国立大学法人 山口大学
Faculty of Agriculture, Yamaguchi University
農学部

Faculty of Agriculture
Yamaguchi University

2025

Contents

Academic staff list

Department of Biological and Environmental Sciences

Academic staff list

Department of Biological Chemistry

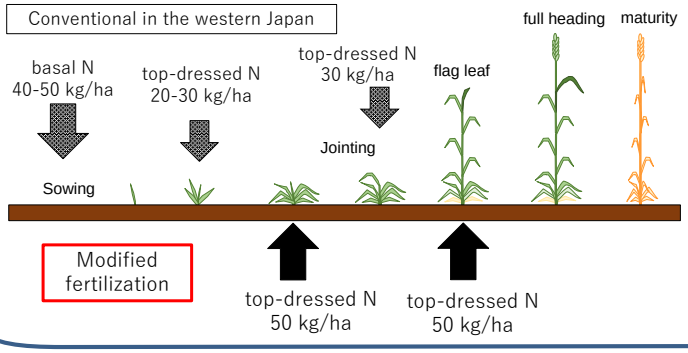
Interaction of Physiology, Ecology, and Cultivation Technologies of Crops for High Yield and Quality

High yield and quality wheat production in western Japan

In the warm and rainy climate of western Japan, wheat is grown in fields temporarily converted from lowland rice paddies. These conditions reduce wheat yield and quality. We have developed the modified fertilization(figure below) adapting to this area. Wheat productors who employ the modified fertilization is now increasing.

High-quality rice in eastern Japan

In the rice crop in western Japan, quality is declining due to high temperatures. We are working to establish a technique for diagnosing rice growth in order to improve the quality of sake rice, which is the raw material for high-quality sake in Yamaguchi Prefecture.



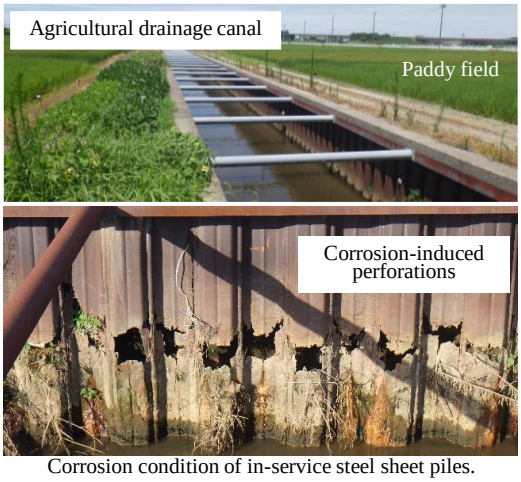
Development of remote sensing for diagnosis of paddy rice growth

ARAKI, Hideki

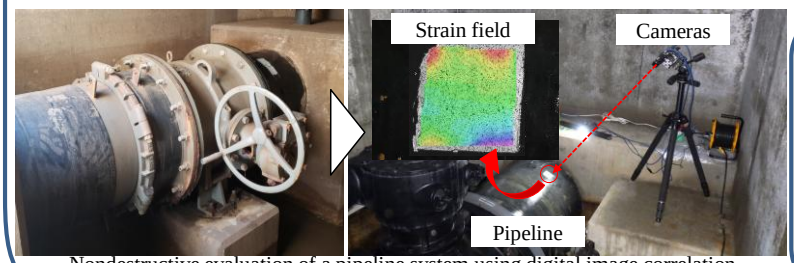
Ph. D., 2002
Nagoya University

Nondestructive Testing and Evaluation of Infrastructure for Water Use

Irrigation and drainage engineering focuses on the effective management and utilization of essential resources such as water and soil through appropriate control with the goal of enhancing the infrastructure and environments that support agricultural production. Our research centers on agricultural water infrastructure that has undergone significant deterioration. We apply nondestructive testing (NDT) techniques to detect and evaluate material degradation and damage. We particularly focus on the interfaces and interactions between materials and fluids. Key research topics include: non-contact detection of corrosion in steel sheet pile walls; non-contact detection of water leakage in pipeline systems using transient wave analysis and pipe deformation monitoring; and disaster prevention and mitigation for agricultural infrastructure.



Corrosion condition of in-service steel sheet piles.



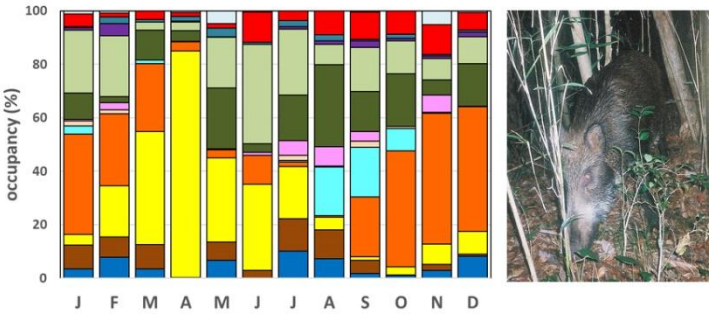
Nondestructive evaluation of a pipeline system using digital image correlation.

HAGIWARA, Taiki

Ph. D., 2023
Niigata University

Wildlife Ecology

Wildlife damage to crops has become more serious in our country over the past few decades. From a standpoint of wildlife management, not only culling pest animals, but also habitat management and damage prevention are indispensable. To prevent damage to crops, we must understand the ecology of the target species. In our laboratory, ecology, particularly food habits, of wild animals, such as deer, wild boars, raccoon dogs, bears and other species, have been investigated. We have elucidated that wild boars in Shimonoseki City mainly feed on bamboo shoots from mid-winter to early summer, and that they also feed on certain types of acorns from early fall to mid-winter. This suggests that the elimination of bamboo plants and acorn trees in and around villages removes a large part of the food resources of wild boars and that their range must shift to secluded places, which results in a peaceful coexistence of humans and wildlife. Such an application of scientific knowledge to wildlife management is our primary goal.



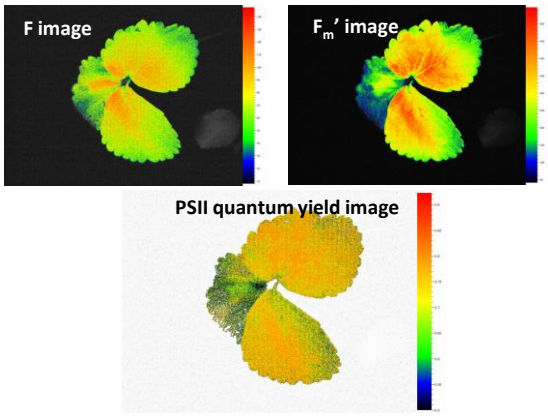
Monthly food habit of wild boars in Shimonoseki City, Yamaguchi Prefecture, using the point frame method. We can see that bamboo (yellow) and acorn (orange) are important food items for wild boars

HOSOI, Eiji

Ph. D., 1992
Colorado State University

Environmental Control and Plant Monitoring in Plant Production

In Bio-Environmental Information Engineering laboratory, we perform research on the environmental control and use of information technology for plant production systems, including protected cultivation, plant factories, and plant tissue culture. We investigate the relationships among environmental factors, plant growth and development, and physiological state. Our aims are to develop systems to optimize the growth environment in plant production systems based on this knowledge.
We also attempt to develop methodologies to acquire information related to plant growth and development or physiological state. This information is then used to improve the efficiency of plant production (i.e., to improve the quality and quantity of products or to suppress plant diseases). Image analysis is a promising technique for the nondestructive acquisition of information on the plant physiological state, linking to AI technologies. We not only use digital cameras including a mobile phone or a web camera but also use other types of cameras such as hyperspectral cameras or thermal cameras. Fluorescence imaging from plant leaves is also used for the analysis of the plant physiological state.



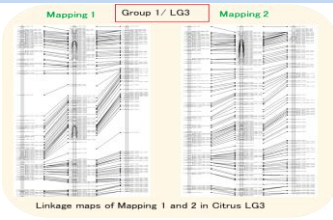
Chlorophyll florescence imaging for analysis of photosynthesis

IBARAKI, Yasuomi

Ph. D., 1996
The University of Tokyo

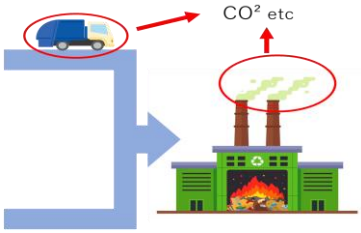
Fruit Tree Genetic Traits and their Application to Breeding

Our research studies important fruit tree genetic traits and their application to breeding. We focus on the following subjects: (1) Inheritance of various traits in fruit trees and their use in breeding, (2) Research on functional components of fruit trees, especially in search of effective utilization methods for underutilized plant parts, etc, and (3) Elucidating the mechanism of thorn formation in Citrus for the development of thornless cultivars.
To elucidate the mechanism of self-incompatibility, establish basic techniques for breeding citrus varieties, and open up prospects for the development of seedless varieties.
Nanoparticulation is an effective method for efficiently extracting functional components from fruits and other ingredients, and is expected to be applied in a variety of fields to fruit and peels that are usually discarded.
We will identify practical methods for developing varieties that are easy to cultivate and manage, and for preventing the formation of thorns.



Linkage maps of Mapping 1 and 2 in Citrus LG3


Ultrasonic homogenizer



KIM, Junghee

Ph.D., 2011
Kyushu University

Flowers to Leaves: Unique Mechanism Underlying Bacterial Plant Diseases

Our laboratory works to elucidate molecular mechanisms underlying plant diseases. One example is “Phyllogen”, a unique protein secreted by phytoplasmas, a group of plant pathogenic bacteria. Phyllogen transforms plant flowers into leaves, and we revealed that phyllogen binds to the MADS domain transcription factor (MTF) that regulates flower development of plants. Then, phyllogen degrades MTF via host proteasome, thereby inducing the change of flowers into leaves. Although the proteasome generally degrade ubiquitinated proteins, we found that MTF degradation by phyllogen is ubiquitin-independent. Such ubiquitin-independent hijacking of the proteasome is quite unique mechanism, that is not known in other bacterial proteins. Moreover, we constructed an interaction model of phyllogen and MTF by combining two approaches: experimental identification of the binding-involved region and AI-based speculation of protein structures.

Now, we are also interested in developing detection and quantification technologies for diverse pathogens causing serious problems in Yamaguchi Prefecture and emerging pathogens.


A hydrangea flowers, changing into leaves by phyllogen (Right)

KITAZAWA, Yugo

Ph. D., 2017
The University of Tokyo

Protected Cultivation: Production Technologies of Vegetables in Greenhouses and Plant Factories

Protected cultivation, such as in greenhouses and plant factories, allows for the stable production of vegetables with a high yield and high quality by controlling environmental conditions including temperature, humidity, light quality and intensity, and carbon dioxide concentration. The mission of our laboratory is to develop new technologies for environmental control to achieve vegetables with higher yields and higher quality in greenhouses and plant factories. Therefore, we determine relationships between plant physiology and environmental conditions using methods to measure plant physiological information and environmental conditions. Research interests include the following:

• Responses of ion absorption by plant roots to environment conditions.
• Production of value-added vegetables by applying environmental stresses to roots in a soil-less culture.
• Improvement in plant productivity by preventing tipburn development on butterhead lettuce.
• Utilization of unused resources from other industries for crop production.
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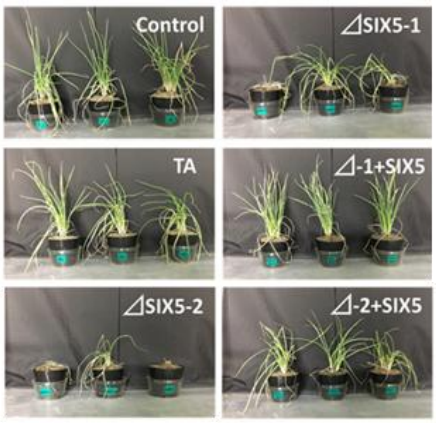
The actual condition of experiments in demonstration facilities for plant factories at the Yamaguchi University

SAGO, Yuki

Ph. D., 2010
Kyushu University

Effector Proteins of Plant Pathogenic Fungi

Our research focuses on the infection mechanisms of the plant pathogenic fungus *Fusarium oxysporum.* The fungus is soilborne and infect more than 120 host plants including onion and tomato. Plant pathogenic fungi can secrete pathogenicity proteins, such as effector proteins, into plant cells to suppress plant defense and facilitate fungal colonization. Some effector proteins are recognized by resistance genes of the host plant, and they function as avirulence factors. We aim to clarify the effector-mediated infection mechanism of the pathogen using molecular biology tools such as next-generation sequencing, transcriptome and proteome analyses, and genetic transformation. In addition, We are developing new methods to induce resistance to the pathogens in host plants using natural products.



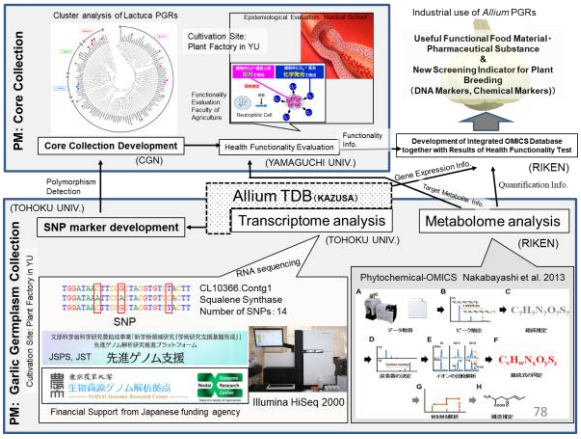
FocSIX5 acts as an avirulence effector towards shallot.

SASAKI, Kazunori

Ph. D., 2015
Tottori University

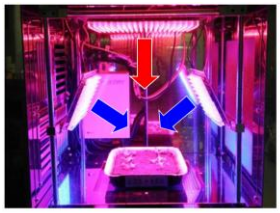
Genetics and Environmental Control in Vegetable Crops

In my laboratory, we conduct basic research on vegetable breeding and cultivation. We collect and maintain wild species and local varieties that are disappearing from the earth, and produce own genetic resources that provide a source of breeding materials with resistance to unknown diseases caused by global warming. Thus, we possess special resources not available at other research institutions, such as chromosome addition lines, nuclear-cytoplasmic substitution lines and doubled haploids. Using these lines, we are developing a novel omics-based technology for developing new varieties that can be used as a countermeasure against global warming. In addition, we have successfully developed a high-speed cultivation technique for leafy vegetables such as lettuce by conducting light irradiation tests using LEDs.

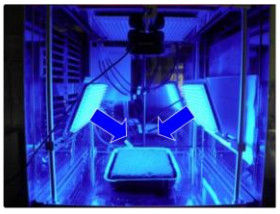


Allium omics concept

LED irradiation condition



RB（Simultaneous）
12h light / 12h dark



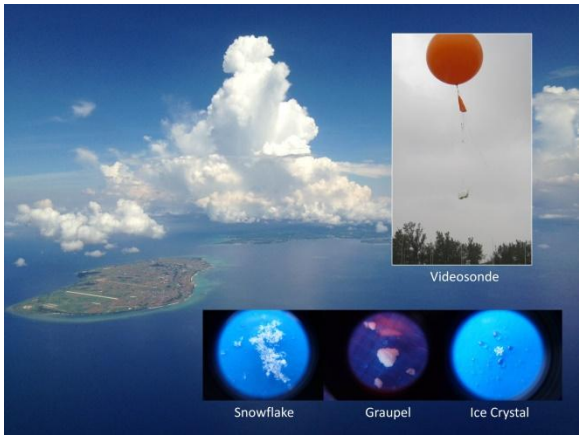
R/B（Alternating）
12h blue / 12h red

SHIGYO, Masayoshi

Doctor of Agriculture, 1997
Kagoshima University

In Situ Observational Study of Microphysics in Heavy Rain/Snow Clouds

Global warming is one of the problems that must combat in the 21st century. The decrease in sea ice, delayed coloring of leaves, northward trend of the growth area of insects, and increase in heavy rains are all assumed to be influenced by global warming. Climate change brings about serious influences to ecosystems, agriculture, energy, water resources, and human health. For example, some scientists state that recent heavy snowfalls were influenced by the high sea surface temperatures caused by global warming. To predict climate change due to global warming, it is necessary to understand weather phenomenon. Of major concern is the rainfall mechanism, particularly the microscale phenomenon in clouds (cloud microphysics). My research consists of in situ observations using balloon-borne/ground-based precipitation particle imaging sensor (Rainscope), which can capture particle images and measure thier fall velocity. Investigating the vertical distribution of precipitation particles will contribute to improve our understanding of water concentration processes in clouds that bring torrential rain. I am also interested in the development of observation techniques and new equipment.



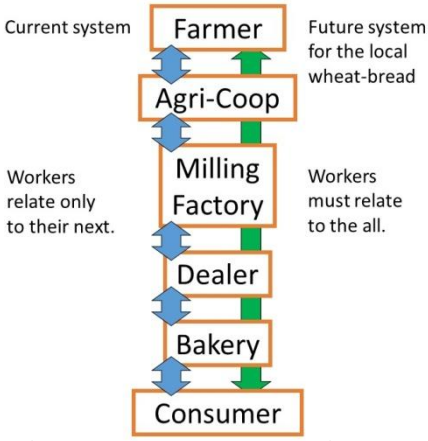
A launching videosonde and precipitation particle images

SUZUKI, Kenji

Doctor of Science, 1997
Kyushu University

Crop Science Laboratory

The Takahashi Laboratory focuses on agronomy and crop science research for wheat and barley crops. We have been examining not only how to improve the yield and quality of wheat products but also how to make the cultivation work easier and more comfortable. We aim to make the sowing period earlier than November, which is typical when cold rain prevents sowing. We use the west Japan ecotype for wheat production in Hokkaido where the climate is getting warmer, and rainy summers, like those in west Japan, have recently been occurring. This ecotype is tolerant to rainy conditions. The aim is for our local bread, which is made from the local wheat product in Yamaguchi, to go on the market. The local wheat-bread system is too difficult to develop, because there are many steps in its process. Each step, from growing wheat, milling flour, to baking bread is skillful work. These workers must relate to each other but are currently not even familiar to each other. In particular, consumers are not familiar with growing wheat or milling flour. The price of fertilizer has become high. We will establish an economical fertilization system for bread wheat, which can achieve high yields and high quality with a small amount of fertilizer.



Process from wheat cultivation via milling flour to baking bread

TAKAHASHI, Tadashi

Ph. D., 1993
Hokkaido University

Species and Ecological Diversity of Termites (Isoptera) in Asia

Insects are the most prolific animals on earth and are closely related to the environment and humans. Our work focuses on termites. Their taxonomy, biodiversity, and ecology were studied to obtain useful knowledge for the conservation of forests and to develop environmentally friendly termite control.

Major research subjects are as follows:

(1) Taxonomy and biodiversity of termites in Asia

Termites play a crucial role in forest ecosystems as a decomposing agent, but termite diversity significantly varies according to its environment. We investigate the taxonomy, diversity, and molecular phylogeny of termites in Asian to clarify the relationship between the forest environment and termite diversity.

(2) Nestmate recognition of termites

Termites are social insects, and they have a unique recognition system to form and maintain colonies. We investigate the nestmate recognition of termites by comparing the cuticular hydrocarbon composition of respective species with their agonistic and trophallactic behaviors. The research results will be used to improve not only the taxonomy but also the control of termites.

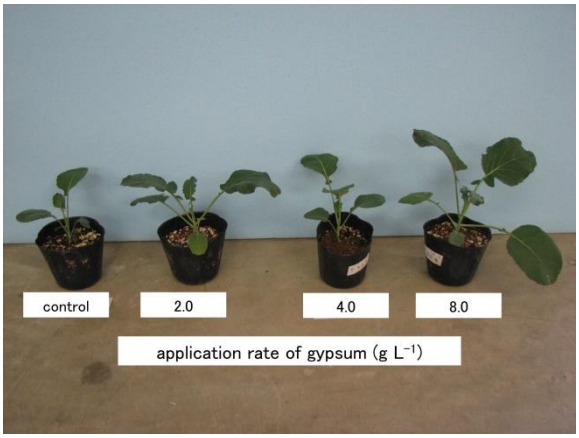
Left: Species diversity survey in Borneo; Right: The open-foraging termite *Hospitalitermes lividiceps* in Borneo.

TAKEMATSU, Yoko

Doctor of Agriculture, 1997
Kyushu University

Establishment of Agricultural Uses of By-product Gypsum

In our Environmental Soil Sciences Laboratory, we study the relationships between soil and agricultural environments, specifically focusing on the improvement in nutrient supplies to crops and the amelioration of soil conditions for crop production and natural vegetation. One of our main research topics is the establishment of agricultural uses of by-product gypsum. Gypsum (CaSO4•2H2O) has been used in agriculture for many years as a soil conditioner and ameliorant for sodic soils and as a nutrient source of Ca and S for plant growth. Recently, the utility of gypsum has been extended to acidic and infertile soils as an ameliorant for subsoil acidity. Two types of gypsum, mined gypsum and industrial by-product materials, are used. The production of by-product gypsum is increasing, although it is mostly limited to industrial uses such as wall boards and cement. These industrial uses are relatively unstable because of the economic situation. Therefore, establishing the agricultural uses of by-product gypsum is important. In our laboratory, we are currently researching the effects of by-product gypsum as a nutrient source of Ca and S for various crops on both crop yield and quality.



The effect of by-product gypsum on broccoli seedlings

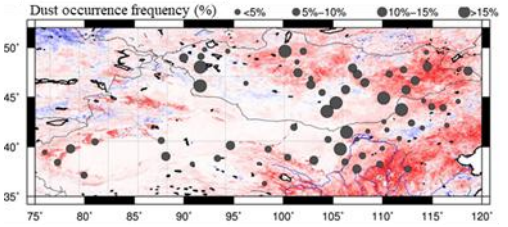
TOMA, Mitsuru

Ph. D. (Agri.), 1996
Tohoku University

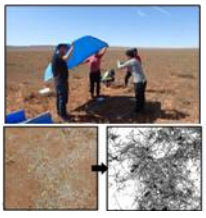
Wind Erosion and Dust Climatology

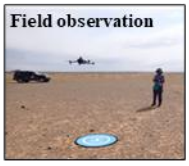
Wind erosion is one of the worst natural and anthropogenic hazards in drylands, which covers about 40% of the global continental area, and 10－20% of which are already degraded. Dust emission, resulting from wind erosion has impacts on air pollution, on the health of humans and livestock, and on the climate, not only in source areas but also in downwind regions such as Japan. Our laboratory conducts research on wind erosion and dust climatology, particularly the following themes:

(1) Spatial and temporal distributions of dust occurrence (mainly in East Asia)
(2) Elucidation of the dust occurrence mechanisms
(3) Effects of climate change and anthropogenic activities on desertification and dust occurrence
(4) Remote sensing and field observation of the land surface conditions, especially vegetation
(5) Improvement of wind erosion risk assessment



Dust monitoring site @ Gobi Desert, Mongolia





WU, Jing

Ph. D., 2016
Nagoya University

Dynamics of Soil Organic Matter and Soil Formation

Various types of soils are present on Earth. Soils have a variety of functions, such as plant production and environmental regulation, and support life in Earth. Various components in soil are involved in these functions, and in particular, soil organic matter, secondary minerals, and microorganisms play important roles. Thus, understanding the characteristics and formation processes unique to each type of soil, as well as the fate of soil organic matter and the microbial activity that is responsible for it, is a crucial issue for sustainable agriculture and environmental conservation, which require harmony between modern society and the environment. In our laboratory, we aim to clarify the interactions among soil organic matter, microorganisms, and plants. Specifically, we focus on the following subjects: (1) degradation of humic substances by ligninolytic fungi and enzymes and (2) effect of soil mineral components on degradation of humic substances. We are also investigating the characteristics of the soils in Yamaguchi Prefecture, such as the unique limestone karst topography of Akiyoshidai and the Andisols found in the eastern part of the prefecture, and are working to clarify the formation mechanisms of these soils.

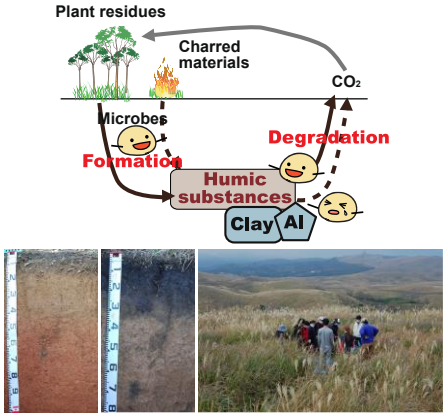


Diagram of the dynamics of soil humic substances (top) and soil profile and field survey in Yamaguchi Prefecture (bottom)

YANAGI, Yukiko

Doctor of Agriculture, 2002
Kobe University

Research on Physiological Role of Aroma (life/nature) and its Applications

Research interests range widely among a variety of physiologically active compounds in nature. In particular, analysis and synthesis are my main tools for the demonstration of the chemical ecology. We are currently investigating pheromones and allelochemicals in marine organisms. Citrus fruits and herbs are found worldwide, and the essential oils are widely utilized in foods and beverages and as fragrances in cosmetics. The essential oils can have relaxing or stimulating effects on humans. Our odor descriptions and physiological analyses reveal the relationships between odor and the human brain.

Research interests
1) Investigation and synthesis of pheromones and allelochemials in marine organisms
2) Flavor chemistry of agricultural, marine, and livestock products and their processed foods
3) Elucidation of mechanistic pathways for the biogeneration of aroma compounds
4) Relaxation effects of aroma on humans
5) Isolation and synthesis of physiologically active compounds
6) Development of functional foods and cosmetics.

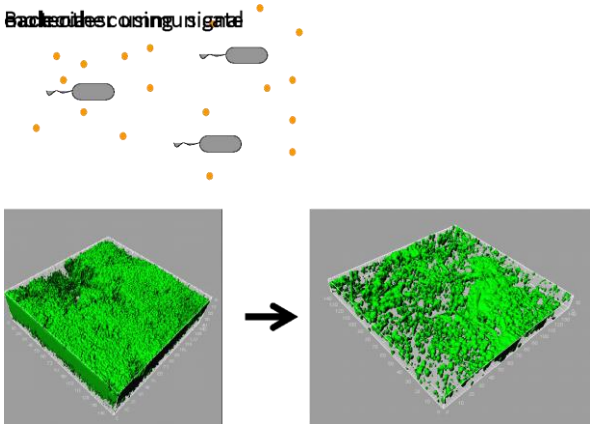
Diversity of naturally occurring compounds

AKAKABE, Yoshihiko

Ph. D., 1994
Okayama University of Science

Pathogenic bacterial adhesion and colonization of host cells

When pathogenic bacteria infect animal and plant hosts, they must adhere to host surfaces. These bacteria have various adhesion factors against host defense mechanisms. Additionally, most of these bacteria communicate each other within biofilm community. Employing biochemistry and molecular biology techniques, we aim to uncover the mechanisms governing pathogenic bacterial communication and colonization. Particularly, we aim to investigate the mechanism of bacterial adhesion and colonization of animal and plant host cells and screen for inhibitors of biofilm formation. Dissecting the mechanism of bacterial communication will provide insights into managing and even preventing biofilm formation, which is necessary to prevent diseases and maintain quality in various industrial fields.


Inhibition of bacterial communication affects biofilm formation

AZAKAMI, Hiroyuki

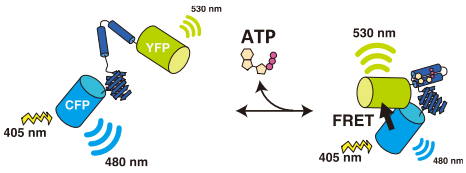
Ph. D., 1994
Hiroshima University

Understanding Spatiotemporal Dynamics of Cellular Metabolism using Advanced Molecular Tools

Cells obtain the energy essential for life activities through energy metabolism. If energy metabolism cannot be adjusted to meet the energy demands that change depending on the environment and cell state, the energy homeostasis of the cell will collapse, potentially leading to disease. By developing molecular tools that visualize metabolites using fluorescent proteins, we have enabled the imaging of metabolic states inside living cells with high spatial and temporal resolution. Using these technologies, we are investigating how metabolism in cancer and neuronal cells is regulated under various cellular contexts. we are investigating how metabolism in cancer and neuronal cells is regulated under various cellular contexts. Our research not only addresses energy homeostasis, which is central to life, but is also expected to contribute to understanding disease mechanisms and developing future treatments.

Ongoing research projects

- Study on the dynamics of cellular metabolism
- Development of molecular tools to visualize metabolism



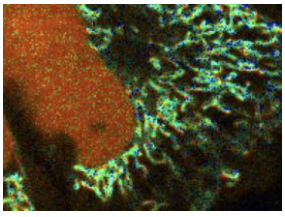


Fig. Imaging of intracellular ATP using a fluorescent biosensor

IMAMURA, Hiromi

Ph. D., 2002
The University of Tokyo

Anti-aging and Life Span Extension

Our main subject of research is the understanding of the aging process and the development of effective methods for anti-aging and life span extension. Because we have a limited understanding of the aging mechanism, we investigate it in terms of oxidative stress. With regard to the aging process, we emphasize on reactive oxygen species (ROS) generated inside the body and the antioxidant systems protecting against ROS-mediated oxidative stress. We study the benefits as well as the damages of ROS. In addition to these research themes, we attempt to reveal the anti-aging strategy of long-lived termites.
Ongoing research projects in our laboratory are

1. Analysis of the long-lived termite from the standpoint of the antioxidant system.
2. Edible insects as a functional food for health.

Japanese long-lived termite,
R. speratus

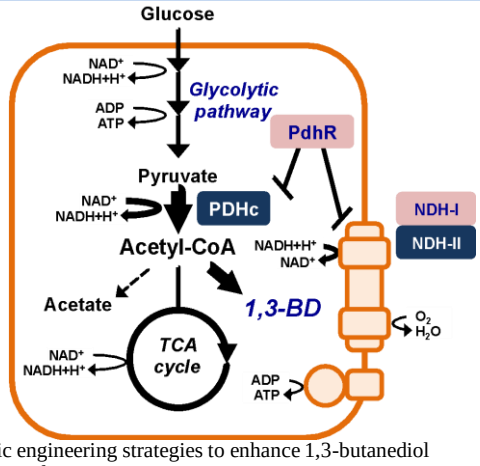
Insect cuisine

IUCHI, Yoshihito

Ph. D., 1995
Hiroshima University

The Role of Microbial Physiology and Metabolic Engineering in Fermentation

Our laboratory mainly focuses on the "fermentation physiology" and "metabolic engineering" of microbes. Acetic acid bacteria, such as *Gluconobacter* spp. and *Acetobacter* spp., and amino acid-producing bacteria, such as *Corynebacterium* spp., are industrially important microbes used for the fermentative production of vitamin C, acetic acid, amino acids and so on. These microbes produce various chemical compounds through their respective metabolic processes. We are studying the dynamics of this "fermentative physiology" to molecularly understand these metabolic process.
Due to increased concerns about the depletion of fossil resources and ensuing environmental problems, biological production of platform chemicals from renewable sources has attracted much attention as a viable alternative to petroleum-based manufacturing. "Metabolic engineering" is one of the most promising means to respond to this demand. In this field, metabolically and genetically well-studied microbes, such as *Escherichia coli* and *Corynebacterium glutamicum*, are engineered to produce the desired products, i.e., platform chemicals. Thus, we aim to produce valuable chemical compounds via "metabolic engineering" approaches, such as constructing the synthetic pathways to generate platform chemicals on a large scale.



Metabolic engineering strategies to enhance 1,3-butanediol (1,3-BD) production

KATAOKA, Naoya

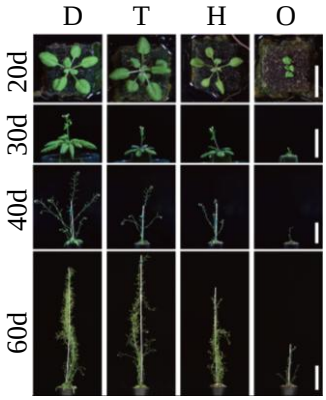
Ph. D., 2013
Hiroshima University

Analysis of the Effects of Chromosome Duplication on Plant Growth and Reproduction

Chromosome duplication plays a significant role in plants. Polyploidization, a common phenomenon in land plants, involves an increase in the number of homologous chromosome sets to three or more. The growth changes and enhanced environmental adaptability associated with polyploidization are thought to have been major drivers of plant speciation. Similarly, endoreduplication results in chromosome duplication at the cellular level. While endoreduplication is often correlated with increased cell volume, there are notable exceptions. Our laboratory focuses on the quantitative image analysis and functional analysis of genes to comprehensively understand the effects of chromosome duplication on various aspects of plant growth and reproduction.

Ongoing Research Projects

- Analysis of the effects of polyploidization on environmental responses in plants, with a particular emphasis on root growth
- Elucidation of mechanisms underlying meiotic aberrations in high-polyploids, such as autooctoploids
- Investigation of the effects of endoreduplication on tissue-specific cell growth regulation



Autopolyploid series of *Arabidopsis thaliana* (D, diploid; T, tetraploid; H, hexaploid; O, octoploid) 20-, 30-, 40- and 60-day-old plants of each (ecotype: Columbia). Scale bars = 2 cm (20d), 5 cm (30d), 10 cm (40d and 60d).
Kikuchi and Iwamoto (2020) *Cytologia*

KIKUCHI, Suzuka

Ph.D., 2023
Kanagawa University

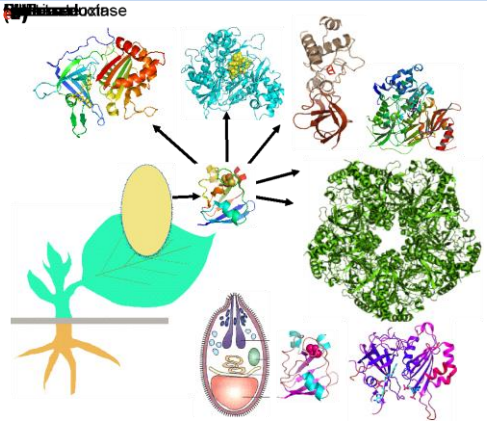
Molecular Mechanism for the Reducing Power Supply System in the Plastids of Plants and Malaria Parasites

We are interested in the way plants utilize light energy to synthesize various biomolecules which nourish life on earth. We have been focused on the mechanism by which high-energy electrons (reducing power), provided from photosystems, are properly distributed into various biosynthetic metabolisms depending on the environmental and physiological demands (Figure). A small stromal electron carrier protein, ferredoxin (Fd), which receives electron from photosystem I, plays a key regulatory role. On this front, we are currently working on identifying;

1) molecular mechanism for the distribution of reducing power in the plant plastids, in terms of protein-protein interactions and electron transfer between ferredoxin and its dependent metabolic enzymes. Recently, malaria parasites were found to possess a system for supplying reducing power, of which protein components (ferredoxin and its dependent NADP+ oxidoreductase) are homologous to those of plants. Therefore, we are also working on;

2) characterization of the system for reducing power supply in the plastids (apicoplasts) of malaria parasites.

We are studying these molecular mechanisms using biochemical and physicochemical methods, for the purpose to regulate the energy flow into their plastids, and also, from the viewpoints of their physiological significances and evolutional development of plastids in the parasitic organisms.



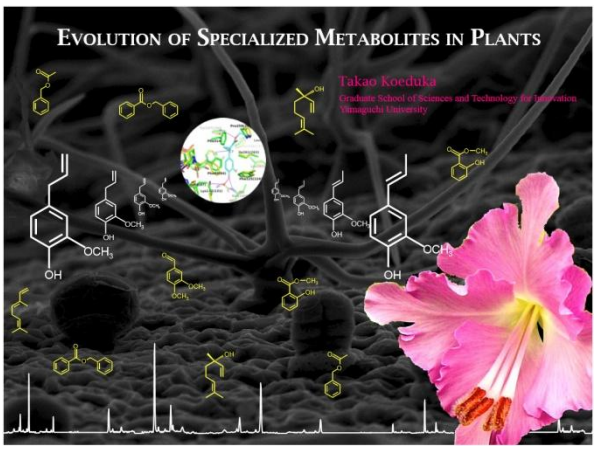
Electron distribution in chloroplasts (a) and the homologous system of ferredoxin (Fd) and Fd-NADP+reductase (FNR) in malaria parasites (b)

KIMATA, Yoko

Ph.D., 1993
North Carolina State University

Functional Analyses of Biosynthetic Enzymes Involved in Plant Specialized Metabolites

Plants biosynthesize many specialized metabolites (secondary metabolites) including volatile compounds that serve as attractants for pollinators or for defense against herbivores and bacterial pathogen for adaptation to their ecological niches. Since antiquity, humans have used plant metabolites as commercial resources, such as medicinal, food flavoring agents, and perfumes. However, the biosynthetic pathways leading to these metabolites and their regulatory mechanisms are largely unknown. My goal is to investigate the biosynthetic pathways involved in the production of specialized plant metabolites, including plant volatiles, and the enzymes that catalyze them. Genetic engineering of plant production systems with such enzymes could offer high potential for the introduction of new scents and flavors into various plant species.



Research overview

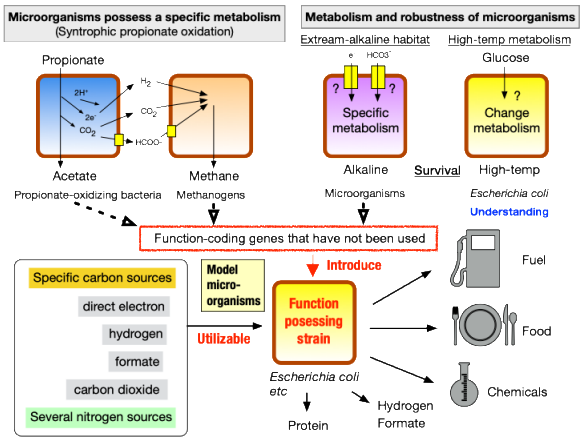
KOEDUKA, Takao

Ph.D., 2005
Tottori University

Understanding and Utilization of the Functions of Microorganisms

Microorganisms in a given environment have specific functions in response to environmental factors such as temperature and pH, as well as essential growth factors such as carbon and nitrogen sources. This function is derived from the genes encoded in the chromosomes. Advances in genetic engineering have made it possible to genetically modify microorganisms to introduce the functions of specific microorganisms. Our goal is to understand and apply the specific function of a particular microorganism. It will be possible to manufacture products and produce energy based on environmental energy using microorganisms. We are currently implementing these three projects.

• Unique Metabolic Mechanisms of Microorganisms: Propionate oxidation under anaerobic conditions requires a syntrophic relationship between propionate-oxidizing bacteria and hydrogenotrophic methanogens, then this unique metabolic mechanisms is conducted by these microorganisms. In addition, alkaline environment may confer their unique metabolism to the microorganisms living there.
• Metabolism and Robustness of Microorganisms: To understand the system of the model microorganism, we are investigating the pathways required by *Escherichia coli* for growth at high temperatures.
• Visualization of Gene Function using Microbial Cells: Using genome modification, fluorescent proteins and tags, we will visualize and enhance the expression of target genes in the cells.



KOSAKA, Tomoyuki

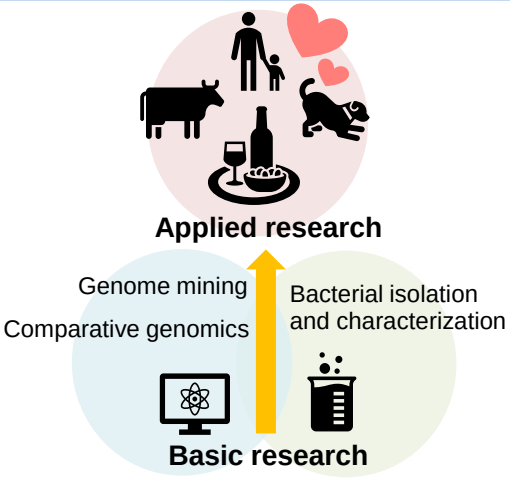
Ph.D., 2003
Kyushu University

Evolution, Taxonomy, and Biotechnological Applications of Bacteria

Our laboratory conducts research on bacterial evolution and environmental adaptation using both in silico genome analysis and wet-lab experimental approaches. We also investigate evolutionary processes through taxonomic analyses, aiming to unravel how microorganisms have achieved their current diversity.

In applied research, we focus on identifying lactic acid bacteria (LAB) suitable as food starters and assessing their functional properties to enhance the value of food products. Additionally, we are committed to developing probiotics and postbiotics that can improve the health of humans, livestock, and companion animals.

Research Interests
1. Evaluation of bacterial classification methods through *in silico* analysis
2. Evolution and classification of LAB in the context of environmental adaptation
3. Discovery of high-functionality LAB for use as food starters
4. Investigation and application of thermotolerance mechanisms in thermotolerant yeasts
5. Discovery of new insights through genome data mining taxonomy, bacterial evolution, genomics, lactic acid bacteria



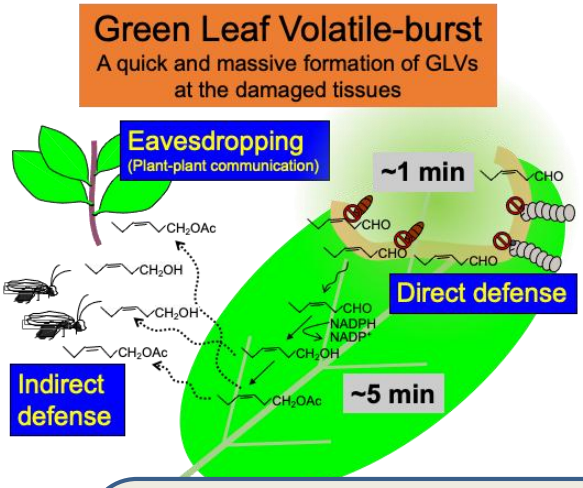
MAENO, Shintaro

Ph. D., 2020
Tokyo University of Agriculture

Plant Volatiles as Tools to Communicate with Animals, other Plants, and Microbes

Plants biosynthesize a variety of volatile substances and release them into the atmosphere. What do plants produce volatiles for? And how do plants produce volatiles? My research group is studying a group of volatile compounds called green leaf volatiles (GLVs) among the various volatile compounds produced by plants. GLVs are the main body of the green scent that you get when you grind the leaves of plants.

Why do plants produce GLVs? The amount of GLVs in an intact plant is very low, but they are rapidly produced when the plant is injured. It is produced in response to stresses that damage the body, such as feeding damage or infection by pathogens. This is a defense mechanism to protect the plant body. It has also been discovered that GLVs produced in this way attracts carnivorous insects and communicates danger to neighboring plants. The development of new ecological control technologies may be possible by making better use of these functions of volatile compounds.



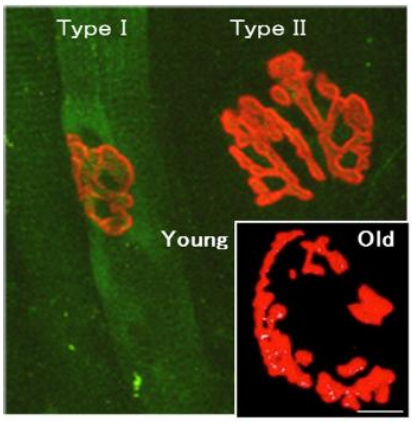
MATSUI, Kenji

Ph. D., 1991
Kyoto University

Muscle and Motoneuron Plasticity

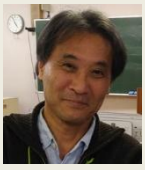
Our research interests encompass several areas of motoneuron and muscle plasticity, including 1) accommodation of skeletal muscle and motoneuron functions during altered use; 2) neurophysiology of locomotion and respiratory motor system during development and aging; and 3) optimal training stimulation for muscle adaptation in mammals. We conduct research employing histochemical, biochemical, and basic electrophysiological techniques.

Several ongoing research projects in the laboratory include 1) morphological changes in the endplate of aged rat diaphragms; 2) training and detraining effects on satellite cell responses after exhaustive exercise in thoroughbred horses; 3) muscle fiber properties in mammals, including humans; and 4) effect of eccentric muscle contraction on satellite cell activation in human anti-gravity muscles. We are embarking on collaborative research efforts within Yamaguchi University, the Japanese Racing Horse Society, and the Mayo Clinic (USA).



One of our research projects is assessing the aging of the 3D endplate in aged rats

MIYATA, Hirofumi



Ph.D., 1992
Osaka University

Structure and Function of Metalloproteins

Iron is an essential metal element in most living organisms, including bacteria. Pathogenic bacteria have developed diverse mechanisms to survive under iron-limited conditions. For example, gram-negative bacteria produce siderophores, which have high affinity for Fe(III). Siderophores chelate iron and transport it into the bacteria. However, iron atoms in host cells are tightly bound to proteins such as transferrin or ferritin. Very low concentrations of free iron pose severe challenges to pathogenic bacteria. Under such circumstances, heme could be a major iron source and some bacterial pathogens use hemophores for iron uptake from heme. Heme acquisition system A (HasA) is known as a hemophore in several gram-negative pathogens including *Pseudomonas aeruginosa*, *Serratia marcescens*, and *Yersinia pseudotuberculosis*. Using spectroscopic, crystallographic, and kinetic techniques, we have shown that iron–tyrosine coordination is critical for prompt heme capture by HasA from *Y. pseudotuberculosis*. We have also shown that interactions of the guanidinium group of the distal arginine with propionates and the heme plane contribute to the retention of heme in this hemophore.

The Structure of Heme Acquisition System A from *Y. pseudotuberculosis*

OZAKI, Shin-ichi

Ph.D. 1992
Texas A&M University

Elucidation and Application of Temperature Adaptation Mechanisms

Prokaryotes are found in every environment of diverse temperatures on Earth. For instance, there are polar regions with sub-zero temperatures, hydrothermal vents with temperatures exceeding 100 ºC, hot springs with various temperatures, and deserts with extreme temperature differences between day and night. One of our goals is to understand how these prokaryotes adapt to each temperature. We are also searching molecules to improve thermo- and cold-tolerance of organisms and developing new technologies to manipulate the temperature range in which they grow. Our research may provide clues for the sustainable use of biological resources after global warming

Research interests
1) Ecophysiology of microorganisms from various hot-springs
2) Isolation and characterization of novel thermophiles
3) Effect of diverse chaperons on temperature adaptation
4) Development of technologies to utilize non-model micro-organisms

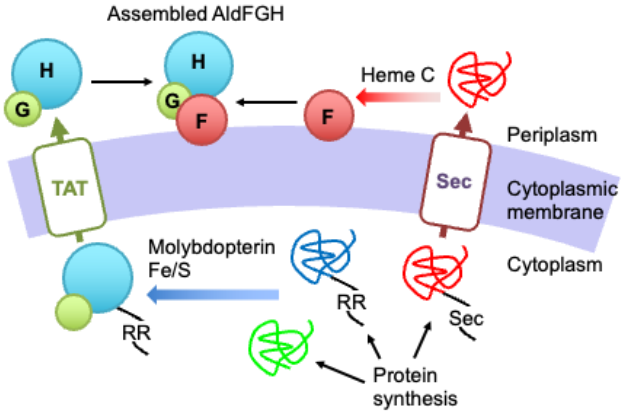
Fig. Microorganisms in various hot-springs

SATO, Yu

Ph. D., 2018
Shizuoka University

Biochemical Function, Physiological Role, and Molecular Architecture of Membrane Proteins in Bacteria

We are interested in the fermentation process orchestrated by bacteria, such as acetic acid bacteria. Particularly, we are assessing the molecular architecture of membrane-bound bacterial enzymes involved in fermentation (such as alcohol dehydrogenase), via genetic engineering, molecular biology, biochemistry, and structural biology. Understanding the basic properties of these enzymes in fermentation may provide insights into the development of enzyme-based technologies, such as biosensors and fuel cells, and may improve fermentation processes.



Molecular architecture of membrane-bound aldehyde dehydrogenase in acetic acid bacteria

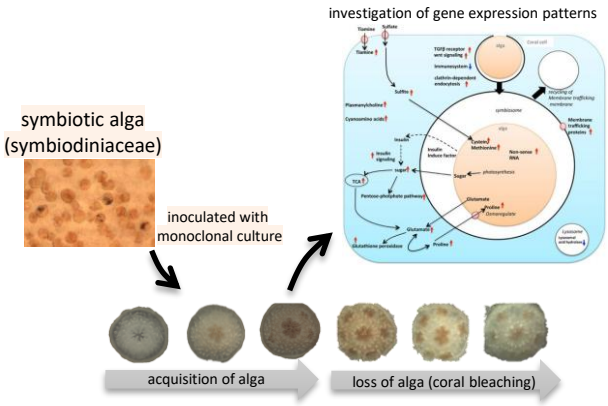
YAKUSHI, Toshiharu

Ph. D., 1998
The University of Tokyo

Functional Analysis of Symbiotic Microorganisms

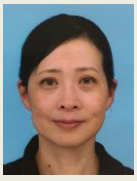
Research in my laboratory focuses on the characterization of environmental and symbiotic microorganisms. To clarify the role of symbiotic microorganisms and symbiotically process, we have used Scleractinian corals and conducting incubation experiments, transcriptome analysis, immunohistological analysis, and physiological analysis. My current research interests include the following:

・Effects of bacterial communities on stress tolerance of corals.
・ Identification of genes involved in the establishment of symbiotic relationship, and genes related to the stress response.
・ Establishment of new monoclonal culture collections of coral symbiotic microorganisms.
・ Characterization of bacterial communities involved in mass mortality of corals



Experimental system for investigating symbiotic relationships between coral and algae

YUYAMA, Ikuko



Ph. D. 2009
The University of Tokyo