

Invitation to Life Science and Technology



Tokyo Institute of Technology
School of Life Science and Technology

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



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Greetings from the Dean

Professor KONDOH, Shinae, Dean



Invitation to the School of Life Science and Technology

The School of Life Science and Technology is the largest science and engineering research and educational institution in Japan, with over 120 faculty members who teach specialized subjects while promoting about 70 independent research fields. We not only conduct research and studies in a great variety of fields, but we also strive to create an advanced research and education environment rich in diversity. Our School has the highest number of female students at Tokyo Tech as well as a rising number of international students, with programs seeking excellent scholars from all over the world and promoting international student exchange. We have created a global environment via collaboration with research institutions worldwide, such as faculty exchange programs and inviting professors from the world's top universities to be guest lecturers. Furthermore, the study of bioethics and research ethics as well as self-evaluation have been incorporated into each of the bachelor's and graduate programs to encourage the development of high ethical standards.

Our undergraduate course curricula are designed to enable the systematic study of physical chemistry, organic chemistry, biochemistry, and molecular biology, which are necessary for learning about life science technology. To provide students with the opportunity to gain knowledge a wide range of specialized fields, Tokyo Tech established in 2001 a multidisciplinary course in collaboration with Tokyo Medical and Dental University, Hitotsubashi University, and Tokyo University of Foreign Studies. Students further their understanding of research by taking courses such as the Comprehensive Life Sciences Course and Medical Engineering Course. In order to develop human resources that contribute to the global society, a goal emphasized in the educational reform of 2016, Tokyo Tech offers a variety of study abroad programs starting at the undergraduate level. Many of our bachelor, master's, and PhD students have participated in study-abroad programs.

Our graduate programs focus on developing global human resources with specialized knowledge by offering career courses that include lectures taught by specially-invited professors from world-class universities who have experience in Europe and the United States. In addition, since 2016, we have been providing an interdisciplinary graduate major called "Human Centered Science and Biomedical Engineering" in coordination with the departments of Mechanical Engineering, Electrical and Electronic Engineering, Information and Communications Engineering, Materials Science and Engineering, and Chemical Science and Engineering. We thereby aim to nurture individuals – through research exchange and studies with students of other schools – who can engage in the latest cross-disciplinary research developments. We have also started entrepreneurship training classes in 2019 to train students to actively contribute to new industrial developments and ultimately become valuable global human resources who are flexible thinkers, can respond to the needs of diversifying societies, and can discover and create new things with a vigorous curiosity.

To strengthen the partnership between industry and academia, we launched the Life Science and Technology Open Innovation Hub (LiHub), which serves as a knowledge hub for innovations in the field. We will continue taking initiatives regarding fundamental and applied research in the areas of life sciences and technology.

Associate
Deans

Planning Prof. MARUYAMA, Atsushi

Education Prof. HONGO, Yuichi

Research Prof. YAMAGUCHI, Yuki

International
Affairs Prof. KOBATAKE, Eiry

Councilor

Prof. WACHI, Masaaki

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



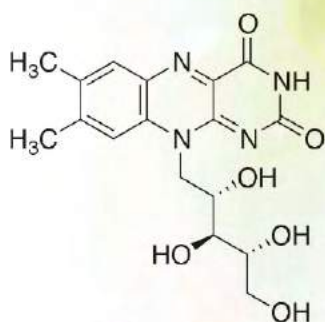
1929	Foundation of the Tokyo Institute of Technology
June 1990	Foundation of the School of Bioscience and Biotechnology
April 1992	Foundation of the Graduate School of Bioscience and Biotechnology
Autumn 1993	Establishment of the Gene Research Center
March 1997	Establishment of the Research Center for 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

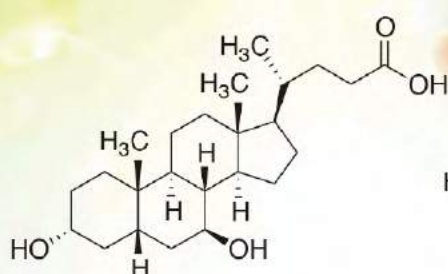


Tokyo Tech successfully created vitamin B2 by hand for the first time, thereby making industrial production possible. In addition, a drug for improving liver function, Urso, and an antiviral drug, Arasena, were also synthesized at Tokyo Tech.

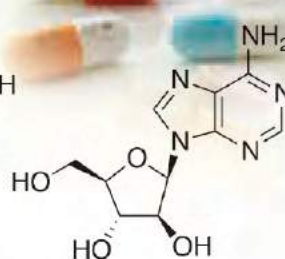
Furthermore, a group of Tokyo Tech researchers discovered alkaline enzymes, which led to the development of enzyme-containing detergents. Based on this pioneering research, Tokyo Tech established the School of Bioscience and Biotechnology, which was Japan's first interdisciplinary school of life science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

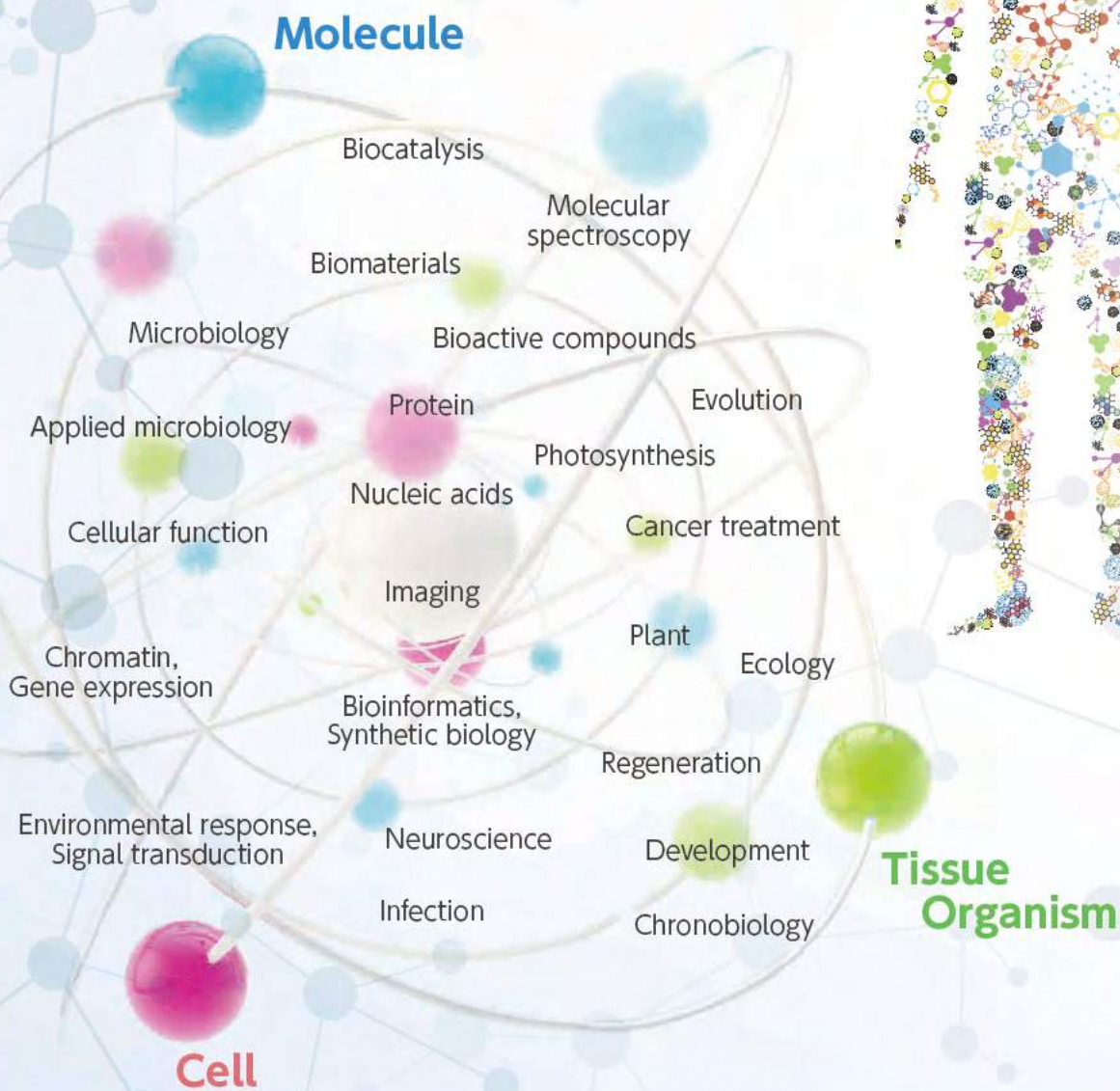
Science is a human activity that is built on a body of knowledge obtained over many generations. Therefore, it is impossible to separate scientists from the age in which they live. I am an example of this, having drawn inspiration from the scientific developments of my time and my own personal experiences 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.



School of Life Science and Technology

The School is actively engaged in a wide spectrum of research that covers the life sciences from the micro to the macro and from the basics to cutting-edge applications.



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

Faculty Members List

<Life Science and Technology>

<Human Centered Science and Biomedical Engineering>

NAME	FIELD	Room No.	PAGE
Professor			
FUKUI, Toshiaki	C S	B1-913	12
HONGO, Yuichi	T	W3-706	16
ICHINOSE, Hiroshi	T S	B2-820	16
ISHII, Yoshitaka	M S	J3-814	8
ITOH, Takehiko	C M	M6-202C	12
IWASAKI, Hiroshi	C S	S2-303	12
KAMACHI, Toshiaki	C M	M6-301A	12
KIMURA, Hiroshi	C S	S2-506	13
KINBARA, Kazushi	M S	B2-1120	8
KITAO, Akio	M M	M6-201C	8
KOBATAKE, Eiry	M S	G1-314	8
KOMADA, Masayuki	C S	S2-502	13
KUME, Shoen	T S	B1-812	16
MARUYAMA, Atsushi	M S	B2-1220	8
MIHARA, Hisakazu	M S	B1-801	9
MURAKAMI, Satoshi	M S	J2-904	9
OHTA, Hiroyuki	T S	B2-330	16
TAGUCHI, Hideki	M S	S2-602	9
TOKUNAGA, Makio	C S	B1-511	13
UENO, Takafumi	M S	B2-1034	9
URABE, Hirokazu	M S	B2-1131	9
WACHI, Masaaki	C S	J2-1003	13
YAMAGUCHI, Yuki	C S	B2-1231	13
YUASA, Hideya	M S	J2-803	10
Visiting Professor			
FUSE, Shinichiro	M S	R1-916	10

Research Field

M : Molecule

C : Cell

T : Tissue, Organism

NAME	FIELD	Room No.	PAGE
Associate Professor			
AIZAWA, Yasunori	C S	B1-501	14
ASAKURA, Noriyuki	M M	M6-301C	10
FUJIE, Toshinori	M S	B2-1022	10
FUJITA, Naonobu	C S	S2-2F	14
HATA, Takeshi	M S	B2-1127	10
HAYASHI, Nobuhiro	M M	M6-302C	11
HIRASAWA, Takashi	C S	J2-1109	14
HIROTA, Junji	T S	B-C-203	17
HOSHINO, Ayuko	T S		17
KAJIKAWA, Masaki	C S	B2-939	14
KANO, Fumi	C S	S2-609	14
KATO, Akira	C S	B2-522	15
KAWAKAMI, Atsushi	T S	B1-603	17
MASUDA, Shinji	T S	B-B-305	17
MATSUDA, Tomoko	M S	J3-913	11
MIE, Masayasu	M S	G1-316	11
NAKAMURA, Nobuhiro	C S	B2-720	15
NAKATOGAWA, Hitoshi	C S	B2-928	15
NIKAI, Masato	T	W3-612	17
OHKUBO, Akihiro	M S	J3-815	11
OSADA, Toshiya	T S	B2-921	18
SEIO, Kohji	M S	J2-806	11
SHIMOJIMA, Mie	T S	B2-330	18
SHIRAKI, Nobuaki	C S	B1-810	15
SUZUKI, Takashi	T S	B2-534	18
TACHIBANA, Kazunori	T S	B2-835	18
TAGAWA, Yoh-ichi	T S	B2-1221	18
TANAKA, Mikiko	T S	B1-715	19
TSUTSUMI, Hiroshi	M S	B1-802	12
YAMADA, Takuji	C M	M6-201A	15
YATSUNAMI, Rie	C S	J2-908	16

NAME	FIELD	Room No.	PAGE
Professor			
FUJII, Masaaki	M S	R1-312	19
HISABORI, Toru	C S	R1A-209	21
KONDOH, Shinae	T S	B2-521	22
KOSHIKAWA, Naohiko	T S		22
NAKAMURA, Hiroyuki	M S	R1-914	19
NISHIYAMA, Nobuhiro	M S	R1-812	19
TANAKA, Kan	C S	R1-814	21
UEDA, Hiroshi	M S	R1-614	19
YAMAMOTO, Naoyuki	C S	J3-1014	21
Visiting Professor			
KAJIWARA, Susumu	C S	J3-1018	21
Associate Professor			
AKAMA, Hiroyuki	T	W9-614	22
IMAMURA, Sousuke	T S	R1-816	23
ISHIUCHI, Shun-ichi	M S	R1-316	20
KITAGUCHI, Tetsuya	C S	R1-616	21
MIURA, Yutaka	M S	R1-810	20
MIYASHITA, Eizo	T S	G3-1114	23
MORI, Toshiaki	M S	B2-1121	20
OGURA, Shun-ichiro	M S	B1-702	20
ORIHARA, Kanami	C S	J3-1018	22
WAKABAYASHI, Ken-ichi	C S	R1A-215	22
Assistant Professor			
KADONOSONO, Tetsuya	M S	B2-421A	20

Facility Name

S Suzukakedai Campus

① B1 Bldg.

② B2 Bldg.

③ B-A (B1-B2 Annex A)

④ B-B (B1-B2 Annex B)

⑤ B-C (B1-B2 Annex C)

⑥ J2 Bldg.

⑦ J3 Bldg.

⑧ G1 Bldg.

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

M Midorigaoka Area

⑯ Midorigaoka Bldg. 6

Suzukakedai Campus



Ookayama Campus





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

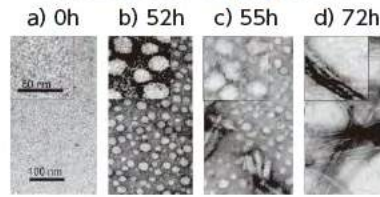
Structural biology of amyloid and molecular mechanism of Alzheimer's

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

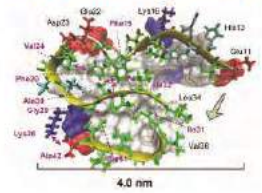
Keywords Amyloid, structural biology, solid-state NMR, carbon nanomaterials

Protein

Time-resolved electron micrograph of Alzheimer's Aβ protein



First atomic model of Aβ42 fibril by SSNMR



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

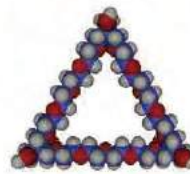
Developing functional molecules inspired by biological systems

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

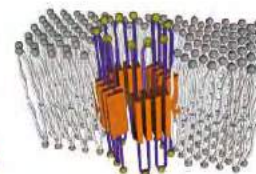
Keywords organic chemistry, molecular devices, self assembly, biomimetics

Biomaterials

Structured PEG



Ion channel



Photoactive protein



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

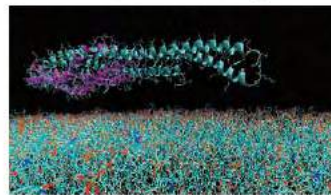
Observing Biological Phenomena by Computer

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

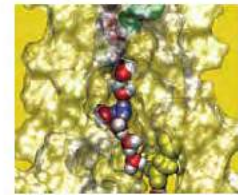
Keywords Protein Dynamics, Computational Biology, Biophysics, Computational Chemistry

Computational Biology

Membrane deformation simulation induced by I-BAR



Proton transfer through flagellar motor



Professor **KOBATAKE, Eiry** | Assistant Professor **MASHIMO, Yasumasa**

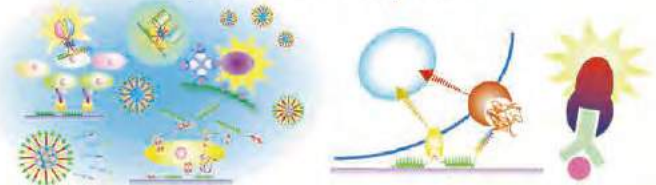
Construction of super biofunctional protein materials

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

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

Biomaterials

Construction and application of super biofunctional proteins



Professor **MARUYAMA, Atsushi** | Assistant Professor **SHIMADA, Naohiko**

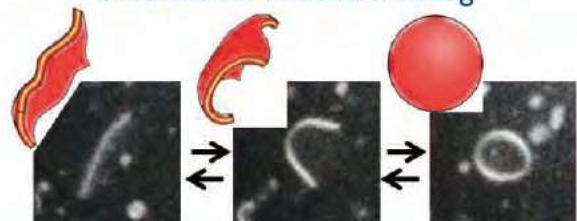
Design of bio-functional and bio-conjugate materials

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

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

Biomaterials

Control of bio-membrane folding





Professor
MIHARA, Hisakazu Assistant Professor
MIKI, Takayuki

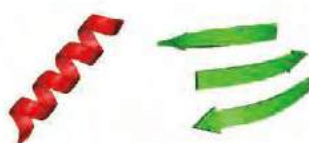
Peptide engineering and chemical biology

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

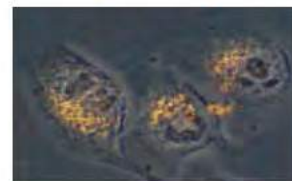
Keywords peptide, synthesis, phage-display library, cell analysis

Biomaterials

Design of functional peptides



Drug delivery by peptide-gold nanoparticle hybrids



Professor
MURAKAMI, Satoshi Assistant Professor
OKADA, Ui

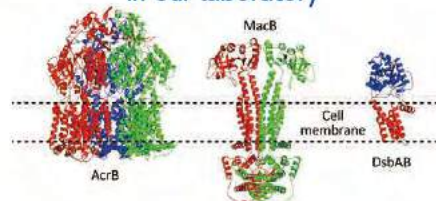
Structure and molecular mechanism of membrane protein complex

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

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

Protein

Crystal structures of membrane protein solved in our laboratory



Professor
TAGUCHI, Hideki Assistant Professor
NIWA, Tatsuya

Elucidation of molecular mechanisms of chaperone and prion/amyloid

We are studying molecular mechanism of chaperones and protein aggregates such as yeast prions/amyloids.

Keywords protein, chaperone, prion, amyloid

Protein

"unboiled" egg with chaperone



Yeast prion fibrils



Professor
UENO, Takafumi Assistant Professor
ABE, Satoshi

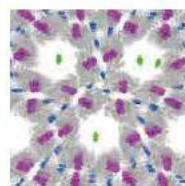
Development of artificial enzymes and biosupramolecular materials

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

Keywords protein engineering, bioinorganic chemistry, chemical biology

Biomaterials

Functionalized protein crystal and artificial needle protein



Professor
URABE, Hirokazu Assistant Professor
SHIGETA, Masayuki

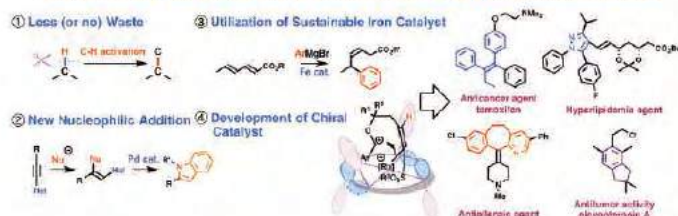
Organic chemistry – The area leading biosciences

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

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

Bioactive compounds

Chemical synthesis of biomolecules and pharmaceuticals





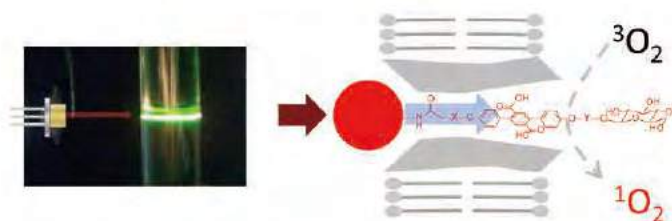
Professor
YUASA, Hideya | Assistant Professor
KANAMORI, Takashi

Photosensitizers and photodynamic therapy of cancer

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

Keywords photodynamic therapy, photosensitizer, lanthanide nanoparticle

Bioactive compounds



Visiting Professor
FUSE, Shinichiro

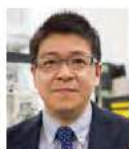
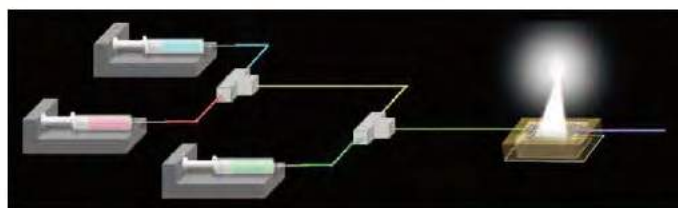
Natural product synthesis & micro-flow synthesis for drug discovery

We develop efficient synthetic methodology of bioactive natural products using micro-flow technology toward drug discovery.

Keywords natural product synthesis, micro-flow synthesis, medicinal chemistry

Bioactive compounds

Efficient micro-flow synthesis of natural products



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

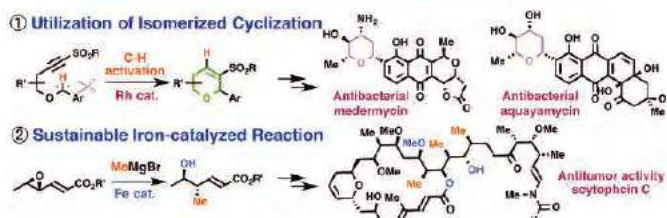
Synthesis of bioactive compounds by sustainable molecular transformation

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





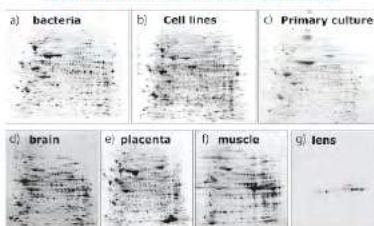
Associate Professor
HAYASHI, Nobuhiro

Elucidation of something unknown of the life through high performance proteomics

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

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

2D-PAGE of some tissues



Protein

Image of future healthcare society



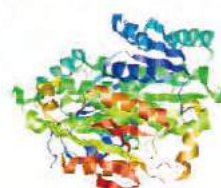
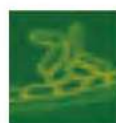
Associate Professor
MATSUDA, Tomoko

Organic synthesis by enzymes

We have been using enzymes as a catalyst and CO₂ as a solvent for organic synthesis to promote green chemistry.

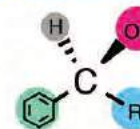
Keywords enzyme, organic synthesis, CO₂, green chemistry

Microorganism with useful enzymes as catalysts



Biocatalysis

Optically pure compounds for intermediates of pharmaceuticals



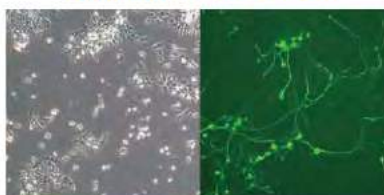
Associate Professor
MIE, Masayasu

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.

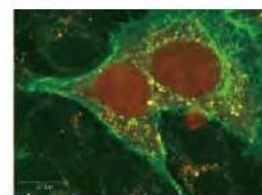
Keywords biomaterials, protein engineering, cellular engineering

Induction of neural differentiation by protein transduction



Biomaterials

Bioimaging with engineered protein tag



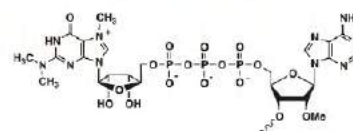
Associate Professor
OHKUBO, Akihiro

Development of new nucleic acid drugs for gene therapy

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

Keywords bioorganic chemistry, nucleic acid chemistry, nucleic acid drugs

Nucleic acid drugs for accurate regulation of biochemical reactions



Bioactive compounds



Associate Professor
SEIO, Kohji

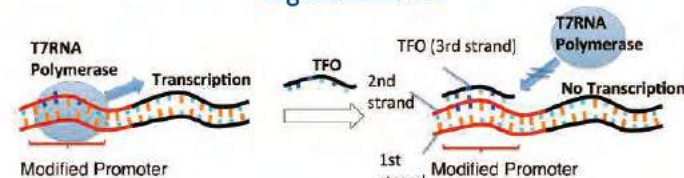
Assistant Professor
MASAKI, Yoshiaki

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

Transcription regulation by triplex forming oligonucleotides





Associate Professor
TSUTSUMI, Hiroshi

Control and Analysis of Cell Environment based on Chemical Biology

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

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

Supramolecular hydrogel



Biomaterials

Cell culture using supramolecular hydrogels



Professor
FUKUI, Toshiaki

Analyses and engineering of microbes for production of useful compounds

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

Assistant Professor
ORITA, Izumi

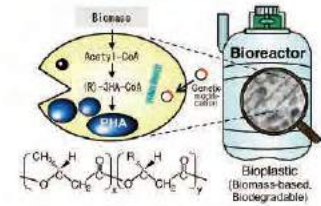
Keywords bacteria/archaea, metabolic engineering, hyperthermophiles, bioplastic-producing bacteria

Hyperthermophilic archaeon



Microbiology

Bioplastic-producing bacterium



Professor
ITOH, Takehiko

Elucidation of biological phenomenon using NGS and bioinformatics

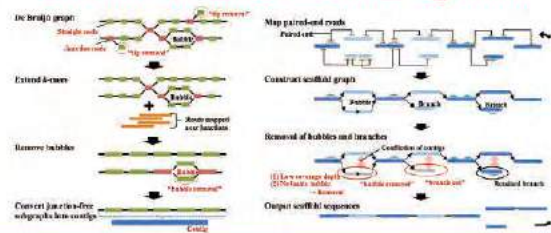
We are studying biological phenomenon, using next generation sequencer and various computational bioinformatics techniques.

Assistant Professor
KAJITANI, Rei

Keywords genome informatics, chromosome dynamics

Bioinformatics

Overview of Platanus assembler algorithm



Professor
IWASAKI, Hiroshi

Temporospatial regulation of chromosome dynamics

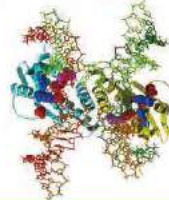
We are studying the molecular basis that underlies temporospatial regulation of chromosome dynamics through various techniques. In particular, we focus on the process of homologous recombination and mating type switching in fission yeast.

Assistant Professor
TSUBOUCHI, Hideo

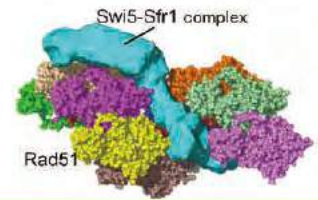
Keywords chromosome biology, homologous recombination, DNA repair, genome integrity

Chromatin, Gene expression

A model for RuvC and Holliday junction



A model for Rad51 filament and Swi5-Sfr1 complex



Professor
KAMACHI, Toshiaki

Elucidation and application of metal ions in biological system

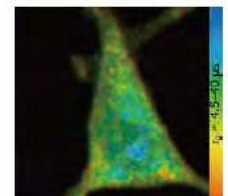
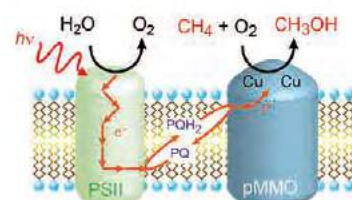
We are studying transduction of light energy into chemical energy by metalloenzyme and elucidation of oxygen dynamics inside a single cell.

Assistant Professor
ITO, Hidehiro

Keywords metalloenzyme, oxygen imaging, energy transduction

Microbiology

Light energy transduction and oxygen imaging of cell



Life Science and Technology

Molecule

Cell

Tissue, Organism



Professor
KIMURA, Hiroshi

Assistant Professor
NISHIHARA, Hidenori
SATO, Yuko

In vivo regulation of epigenetic dynamics

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

Keywords epigenetics, cell nucleus, transcription, live cell imaging

Chromatin,
Gene expression



Localization of various histone modifications



Professor
KOMADA, Masayuki

Assistant Professor
FUKUSHIMA, Toshiaki

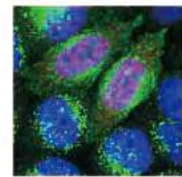
Regulation of cell proliferation by growth factor receptor downregulation

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

Keywords cancer, tumor, growth factor receptor, ubiquitin

Cellular function

USP8 mutation in pituitary tumor in Cushing's disease



Professor
TOKUNAGA, Makio

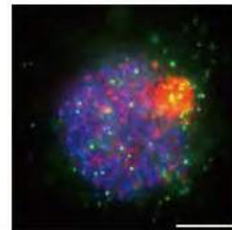
Assistant Professor
ITO, Yuma

Visualization and quantitation of cellular mechanisms

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

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

Cellular function



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

5 μm



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.

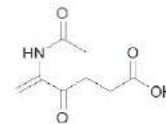
Keywords *E. coli*, cell division, metabolism, antibiotics, *Corynebacterium glutamicum*

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

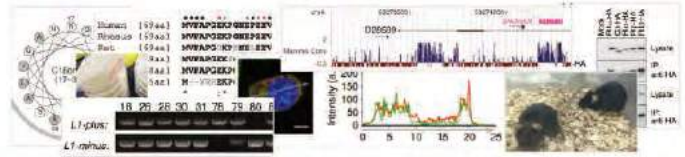
Elucidation of sequence-function relationship in the human genome

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

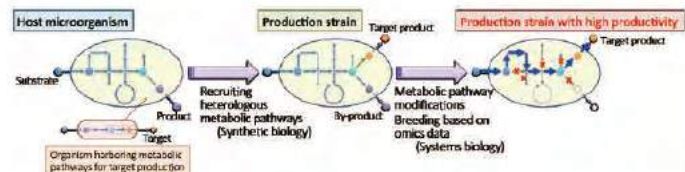
Metabolic engineering toward bioproduction of useful materials

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

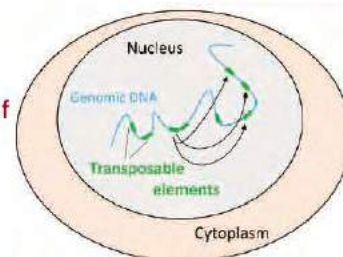
Are transposable elements alive?

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

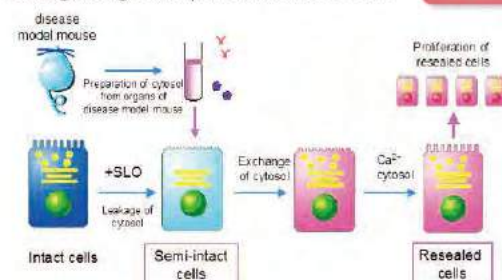
Assistant Professor
NAKATSU, Daiki

Cell-editing technology based on cell-resealing technique

Kano lab is devoted to the development of "Cell-editing technology" to design functions and fate of cells by using "cell-resealing technique", a novel method to introduce molecules into cells.

Keywords cell-resealing technique/ cell editing/image analysis/human iPSCs

Cellular function



Scheme of cell-resealing technique



Associate Professor
KATO, Akira

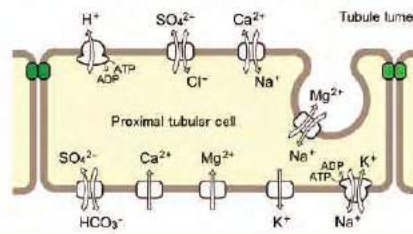
Epithelial mechanisms responsible for environmental adaptation

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

Keywords electrophysiology, molecular physiology, cell biology, comparative genomics

Cellular function

Renal excretion of divalent ions in marine teleost



Associate Professor
NAKAMURA, Nobuhiro

Regulatory mechanism of cell and tissue shape and function

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

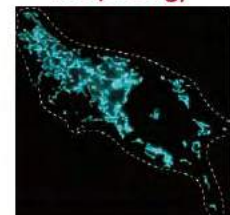
Keywords receptor, signal transduction, knockout mice, ubiquitin

Cellular function

Abnormal lung morphology in knockout mice



Mitochondrial morphology



Associate Professor
NAKATOGAWA, Hitoshi

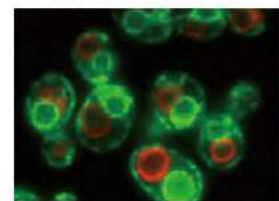
Elucidation of molecular mechanisms and physiological roles of autophagy

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

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

Cellular function

Electron and fluorescence microscopy of yeast cells



Associate Professor
SHIRAKI, Nobuaki

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

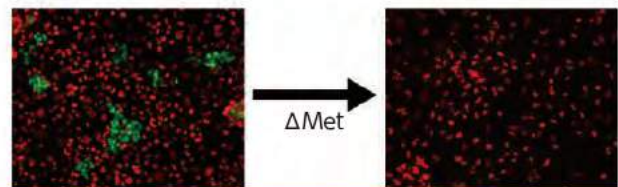
We are studying the role of amino acid metabolism in maintenance and differentiation of stem cells and its application for ES/iPS cell endoderm differentiation.

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

Cellular function

Methionine deprivation induced cell death only in undifferentiated cells

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



Associate Professor
YAMADA, Takuji

Big data for human gut microbiome

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

Keywords gut microbiome, metagenome, metabolic pathway, bioinformatics

Bioinformatics, Synthetic biology

Data for human gut microbiomes





Associate Professor
YATSUNAMI, Rie

Extremophiles and extremozymes have limitless possibilities !

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

Keywords protein engineering, metabolic engineering, extremophiles, extremozymes

Microbiology



AFM image of triangular disk-shaped halophilic archaeon



Professor
HONGOH, Yuichi Assistant Professor
KUWAHARA, Hirokazu

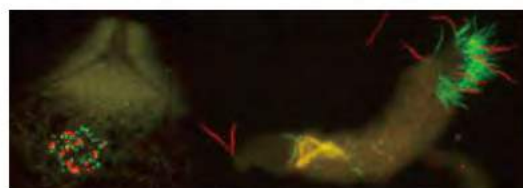
Molecular ecology and genome evolution of symbiotic systems

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

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

Microbial Ecology

Termite-gut protists and their symbiotic bacteria



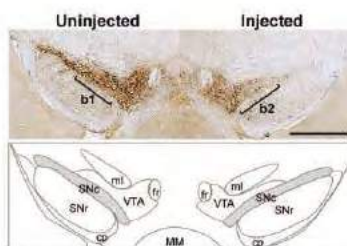
Professor
ICHINOSE, Hiroshi Assistant Professor
HARA, Satoshi

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

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

Keywords dopamine, Parkinson's disease, biomarker

Neurochemistry



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



Professor
KUME, Shoen Assistant Professor
SAKANO, Daisuke

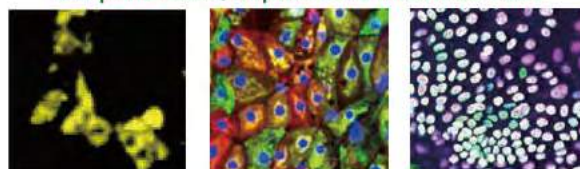
Modeling organ development and homeostasis using human iPS cells

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

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

Development, Regeneration

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



Professor
OHTA, Hiroyuki Assistant Professor
HORI, Koichi

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

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

Keywords microalgae, plants, stress response, oil, bioenergy

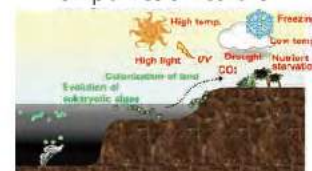
Plant, Microbiology

Oleaginous alga *Nannochloropsis*



Studies on colonization of land by plants

How plant colonized land?





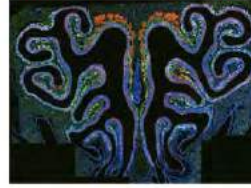
Associate Professor
HIROTA, Junji | Assistant Professor
NAGASHIMA, Ayumi

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

Visualization of neurons in the main olfactory epithelium



Neuroscience

Artificial chromosome & genome editing



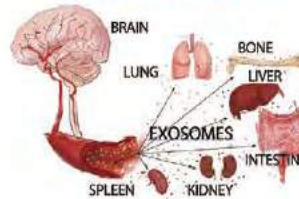
Associate Professor
HOSHINO, Ayuko

Exosomes in Disease Etiology and Detection

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

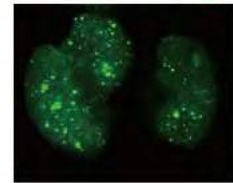
Keywords Molecular Biology of Disease, Cancer Metastasis, Neurological Disorder, Maternal-Infant Interaction

Exosomes as organ to organ communication tool



Exosomes

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



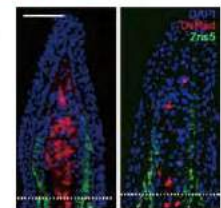
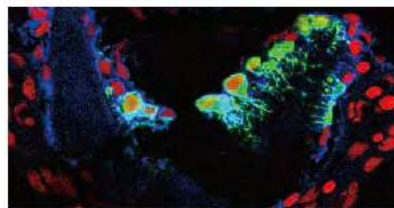
Associate Professor
KAWAKAMI, Atsushi

Cellular and molecular mechanism of tissue regeneration

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

Keywords regenerative biology, zebrafish, stem cell, tissue homeostasis

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



Development, Regeneration



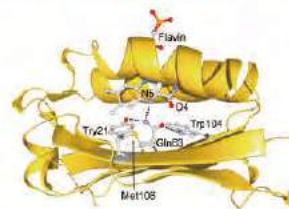
Associate Professor
MASUDA, Shinji

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

Photoreceptor protein BLUF



Photobiology

A photosynthesis regulatory mutant plant



Associate Professor
NIKAIIDO, Masato

Understanding the molecular mechanism of adaptive and parallel evolution

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

Keywords evolutionary biology, pheromone, cichlids, mammals

Parallel evolution from hairs to spines (hedgehogs and tenrecs)



Evolution, Ecology

Enlarged lip (cichlids)



Life Science and Technology

Molecule

Cell

Tissue, Organism



Associate Professor
OSADA, Toshiya

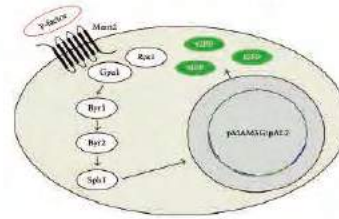
Development of olfactory receptors based chemical sensor

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

Keywords olfactory receptor, pheromone, fission yeast, sensor

Neuroscience

The ligand assay



Associate Professor
SHIMOJIMA, Mie

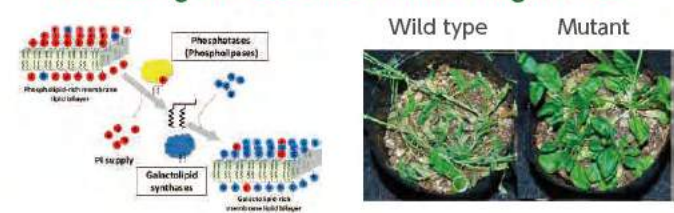
Physiological role of lipid remodeling in plants

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

Keywords plant, lipid, oil, stress response

Plant

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



Associate Professor
SUZUKI, Takashi

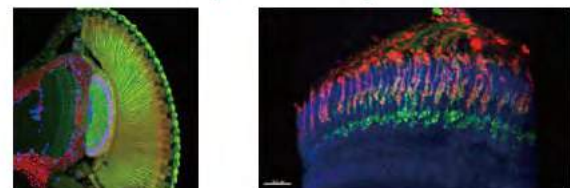
Neuronal circuit formation and its plasticity

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

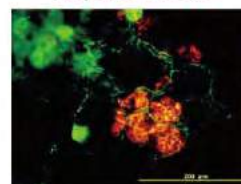
***in vitro* living models for animal experiment alternatives and pre-clinical studies**

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**





Associate Professor
TANAKA, Mikiko

Developmental basis of the evolution of vertebrate morphology

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

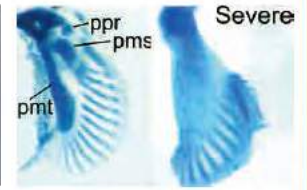
Keywords evolutionary developmental biology

MafB is controlled by BMP in limb bud



Development

Control and "posteriorized" shark fin



Professor
FUJII, Masaaki

Assistant Professor
HIRATA, Keisuke

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

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

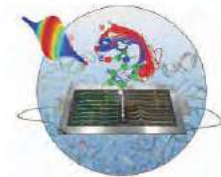
Keywords cluster, molecular recognition, solvation dynamics, proton / H atom transfer

ESI/Cold QIT laser spectrometer



Molecular Spectroscopy

Picosec. time-resolved IR spectroscopy and MD simulations



Professor
NAKAMURA, Hiroyuki

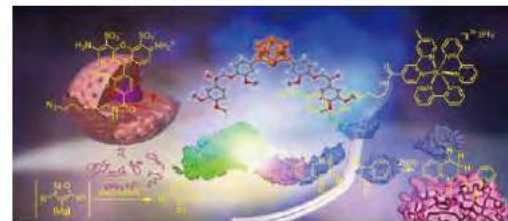
Assistant Professor
SATO, Shinichi

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

Control of target protein functions by small molecules



Bioactive compounds



Professor
NISHIYAMA, Nobuhiro

Assistant Professor
TAKEMOTO, Hiroyasu
NOMOTO, Takahiro

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



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

Biomaterials

MR imaging of small metastatic tumors in liver



Professor
UEDA, Hiroshi

Assistant Professor
OHMURO-MATSUYAMA, Yuki

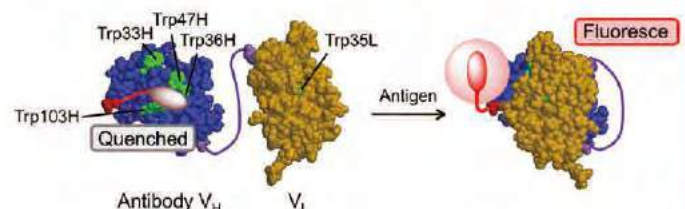
Creation of novel biosystems by antibody/enzyme engineering

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

Keywords antibody engineering, enzyme engineering, biosensor

Protein

Novel immunosensor Quenchbody





Associate Professor
ISHIUCHI, Shun-ichi

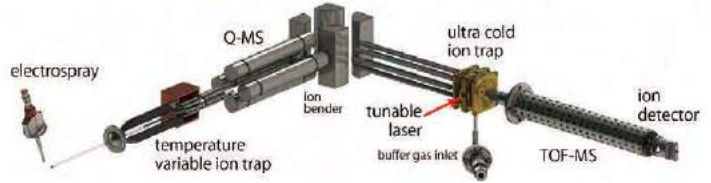
Novel structural analysis method for biomolecules by combining mass and laser spectroscopy

We are developing a new spectroscopic technique to interrogate the molecular structures associated with molecular recognitions of small drug molecules.

Keywords mass spectrometry, laser spectroscopy, molecular recognition, hydrated clusters

Bioactive molecules

Electrospray • cold ion trap • laser spectrometer



Associate Professor
MIURA, Yutaka

Development of novel biomaterials by using well-defined macromolecules

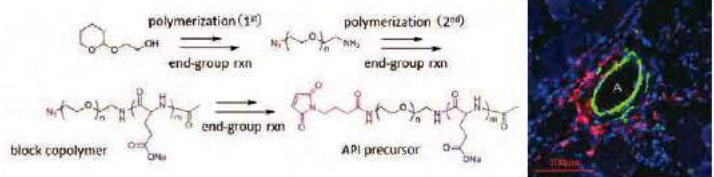
Our spotlight areas of research include the development of functional polymers and biomaterials for medical applications such as drug delivery and imaging.

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

Biomaterials

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

Typical polymerization/reaction



Associate Professor
MORI, Toshiaki

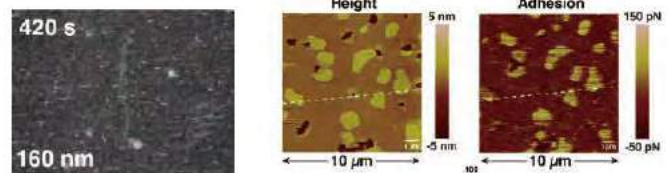
Interaction analyses of glycoconjugate on cell surface and its application for medical engineering

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



Assistant Professor
KADONOSONO, Tetsuya

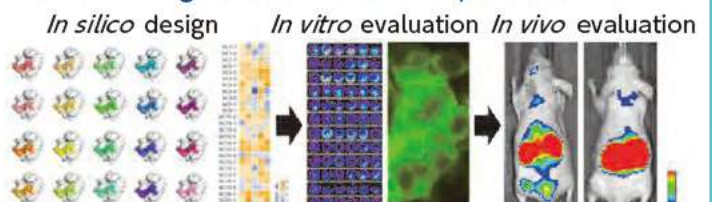
Novel biopharmaceuticals for molecular target therapy of cancer

We are establishing a novel technology for creating high-performance biopharmaceuticals for cancer therapy. We are also aiming to identify novel cancer therapeutic targets.

Keywords drug development, biopharmaceuticals, cancer therapeutic targets

Protein

In silico design and evaluation of biopharmaceuticals



Human Centered Science and Biomedical Engineering

Molecule

Cell

Tissue, Organism



Professor
HISABORI, Toru

Assistant Professor
NOMATA, Jiro
YOSHIDA, Keisuke

Elucidation of energy conversion and redox regulation mechanisms of photosynthetic organisms

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

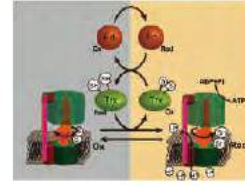
Keywords ATP synthesis, bioenergetics, redox regulation, photosynthetic micro-organism

Protein function

Molecular structure of the ε subunit of ATP synthase



Redox regulation of photosynthetic ATP synthesis



Visiting Professor
KAJIWARA, Susumu

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

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

Keywords pathogen, immunity, drug discovery, renewal resources

Applied Microbiology & Infection

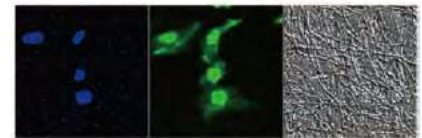
Hemolysis



Drug efflux pump expression



Induction of enzyme activity in human cell by pathogenic fungi



Professor
TANAKA, Kan

Assistant Professor
KOBAYASHI, Yuki

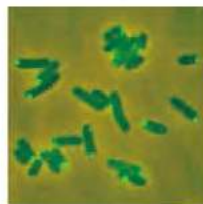
From understanding to design of cell systems

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

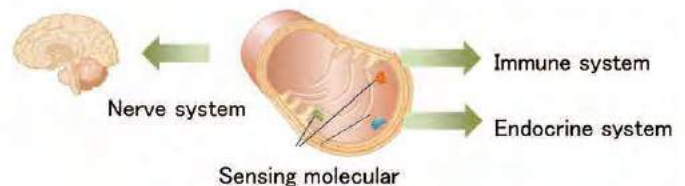
Assistant Professor
IWATANI, Shun

Sensing molecules and these roles in host-bacterial communications

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

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

Host-bacterial communication



Associate Professor
KITAGUCHI, Tetsuya

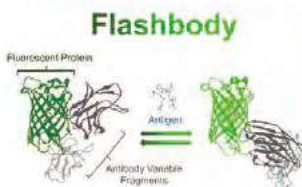
Development of genetically-encoded biosensors

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

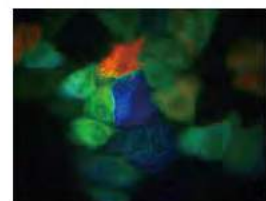
Keywords GFP, bioimaging, cell signaling

Cellular function

Schematic diagram of genetically-encoded biosensor



Fluorescence microscopy by biosensor



Human Centered Science and Biomedical Engineering

Molecule

Cell

Tissue, Organism



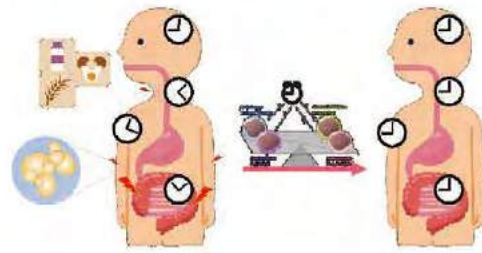
Associate Professor
ORIHARA, Kanami Assistant Professor
CHEN, Xinyue

Preventing severe immune diseases by regulating peripheral clock

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

Keywords immunology, molecular biology, circadian rhythm, drug resistance

Bioactive Molecules



Associate Professor
WAKABAYASHI, Ken-ichi

Mechanisms of flagellar motility and photomovement of green algae

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

Keywords flagella, cilia, photomovement, green alga

Cellular function

Chlamydomonas reinhardtii

Volvox carteri

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



Professor
KONDOH, Shinae Assistant Professor
KUCHIMARU, Takahiro

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

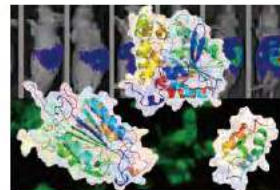
We are aiming at developing novel drugs and diagnostic agents for hypoxic cancers. We are also establishing a novel technology for creating highly target-specific peptide drugs.

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

Cancer treatment, Imaging

Innovative biopharmaceuticals development

Visualization of cancers with an optical imaging probe



Professor
KOSHIKAWA, Naohiko

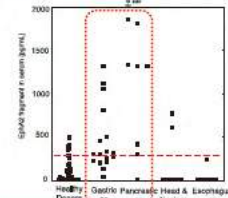
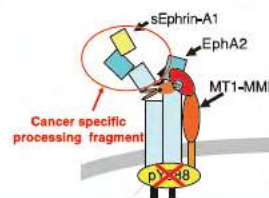
Analysis of tumor progression by extracellular proteolysis and its clinical applications

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

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

Cancer biology

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



Associate Professor
AKAMA, Hiroyuki

Elucidation of the neural system of human brain by MRI

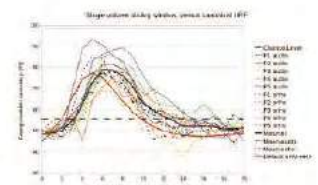
We are exploring the neural system of human brain by using techniques of fMRI with machine learning (Multi-voxel pattern analysis) and graph-theoretical analysis.

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

Neuroscience

Distributed neural patterns

MVPA Accuracy functions





Associate Professor
IMAMURA, Sousuke

Elucidation of molecular mechanisms of plant environmental adaptation

We are studying fundamental molecular mechanisms of environmental responses of plants, especially nutrient signaling pathway, using microalgae.

Keywords environmental response, microalga, nitrogen metabolism, biomass production, TOR kinase

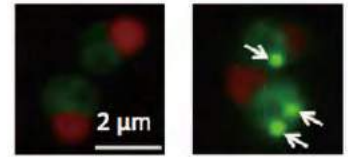
Plant

Microalgal culture



TOR-inactivation results in oil accumulation (right picture)

(Green : neutral lipid)



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



B1 • B2 Bldg.



J2 • J3 Bldg.



S2 Bldg.



R1 Bldg.



M6 Bldg.

(Other Professor)

YAMAMURA, Masayuki
: Computational modeling collective function and morphogenesis

YANAGIDA, Yasuko
: Device innovation by MEMS and biotechnology

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

(Assistant Professors)

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

IKEDA, Hiroshi : Biomimetic materials science

INOHAYA, Keiji : Bone formation and development

KANAMARU, Shuji : Structural study of assembly and infection of phages

KANEKO, Shinya : Nobel genome technology, Fruiting-body formation of mushroom

OKUMURA, Eiichi : Cell cycle control and signal transduction

SATO, Takao : Protein structure analysis and elucidation of mechanism

TAMORI, Masaki : Physiology and morphology of echinoderms

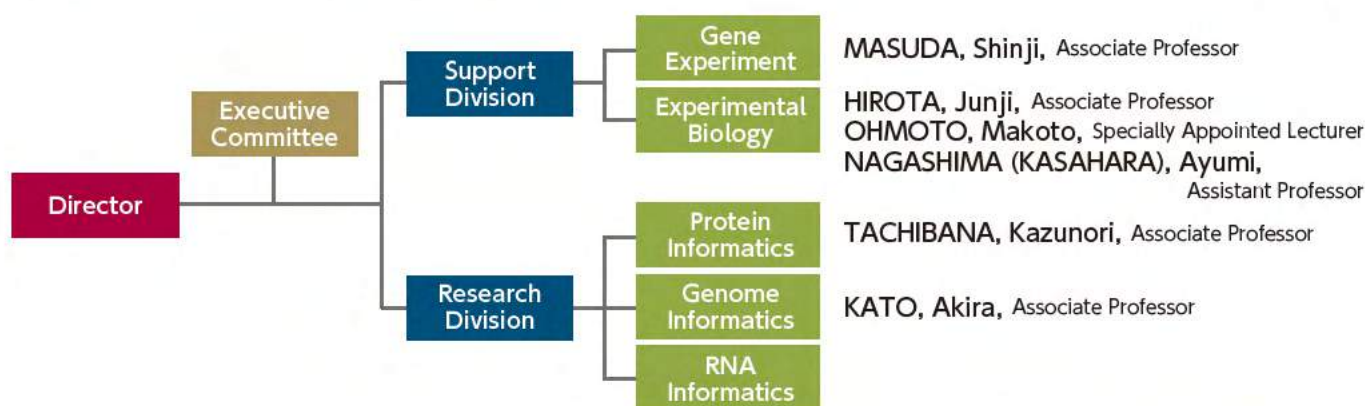
TANAKA, Toshiaki : Protein transport and cell proliferation

NAGASAWA, Tatsuki : Diversity and evolution of hatching mechanisms

Center for Biological Resources and Informatics

<http://www.grc.bio.titech.ac.jp/>

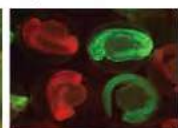
The Center for Biological Resources and Informatics (Bio-Center) was established in 2003 as a facility for performing genetic and animal experiments by merging the Gene Research Center (established in 1989), Research Center for Experimental Biology (established in 1994), and Radioisotope Research Center (established in 2001). In 2011, the Radioisotope Division was separated from the Bio-Center and renamed as the Radiation Research and Management Center. The new Bio-Center consists of 5 sections: Gene Experiments, Experimental Biology, Protein Informatics, Genome Informatics, and RNA Informatics. The Gene Experiments and Experimental Biology sections mainly 1) provide education, training, and safety management on recombinant DNA and experimental animals, 2) provide technical support and maintenance of the core equipment, and 3) maintain the animal and plant facilities. The main mission of the sections of Protein Informatics, Genome Informatics, and RNA Informatics is to perform leading-edge bioinformatics research on proteins, DNA, and RNA in the post-sequencing era.



Animal Facilities

- 1) Maintain and manage animal facilities
- 2) Provide equipment for animal experiments
- 3) Facilitate higher research and education

Rabbit, guinea pig, mouse, rat
 Freshwater organisms (zebrafish, medaka, *Xenopus* frog, etc.)
 Seawater organisms (puffer fish, starfish etc.)
 Provide services for mouse germ cell operations
 (in vitro fertilization, embryo/sperm freezing, transplantation)



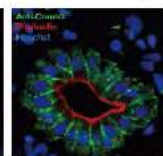
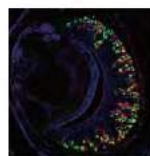
Safety Management

- 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 using computer simulation



Core Equipment Service

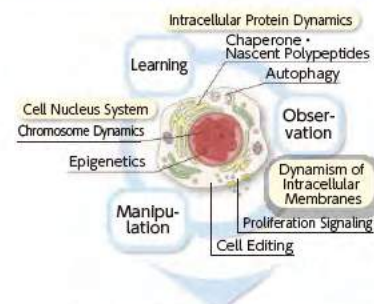
- Microscope systems (confocal microscopes, light microscopes, zoom microscopes etc.)
- Electron microscope
- Scanning electron microscope
- Cryostat
- Spectrophotofluorometer etc.



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

Location: Suzukakedai Campus, S2 Building

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



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



Honorary Professor
OHSUMI, Yoshinori

Keywords yeast, autophagy, vacuole, starvation, growth control

Comprehensive studies of physiological roles of autophagy in yeast

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

Autophagosome by microscopy

Cellular Function

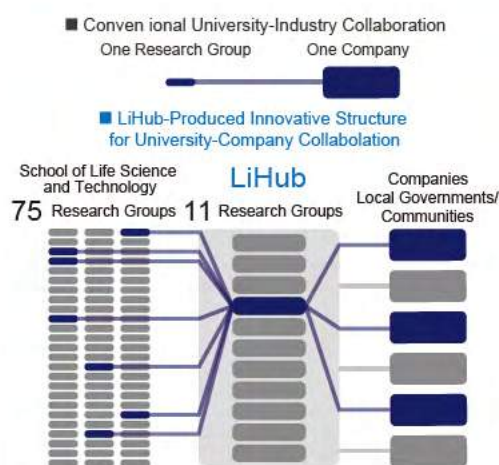


Life Science and Technology Open Innovation Hub (LiHub)

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

By taking this strong advantage, LiHub serves as interfaces for companies and/or public sectors that need expertise of life science and biotechnology for their business and social activities. LiHub arranges communication, discussion and collaborations with faculty members who meet requests from companies and/or public sectors. In LiHub, there are 11 research groups that have already created communities for smooth academia-industry interactions, each of which is composed of 6-12 members of our faculties and specialized by one particular cutting-edge field such as healthcare industry, biomaterial, brain-environment interface, drug development, and synthetic biology. New more LiHub research groups will be created upon companies and/or public sectors' requests.

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



Open Research Facilities for Life Science and Technology

Our school operates the Open Research Facilities for Life Science and Technology, which consists of the Shimadzu Corporation Precision Analytical Instruments Room, cell and protein analysis facility, ultracentrifuge facility, cold room, bioimaging facility, aquatic animal laboratory, biomolecular analysis facility, microbial culture room, and shared laboratory and office spaces. 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.

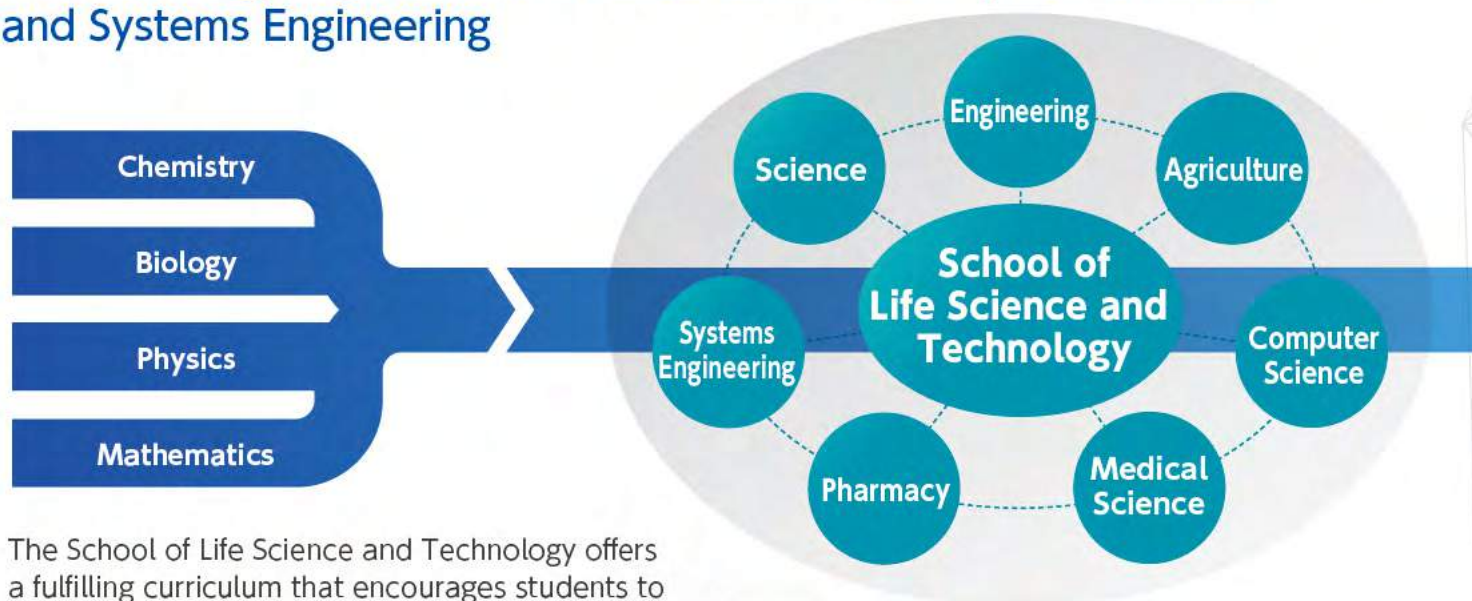
In a collaboration between Tokyo Tech and the Shimadzu Corporation, The Shimadzu Corporation Precision Analytical Instruments Room was established in 2017. This is a unique attempt to enhance research activities at Tokyo Tech by using the instruments and knowledge of the Shimadzu Corporation. This room 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.



The Shimadzu Corporation Precision Analytical Instruments Room

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

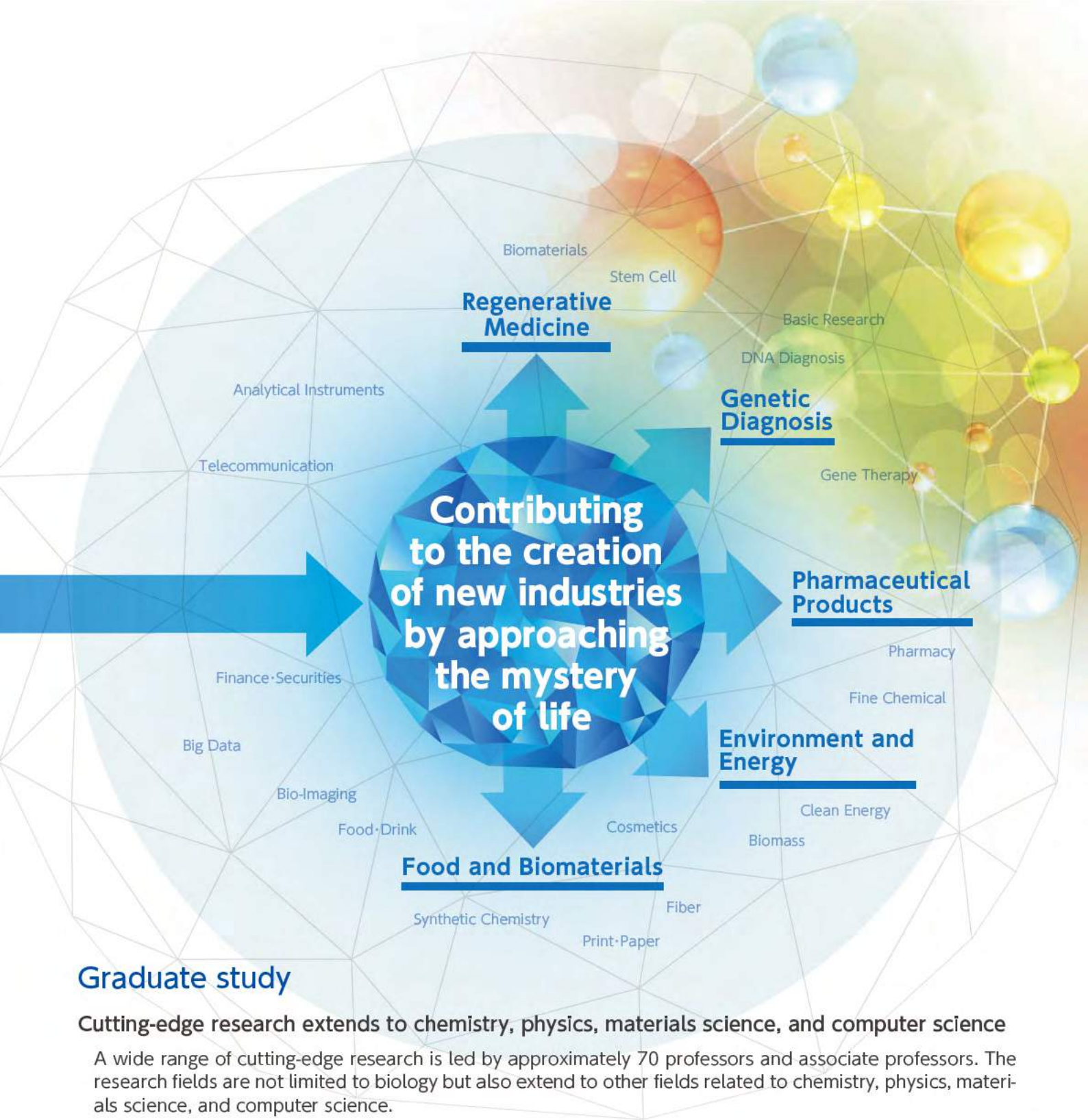
In their first year, students take part in a challenging active learning program in which they create educational materials related to the life sciences. Critical thinking and problem-solving skills are developed through collaborative work.

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.



**Contributing
to the creation
of new industries
by approaching
the mystery
of life**

**Regenerative
Medicine**

**Genetic
Diagnosis**

**Pharmaceutical
Products**

**Environment and
Energy**

Food and Biomaterials

Graduate study

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

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

Research in an international environment

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

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

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

Pursuing New Forms of

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



Bachelor's Degree Program

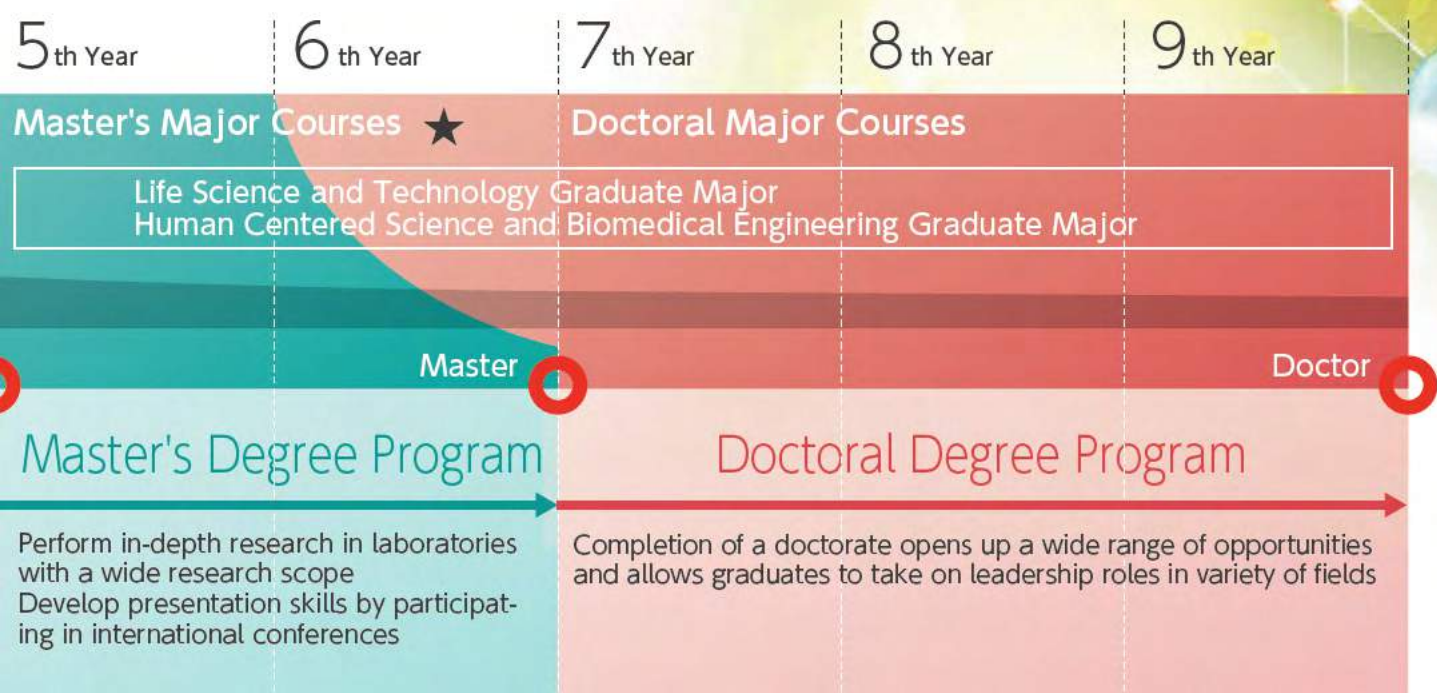
1st Year	2nd Year	3rd ~ 4th Year	
Fundamental Life Science Basic Chemical Thermodynamics Basic Quantum Chemistry Basic Organic Chemistry Basic Inorganic Chemistry Linear Algebra /Recitation Calculus /Recitation Fundamentals of Mechanics Fundamental Life Science Laboratory Introduction to Bio-Frontier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

List of lectures (partial list)

Learning

■ Quarter system

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



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

Master's Degree Program

Learn by engaging in cutting-edge research

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



Doctoral Degree Program

Make an impact in the future of the life sciences

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



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

Student Work and Activities

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

Tokyo Tech BioCon



First-year students at the School of Life Science and Technology develop educational materials that are used to teach elementary school students biotechnology-related topics. At the end of the course, they present their materials at BioCon, the Institute's contest where students showcase the teaching materials that they have developed.

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 doctoral student

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 doctoral student

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

SUZUKI, Shinya doctoral student

Tokyo Tech is a place abound with opportunities, where students can take small but definitive steps in pursuit of possibilities. In my case, these steps involved competing at an international competition with my peers, advancing my studies through research, and reassessing myself in the world of research by studying abroad. I encourage everyone who wants to make a difference to come and study here.



MURAMATSU, Ayaka master's student

My research is concerned with the metabolism in microorganisms that thrive in temperatures that are far too high for humans. There are plenty of times when my research does not go according to plan. But, I find the process of making slow but steady progress with my colleagues and the support of our faculty to be richly rewarding. I would recommend that incoming students join clubs, study abroad, and take part in whatever else that sparks their interest. The diverse range of experiences that they gain will surely broaden their perspectives.



TAKAGI, Michio undergraduate student

Various environmental problems have affected our world. Matsuda laboratory is a great place for research, where organic chemistry and enzyme technology are studied at the same time to establish environmentally friendly organic reactions.

So far in my stay here, I learned many new things that are important, and are really interesting. Matsuda lab also collaborates with other labs, which helps us in improving our ideas.



International Graduate Program (IGP)

https://www.titech.ac.jp/english/graduate_school/international/

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 two Graduate Majors, Life Science and Technology and Human Centered Science and Biomedical Engineering. A student selects one of these majors after discussion with his or her supervisor.



Tokyo Institute of Technology – Tsinghua University Joint Graduate School Program

<http://www.ipo.titech.ac.jp/tsinghua/>

Tokyo Tech and Tsinghua University have a Joint Graduate School Program of master's and doctoral courses. The main objective of this strategic program is to train personnel who can use three languages—Japanese, Chinese, and English—and are versed in these cultures. The Bio-course (Bioscience and Biotechnology course) has historically played a central role among three courses: Bio-course, Nano-course (Nanotechnology course), and Decision Science & Technology course. Staff, students, and industry representatives deepen their mutual understanding of each other by taking part in two symposia held every year in Beijing and Tokyo. This program provides an ideal opportunity to improve international relationships and educate a young generation who will contribute to the industrial and cultural development of both countries.



Education Academy of Computational Life Sciences

<http://www.acls.titech.ac.jp/>

The Education Academy of Computational Life Sciences (ACLS) has provided an educational program since 2012 with the goal of training potential leaders from the fields of life sciences and computer science to take active, international roles in multiple fields. The program is an integrated master's and doctoral education program in which students from both the School of Life Science and Technology and the School of Computing participate in a close environment. Students can enroll in the program without leaving their main curriculum courses. Students who complete the program will receive a doctoral degree with a statement on their degree certificate that confirms that they have completed all the requirements of the Education Academy of Computational Life Sciences.

Previously, both life sciences and computer science evolved independently leading to a lack of mutual understanding and impeding attempts to collaboratively resolve issues. Flexible collaboration between these two fields is in high demand because it will inevitably drive research in life sciences and health care, which should significantly advance science and technology in the 21st century.

For these reasons, the program is focused on fostering potential leaders with fundamental knowledge of both life sciences and computer science, as well as collaborative skills, who will ultimately excel in a global environment.

This program defines and nurtures Γ (Gamma)-type specialists who are 1) distinguished life sciences specialists with the ability to use cutting-edge computer science technology; or 2) distinguished computer science specialists with the ability to comprehend life sciences methodology and concepts.

The program was carried out from 2011 to March 2018 with the financial support from MEXT as "Program for Leading Graduate Schools". Tokyo Tech will continue the program independently from April 2018.



International Summer School at Nanyang Technological University



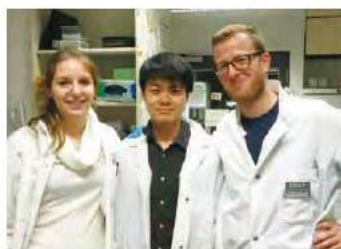
Short-term Internship



Global Communication Contest



International Internship

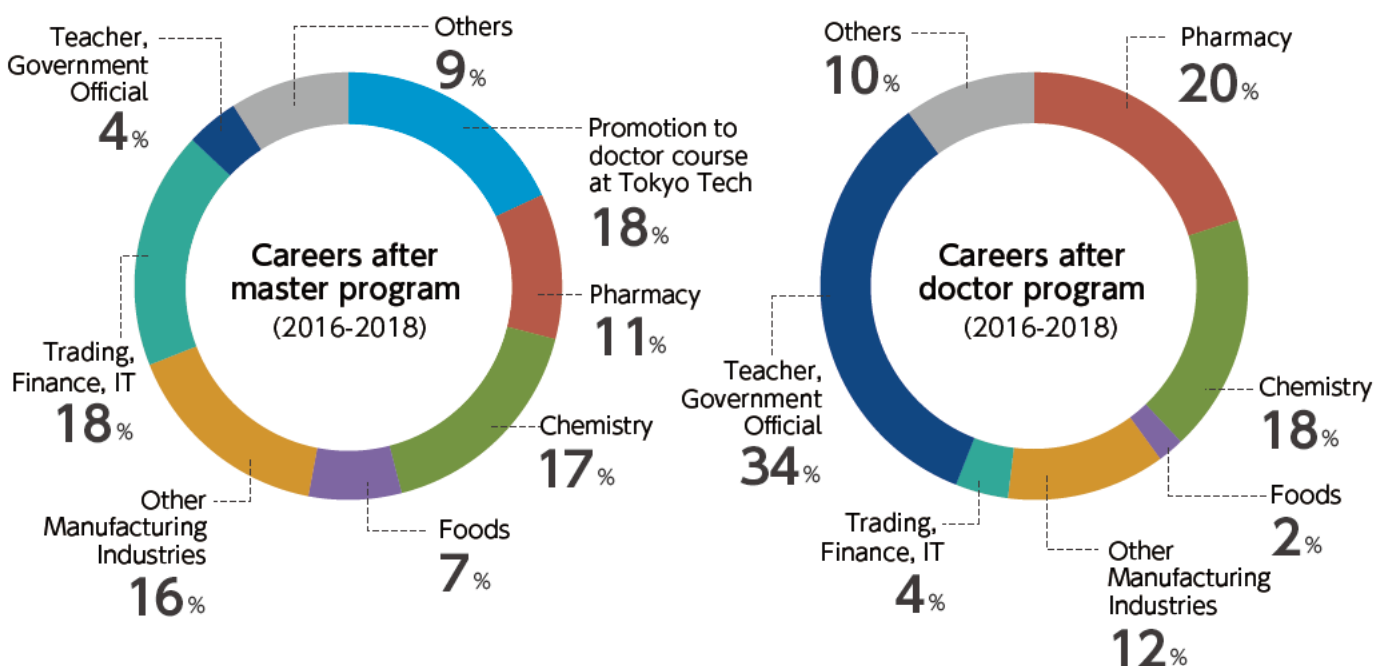


Global Career Seminar



Working Globally

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



Places of the employment

Pharmacy

Astellas Pharma, Chugai Pharmaceutical, Daiichi Sankyo Healthcare, Japan Blood Products Organization, Kobayashi Pharmaceutical, Kyowa Kirin, Medical and Biological Laboratories, Mitsubishi Tanabe Pharma, Mochida Pharmaceutical, Pfizer Japan, Nihon Generic, Sumitomo Dainippon Pharma, Taisho Pharmaceutical, Takeda Pharmaceutical, etc.

Chemistry

Asahi Kasei, Du Pont, Fujifilm, Idemitsu Kosan, JSR, Kao, Kuraray, Lion, Mitsubishi Chemical, Mitsui Chemicals, Nippon Shokubai, Sekisui Chemical, Shin-Etsu Chemical, Shiseido Japan, Sumitomo Chemical, Teijin, Toray Industries, etc.

Foods

Ajinomoto, Asahi Breweries, Calpis, Ezaki Glico, Itoham Foods, Kagome, Kewpie, Kirin, Lotte, Megumilk Snow Brand, Meiji, Morinaga, Nissui, Sapporo Breweries, Suntory Holdings, Yakult, etc.

Other Manufacturing Industries

Canon, Dai Nippon Printing, Daikin Industries, Fujitsu, Hitachi, Japan IBM, JGC, Kobe Steel, Konica Minolta, Kyocera, Mazda Motor, Panasonic, Shimadzu, Showa Denko, Tokyo Gas, Toppan Printing, Toshiba, Toyota Motor, etc.

Trading, Finance, IT

NTT, Bank of Yokohama, Daiwa Securities, Goldman Sachs, Marubeni, Mitsubishi Research Institute, Mizuho Bank, Nomura Securities, Softbank, Sumitomo Mitsui Banking, Sumitomo, The Bank of Tokyo-Mitsubishi UFJ, Tokio Marine & Nichido Fire Insurance, etc.

Teacher, Government Official

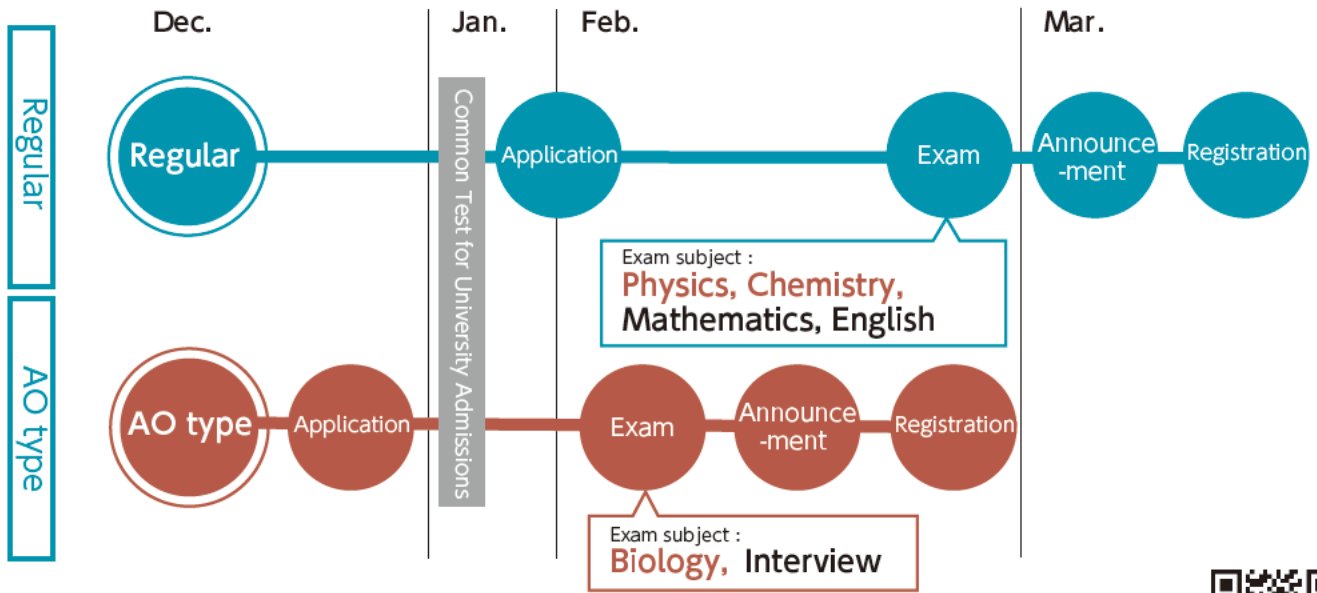
Tokyo Tech., Tokyo Univ., University of Occupational and Environmental Health, Japan, Yamanashi Univ., Kyoto Prefectural Univ. of Med., Ochanomizu Univ., Cabinet Office, Labor and Welfare, Ministry of Health, National Center of Neurology and Psychiatry, National Institute of Advanced Industrial Science and Technology, National Institute of Physiological Sciences, National Research Institute of Police Science, NHK, RIKEN, Tokyo Metropolitan Government, etc.

Others

Dentsu, Hakuodo, Mori Building, East Japan Railway, Z-kai, etc.

Schedule for Admission

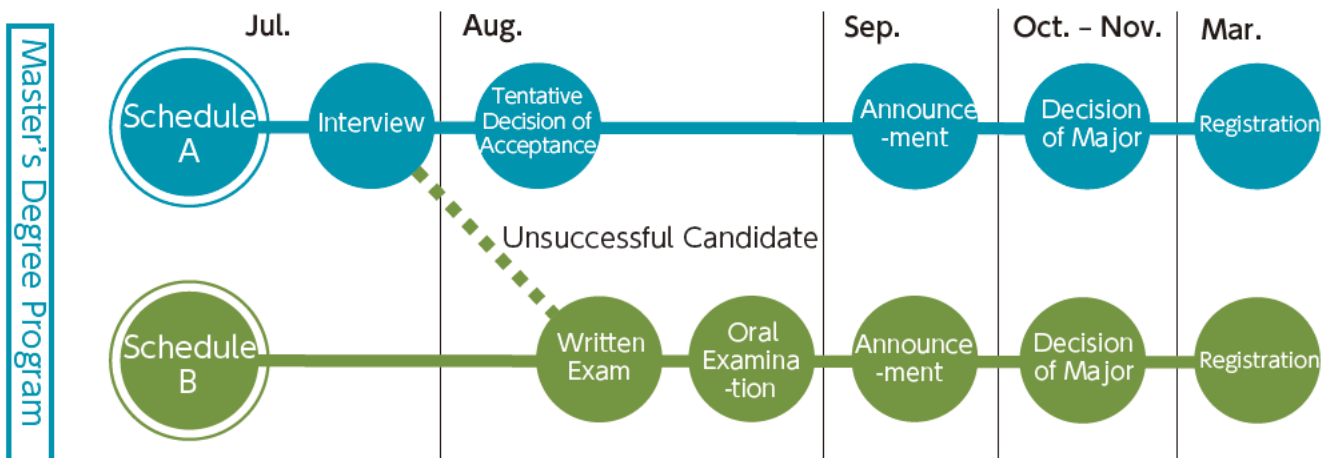
Undergraduate School	Capacity	Examination Category	
	150	Regular 135	AO type 15



For detailed information, please see <https://admissions.titech.ac.jp/admission>



Graduate School	Capacity
	Master : 168 Doctor : 52

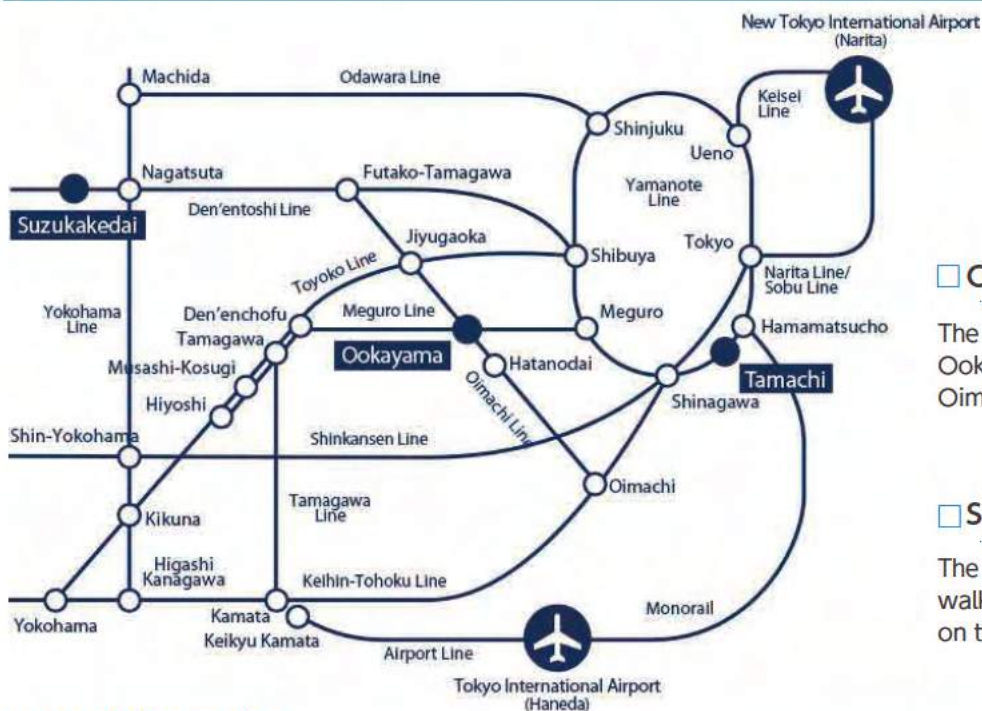


For detailed information, please see https://www.titech.ac.jp/english/graduate_school





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/graduate_school/index.html



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