



Fungus/Mushroom Resources Open the Future!

Global COE Program, Tottori University

“Advanced Utilization of Fungus/Mushroom Resources
for Sustainable Society in Harmony with Nature”

Courses in the Program

United Graduate School of Agricultural Sciences (Bioenvironmental Science)
Graduate School of Engineering (Chemistry and Biotechnology)



Global COE Program



The educational research project proposed by Tottori University has been adopted as one of the “Global COE Program” in 2008. For FY 2008, 68 projects of 29 universities were selected out of 315 applications from 130 universities.



Building a Sustainable Society in Harmony with Nature.

Program Director : Professor Nitaro MAEKAWA



Much attention has been paid to the many functions of the fungus/mushroom group. As decomposers of plants and animal remains, they contribute to the balance of natural ecosystem. In addition, they promote the growth and stress tolerance of plants through their symbiotic relationship and the degradation of environmental pollutants. Furthermore, “mushrooms” are widely used as healthy diets due to their nutritional excellence, and people have shown great interest in their medical effects. As described above, the

fungus/mushroom is a treasury of genetic resources having functions and constituents that are beneficial to humans. The “Fungus/Mushroom Resource and Research Center (FMRC)” in affiliation with the Faculty of Agriculture was established in 2005 in order to promote a high-level and unique systematic education and research related to fungus/mushroom resource science and to promote the development of human resources. In addition, this center aims to activate local industries and also to create new industries with the support of the Tottori Prefecture in cooperation with the Tottori Mycological Institute of the Japan Kinoko Research Center Foundation. In 2008, the educational research hub program “Advanced Utilization of Fungus/Mushroom Resources for Sustainable Society in Harmony with Nature”, which proposed by the Tottori University was adopted as a Global COE Program by the Ministry of Education, Culture, Sports, Science and Technology, and the center currently plays a main role in the promotion of the program.

We are going to continue to make efforts in order to play a pioneering role as the one and only education and research center in Japan focusing on “Fungus/Mushroom Resource Science”.

Program Descriptions

Program Summary

This Center of Excellence (COE) is underpinned by the world-class fungus/mushroom genetic resources and the distinctive research base possessed by Fungus/Mushroom Resource and Research Center (FMRC) in the Faculty of Agriculture. The purpose of this COE is to foster personnel who can carry out research on discovering and applying the diverse functions of fungus/mushroom genetic resources, to conduct research on the multifaceted and advanced use of fungus/mushroom resources that contribute to building a sustainable society in harmony with nature, and to build a core education and research center (global COE) that will lead the science on fungus/mushroom resources in the world.

Features

Faculty of agriculture provides the distinctive educational curriculum on plant and fungus resource science from the undergraduate through the graduate school master's degree program. Furthermore, a

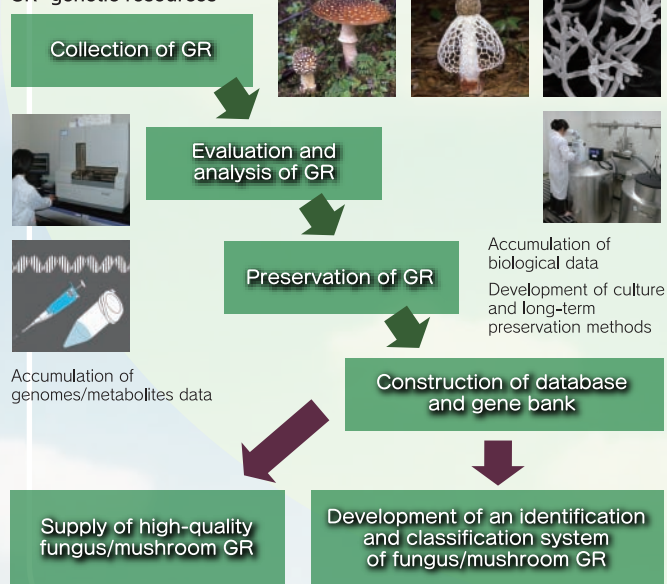
practical overseas training on field and laboratory study is included in a curriculum of the United Graduate School of Agricultural Sciences. The Fungus/Mushroom Resource and Research Center (FMRC), which is the core institution of this COE, is the only education and research organization for fungi and mushroom in Japan. The FMRC has the genetic resources of about 13,000 strains in about 1,300 species of mushroom, which were mainly offered by the Tottori Mycological Institute, Japan Kinoko Research Centre Foundation. The number of these resources is among the largest in the world. In this COE program, we shall strive not only to leverage the present genetic resources but also to explore further and to enhance information exchange and personnel development by networking with research center and cooperating institutions in other countries. In order to realize the objectives, we provide the long or short term overseas stay program for doctoral course students to improve their experience in field work and also to develop the academic exchange between the institutions.

Basic Research Group

Group Leader: Professor Motoichiro KODAMA

The Basic Research Group aims to accumulate high-quality fungus/mushroom genetic resources through the discovery, evaluation, and preservation of these resources, and to construct a comprehensive database/genetic resource bank that will include genetic information. Specifically, the Group will promote the collection of fungus/mushroom genetic resources, not just from Japan, but from around the world. Collected fungal strains will be subjected to rigorous investigation in order to identify and evaluate the taxonomic status of the collected specimens and to further the discovery of novel genetic resources. The group also intends to store and conserve these high-quality genetic resources and establish a genetic resource bank consisting primarily of mushroom strains. The Group also aims to compile a fungus/mushroom genetic resource database that will combine all of the available information of the collected genetic resources at morphological and genetic levels, and to develop a system for identifying fungi/mushrooms using this database. It is expected that this high-quality genetic resource bank will be used extensively in the identification of new compound functions and to maximize the application of these fungus/mushrooms in environmental conservation, food production, and health promotion, all of which are essential for a sustainable society in harmony with nature.

GR=genetic resources



Program Member

Prof. Motoichiro KODAMA <Bioenvironmental Science, United Graduate School of Agricultural Sciences (UGSAS)>(Group Leader)
Prof. Nitaro MAEKAWA <Bioenvironmental Science, UGSAS>
Prof. Eiji NANBA <Research Center for Bioscience and Technology>
Prof. Shinichi ITO <Bioenvironmental Science, UGSAS, Yamaguchi Univ.>
Prof. Teruyuki MATSUMOTO <Bioenvironmental Science, UGSAS>
Prof. Akira NAKAGIRI <Bioenvironmental Science, UGSAS>(Leader of Networking with Research Center in Other Countries)

Associate Member

Associate Prof. Akihiro ITAI <Bioproduction Science, UGSAS>
Assistant Prof. Takashi SHIROUZI <Fungus/Mushroom Resource and Research Center (FMRC), Faculty of Agriculture>
Assistant Prof. Kozue SOTOME <FMRC, Faculty of Agriculture>

Human Resources Development

We will support researchers with abundant knowledge of fungal resource science and highly specialized personnel who are capable of solving problems and can work actively across the world.

Toward Establishment of Sustainable Society in Harmony with Nature

Field-minded, pioneer-spirited specialists and professionals with international competitiveness, excellent problem-solving capabilities, broad perspectives, and high flexibility to meet social needs.

Specific Measures for Human Resources Development

Sophisticated doctoral education; Interdisciplinary fungus/mushroom resource science education through cooperation between Faculties of Agriculture, Engineering and Medicine.

Diverse Programs for Human Resources Development

- Acquisition of the latest experimental techniques through the "Educational Program at the Research Center for Bioscience and Technology, Tottori University"
- "The Fungus/Mushroom Genetic Resources Science Seminar" allows participants to hone their presentation and communication skills and to improve their foreign language ability. They can also further their understanding of fungal/mushroom resources through the collection and identification of mushrooms
- The Global COE Program Open Seminar is held once a month with presentations by teaching staffs, young researchers, and visitors to the school, with different research groups presenting their work in rotation.
- Seminars are held together with foreign researchers that have been invited to attend.
- Support for degree holders seeking positions at domestic and overseas testing laboratories and research institutions



Applied Research Group

Group Leader: Professor Hiromitsu NAKAJIMA

Using fungus/mushroom genetic resources, the Applied Research Group is working to develop ecosystem conservation technologies and methods that can be applied to reduce environmental impacts. The Group is also working to isolate and identify useful biologically active substances from fungi/mushrooms, and to develop technologies for the stable production of these substances. The areas of study that the Group sees as particularly important are increasing the disease resistance of plants using the mycelia of edible mushrooms, tolerance to environmental stress in plants resulting from mycorrhizal symbiosis and its application, the development of methods for pest control using substances derived from fungi/mushrooms, identification and application of useful substances derived from mushrooms, and the development of technologies to enhance the production of the useful substances in mushrooms.

Program Member

Prof. Hiromitsu NAKAJIMA <Bioenvironmental Science, UGSAS> (Group Leader)

Prof. Tadanori AIMI <Bioenvironmental Science, UGSAS> (Leader of Human Resources Development)

Prof. Yasushi KAWATA <Chemistry and Biotechnology, Graduate School of Engineering>

Prof. Ichiro HISATOME <Institute of Regenerative Medicine and Biofunction, Graduate School of Medical Sciences>

Prof. Hiroshi OTANI <Bioenvironmental Science, UGSAS>

Prof. Hideshi YANASE <Chemistry and Biotechnology, Graduate School of Engineering>

Prof. Sakae ARASE <Bioenvironmental Science, UGSAS, Shimane Univ.>

Prof. Kazuhito ITOH <Bioenvironmental Science, UGSAS, Shimane Univ.>

Associate Member

Prof. Tsuyoshi KAWANO <Bioresources Science, UGSAS>

Associate Prof. Atsushi ISHIHARA <Bioenvironmental Science, UGSAS>

Associate Prof. Tsuyoshi ICHIYANAGI <Bioresources Science, UGSAS>

Associate Prof. Jiro ARIMA <Bioresources Science, UGSAS>

Associate Prof. Yukinori YABUTA <Bioresources Science, UGSAS>

Associate Prof. Naoki KITAMURA <Veterinary Medicine, Faculty of Agriculture>

Associate Prof. Norihiro SHIMOMURA <Bioenvironmental Science, UGSAS>

Associate Prof. Hironori KAMINAKA <Bioresources Science, UGSAS>

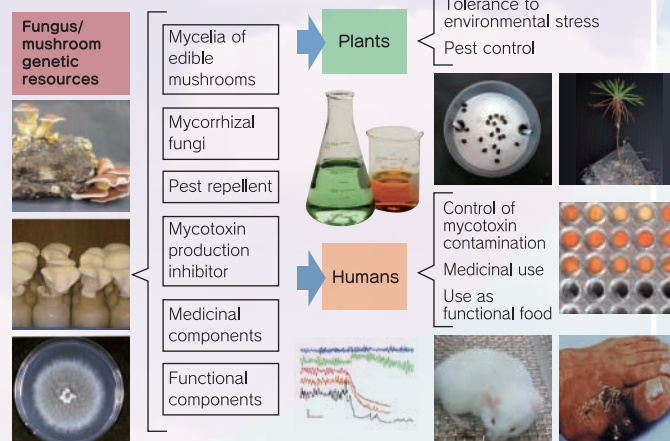
Associate Prof. Kenji OKAMOTO <Chemistry and Biotechnology, Graduate School of Engineering>

Associate Prof. Junichi KIHARA <Bioenvironmental Science, UGSAS, Shimane Univ.>

Associate Prof. Makoto UENO <Bioenvironmental Science, UGSAS, Shimane Univ.>

Assistant Prof. Masahide YAMATO <Fungus/Mushroom Resource and Research Center (FMRC), Faculty of Agriculture>

- Development of ecosystem conservation technologies
- Development of technologies for reducing environmental impacts
- Application of useful, biologically active substances



Further Enhanced Program for Training Young Researchers

A variety of initiatives have been implemented to support young researchers of exceptional ability, who have the desire to become researchers or professionals, and who have a broad academic outlook.

- Implementation of Trilingual Language Training Program (74)
- Sponsorships for:
 - Domestic/International Conference Presentation (47)
 - Domestic/Overseas Surveys (25)
 - Survey at the Northwestern Center for Biological Research (CIBNOR) (7)
 - English Language Editing for Publication (41)
 - English/Spanish Tests (30)
- Research Fellowships for students of doctoral course (32)
- Grants in Aid for Assistant Professors (6)

(): Number of total awardees *as of July, 2011

Researchers, professionals and specialists capable of Fungus/Mushroom Genetic Resources exploration and identification

Researchers, professionals and specialists capable of development of practical applications of Fungus/Mushroom Genetic Resources

Genetic Resource Bank

Exploration of new species in Asia and Central and South America
Accumulation of Genetic Resources
Development of applied technologies

Utilization of Genetic Resources

Development of applied technologies
Databasing of functionality information

Dissemination and practical application of research achievements

Establishment of Sustainable Society in Harmony with Nature by the contribution to "Environmental Conservation", "Food Production" and "Health Promotion".

Networking with Research Centers in Other Countries

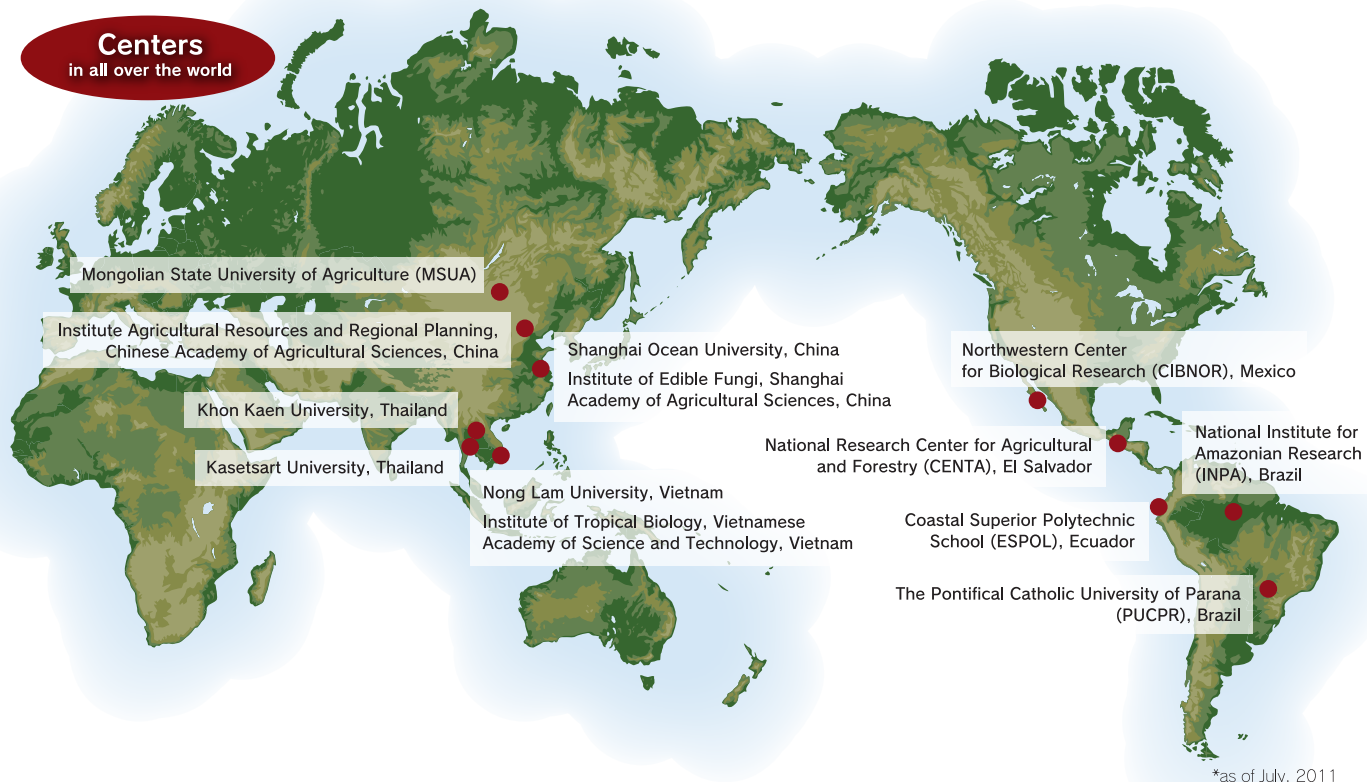
This global COE program has research bases located in different parts of the world and establishing a fungal information network among collaborative research institutions. One of these, the Northwestern Center for Biological Research (CIBNOR) in Mexico, established a joint laboratory with Tottori University in 2009. Through their collaborative research, the researchers engage in vigorous academic exchange.



Northwestern Center for Biological Research (CIBNOR), Mexico



Investigation in CIBNOR:2010.9



Studies by Young Researchers

Project Researcher of the Global COE Program
Roxana Y. PARADA



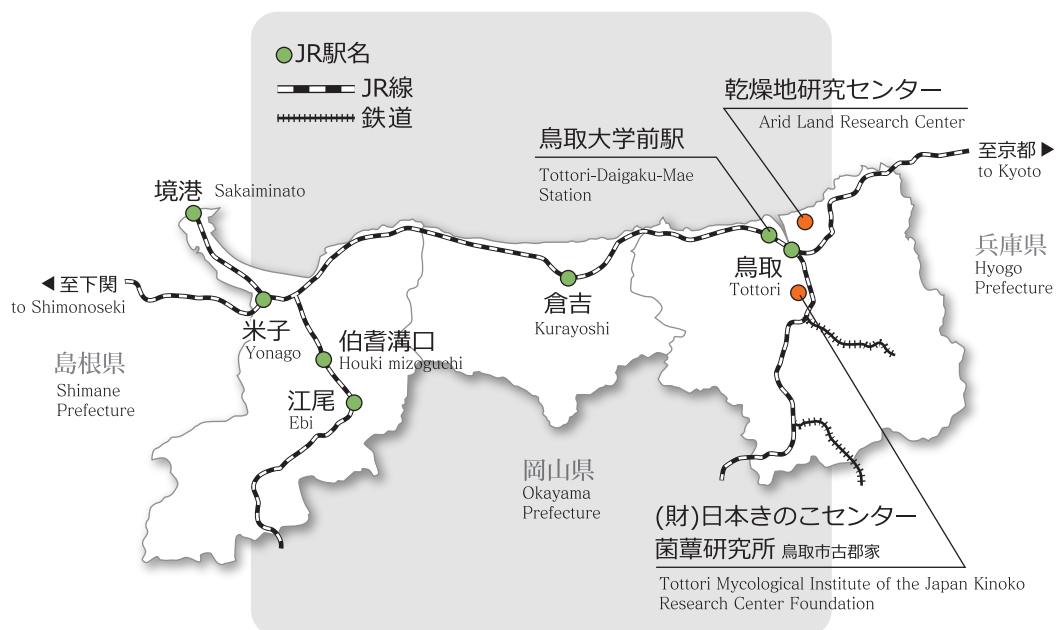
Plant pathogens are a major constraint in agriculture production, and their control is primary through chemical methods. However, environmental contamination and influence on human health are the major concerns in the past decades; consequently alternative technologies for disease control are being investigated. One technology is the use of elicitors that are released from the cell walls of the fungal mycelia and activate the mechanism of plant to defend themselves against pathogens. I am now investigating disease control by the activation of defense mechanism in cucumbers, using elicitors from mycelial cell walls of edible mushrooms that are prevalent in the spent substrate. Interesting results are being obtained with the spent substrates of *Lyophyllum decastes* (hatakesimeji) and *Pleurotus eryngii* (eringi), which significantly suppress occurrence of important cucumber diseases like anthracnose and powdery mildew. Thus, the spent substrate of edible mushrooms may be an alternative solution for disease control and offer a technology for the recycling of waste from mushroom cultivation.

Bioenvironmental Science, UGSAS (DC2)
Konomi YANAGA



The Order Cantharellales is comprised of numerous taxa, including the genera *Cantharellus* and *Hydnum*. Ecologically, the order not only includes saprophytic and mycorrhizal species, but it also contains the basidiolichens, which share a symbiotic relationship with lichens. Since a detailed understanding of the taxonomic relationships within the order is not yet clearly known, classification at the level of the order is currently being reevaluated using molecular phylogenetic techniques. The Order Cantharellales is of considerable interest as it includes edible fungi that are widely regarded as having excellent flavor, as well as fungi that synthesize functional components that can be used in cosmetics. Genetic resources that have been accurately identified are thus very important. Although more than 100 species have been reported in the genus *Cantharellus* alone, no more than 10 or so species exist within Japan. I am therefore conducting research to reconstruct and clarify the diversity of the taxa within the Order Cantharellales using fungi from Japan and Central and South America, which has a wealth of genetic resources that are yet to be examined.

Location of Tottori University



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