and controlling biological functions

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

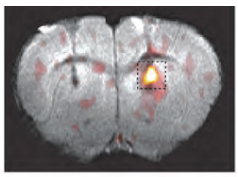
Keywords materials chemistry, chemical biology, molecular imaging

Biomaterials

pH-responsive core-shell magnetic nanoparticle



Brain Ca^{2+} imaging by MRI probes



Professor
KAJIWARA, Susumu

Assistant Professor
CHEN, Xinyue

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

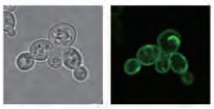
We study about applied biochemistry and molecular microbiology for medical care and environmental conservation (notably, infection, drug resistance, host response, renewal resources).

Keywords pathogen, immunity, drug discovery , renewal resources

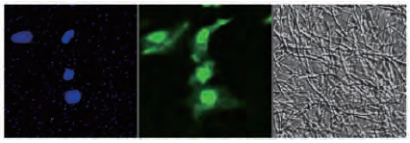
Applied Microbiology & Infection

Hemotysis of pathogenic fungus

Drug efflux pump expression



Appotosis induction of human cell by pathogenic fungus



Professor
NAKATOGAWA, Hitoshi

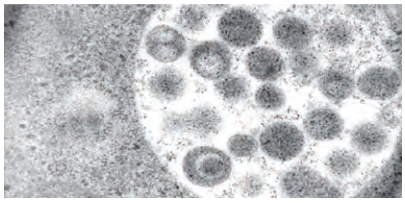
Elucidation of molecular mechanisms and physiological roles of autophagy

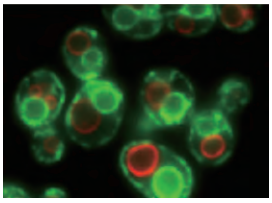
We are studying molecular basis and physiological functions of autophagy (self-eating), an intracellular bulk degradation/recycling system, using various techniques.

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

Cellular function

Electron and fluorescence microscopy of yeast cells





Professor
TANAKA, Kan

Assistant Professor
MAEDA, Kaisei

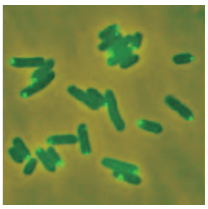
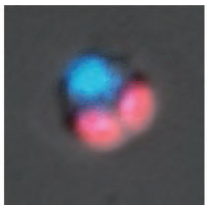
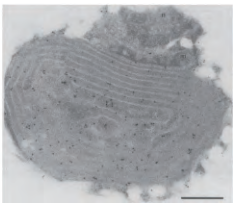
From understanding to design of cell systems

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

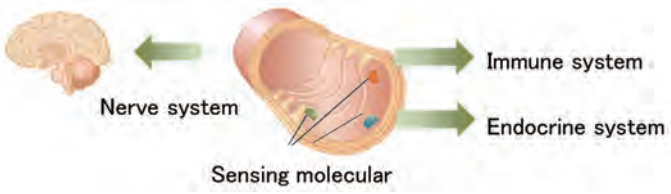
Professor
YAMAMOTO, Naoyuki

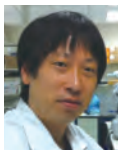
Sensing molecules and these roles in host-bacterial communications

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

Assistant Professor
ZHU, Bo
YASUDA, Takanobu

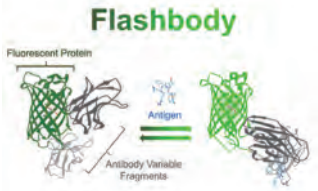
Development of genetically-encoded biosensors

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

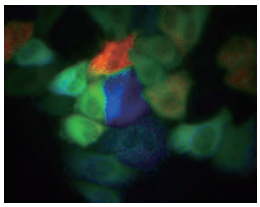
Keywords GFP, bioimaging, cell signaling

Cellular function

Schematic diagram of genetically-encoded biosensor



Fluorescence microscopy by biosensor



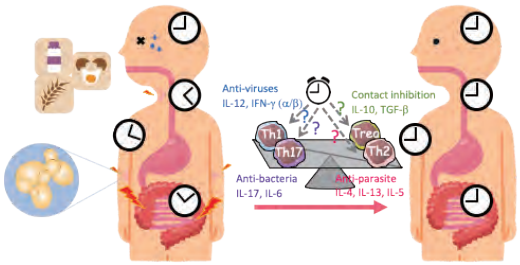
Assistant Professor
ORIHARA, Kanami

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
YOSHIDA, Keisuke

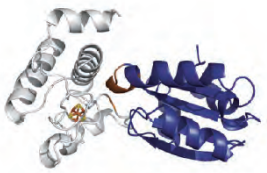
Comprehensive analyses of regulatory mechanisms of plant organelle functions

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
KOSHIKAWA, Naohiko
Assistant Professor
FUNAHASHI, Nobuaki

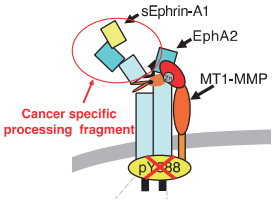
Analysis of tumor progression by extracellular proteolysis and its clinical applications

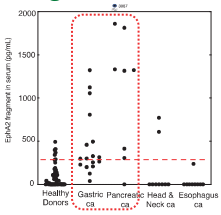
Aim of our study is to develop novel cancer diagnostics and therapeutics focusing on extracellular metalloproteases that act as a driving force of tumor malignant progression.

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

Cancer biology

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





Professor
KURODA, Kumi

Neurobiology of social affiliation

We study the neural mechanisms of affiliative social behaviors, esp. parent-infant relations in mammals, aiming to science-backed parenting support and social security.

Keywords Parental care, infant attachment, Transport Response, mouse model

Neuroscience

Neural mechanism of parental care in mammals

Associate Professor
AKAMA, Hiroyuki

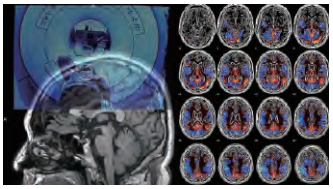
Elucidation of the neural system of human brain by MRI

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.

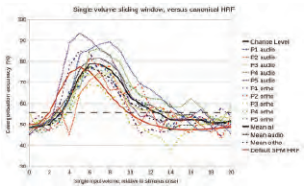
Keywords brain imaging (fMRI), machine learning (MVPA), complex networks

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

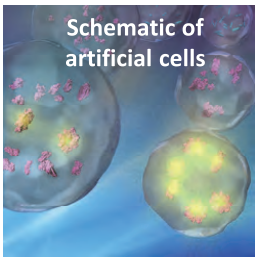
Professor
MATSUURA, Tomoaki

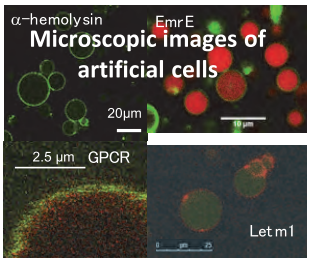
An artificial cell construction by design and evolution, and its application

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





Associate Professor
FUJISHIMA, Kosuke

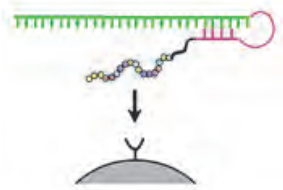
Study of RNA-peptide function for understanding the biological system

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

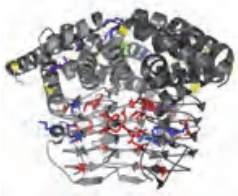
Keywords Origins of life, Directed evolution, RNA, Peptide, Astrobiology

Synthetic biology

mRNA display method to screen for functional peptides



Designing *de novo* functional enzymes



Associate Professor
MCGLYNN, Shawn

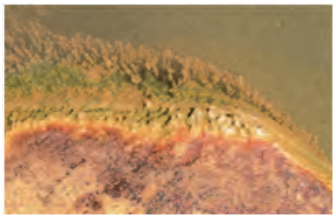
The origin and evolution of life

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)

TAKINOUE, Masahiro : DNA nanotechnology, artificial cell engineering, and molecular computing

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

(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/

B1・B2 Bldg.

J2・J3 Bldg.

S2 Bldg.

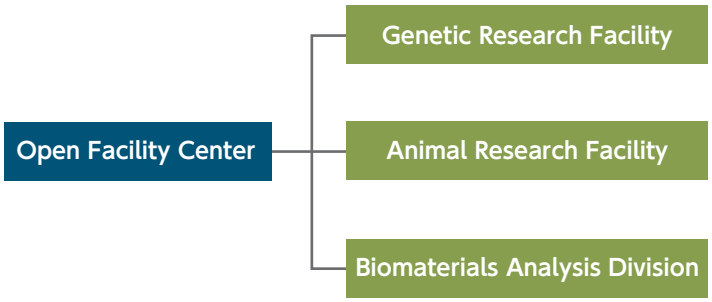
R1 Bldg.

M6 Bldg.

In April 2023, the reorganisation into Integrative Bioscience Center will be implemented.

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.

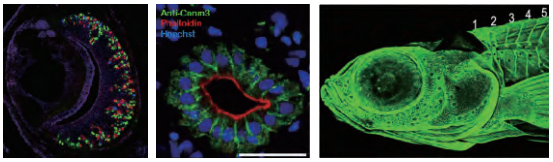


Genetic Research Facility

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

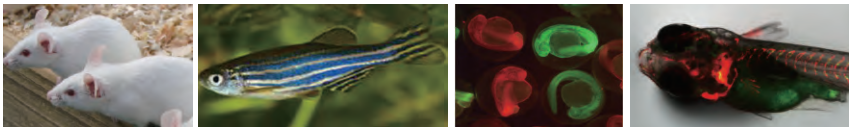
DNA sequencer, Transmission electron microscope, Scanning electron microscope, Inverted confocal microscope, Upright confocal microscope, Light microscope, Zoom microscope



Animal Research Facility

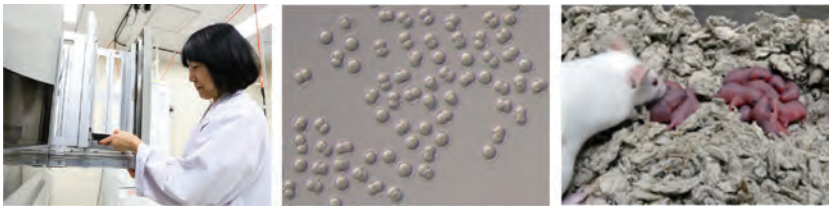
1) Maintains and manages animal facilities
2) Provides equipment for animal experiments
3) Facilitates higher research and education

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



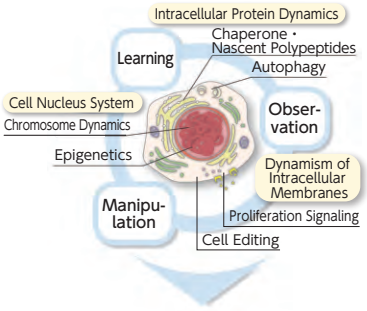
Cell Biology Center

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 Director Yoshinori Ohsumi, and Prof. Hiroshi Iwasaki, Prof. Hiroshi Kimura, Prof. Masayuki Komada, Prof. Hideki Taguchi, Prof. Hitoshi Nakatogawa, Assoc. Prof. Fumi Kano, Assoc. Prof. Naonobu Fujita, Assist. Prof. Alexander I May, Assist. Prof. Toshiaki Fukushima, Assist. Prof. Tomoko Horie, Assist. Prof. Daiki Nakatsu, Assist. Prof. Tatsuya Niwa, Assist. Prof. Yuko Sato, Assist. Prof. Hideo Tsubouchi.



Elucidating the phenomena underlying life on a cellular level

Contribution to human health and the treatment of disease through interdependent investigations

Honorary Professor

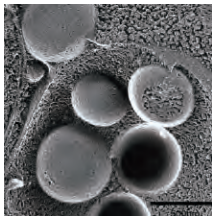
OHSUMI, Yoshinori

Keywaords yeast, autophagy, vacuole, starvation, growth control

Cellular Function

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.



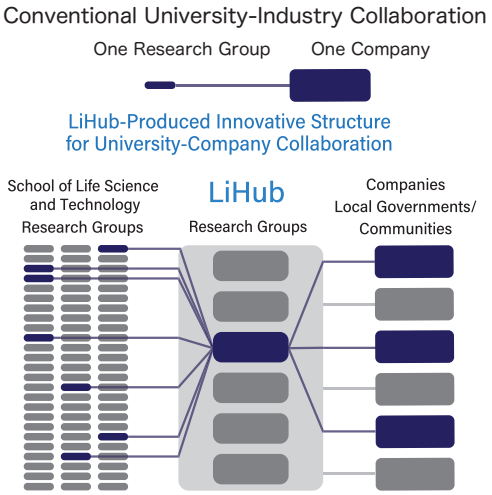
Autophagosome by microscopy

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, we have research groups that have already created communities for smooth academia-industry interactions, each of which is composed of 3-10 members of our faculties and specialized by one particular cutting-edge field such as biomaterial, biomatrix, bio-sustainable science, brain-environment interface, photosynthetic science, drug development and cancer research. 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



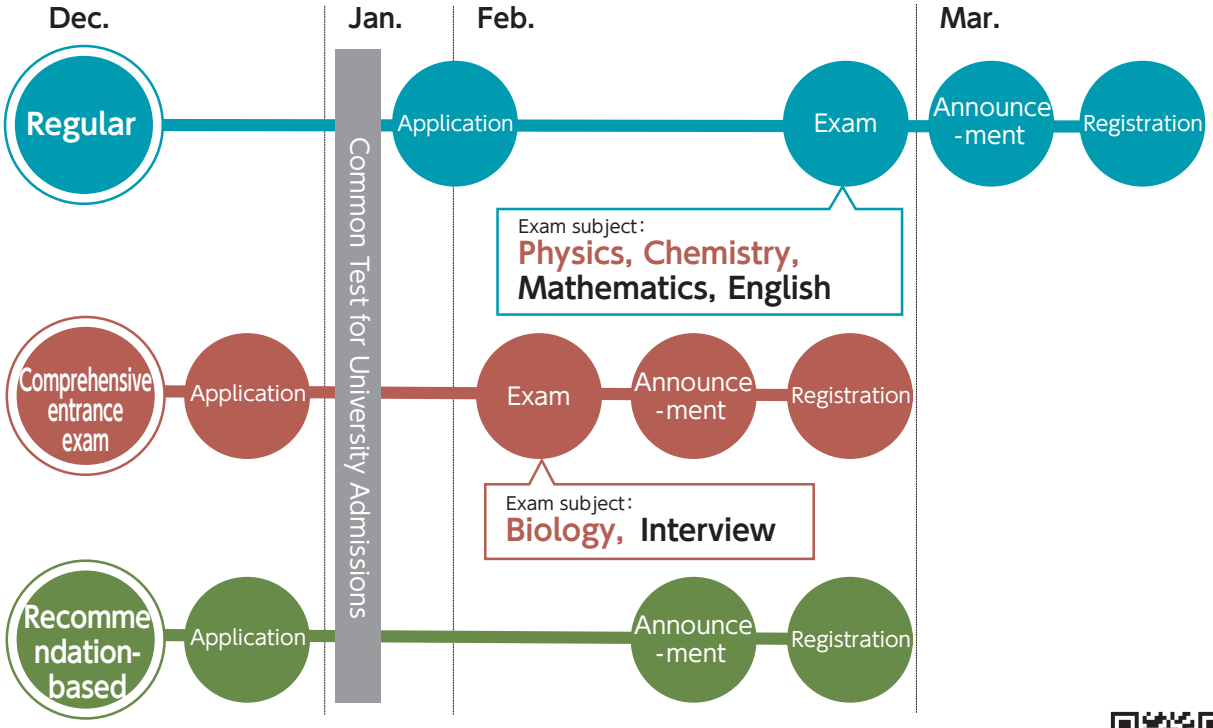
Open Research Facilities for Life Science and Technology

Our school operates the Open Research Facilities for Life Science and Technology, which consists of the Shimadzu Corporation Precision Analytical Instruments Room, biomolecular analysis facility, synbio foundry, shared organic synthesis laboratory, cell and protein analysis facility, ultracentrifuge facility, cold room, bioimaging facility, aquatic animal laboratory, microbial culture room, and shared laboratory and office spaces. In 2022, the nuclear magnetic resonance spectrometer was upgraded to the latest model, and we are promoting the enhancement of these open research facilities by installing new equipment. In addition, we established "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.

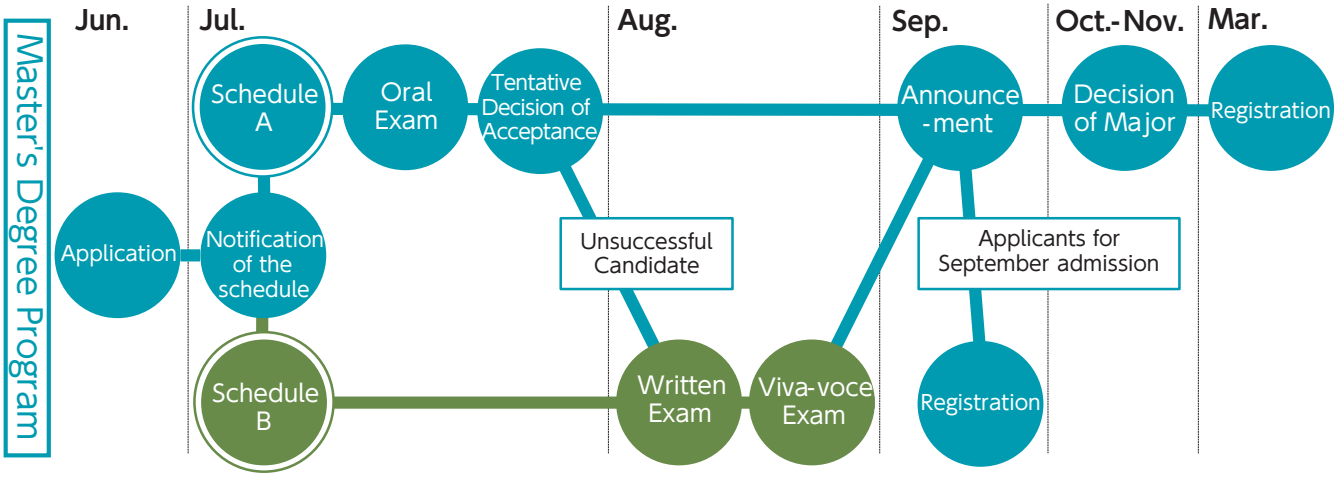
Schedule for Admission

Undergraduate School	Capacity	Examination Category			
		Regular	Comprehensive entrance exam	Recommendation-based	
	150	105	15	15 (General quota)	15 (Female-only quota)



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

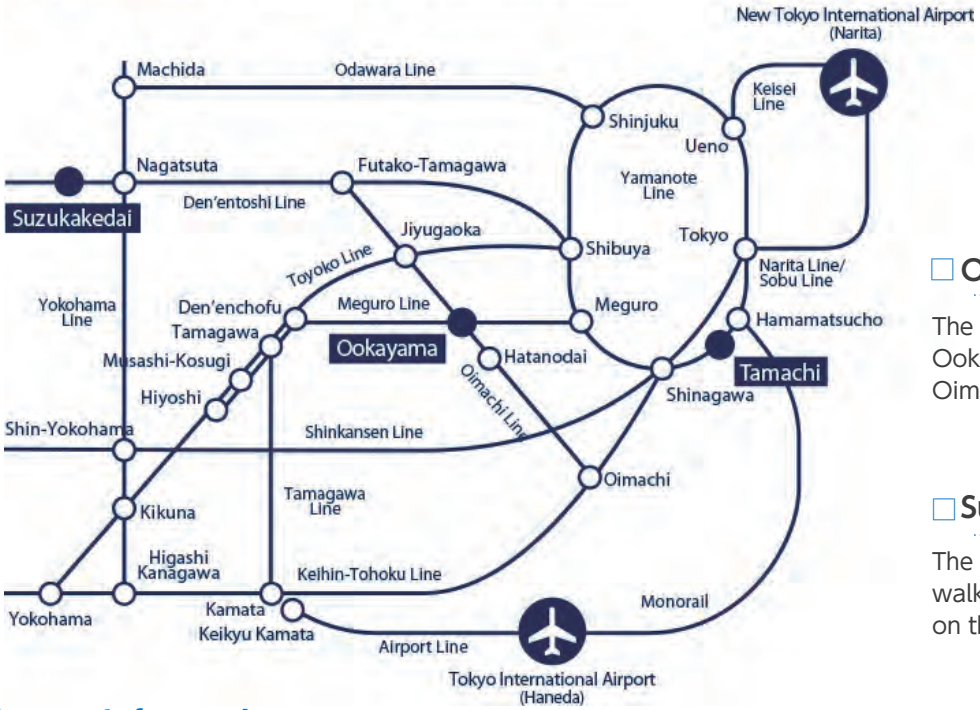
Graduate School	Capacity
	Master : 168 Doctor : 52



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

Tokyo Institute of Technology
School of Life Science and Technology

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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