



GRADUATE SCHOOL OF  
FRONTIER SCIENCES  
THE UNIVERSITY OF TOKYO

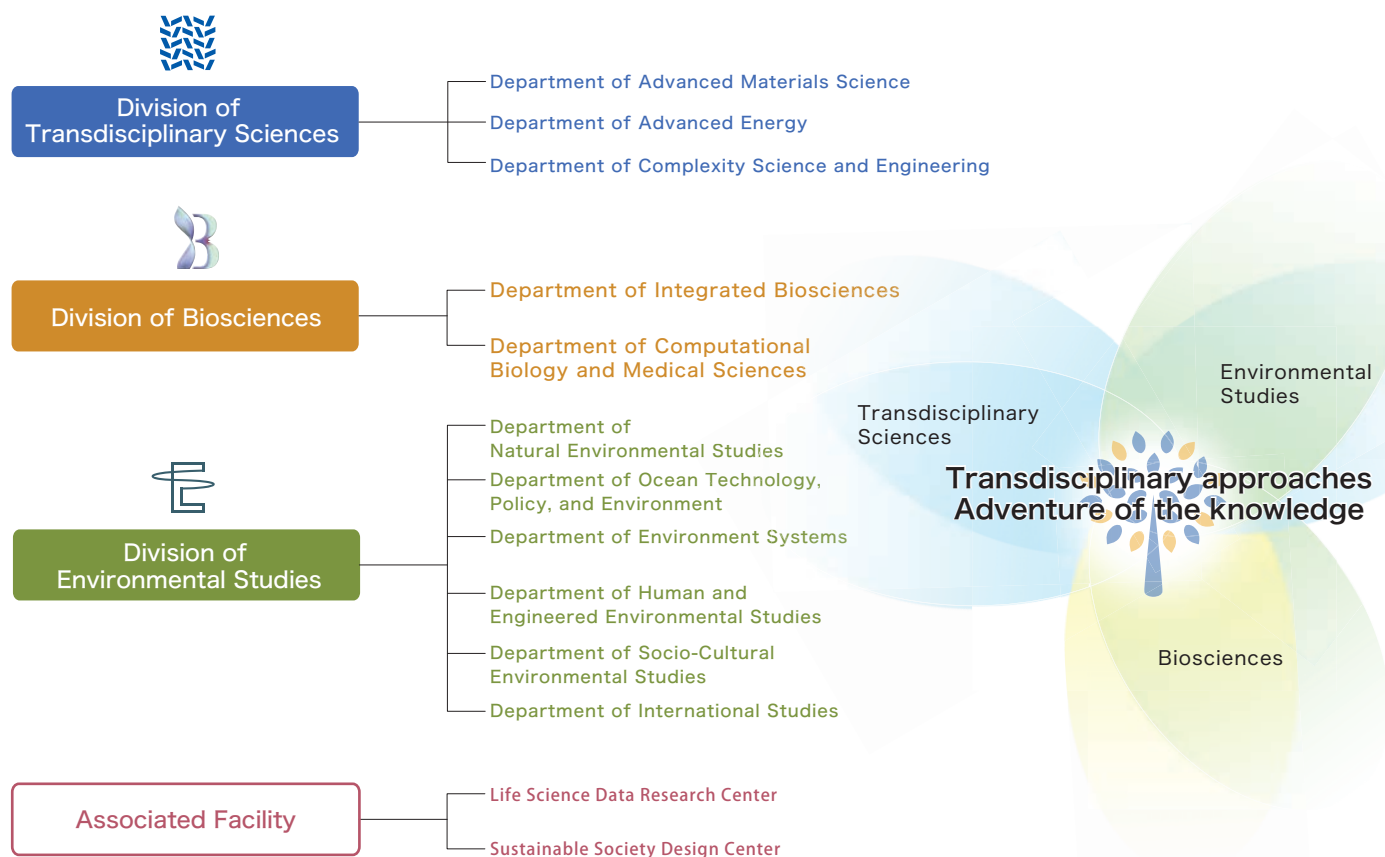
# Into an undiscovered field, linking to society With the joy of intellectual exploration, pioneering new fields

As the world of academia continues to deepen specialization in traditional fields it also encourages crossing disciplinary borders and working in multiple fields.

However, interdisciplinary approaches that rely on the traditional inquiry structures of each individual discipline have not sufficiently handled key challenges that transcend several fields. These key transcending challenges that involve breaking down the barriers between fields and opening up new frontiers of knowledge identify the mission of the Graduate School of Frontier Sciences (GSFS).

Founded in 1998, the GSFS offers both master's and doctoral courses to tackle important multi-disciplinary issues that cannot be dealt with by traditional academic approaches, and pushes knowledge creation beyond the boundaries inherent in traditional fields and existing interdisciplinary approaches.

Although derived from existing traditional academic fields, the three divisions of GSFS -Transdisciplinary Sciences, Biosciences, and Environmental Studies- target undeveloped areas in an effort to create new fields of inquiry for research and education.





The future demands a constant search for new knowledge.  
Knowledge that will bore into the wall of unsolved problems that stand in  
our way; sound and powerful knowledge that will show the way forward.

Novel materials, resources, energy, genomes, the brain, the environment,  
space, the Earth, oceans. Big Data, complexity, safety, risk, climate change,  
social design, sustainability, human augmentation, medical and  
healthcare systems, life and bioscience.

With passion and perception, members of the Graduate School of  
Frontier Sciences support the future of humanity by  
searching research fields for undiscovered wisdom and imagination.

By bringing together the power of members that are keen to challenge  
themselves, GSFS faculty, administrative staff, researchers, and  
students push forward research and education in new fields.

Facing territories that have never before existed, confronting the unknown,  
we have begun linking knowledge and society.  
Let's embark together on a challenging yet stimulating adventure.

## Campus Life

Barbeques and mini-concerts; tennis and basketball competitions, our spacious campus plays host to a range of events for students to mingle. Currently housing 450 thousand items and the University of Tokyo's collection of natural science academic journals, the library provides a large, comfortable reading room in addition to a media hall that hosts a variety of seminars. Access to such substantial facilities supports a thoroughly enjoyable campus life.







## Division of Transdisciplinary Sciences

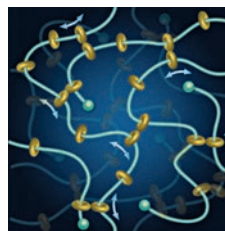
Creating new fields spanning pre-existing scientific and technical fields and contributing to human welfare and happiness

### Department of Advanced Materials Science

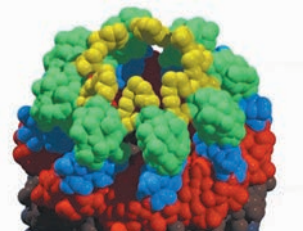
[https://www.k.u-tokyo.ac.jp/materials/index\\_e.html](https://www.k.u-tokyo.ac.jp/materials/index_e.html)

**Raising advanced materials scientists who will spread their wings and take-off from here and journey around the world**

We pioneer research to draw out undiscovered functions hiding in the depths of "materials." We create fundamental science and technology for the 21<sup>st</sup> century and fulfill our role as a global location for comprehensive, systematic education and research by clarifying the organization of various phenomena and developing theories; imagining new devices; and establishing revolutionary material measurement methods.



Slide-ring material with freely moving cross-linking points. Applications in various fields, such as coatings and damping materials, are currently under development



Molecular model of a chaperone to prevent protein denaturation

### Department of Advanced Energy

<https://www.ae.k.u-tokyo.ac.jp/en/>

**Venturing to develop the energy of the future and leading-edge uses of energy.**

We conduct comprehensive education and research with "Energy". In collaboration with Japan Aerospace Exploration Agency (JAXA), Central Research Institute of Electric Power Industry (CRIEPI), and National Institute for Fusion Science (NIFS), we make full use of large-scale experiment equipment and work in such fields as aerospace engineering, deep space exploration, advanced electromagnetic energy use, nuclear fusion energy, and plasma science and engineering.



Wireless power transfer to electric vehicle



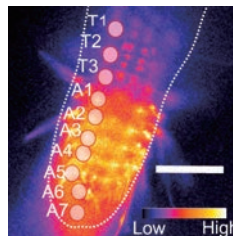
Plasma confinement experiment device

### Department of Complexity Science and Engineering

[https://www.k.u-tokyo.ac.jp/complex/index\\_e.html](https://www.k.u-tokyo.ac.jp/complex/index_e.html)

**Developing multiscale complexity science and technology**

We research "complexity" from the nanoscale to the interstellar scale based on four modules: the brain, astrobiology, extreme matter, and complexity platform. We raise researchers and technicians who can continue to discover new approaches that merge engineering and the physical sciences and that can dream up revolutionary paradigms.



Nerve activity visualization



Haptoclon (Haptic & optical clone)



## Division of Biosciences

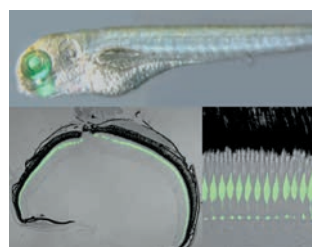
Fostering human resources who can preempt changes in the biosciences and lead those transformations

### Department of Integrated Biosciences

<http://www.ib.k.u-tokyo.ac.jp/english/index.html>

**Integrating leading-edge fields in the biosciences and opening up new frontiers**

We analyze the elementary processes and collaborating organs in life phenomena and, from the aspects of structure and function, study topics including the universality and diversity of life, cooperation and competition between living beings, and the origins and evolution of life. Relying on "advanced, transdisciplinary education and research" as our common philosophy and covering everything from the fundamentals to applications, we foster human resources that can contribute to problem-solving in the biosciences, as well as create next-generation biosciences.



Ultraviolet-sensitive photoreceptor cells from a zebrafish retina, made visible with green fluorescent protein (GFP)



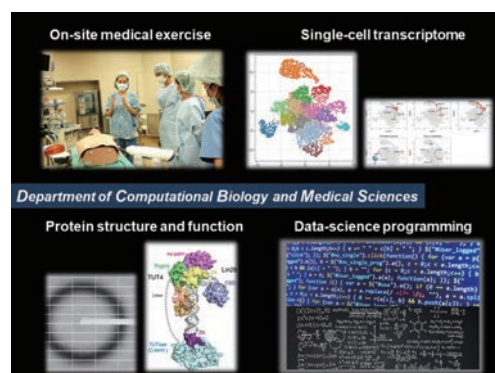
Creatures used as research materials/subjects: (clockwise from left) spider monkey, mouse, Drosophila, Arabidopsis, budding yeast and silkworm moth

### Department of Computational Biology and Medical Sciences

<http://www.cbms.k.u-tokyo.ac.jp/english/index.html>

**Leading research in the field of biomedical sciences through the integration of life science and computational science**

CBMS endeavors to understand the mechanisms of the orchestrated formation of living organisms by employing two approaches. One is biological experiments and observation to elucidate various stages of biological phenomena, such as the mechanisms that regulate gene expression, the functions of proteins and nucleic acids in cells, and the maintenance of living organisms. The other is computational data-mining to quantify and analyze the massive amount of biological data in a comprehensive and integrated manner to enhance our understanding of complex biological mechanisms. In addition, the Medical Innovation Course conducts research to effectively socialize the results of basic research from an ethical, legal, and social perspective (ELSI). Through the integration of the above diverse research fields, CBMS develops human resources, who will lead research in the field of advanced biomedical sciences.



## Department of Natural Environmental Studies

<http://nenv.k.u-tokyo.ac.jp/en/>

**Exploring relationships between the natural environment and human activity and aspiring to make a better environment**

To tackle transdisciplinary subjects, our education and research activities are designed into two programs: land environmental studies and ocean environmental studies that mirror the close interrelationship of both the land we occupy and the vast oceans that occupy 70% of the Earth's surface. In addition to natural scientific approaches to the four basic components of nature, i.e., atmosphere, geosphere, hydrosphere, and biosphere, we also study the impact of human society on these four components and their interactions in various time and geographical scales. Human society can only exist with the continued services provided by a healthily functioning nature. Our studies and the scientific knowledge obtained from our studies are designed to contribute to the development of a sustainable and healthy relationship between human society and nature.



Landscape observation from "Pet utur us pe," a practical forest in Hokkaido



Sampling of deep-sea creatures with "Shinsei-maru," the research vessel

## Department of Ocean Technology, Policy, and Environment

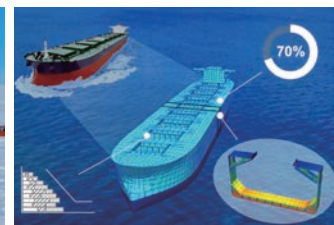
<https://www.otpe.k.u-tokyo.ac.jp/en/>

**Producing human resources who will contribute to ocean use and the generation of industry, ocean preservation, and environmental creation**

We conduct education and research that contributes to the development of technology and technical policy studies relating to ocean use and preservation, the generation of new ocean industries, and the creation of ocean environments. We have established programs on ocean use systems, ocean environment creation, ocean sensing, and ocean research and development systems, and we foster human resources with advanced expertise and international perspectives who can contribute to efforts to propose ocean-related policies, promote industry, and achieve environmental preservation.



Participating in an Antarctic research expedition



Digital Twin, a marine transportation system

## Department of Environment Systems

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

**Modeling of Environment Systems and design of sustainable societies**

Human activities have significantly affected the environment systems which are composed both by natural environments and human societies. This department conducts research and education to design and realize the sustainable societies by analyzing the interaction and relationship between human societies and natural environment, developing the model to represent the environment systems based on the detailed analyses, clarifying the causes of the problems using the systems model, and investigating the possible solutions and the way to manage the system.



Reaction experiment using supercritical water



Ocean environment survey

## Department of Human and Engineered Environmental Studies

[https://www.h.k.u-tokyo.ac.jp/index\\_e.html](https://www.h.k.u-tokyo.ac.jp/index_e.html)

**Development of innovative technologies that are friendly to humans**

By fusing individual elemental technologies in the fields of engineering, information, human and environmental sciences, our department aims to solve human-centered environmental problems with various scales and forms that will eventually bring about harmony between humans and their environment.

Specifically, by understanding people's behaviors, sensibilities, and thoughts; being close to and supporting people; and connecting people with people, and man-made objects with people, our research activities will help create a society in which all people can enjoy a rich and fulfilling life.



Advanced use of information technology



Compact mobility technology for senior citizens



## ■ Department of Socio-Cultural Environmental Studies

[https://sbk.k.u-tokyo.ac.jp/index\\_e.html](https://sbk.k.u-tokyo.ac.jp/index_e.html)

### Exploration of design in interactions among human, architecture, and local communities

Our department is structured into three core programs—Society and Humanity; Spatial Planning and Design; Water and Material Cycle—in addition to one cooperative program: Spatial Information Science. We engage in education and research on the analysis, evaluation, prediction, creation, and management of physical and socio-cultural environments at the architectural, urban, regional, and global levels. By taking a multi-faceted approach to both the natural and socio-cultural sciences, students acquire the ability to accurately deal with a variety of challenges in environmental studies.

## ■ Department of International Studies

<https://inter.k.u-tokyo.ac.jp/?lang=en>

### Aspiring to achieve a universal state of sustainable coexistence through the “optimal management of global public goods”

Our department explores topics across three themes: “development cooperation,” “environment and resources,” and “institutional design”. While faculty members provide the necessary expertise and guidance to help researchers foster their knowledge of specialized methodological approaches, the curriculum and inter-/intra-departmental research activities are also designed to strengthen transdisciplinary perspectives. This field of inquiry cultivates analytical skills supported by theory, as well as the determination to bravely challenge oneself to address the multitude of problems confronting the global community. We conduct education and research with the objective of producing researchers in the field of international cooperation, as well as new mission leaders with both the administrative skills and the creativity for crafting innovative policy proposals.



Negotiating with salmon to share the abundance of a more-than-human world



Hagoromo structure created in the design studio



Interview survey in a farming village

## Associated Facility

### ■ Life Science Data Research Center

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

#### Achieving a sustainable environment for life through the analysis of Big Data on life sciences

The Life Science Data Research Center (LiSDaC) collects Big Data that measures life phenomena of many species from diverse environments and systematically analyzes the information. By discovering the diversity of life and its evolution and developing engineering design technologies for life science systems, we aim to contribute to achieving a sustainable environment for life.

### ■ Graduate Program in Sustainability Science—Global Leadership Initiative

<http://www.sustainability.k.u-tokyo.ac.jp/>

#### Fostering future leaders who embrace both a global sustainability perspective and an action-oriented mindset

The Graduate Program in Sustainability Science—Global Leadership Initiative offers Master's and Doctoral degrees in Sustainability Science that fosters future leaders with a global perspective and action-oriented mindset who will contribute to realize sustainable societies. All the learning experiences that we provide including lectures, practicums, and seminars are conducted in English and these experiences are greatly enhanced by the fact that more than half of our student population join us from overseas.

### ■ Sustainable Society Design Center

<https://www.k.u-tokyo.ac.jp/en/gsfscs/center>

#### Contributing to capacity development and research on sustainable science

Global society today faces various sustainability-related issues. The center plans to offer a wide range of education programs on sustainability science, as well as a variety of recurrent education programs targeting those who are already working. The center seeks new pathways to sustainable societies by providing capacity development through these education programs and by conducting research on sustainability science.



Practicum in South Africa



Practicum in Kashiwanoha

# An optimal environment for innovative studies

The open, lush campus features a research support environment including Japan's top-level research facilities such as a hypersonic enthalpy wind tunnel and an RT-1 magnetospheric plasma experiment device. Leading-edge research facilities are available to researchers from within the University of Tokyo as well as elsewhere to serve the community and the collaborative efforts of academia, industry, and the government.



Kashiwa campus

The graduate school is fortunate to be located in Kashiwa, a city in Chiba Prefecture that promotes the "Kashiwa-no-ha International Campus Town Initiative." Through collaboration, the public, private, and academic sectors endeavor to create both an international academic research city and next-generation environmentally friendly city. In order to further this world-class leading-edge community building effort, we also opened the Urban Design Center Kashiwa-no-ha (UDCK) in front of Kashiwanoha-campus Station on the Tsukuba Express in 2006. In 2013 the University further deepened collaboration with the community and between academia and industry by opening the University of Tokyo Kashiwa Campus Station Satellite, which includes a 6,000 m<sup>2</sup> research building.

In terms of industry-academia collaboration, through the Tokatsu Techno Plaza (Chiba Prefecture) and Todai Kashiwa Venture Plaza (Organization for Small & Medium Enterprises and Regional Innovation) we are helping to promote the growth of venture companies originating from the University of Tokyo.

The University also built an industry-academia cooperation center on the Kashiwa II campus. In addition, the Kashiwa International Office is actively taking a role as a contact point for internationalization at the University of Tokyo by assisting international students and researchers with procedures when they come to Japan and by providing lifestyle support during their stay in Japan.



Kashiwa II campus



Kashiwa library



Hypersonic enthalpy wind tunnel



UDCK

The overriding education principle of the GSFS is to cultivate broadly educated human resources who also have deep expertise. The University offers various education programs to cultivate skills in taking multiple perspectives, communicating effectively, and putting ideas into practice that builds on the highly specialized education conducted in collaboration with the Institute for Solid State Physics, the Atmosphere and Ocean Research Institute, the Kavli Institute for the Physics and Mathematics of the Universe, the Institute for Cosmic Ray Research, the Institute of Industrial Science, and Information Technology Center in the Kashiwa Campus. The graduate school has also offered a special learning program named Specially Registering Graduate Students (<https://www.k.u-tokyo.ac.jp/en/exam/>) and is aggressively taking on recurrent education.

## ■ World-leading INnovative Graduate Study Program in Proactive Environmental Studies (WINGS-PES)

<https://wings-pes.edu.k.u-tokyo.ac.jp/home-english>

**Five-year program that spans the master's- doctoral experience for fostering professionals with environmental knowledge**

Located in the rich and active research community of Kashiwa, and based on GSFS's transdisciplinary philosophy and innovative instruction, WINGS-PES' five-year program that spans the master's- doctoral experience, selects brilliant Japanese and international students from all fields who are motivated to develop into "Environmental Knowledge Professionals" and who can proactively anticipate, define and address the challenges in creating a sustainable global society.

## ■ Professional Education Program

We offer educational programs for working professionals in order to strongly promote diverse educational activities to cooperate and share research findings with society.

UTokyo-MIT-Industry Joint Program for Professional and Graduate Education

SMART CITY SCHOOL

## ■ Diverse education programs and courses that cross department boundaries

[https://www.k.u-tokyo.ac.jp/en/education/education\\_program/](https://www.k.u-tokyo.ac.jp/en/education/education_program/)

### Nuclear Fusion Research Education Program

<https://www.k.u-tokyo.ac.jp/fusion-pro/>

### Education Program for High-Dimensional Data-Driven Science (HD3)

<https://www.k.u-tokyo.ac.jp/HD3>

### Deep Space Education Program (DESP)

<https://www.astrobio.k.u-tokyo.ac.jp/DeepSpace/en/>

### Data Scientist Training/Education Program (DSTEP)

<http://www.cbms.k.u-tokyo.ac.jp/curriculum/dstep.html>

### Biomedical Innovation Course

<http://www.cbms.k.u-tokyo.ac.jp/curriculum/bip.html>

### Medical Genome Science Program (MGSP)

<http://www.cbms.k.u-tokyo.ac.jp/curriculum/mgsp.html>

### Computational Biology Science Program (CBSP)

<http://www.cbms.k.u-tokyo.ac.jp/curriculum/cbp.html>

### Integrated Environmental Design Program (IEDP)

<http://iedp.site/>

### Minor Program in Sustainability Science (MPSS)

<https://www.k.u-tokyo.ac.jp/en/campuslife/kougai/#department-4-2>

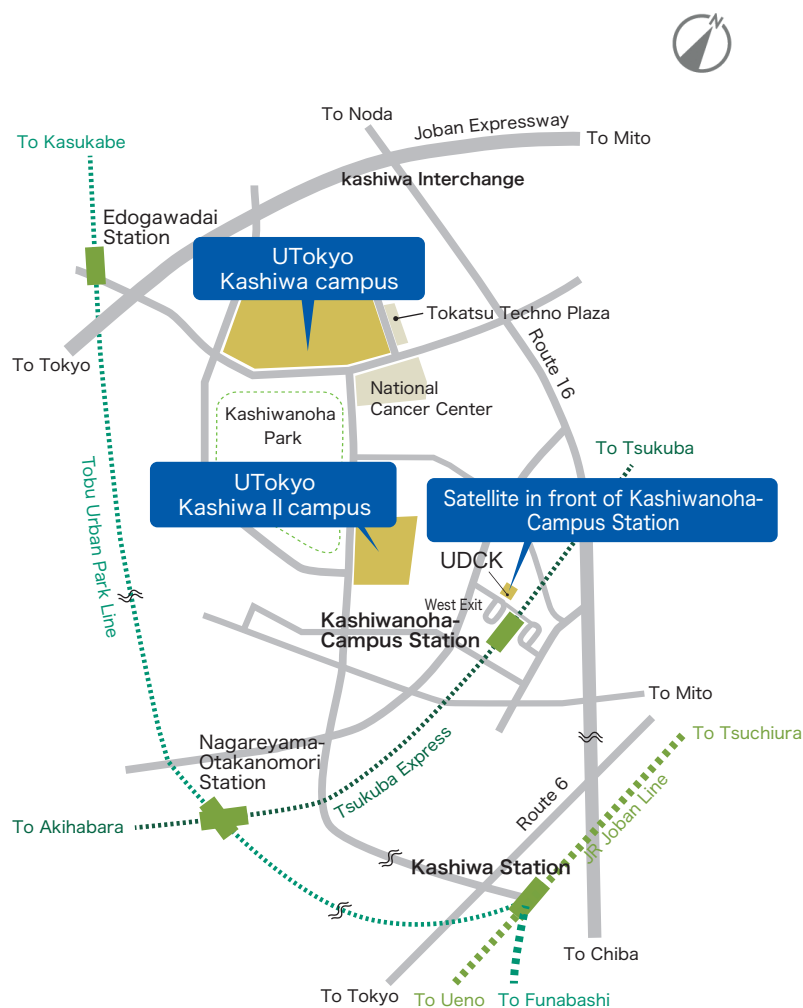
### Environment Engineer Training Program

[http://envsys.k.u-tokyo.ac.jp/en/cur\\_education.html](http://envsys.k.u-tokyo.ac.jp/en/cur_education.html)

### Environment Manager Training Program

[http://envsys.k.u-tokyo.ac.jp/en/cur\\_education.html](http://envsys.k.u-tokyo.ac.jp/en/cur_education.html)

## ACCESS



### By Car

#### From Kashiwa Interchange

From the Chiba exit at the Kashiwa Interchange on the Joban Expressway, take National Route 16. In 500 m, turn right at the Toyofuta Industrial Estate Entrance intersection. In 1 km, the University of Tokyo Kashiwa Campus is on the right.

### Tsukuba Express

#### From Kashiwanoha-Campus Station

- Route bus (West Exit, Tobu Bus Stop No.1)
  - Nishikashiwa 03 (西柏03) bound for Nagareyama Ōtakanomori Station East Exit/UTokyo West
  - Nishikashiwa 04 (西柏04) bound for Edogawadai Station East Exit
  - Nishikashiwa 10 (西柏10) bound for Edogawadai Station East ExitGet off at UTokyo West or UTokyo
- Taxi
  - About 5 mins from Kashiwanoha-Campus Station West Exit

### JR Joban Line, Tobu Noda Line (Tobu Urban Park Line)

#### From Kashiwa Station

- Route bus (West Exit, Tobu Bus Stop No.2)
  - Nishikashiwa 01 (西柏01) bound for National Cancer Center (via Kenmin Plaza) Get off at UTokyo West or UTokyo
- Taxi
  - About 20 mins from Kashiwa Station West Exit

### Tobu Noda Line (Tobu Urban Park Line)

#### From Edogawadai Station

- Route bus (East Exit, Tobu Bus Stop)
  - Nishikashiwa 04(西柏04) bound for Kashiwanoha-Campus Station
  - Nishikashiwa 10 (西柏10) bound for Kashiwanoha-Campus StationGet off at UTokyo West or UTokyo
- Taxi: About 5 mins from Edogawadai Station East Exit

## Graduate School of Frontier Sciences, the University of Tokyo

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