

UTSIP Kashiwa 2025 Program B

Host Laboratory List

Division of Biosciences

- Integrated Biosciences
- Computational Biology and Medical Sciences

Division of Environmental Studies

- Environment Systems
- Human and Engineered Environmental Studies
- International Studies

Division of Biosciences

Department of Integrated Biosciences

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Laboratory of Plant Functional Analyses	Prof. OHTANI Misato	<p>Plants develop and grow in ways that are completely different from animals: they are born without deciding the number of organs they will make during their lives, and they develop and grow to suit the environment where they take root. In addition, they continue living by regenerating lost organs through their advanced organ regeneration abilities, while some of their cells choose death for the benefit of other cells. Our aim is to obtain molecular information on how plants sense and react to environmental conditions, and how control flexibly cell proliferation and differentiation, for an active control of their life system.</p> <p>For this purpose, we focus on "dynamics of RNA metabolism" and "dynamics of cell wall polymer", which are key regulatory elements of gene expression and cell function in plants. Furthermore, we aim to develop new technologies that can contribute to a sustainable society, by maximizing plant functions and/or creating new functions by artificial modification of these molecular factors.</p>	plant cell; xylem vessel; transcription factor; totipotency; pre-mRNA splicing	<p>As part of the summer program, we propose the following two projects. Students will choose one of them and carry out the research.</p> <p>1) "Molecular mechanisms of xylem vessel cell differentiation" project Xylem vessels are one of essential tissues of vascular plants for their survival. Student will participate this project to learn molecular biological techniques using our original induction system VND7-VP16-GR for xylem vessel cell differentiation, as shown below.</p> <ol style="list-style-type: none"> 1. Sowing and growing plants by aseptic manipulation 2. Induction of xylem vessel cell differentiation 3. Microscopic observation of plant cells 3. Examination of transcriptional activity by transient expression system <p>2) "RNA metabolic regulation for plant cell potency" project Totipotency is a characteristic property of plant cells. We have shown the importance of RNA metabolic regulation, especially pre-mRNA splicing, in the expression of totipotency of plant cells. Student will participate this project to learn RNA biological and plant cultural techniques using tissue culture system as below.</p> <ol style="list-style-type: none"> 1. Sowing and growing the wild type and mutant plants by aseptic manipulation 2. Tissue culture of explants derived from the wild type and mutant plants 3. Observation of resultant explants 3. Examination of gene expression level and splicing patterns
Molecular Recognition Laboratory	Prof. NAGATA Shinji	<p>My research interest is to investigate the instinctive behavior observed in insects. We are particularly interested in selective nutritional feeding behavior between carnivorous and herbivorous feedings in the omnivore insects. To explore the mechanisms of host preference and feeding motivation observed in insects, we focus on the endocrine control in the nervous system and metabolic mechanisms. In the lights of biology, biochemistry, molecular biology, and chemical biology, we run our projects to address the insect's innate behavioral motivation.</p>	Insect; feeding behavior; endocrine factors; knockdown; metabolism	<p>【Experimental projects】 Using crickets <i>Gryllus bimaculatus</i>, program students will experience the functional assay of feeding behavior. Program students will also experience a transcriptional knockdown technique of RNA interference targeting several genes, which encode endocrine factors or metabolism-related molecules. Finally, program students must evaluate if those target molecules can influence innate feeding behavior and/or metabolisms in crickets.</p> <p>【Experience during UTSIP activity】 RT-PCR, quantitative RT-PCR, GC-MS, MALDI-TOF MS, and generally using techniques of molecular biology and chemical biology, and behavioral analyses using crickets.</p>

Division of Biosciences

Department of Computational Biology and Medical Sciences

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Frith Laboratory	Prof. FRITH Martin	<p>We look for interesting information in genetic sequences, and develop algorithmic and mathematical methods to do that. For example, we found animal DNA segments that have been conserved since the Precambrian ancestors of most animals: these segments control gene expression for embryonic development. This reveals a control system for animal development conserved since the common ancestors of humans and corals. In another project, we discovered the oldest ever "protein fossils", segments of formerly protein-coding DNA, by sensitive probability-based analysis. This revealed a great diversity of transposable elements in vertebrate ancestors of the Paleozoic Era. We also found the oldest ever virus fossils: relics of viral DNA inserted into host genomes. In addition, we collaborate with medical geneticists to understand complex chromosome rearrangements, tandem repeat expansions/contractions, and viral DNA insertions that cause disease. We discovered the cause of neuronal intranuclear inclusion disease: a tandem repeat expansion in a human-specific gene. Another project found significant non-existence of sequences in genomes and proteomes, providing clues about immune recognition and pathogen/host adaptation. Finally, we developed a mathematically-optimal way to sample a subset of positions in a sequence, for fast analysis of big sequence data.</p>	<p>Genome; evolution; probability; algorithms</p>	<p>Students are encouraged to pursue their own ideas on analyzing genetic sequences. There are broadly two types of project: biological investigation, and method development. Examples of biological investigation: survey the evolution of gene structure by gain or loss of splice sites, frameshifting, gene fusion or fission, etc; compare the evolution of mitochondrial versus plastid genomes; compare genome evolution to major body-form evolution (e.g. snakes, whales). Examples of method development: make a sensitive probabilistic model for finding distantly-related DNA sequences; devise a beautiful way to visualize complex sequence rearrangements; develop a way to extract specific rearrangement events from pair-wise alignments of long sequences (e.g. long DNA reads or whole genomes).</p>

Division of Environmental Studies
Department of Environment Systems

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Akizuki Laboratory	Assoc. Prof. AKIZUKI Makoto	<p>"Supercritical water" refers to water whose temperature and pressure are above the critical point. Water near and above the critical point offers dramatic physical changes depending on the operating conditions. In particular, the ionic and dielectric constants of water change significantly with temperature and/or pressure. As a result, it becomes possible to select a reaction based on the objective: from an ionic atmosphere suitable for acid/base reactions to one that implements the dissolution of organics, which is equivalent to a non-polar solvent.</p> <p>Taking advantage of these properties, it is expected that this new, inexpensive, environmentally friendly reaction medium will replace conventional organic solvents. Our laboratory has many research goals covering a wide range of topics: Organic synthesis without catalyst or with solid catalysts, waste decomposition by supercritical oxidation reaction, and synthesis of metal oxide nanoparticles. In all of these areas, through the design, analysis, and control of reactions based on the study of chemical reaction kinetics and reaction engineering, we are advancing extensive research, from fundamental research related to chemical reactions in subcritical and supercritical water to the development of new engineering applications.</p>	<p>Supercritical Water; Reaction Engineering; Organic Synthesis; Catalysis; Nanoparticle synthesis</p>	<p>Supercritical water is a promising reaction medium for organic synthetic reactions and inorganic nanoparticle synthesis because its solvent properties can be varied with temperature and pressure, and these properties affect the reaction kinetics and mechanisms. In this project, we will investigate how the reactions in supercritical water can be controlled by changing the temperature and pressure of supercritical water and how this reaction control affects the yield and properties of the products.</p>
Geosphere Environment Systems Laboratory	Prof. TOKUNAGA Tomochika	<p>Underground geosphere environment has been extensively used to support highly developed human society; e.g., extraction of energy resources and groundwater, waste disposal, construction of tunnels and underground spaces. Because of these activities, environmental problems which affect the sustainability of our society have emerged. The target of our laboratory is to understand and predict the change of geosphere environment caused by human activities, and to develop necessary engineering measures to attain sustainable use of geosphere environment. Current research topics include, studying and evaluating geosphere environmental changes caused by energy resources development and proposing necessary technological measures for sustainable resources development, securing stable and safe freshwater resources and development of efficient management schemes, and modeling long-term fluid flow and material transport processes through geosphere and its application to waste disposal and energy resources exploration.</p>	<p>Groundwater; coastal zone; seawater intrusion; modeling; field survey</p>	<p>Fresh groundwater in shallow unconfined aquifers is an important water resource for many coastal zones worldwide which, however, is threatened by seawater intrusion. The occurrence of seawater intrusion is controlled by both anthropogenic activities and natural factors. Anthropogenic activities such as land reclamation, abstraction of freshwater and other natural resources, construction of structures such as riverbanks and ditches, and alternation of land surface conditions, could disturb freshwater-seawater interactions from the natural conditions. To what extent seawater intrusion occurs is also dependent on natural factors such as aquifer properties, tidal river dynamics, and meteorological conditions. In this study, computer-based techniques such as numerical modeling combined with field-based geophysical exploration techniques such as 1D and 2D resistivity surveys will be applied to understand seawater intrusion situations both from conceptual cases and realistic sites. Students will learn fundamental knowledge of coastal hydrological processes and gain the ability to analyze environmental issues through hands-on practice of using advanced modeling tools as well as participating field investigation. Also, students will have chances to get involved in other research activities in this laboratory, such as GIS-based mapping, water sampling, and water quality analysis.</p>

Division of Environmental Studies

Department of Human and Engineered Environmental Studies

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Kotani & Shimba Laboratory (Mathematical Biology and Bioengineering)	Prof. KOTANI Kiyoshi	Recent advances of experimental and analytical techniques have shown that biological systems are far more precise in achieving various functions than we have previously imagined. Our laboratory explores a wide range of projects spanning from fundamental research into life phenomena to the development of life-supporting technologies. Biological systems are organized into a hierarchical structure from molecules and cells to organs and individuals enabling them to perform diverse functions. The essence of life phenomena can be understood through mathematical analysis and modeling that integrates data from various levels of biological systems, leveraging nanotechnology and multimodal measurement. Within this overall laboratory direction, this internship focuses primarily on macroscopic human measurement and analysis, as well as mathematical modelling and analysis.	Brain Computer Interface; Computational Neuroscience; Medical ultrasound imaging; Nonlinear Dynamics; Brain dynamics	Applicants are required to carry out one project during the internship term. This project will focus on a subject of interest from areas such as brain-machine interfaces, medical ultrasound measurement support devices, and computational neuroscience, while taking into account the current situation of the laboratory. Examples of specific projects include (1) Experimental research for reliable Brain-Computer Interfaces, (2) Analysis of non-linear and collective dynamics and functions of biologically plausible neuronal models, (3) Improving the quality of medical ultrasound imaging for health management outside hospitals. Please note that English is okay for communication and research during the internship.
Simulation of Complex Systems Laboratory	Prof. CHEN Yu	A wide range of research topics are studied in our lab, including modeling and analysis of social-economics, complex fluids, and biological systems. There are three main research directions: (1) Multi-agent cooperative evolutionary games for modeling and simulations of financial markets; (2) Discrete kinetic models for simulation of complex fluids; (3) Cellular automata and heterogeneous stochastic agent models for simulations of cancer and aging.	Complex Systems; Agent-Based Modeling; Stock Price; Aging; Tumorigenesis	As part of the program, a student will be assigned a small project, involving model construction and computer simulation. The specific complex system for study will depend on the student's interest. A financial market, a solution containing colloid, or a growing tumor could be the target of study. Apart from research, visits to related laboratories at other universities, and/or scenic sites surrounding Tokyo, etc., will also be scheduled.
Laboratory for Intelligent Systems Design	Prof. HIEKATA Kazuo Dr. NAKASHIMA Takuya	Societies and industries can be thought as a system of people, technology, and institutions. Although these social and industrial systems have evolved and met the high expectations of humans, the mechanisms of the systems have become more complex, giving rise to difficult problems to solve, such as global warming and aging populations. This laboratory is engaged in research that contributes to solving such problems by supporting human intellectual activities such as decision-making related to systems with simulation, sensing, and data analysis technologies.	Climate Change Adaptation; Flood Risk Management; System Dynamics; Agent Simulation; Policy Making	In our laboratory, we are working on the construction of a simulation model to examine appropriate adaptation measures that take into account multi-sectoral synergies and trade-offs in response to the effects of climate change, such as an increase in flood risk. Based on the simulation model we constructed for Japanese local area, the internship student will customize and develop the model so that it can be used to approach issues in their home country, or desired region. This research will be conducted with Dr. Takuya Nakashima, an assistant professor at the Hiekata Laboratory.

Division of Environmental Studies
Department of International Studies

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Honda Lab	Prof. HONDA Riki	<p>Our society is exposed to various types of risks including natural disasters. Preparation for such risks is essential, but no countermeasure can provide perfect protection against severe disasters. In the presence of various threats such as climate change, huge earthquakes and tsunamis, society needs to be endowed with capability of adaptation and resilience. In our group, mechanism of collective behavior observed in the society coping with the situation with severe uncertainty is discussed from the viewpoints of social networks, game theory, adaptive systems theory, etc. Innovative mathematical approach for uncertainty management, such as financial problems is also in our scope. Development and management of infrastructure systems, advanced design methods, asset management and international technology transfer are also of our interest.</p>	<p>Infrastructure; community resilience; disaster management; information theory; deep learning</p>	<p>(1) Statistical analysis of survey data to discuss community's attitude for disasters, using Bayesian approach or social network analysis. (2) Methodologies for seismic design/infrastructure maintenance, based on deep learning and information theory.</p>