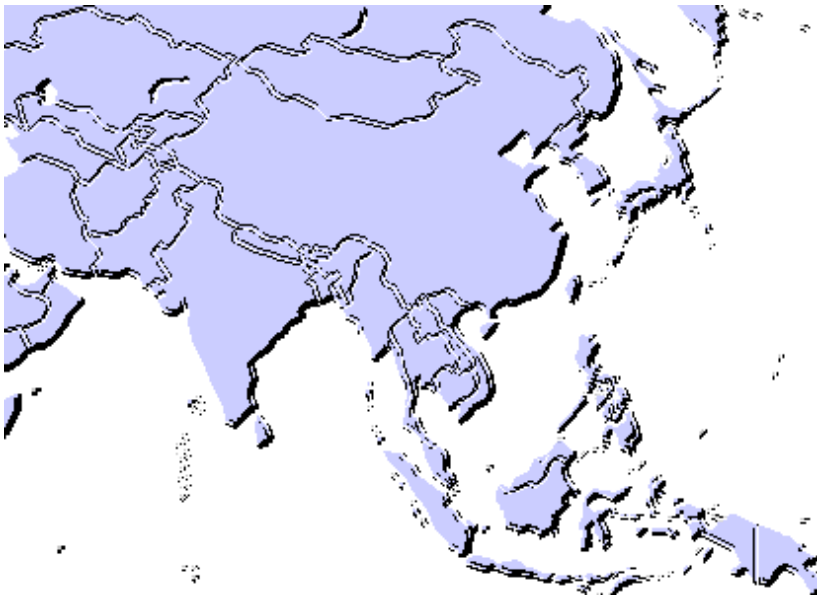
Reports from Asia

- What's going on in Asia -



Edited by

Yoshiteru Aoi
(Waseda University, Japan)
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Getting to know each other

Increasing amounts of both scientific research and technological developments in microbial ecology and related areas are being conducted in Asian countries, and this has resulted in a growing number of researchers. International collaboration in the Asian region has also risen. The future development of research and education in the region would benefit from multinational scientific commitments; these would also allow the investigation of local environmental problems. Such multinational projects currently depend upon scientists who have already made connections with each other, and therefore it is necessary to develop a broader network of human resources. We believe academic societies provide ideal opportunities for fellow scientists to establish contacts, to discuss issues and to share problems.

In order to carry out the above, the first regional meeting for microbial ecologists in Asia, ISME Asia 2007, was held in Matsuyama, Ehime, Japan from September 15-17. In addition to the usual scientific programs, selected scientists from each of 11 nations or regions submitted a report publishing details of microbiological research in their country. These summaries were presented by each author during lunchtime seminar sessions entitled "What's going on in Asia?", chaired by Drs Yoshiteru Aoi, Shiu-Mei Liu, Mio Takeuchi and Nagappa Ramaiah.

We would like to share these reports from the meeting on both ISME and JSME websites. Each report describes relevant scientific subjects, environmental issues, research sites and human resources, issues in education, and future prospects in each nation or region. They provide contact details for scientists researching various subjects in each area as well as updated scientific information. These will thus open up future communication in the region.

We hope this informative report will help scientists in different countries, as well as more junior scientists, to facilitate international communication. We are at the starting point of the establishment of newer and stronger international cooperations within Asia, an exciting time to be a Microbial Ecologist!

Hilary Lappin-Scott
President, ISME

Kenji Kato
President, JSME

ISME Asia 2007

From organizers for preparing a session,
'What's going on in Asia?'

Dear colleagues;

Perhaps, foreign communication may largely depend upon a human-to-human basis, and you may sometimes want to develop a broader network of human resources. Academic society like us, ISME, may possess such function as to introduce others.

A main purpose of ISME Asia 2007 is to get to know with each other; namely to see an individual and to learn his/her background and problem. It may not be easy to learn somebody else just by listening to his/her talk or to have conversation at a reception. You may sometimes want to have more information about an individual, an institution or often nation's characteristics which may relate to microbiology where he/she is from.

We want you to prepare a small 'report' describing such things as; relevant scientific subjects, environmental issues, research sites and scientists in each nation/region. You may write about problems in research and education and future prospects. Please find the following page, in which you will learn more specifically what we want you to prepare. We also ask you to present your 'report' at a lunch-on-seminar in 10 min.

It may not be easy for you to write this 'report' systematically or comprehensively. This may be because we ask one person from one nation/region. But you don't necessarily represent where you are from, but you may write it from your own stand point basically. However, we want you to write it informative to foreign scientists and younger generation to facilitate international communication. Because, anyhow, we all are at a starting point to establish newer and deeper international interaction in Asian region by joining ISME Asia 2007.

If you will permit, we want to compile your reports and upload to ISME and JSME websites as a blue paper. Please kindly respond us if you will support this idea of ours. We hope you understand our intention and agree with us.

Yuichi Suwa
Chair, ISME Asia 2007

Instructions for preparing a report for 'What's going on in Asia?'

We want you prepare a report about your nation/region with regard to the following several points. A report should be prepared in two pages (single space) or shorter. We raised instances of useful information for future international communications. You don't need to respond to all the instances, but you may provide information which you can write by yourself at a circumstance in which you are at.

1. Scientific society

Please provide information about scientific society for the field of microbial ecology or its related disciplines in your nation/region, which may include;

- Information about domestic scientific societies for the field of "microbial ecology" or its related disciplines (number of memberships, activities of annual conference, meetings and symposium, or other activities etc.).
- The scientific society for the field of microbiology addressing the topics in "microbial ecology", such as general microbiology, environmental microbiology, applied microbiology, medical microbiology etc.
- Other scientific societies in which researchers addressing the topics in "microbial ecology" is joining such as bioengineering, agricultural science etc.

2. Research activities

Please provide information about characteristics and current situation of research activities in your nation/region, which may include;

- Trends or relevant topics/issues in the field of "microbial ecology", or related area of science/engineering.
- Unique/common subjects for the microbial ecological research, such as marine environment, soil environment, wastewater treatment, and extreme environments and so on, which may well characterize microbiology in your nation/region.
- Current and past international collaborations, in Asian region and other region, or your experience on this issue.

3. Education

Please provide information about characteristics, situation and opportunities in education of microbial ecology or related discipline in your nation/region, which may include;

- In which department microbial ecology related subject can be learned.
- Career path of microbiologists
- Current situations for foreign student from or to other countries especially from or to Asian countries.

4. Practical applications

Please provide information or your comments on current situations, possibilities of microbial ecology in your nation/region, which may include;

- Contributions of microbial ecology for the practical applications to industrial, agricultural, environmental, medical fields and so on.
- Needs, possibilities for practical applications. Which subjects microbial ecology is applied.

5. Your future aspects / International relations

Please provide your comments on future aspects with regard to international relations.

Country Report - China

Microbial ecology-What's going on in China?

Xiaojun Zhang, Liping Zhao
Shanghai Jiao Tong University

Scientific society

There are no national level independent scientific societies specifically organized for the field of microbial ecology. However, in three Chinese scientific societies we have branches or subcommittees for microbial ecology or directly related topics.

1) Committee for environmental microbiology under Chinese Society for Microbiology.
This committee was founded in 1993. It is currently chaired by Prof Shunpeng Li in Nanjing Agricultural University, Nanjing. This committee has its annual meeting in the fallr. Each meeting will attract about 200-300 participants and the attendance is increasing significantly in the past three years. This committee gathers the most active researchers in microbial ecology and environmental microbiology throughout China. It has very strong links with international societies and one of the most important partner is ISME. Professors Yehuda Cohen, Hilary Lapping-scott, David Stahl, Linda Blackall all have been invited to give keynote talks in the annual meetings of this committee.

2) Committee of Microbial Ecology, Ecological Society of China (PCME-ESC):
This Committee was established in 1984 with its objectives as (1) promoting education and research activities in microbial ecology at the national and international levels; (2) strengthening interactions among researchers in the field of microbial ecology and its related disciplines. Currently, PCME-ESC has about 400 individual members. It sponsors various symposia and publications in addition to the annual national conference. The present chair is Prof. Min Yang, from the Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences (RCEES-CAS).

3) Committee for Microecology under Chinese Society for Preventive Medicine.
This committee was founded in xxxx. It is currently chaired by prof Dexin Xiong, from the 301 Army Hospital, Beijing. It has its membership meeting every four years with 400-500 participants each time. It has several subcommittees that organize meetings focus on various topics related with microbial ecology and human health. This committee has its own journal-Chinese Journal of Microecology.

4) Soil Science Society of China:
About 800 members; nationwide conference hold once every 4 years; there is a Soil Microbiology and Biochemistry sub-society which meets once every 2 years to discuss microbial ecology related topics.

Research activities of Chinese Groups in the microbial ecology field:

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Research on microbial ecology focused on followings: Diversity surveys of soil bacterial community by cultivation-based methods and molecular fingerprinting techniques; Biosorption characteristics of *Bacillus gibsonii S-2* biomass for removal of lead (II) from aqueous solution; Studies on levoglucosan kinase gene from *Aspergillus nige* ; Extracts from *Aspergillus tamarii* 827, *A. niger* PE-1650, *P. oxalicum* BZH-2002 for induced plant disease resistance; Microbial diversity of acidophilic oxidation of refractory gold ore and biodiversity of acidophiles in acid mine drainage .

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Research Area: The central theme of our research is to understand the structure and function of microbial communities in their natural habitats of agricultural ecosystems. We study structure and function of microorganisms using molecular ecology tools, including the uses of 16S rRNA gene and 'functional' gene markers. An important technique which we are using is the stable-isotope probing of DNA and RNA, which enables us to directly link activity and identity of microorganisms. One of our current activities is on the structure and function of the microbiota in rice paddies. Rice paddies is an important agricultural resource and is also a good model for the study of microbial ecology. We are exploring the regulations of fertilization, water management, and manure applications on the structure and functions of microbial communities in the rice paddies. Our second major activity is to understand the interaction between aboveground and belowground diversities in the agricultural ecosystems. Intercropping is a traditional field practice by Chinese farmers. We are exploring the beneficial and detrimental effects of this practice on the agricultural ecosystem in terms of the linkage between the aboveground and belowground diversity.

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The research team at Institute of Microbiology (Beijing), Chinese Academy of Sciences includes 5 scientists and some 20 Ph. D students. During the last five 5 years, research activities were focused on the microbial diversity and interaction of microbial communities that populates lake sediments (such as Taihu Lake in Jiangsu and salty lakes in Xinjiang), bioreactors receiving industrial wastewaters. While molecular phenotying (such as 16S rRNA library, DGGE etc) of microbial community was exploited, Dr. Liu's lab emphasizes on the improving cultivability of microbial species with traditional culture techniques. More than 30 novel bacterial species were identified and those species have been deposited in world wide culture collection centers such as JCM and DZMZ. Dr. Liu's lab works also on the bioremediation of organo-polluted soil. A robust chloronitrobenzene-degrading bacterial Comamonas sp. strain CNB-1 was obtained, and application of this strain CNB-1 alone or with plant for cleaning polluted soil was assessed in in-door (lab) and out-door tests. Results indicated that this strain CNB-1 was efficient in removal of pollutants, and more important, the introduction of strain CNB-1 did not disturb the microbial community in the soil, as indicated by DGGE and RT-PCR techniques.

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My research focuses on the interactions in microbial communities. By using molecular and systems biology approaches we try to understand the inter species signal transductions or interactions in microbial communities at both genomic and community levels. Microorganism rarely exists as pure species or as isolated whether it is on the human skin or in a grain of soil, they rather live in communities and interact with other species. Many important ecological functions may come from the complex interplays of its parts in

microbial communities. We believe that study of microbial communities has crucial impact on human health, plant growth, or the environmental ecosystems. The other subjects we are trying to comprehend are: the genetics and ecological role of antibiotics and antibiotic resistance; and the regulations and functions of bacterial virulence factors. The long term goal is to understand the functioning, the dynamics, and evolution of microbial communities and to develop new antimicrobials or tools targeting microbial communities in order to encounter the biological problems posed to human health, the environment and other areas.

Representative research results:

1. Construction of a bacterial quorum sensing inhibitor screening system and identification of several antipathogenic agents from Chinese herbal medicine.
2. Some new findings in bacterial communication as described in a few papers: Duan, K. and M. Surette, (2007) Environmental regulation of *Pseudomonas aeruginosa* PAO1 las and rhl quorum sensing systems. ***J. Bacteriol.*** 189: 4827-4836; Duan, K. and M. Surette, (2006) LuxS in cellular metabolism and cell-cell signalling in "Bacterial Cell-to-Cell Communication: Role in Virulence and Pathogenesis" ed. by Donald R. Demuth, Series "***Advances in Molecular and Cellular Microbiology***". Cambridge University Press.; Duan, K., C. Dammel, J. Stein, H. Rabin, M. G. Surette, (2003) Modulation of *Pseudomonas aeruginosa* gene expression by host microflora through interspecies communication. ***Mol. Microbiol.*** 50:1477-1491. *The result in this paper has led to a new, polymicrobial view of the infections in the lung of cystic fibrosis patients*.
3. We are carrying out continued collaboration with Dr. Michael Surette in University of Calgary. The collaboration is supported by a joint research initiative between National Natural Science Foundation (NSFC) and Canada Institute of Health Research (CIHR).

MIN YANG, Prof

The present chair of Professional Committee of Microbial Ecology, Ecological Society of China (PCME-ESC) State Key Lab. of Environmental Aquatic Chemistry Research Center for Eco-Environmental Sciences Chinese Academy of Sciences (RCEES-CAS) P. O. Box 2871, Beijing, 100085 China
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Related Activities in RCEES: Microbial ecology provides a very important base for environmental and ecological researches. Several groups in RCEES have some work related to microbial ecology. Following three groups have major interests in microbial ecology.

Group of Biotechnology -- Department of Environmental Bio-Technology: The group is responsible for the development of biotechnologies and methods to remediate polluted environments or remove contaminants from environmental media. Presently, it emphasizes on: (1) the improvement of molecular biological methods for ecological study; (2) isolation and construction of pesticide biodegrading bacteria and fungi for food safety; (3) the investigation of microbial structures in plant phyllosphere or other environment. The group is led by Prof. Guoqiang Zhuang.

Group of Soil Molecular Ecology-- Department of Soil Environmental Sciences: The group is designated to understand the community composition and diversity of microorganisms in natural and anthropogenic influenced soil environment by using molecular biological approaches. The research emphases include: (1) understanding the microbial community composition and diversity of agricultural soils under different management practices to address soil quality and sustainable management strategies; (2) understanding the microbial diversity and functions of polluted soils to assess the soil environmental risks and develop remediation strategies; and (3) coupling molecular biological approaches and chemical approaches to elucidate the biogeochemical processes of some elements (N, S and Mn) in the soil ecosystem. The group is led by Prof. Jizheng He.

Group of Environmental Microbiological Technology -- State Key Laboratory of Environmental Aquatic Chemistry: The group is specialized in the utilization of microbial power for the efficient removal of pollutants from water. Its research emphases include: (1) analyzing the compositions of microbes and functional genes in various water treatment systems to understand the relationship between operational conditions and microbial structures/functions; (2) developing high efficient water treatment systems using the constructed microbial community; (3) conducting researches on relationship among microbes in different trophic levels or types (archaeobacteria, bacteria, yeast, fungi, protozoa, etc.). This group is led by Prof. Min Yang.

XUEDUAN LIU, Prof

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Our group currently focus on the biology of bioleaching microorganisms. The group is belong to the Key Laboratory of Biometallurgy of Ministry of Education of China at Central South University. The studies related to microbial ecology include: (1) Develop microarray-based technologies to explore the community composition, dynamics and functions for bioleaching systems and Acid Mine Drainages. (2) Microbial diversity and biogeochemistry of acidic environments. The projects mainly include the Basic Research of China (973 program: The basic research of biometallurgy), NSFC(Creative Research Groups program: Foundational research on bio-processing of sulfide mineral, Overseas Chinese Young Scholars program: Functional Genomics of microorganisms for biomining).

XIANG LI, Prof

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Dr Xiang Li and his research group carry out study on marine microbial diversity, drug discovery, and metagenomics-based researches. With a broad basis and research interest on biomedicine, microbial diversity, marine metagenomics, recombinatory biology.

Metagenomics-based marine drug discovery: Targeting the non-cultivable majority of microorganisms in ocean, scientists at SCSIO employ state of the art technology and facilities to establish a metagenomics-based platform for natural product drug discovery, and use bacterial artificial chromosome (BAC) for cloning and heterogeneous expression of bioactive secondary metabolites originated from non-cultivable marine microorganisms.

Marine microbial cultivation and biodiversity: Current investigation indicates that there are rich resources of marine microorganisms in South China Sea. It is a big unknown for what, where and how we are going to explore conservatively and sustainably. Scientists at SCSIO carry out a number of research projects, targeting microbial cultivation, bioresource conservation, biodiversity-related R&D research.

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The subject areas include the microbial ecology in soils and engineered wastewater treatment systems. Focus is placed on nitrifying and denitrifying communities/processes involved in nitrogen fertilizer loss, soil fertility, removal of nitrogen compounds (in wastewater treatment plants) and the production and emission of nitrogenous greenhouse gases from the systems. The specific topics that have been addressed included the bacterial communities involved in the competition between denitrification and dissimilatory nitrate reduction to ammonium in soils and the controlling factors, the roles of non- or truncated-denitrifiers in ecological denitrification process in soils, soil microbial community composition characterized at ecological level by N_2O production and consumption patterns that were apparently relevant to *in situ* N_2O emission, detection of biological sources of nitric oxide and screen for nitric oxide producers isolated from environmental samples by use of a *gfp*-reporter fusion, N_2O emission potentials from wastewater treatment plants with various configurations and running parameters, improvement of culturability of bacteria from salt-affected soils/seashore deposits, and the possible compounds from herbal plant *Astragalus mongholicus* that inhibit soil nitrification. Collaboration has been established with Dept of Microbiology in Cornell University (USA), soil science group in University of Melbourne (Australia), Centre de Microbiologie du Sol et de l'Environment (France) and Dept Chemistry, Biotechnology and Food Science, Norwegian University of Life Sciences (Norway).

LIPING ZHAO, Prof

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Prof Liping Zhao has led his research team to become one of the few pioneers in China to apply molecular and genomic tools for understanding structure-function relationship of complex microbial communities in soils, wastewater treatment plants, and animal guts. This group has published more than 40 papers in biological control of plant diseases, microbial ecology of soils, wastewater treatment plants, and animal guts. They have contributed to several technological innovations. They improved the PCR-DGGE technology for structural analysis of complex microbial communities by providing an effective way to eliminate single strand DNA for high quality image of PCR-DGGE fingerprinting and high fidelity retrieving of sequences from interested bands. This group also developed a metagenomic fingerprinting technology, based on long primer RAPD and community DNA hybridization to identify, clone, and sequence genomic fragments of key populations commonly shared by some related communities, e.g. healthy human guts as physical markers for these populations. This research team has monitored and dissected community structures of many important systems, such as a quinoline degrading denitrifying reactor, gut flora of cotton ball worm and tobacco buckworm, gut flora of giant panda etc. also they have established a human-flora associated piglet model for gut ecology and metabolism research; and developed one effective probiotic product, which can be used to prevent and treat diarrhea caused by enterotoxigenic *E. coli* as an alternative to conventional antibiotic treatment. Currently this group focuses on understanding and manipulation of complex microbial communities at systems levels with metabonomics, metagenomics and multivariate statistics as major tools.

MING-GUANG FENG, Prof

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Cell wall proteins of filamentous fungi possess multipurpose functions but none of them has been associated with fungal tolerance to environmental stress such as high temperature and UV radiation. However, this function is very valuable for fungal biocontral agents (FBA) such as *Beauveria bassiana* and *Metarhizium anisopliae* because their conidia are usually formulated into mycoinsecticides or mycoacaricides for use in pest control. As far as known to date, conidial wall proteins of FBA that are formic-acid-extractable (FAE) are considered as hydrophobins or hydrophobin-like proteins and may favor conidial attachment and infection to insect pests. Recently, we found that one of three major FAE proteins of *B. bassiana* was a significant contributor to thermal stress. A new full-length gene encoding this protein, namely Cwp15, was characterized with an opening reading frame encoding a 131-amino-acid sequence and no intron. When the expression of Cwp15 was suppressed using antisense-RNA technique, the overall contents of the FAE proteins from five randomly taken transformants declined significantly in comparison to their parental strain. The protein contents linearly correlated well to the survival indices of all the conidia after 30-min exposure to thermal stress at 48°C ($r^2 = 0.93$). The median lethal time (LT_{50}) of one selected transformant with a median survival index was significantly reduced by 25% during 75-min exposure to 48°C due to the suppressed expression of Cwp15. The results provide new insights into the functions of the FAE proteins and suggest that at least some of them be involved in fungal resistance or tolerance to stressful environmental factors. Future effort is discussed on mapping of all possible FAE proteins and genetic manipulation of conidial wall composition for more stress-tolerable FBA formulations for improved field persistency and efficacy against pest insects and mites.

SHUNPENG LI, Prof

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Molecular ecological effects of pesticides-contaminated sites Most of our research works related with microbial ecology are focusing on two areas: the molecular ecological effects of pesticides contaminated sites, mainly concentrating on the effects of long-term pesticides contamination on microbial community and diversity in soil, the colonization of the GFP/ LuxAB labelled pesticides-degrading bacteria in soil and plant, the effects of inoculation of exogenous pesticides-degrading bacteria on microbial community and diversity, the remediation of pesticides-contaminated soil by inoculation of exogenous degrading bacteria, the diversity of the pesticides degrading bacteria in pesticides contaminated soil and the horizontal transfer of degrading genes and the risk assessment of the environmental release of multifunctional pesticides-degrading GEMs; biodiversity and community structure of red soil in South China, mainly concentrating on the diversity and community structure of red soil and exploitation of gene resources by megagenomic library screen, the cultivation methods (water and fertilizer, etc) on the microbial diversity and community structure, and the relationship between the microbial diversity and soil quality.

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Microbial ecological research and education in India

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Scientific societies

The three notable societies supporting microbial ecology activities are:

1) Association of Microbiologists of India (http://www.ami-india.org): Founded in 1938 to promote microbiology and provide a common platform for educators and researchers in different areas of microbiology. The AMI has over 5000 members, holds annual conference and publishes quarterly the INDIAN JOURNAL OF MICROBIOLOGY (contact: Editor-in-Chief at ijamami@gmail.com). Interest areas include agricultural, food, environmental, industrial, medical, pharmaceutical, veterinary and molecular microbiology.

2) Indian Association of Pathologists and Microbiologists (IAPM: http://www.iapm.net) is affiliated to the International Academy of Pathology. IAPM was founded in 1949 and, currently has >3000 members. It promotes dissipation of knowledge and exchange of new ideas and, acts as a technical and advisory body on education, training, professional practice, quality control etc. It holds annual/regional conferences, publishes research activities in its quarterly journal, the Indian Journal of Pathology and Microbiology and newsletter, and encourages research activities through scholarships, prizes and awards. The IAPM now has many branches, specialties and subspecialties. The parent body of the IAPM has further developed new associations/societies in areas of Hematology, Biochemistry, Immunology, Cytology etc. Following such rapid growth, the IAPM has established many regional divisions that accomplish multiple regional activities. In the last decade, the IAPM also founded the Indian College of Pathologists. One of the objectives of this college is publication of textbooks, recent advances and monographs.

3) Mycological Society of India (www.msi-india.org) was founded in 1973. Fungal ecology, taxonomy, diseases and biotechnology are the major thrust areas of mycology in India. With about 300 members, the Society organizes annual meetings and endowment lectures. "Kavaka" is the official journal of the Society.

Other scientific societies encouraging microbial ecology are: Asian Fisheries Society (Indian Branch) www.asianfisheriessociety.org, Aquaculture Foundation of India www.aquaculturefoundation.in, and Biotechnology Consortium of India www.biotech.co.in. Please see supplementary information for additional details.

Research activities

The overall concept of eco-planning in India is for sustainable development through an understanding of the basic principles of ecology and their application for improving the quality of life. This is bringing about slow but radical changes in eco-development. Many aspects of microbial ecology of different ecotypes like crop lands, forests, grasslands, marine zones (backwaters, estuaries, salterns, mangroves, neritic, offshore, deep-sea), weeds (aquatic and crop), wetlands, and wildlife are being studied. Notably, microbial ecology of the Antarctic ecosystems have received greater attention. There is an increasing effort on pollution microbiology for monitoring, environmental quality assessment and bioremediation. Assessment of microbial biodiversity by traditional and advanced molecular and phylogenetic analyses from many ecotypes is on-going. Conservation of microbial wealth through sustainable management of all the natural ecosystems is gaining momentum. While information and efforts are growing in Applied Microbial Ecology and Ecological Modeling, it is still a long way to becoming proficient in these fields.

Investigations are on-going on: Microbial community dynamics of compost ecosystem; Archaea/ thermophiles of hot-springs; Ecology, morphology, taxonomy and physiology of terrestrial cyanobacteria; Emerging pathogens/diseases of humans (for instance, *Enterobacter* as nosocomial pathogen), veterinary (poultry, dairy and animal husbandry) and shrimp aquaculture. A greater emphasis is also on pollution ecology, environmental auditing, user-friendly tracer-techniques for detecting pollution source-points, waste management, and assessing impact of domestic, heavy metal and industrial effluents on surface and ground water quality.

Marine and Antarctic microbial ecology has been pursued quite strongly. Elucidation of water column bacteria in sustaining a perennially stable biomass of meso-zooplankton; bacterial growth potential and their contribution to biological productivity and regional biogeochemistry; analyses of anaerobic microbial communities and their water column processes; phylogenetic analyses of denitrifying microbial community

in Arabian Sea oxygen minimum zones; detection of >0.4 million years older paleobionts in deep sediments; marine fungi and bacteria for bioremediation of toxic industrial effluents are among the notable achievements in microbial ecology of the seas around India. Apart from characterizing pigments usable in food industry, over 20 species of bacteria new to science, have been reported from the Antarctic.
India has a number of on-going international collaborations in areas of Microbiology with Japan, China, Singapore, Malaysia, and Korea within Asia. While those with US, UK, Germany, France and Australia also cover microbial ecology related researches. I have worked variously with US, French, Brazilian, Australian and Korean researchers.

Education

India's University curriculum offers an array of subject choices to students leading to undergraduate, graduate and doctoral degrees in microbiology. Depending on student numbers and existing departmental facilities and faculty, many universities teach/offer microbial ecology related subjects mostly in department of Microbiology, Biosciences, Environmental Sciences, Botany, etc. India provides excellent education for foreign students. Students, especially from Africa, Middle East, Bangladesh and Thailand study microbiology in many of India's ~100 universities offering courses in microbiology. Career path, especially for graduates and Ph Ds in microbiology is quite promising. There are opportunities in academic, research institutes, government departments, in food, pharmaceutical, quality control, pathology/clinical labs etc.

Practical applications

Degradation of environment due to indiscriminate and unplanned exploitation is a national issue of very serious concern. Inadequate management of natural resources is a major challenge. Abatement of pollution of soil, water and air is a current national priority as they are the major sinks for pesticides, industrial effluents, urban wastes and radioactive wastes. Experimental and pilot-scale technologies using microbial consortia for restoration of degraded ecosystems (mining dumps, domestic and industrial waste treatment); treatment of paper and pulp-mill wastes; microbial detoxification of arsenic for improving drinking water quality; molecular diagnostics for detection of microbial infections; immunochemical techniques for assessment of biohazards and their treatment; adaptation of simple but reliable assays to detect organic xenobiotic exposure; searches for novel microbes plus their enzymes of relevance in pharmaceuticals, neutraceuticals and, environmental bioremediation are some outcomes of pursuing microbial ecology.

Your future aspects / International relations

My strongest desire is to see pollution-free land, river and marine ecosystems. For this, I will continue my research on marine microbiology. I wish to work towards forming Microbial Ecology Society of India (MESI) that will be affiliated and interacting with Asian- (ASME) and International Society for Microbial Ecology (ISME) including JSME. I hope to see MESI fully functional by 2010 and to host meetings of ASME by 2012 and, ISME by 2015 in India. I believe these events will be made possible through international cooperation and by India suitably adapting developments in microbial ecology research and by working on ecological problems of relevance in all our ecosystems.

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Significant progress in microbiology in Indonesia

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Microbiology or microbial ecology related fields in the last thirty years are being developped significantly in Indonesia. This can be seen from the increasing numbers of people who are interested in microbiology and increasing number of applied microbial technologies practiced in several sectors.

Scientific society in microbiology in Indonesia is also getting significant progress. To have a better contact and collaboration among microbiologists, Perhimpunan Mikrobiologi Indonesia (abbreviated as PERMI, Indonesian Society for Microbiology) was esthablished on September 22, 1973. The members of PERMI has flourished to 1,261 in 2007, scattered in 17 Provinces. The members of PERMI come from universities, research institutions, private companies and from different diciplines such as from medical science, veterinary, agriculture, fishery, food technology, water and marine science, soil microbiology, plant pathology, environmental microbiology, animal science, forestry, industry as well as from biotechnology. To intensify the communication in regional level, PERMI has esthablished 20 branches. PERMI organizes regular annual meetings nationalwide, sponsoring seminar on a variety of topics, workshop and other activities related to microbiology. Every five years, PERMI helds national congress to select New General Executive Board. The latest national congress was held in Bali in August 2005. PERMI has been registered as a member of the International Union of Microbiological Societies (IUMS). Homepage PERMI is http://www.permi.or.id

PERMI publishes a biannual refereed scientific journal called Jurnal Mikrobiologi Indonesia - *Indonesian Journal for Microbiology*. The first volume was published in 1992. Based on its content and regularity of issues, the Indonesian Journal for Microbiology was selected by the Ministry of National Education as the best scientific journal in Indonesia. It gots the highest (A) accrediation. In April 2007, the first volume of *Microbiology Indonesia* as an international version of *Indonesian Journal for Microbiology* was published. This journal is planned to be published three times a year. Four international microbiologists are a member of the Editorial Board of this journal.

Being a tropical country located in low latitude and believed to be one of the world megabiodiversities, Indonesia should capitalise on its natural resources as a pillar to sustain its development. In this context the largely untapped source of information on biological and chemical diversity of its natural resources for pharmaceutical and agrochemical companies, fragrance and flavour manufacturers, biotech enterprises and crop breeders is an asset which should be wisely used (Saono, 2006). With its wealth of bioresources including in microbes, it is not surprising that biorpospecting of potential microbes receive much interests among Indonesian microbiologists. A variety of topics had been explored, but considering the size of the problems, the absence of focus, the limited available facilities and number of researchers, and last but not least of limited research funding, notably for basic research, so far little scientific and practical outcomes have been obtained (Saono, 1998).

Some research topics being studied intensively in Indonesia are: microbial diversity, symbiotic nitrogen-fixing bacteria, mycorrhizae inoculant, mushrooms cultivation, microbes used in traditional fermented products, acetic acid/lactic acid bacteria, phosphate-solubilizing microbes, biological control, biofertlilizer, food and feed microbiology. Nitrification, denitrification and microbial activities in soil related to efficiency of nitrogen fertilizer, greenhouse gases emission namely CH_4, N_2O and CO_2 are being studied frequently. Waste water treatment, microbes from extreme environment such as black water ecosystem and hot spring are also become interseting subjects of research.

Indonesian microbiologists have set-up a national and international collaborations and networks. These research collaborations is esthablished through formal institutions such as through universities/research institutes as well as through informal collaboration. Research in biofertilizers in Asean Regional (Forum for Nuclear Cooperation in Asia - FNCA) is sponsored by Ministry of Education, Culture, Sport, Science and Technology (MEXT), Japan (FNCA, 2006). To study the role of soil microbes in greenhouse gases emission from different land use types, some collaboration between Indonesian universities with Chiba University and Ibaraki University as well as with NIAES Tsukuba Japan have been esthablished since years

ago.

The present of culture collections for a megabiodiversity region such as Indonesia is a must. In late 1960s the former National Biological Institute of the Indonesian Institute of Sciences - LIPI initiated a survey on the state of research activities in microbiology. In 1989 the National Commission for the Conservation of Genetic Resources (*NCCGR*) undertook a second inventory of the existing culture collections of microbes in Indonesia. There were at least 15 microbial culture collections in Indonesia (research institutes and universities) and they have been registered in the Word Data Center for Microorganisms in Tokyo, Japan. The majority of the holdings of these collections are of domestic origin, while a few cultures had been obtained from overseas on an exchange basis or by other means. Many of them represent microbes commonly used in traditional fermentation, agricultural practices such as biofertilizers and biopesticides, and in traditional dairy industry. (Saono *et al.,* 1998; Saono, 1991).

Microbiology is one of the main subject studied at any faculty in natural science including in faculty of medical science, agriculture, fishery, veterinary, animal husbandry, food technology, industrial technology, environmental science and biotechnology. This subject is given at undergraduate as well as for post graduate levels. In the recents years, many young microbiologists persue their master or Ph. D. degree abroad such in USA, European countries, Japan and Australia. These scientists come from research institutes, universities as well as from private companies.

Significant contribution of microbial ecology in several sectors have been observed. The number microbiologist work at food industries, traditional fermented food, medical companies, environmental sanitation, agricultiure, forestry etc are increasing significantly.

Microbiology as a part of biotechnology is one of the fastest progress sciences in the last few years. Communictions and collaborations among microbiologists in the future should be strengthen. To reduce the gaps of knowledge and related technologies between microbiologists in the developped countries and developping countries (due to some contraints), an equal synergic collaborations among microbiologists should be esthablished. The collaboration might be as advance study, collaborative research, seminar, symposium, workshop and networking. On individual or institutional basis, researchers could actively take the initiatives to collaborate with colleagues of same or related disciplines. These may include: (1) provision of services on any activities dealing with microbes as well as microbial cultures, (2) conducting collaborative research with partners to achieve common goals, (3) soliciting/competing for research grants from various sources, and (4) attending short term, non-degree training courses, as well as long-term degree training program in Indonesia and overseas for capacity building.

REFERENCES

FNCA. 2006. Biofertilizer Manual. Biofertilizer Project. Forum for Nuclear Cooperation in Asia (FNCA). Japan Atomic Industrial Forum (JAIF). Pp 124

Indonesian Society for Microbiology. 2007. Microbiology Indonesia. Vo. 1 No. 1 Aproil 2007.

Saono, S. 1998. Keanekaragaman dan peran jasad renik dalam pembangunan berkelanjutan di Indonesia (*Diversity and the role of microorganisms on sustainable development in Indonesia*). Dalam/*In*: Adisoemarto, S. (Red.), Sumber Daya Alam sebagai modal dalam pembangunan berkelanjutan (*Natural Resources as a capital in sustainable development*), hal./*p.* 58-86. LIPI.

Saono, S., Y. Widyastuti & K. Komagata, 1998. Improvement of microbial culture collections in Southeast Asia. Microbial Culture Collections in Indonesia. The Tokyo International Forum on Conservation and Sustainable Use of Tropical Bioresources, p. 149-157. NEDO-JBA, Tokyo

Saono, S., 1991. Pusat-pusat informasi dan koleksi jasad renik di Indonesia. Komisi Pelestarian Plasma Nutfah Nasional (*Information centers and culture collections in Indonesia. National Committee for Genetic Resources Conservation*), Bogor. 52 hal./*pp.*

Saono, S. 2006. Six decades of non-medical microbiology and microbiologists in Indonesia. A brief overview. 60 pp.

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About microbial ecology in Japan

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Scientific Societies

The Japanese Society of Microbial Ecology (JSME) was established in 1985. Current membership is 892 including 269 student members (Jan, 2007), indicating that the society has attracted the younger generation. JSME has an annual meeting, typically attracting about 400-550 participants and 200-300 presentations, in recent years. Lively atmosphere of the JSME meeting is somewhat similar to the ISME symposium. JSME has an official journal, 'Microbes and Environment', which has 22 volumes.

Microbial ecology in Japan has a relatively long history. By 1950, microbiologists noticed that mixed cultures behave differently from pure culture, and that pure culture may not always explain observations in mixed culture or in nature. Those microbiologists formed a nation-wide discussion group and had occasional meetings. In the mid '70s, the first 'Symposium on Microbial Ecology' was held in Tokyo. This symposium was held annually until 1984. All talks at these symposia were published as review articles, and published in 'Ecology of Microorganisms' series, which continued to vol. 22 published in 1995.

In 1989, ISME-5 was held in Kyoto. In order to host ISME-5, the 'Symposium on Microbial Ecology' was reformed into JSME, and the first annual JSME meeting was held in Tokyo on 1985. ISME-5 was influential to many microbiologists, especially to younger scientists; most of who have stayed and remain active JSME members. Since that time, many Japanese microbiologists have participated in subsequent ISME symposia. It is also notable that Prof Ushio Shimidu of University of Tokyo served as ISME President in the mid '90s and established the current strong fundamentals of the society.

No single unified academic society covering all of the various areas of microbiology has been established in Japan. In addition to JSME, other societies such as Society for Soil Microbiology, The society for biotechnology Japan, Japan Society for Environmental Biotechnology, Japanese Society for Marine Biotechnology, Japanese Society for Extremophiles, and The society for antibacterial and antifungal agents are academic societies for microbiology, include microbial ecology. Each of these societies has their own official journals. Other academic societies which include environmental sciences accept studies on microbial ecology for presentation and publication. Those societies include Japanese society of soil science and plant nutrition, the oceanographic society of Japan, the Japanese society of fisheries sciences, the Japanese society of limnology, Japan society on water environment, and Japan society for bioscience, biotechnology and agrochemistry.

Research activities

Currently, microbial ecology is considered as a 'core' in general microbiology, and has been studied in various departments at many universities and research institutes subsidized by national and local governments. Also, research laboratories in private companies, which, for instance, work on environmental engineering and wastewater treatment, conduct research and development relating to microbial ecology. These activities are presented at the JSME annual meetings, and title of presentation and names of authors are all translated in English and uploaded on the official JSME website (http://wwwsoc.nii.ac.jp/jsme2/Meeting/2007program.pdf). This is a great resource for updating activities of microbial ecology in Japan, and M&E provides open access service for all published papers on line (http://wwwsoc.nii.ac.jp/jsme2/ME/ME.html).

Education

In our academic institutions, there is no department for microbiology. However, microbiology and microbial ecology is taught in several departments; agriculture, fisheries, science, engineering, medicine, pharmaceutical sciences and veterinary medicine. It may be described that microbiology is taught as an important fundamental principal for some application or focused subject. As a general trend, there are more courses and classes in agricultural departments than in science departments, and microbiology courses in engineering school are relatively new. Currently, many universities have MS and Ph.D. courses relating to

microbial ecology. Many undergraduates advance to MS courses. Most young scientists earned their Ph.D. in Japan. Since the 80's, we have accepted many foreign students mainly from Asian countries.

Practical applications

In 1970's, environmental pollution was very serious all over the nation, and consciousness for environmental conservation has considerably been raised in our society. At the same time, the importance of environmental sciences including microbial ecology was recognized. Currently, we have strict policies regarding the regulation of waste and wastewater managements. There is a large demand for environmental purification and conservation. Microbial ecologists are working not only on research and developments in novel environmental engineering processes such as for wastewater treatment and bioremediation, but also on serving as scientific commentaries in governmental committees for updating regulations. Environmental purification technologies such as soil decontamination and spilt oil clean-up often need to evaluate microbial activities on site for designing a procedure, and microbial ecologists often participate in the project. Needs for tracking microbial activities and species during a purification processes and for evaluating the process and diagnosing the environment has appeared as a relatively new field for microbial ecologists as well in Japan.

Now and Then

Perhaps, the learning environment itself is a grand challenge in microbial ecology. For many microbial ecologists, more or less, the local environment has been the their study field and they need to have some other sites for reference. We may find good references in Asia, since we are geographically close. It would be beneficial for Asian scientists to share information in many aspects to make our science progress. To make it easier, we may be better encourage finding a mechanism to facilitate communication among us.

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Country report of republic of Korea

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Scientific Society

Although there has been no society specifically for Microbial ecology among various other scientific communities in Korea, Microbial ecology has always been considered as a major thrust area in several microbiology-related societies. Microbial ecology is regarded as a significant foundation and motivating objective especially by the members of the Microbiological Society of Korea, the Korean Society for Microbiology and Biotechnology, the Korean Society of Mycology and the Korean Society of Virology as well as the Korean Society of Oceanography and the Korean Society of Limnology. Moreover ecological approaches have been constantly emerging in terms of microbiology as well as in other fields of science and engineering, such as environmental biology, environmental engineering, agricultural science, oceanography, fishery and aquatic sciences.

There are a total of 33 scientific societies covering various aspects of microbial Ecology including 15 microbiology-related ones, 7 related to agriculture & fishery and 11 ecology & environment-related societies. The estimated number of scientists in the field of microbial ecology is over 500. Usually every society holds its symposia twice a year and many of them are held as a joint meeting with other societies. Many recent research results are published in several international scientific journals pressed by Korean societies, including representatives like 'The Journal of Microbiology' (IF: 1.644) and 'The Journal of Microbiology and Biotechnology' (IF: 2.037).

Research Activities

Contrary to the increasing general concerns about ecological issues in Korea, far less budgets have been allocated to the research grants in the field of microbial ecology than those in other fields like medical biotechnology. It would be especially noteworthy that recently there are increasing government-funded grants allocated for a biodiversity study, acquiring diverse microbial resources from various habitats in the Korean Peninsula and other countries. As a result, myriads of microorganisms have been isolated and identified from soils, fresh or marine waters, wastewater treatment facilities, traditional fermented foods, animals and plants, clinical samples, and so forth, and many of them have been validly published as novel taxa.

In addition to accessing microbial diversity, a lot of attention is paid to the bioremediation, wastewater treatment and biofilm researches from the standpoint of biofouling and infection of pathogenic bacteria. Vigorous studies are also performed under the topics of bacterial and viral distribution, risk assessment of pathogenic microorganisms, microbial source tracking, soil and marine metagenomics, aquatic microbial food web, harmful algal bloom, biodegradation and biotransformation of recalcitrant chemicals, genomics and functional genomics, and so on. Recently several microbial genomes retrieved from Korean traditional fermentation foods, industrial plants, deep sea hydrothermal vents and cold-seep, ocean waters, and soils have been fully sequenced and their comprehensive ecological roles in the given ecosystems are now under study. But it cannot be denied that more emphasis has been put on biotechnology-oriented researches than conventional major topics of microbial ecology.

Several government funded-research institutes such as Korea Research Institute for Bioscience and Biotechnology (KRIBB), Korea Ocean Research and Development Institute (KORDI) are actively involved in the field of microbial ecology and biotechnology, and they are also making efforts for international cooperative studies on a regular basis. Especially the scientists in KORDI have been co-working with the researchers in JAMSTEC, Japan, in the field of deep-sea microbiology and oceanography, and the scientists in KRIBB also have been co-working with Asian and American scientists for sharing microbial resources. Other international joint studies in Korea are being carried out on a personal basis by college faculties in sharing the state-of-art technologies and bioresources acquired from various ecosystems.

Education

Microbial ecology is a hugely interdisciplinary science that undergraduate and graduate students in Korea are studying in various departments under the disguise of subjects like Microbiology, Life Sciences, Biology, Biotechnology, Biological Engineering, Environmental Science, Environmental Engineering, Environmental Biotechnology, Agricultural and Life Science, Biotechnology and Bioengineering, and Applied Biology and Environmental Sciences. There are approximately 150 microbial ecology-related departments from 70 nation-wide universities. Most departments offer undergraduate and graduate courses dealing with theoretical and experimental approaches for microbial ecology under the names of Microbial Ecology, Environmental Microbiology, Environmental Biotechnology, General Microbiology, Environmental Processes, Soil Microbiology, Marine microbial ecology, and etc.

Many of the microbiologists in Korea might have graduated from US universities or have post-doctoral research experiences. But others might have research careers in Japan while a few others in European countries. There are very few researchers who have academic degrees or research careers from an Asian country other than Japan.

Recently there is an increasing demand for international students who wish to study science and engineering in Korea. As a result, more and more graduate students from overseas are studying in the departments related to microbial ecology and most of them are from China, India, Mongolia and Japan as well as South Asian countries such as Indonesia, Vietnam, and so on. Also some graduate students from Central and South American countries are reported these days. However, very few international students are studying in the undergraduate courses.

Practical applications

Although diverse aspects of microbial ecology are widely studied in Korea, the research results and technologies do not seem to be actively linked to the practical applications. This gap might be due to the lack of intimate interactions between the academies and the industries. The Korean government-funded R&D grants pursuit close interactions between the two parties; as a consequence, the number of domestic and international patents related to environmental microbiology and biotechnology are increasing recently and these patents will be the basis for the practical applications of the research results.

Industrial applications of the environmental biotechnology researches in Korea include mass-production of functional microbial products and probiotics using the microbes from Korean traditional fermented foods and the development of electronic devices to control better fermentation conditions in the food industries and microbial application of deodorants, biological pesticides, and fertilizers in the agricultural industries. In the field of bioremediation, wastewater and food-waste treatments, and controlling harmful algal blooming, effective microorganisms and microbial consortia have been applied to the various field sites. Whole effluent toxicity test systems, biosensors, and DNA chips for monitoring wastewater treatment system have been also developed and now are being sophisticated for practical applications.

Future aspects / International relations

Although there have been cooperative research initiatives for bio-resource screening (e.g., ACM) between Korea and other Asian countries in the past, the microbial ecologists in Korea are interested in expanding their international scientific interaction further. Efforts are being made to carry out joint-studies with US and European scientists. There have not only been successful collaborative projects between Korean and Japanese groups previously but also a recent surge is seen in the joint connections between Korean and Chinese groups. A need for an active sharing of common research projects between Korea and Asian countries, especially South-Eastern Asian countries is strongly felt, which would pave the way to the upgrading of microbial ecology in the whole of Asia.

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Issues and status of microbial ecology in Malaysia

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Introduction

Malaysia has a population of 25 million living in a tropical environment reputedly endowed with a tremendous amount of biodiversity. It enjoys a fortunate situation as one of the 12 megadiversity centres in the world. The flora of the country alone is exceedingly rich and is conservatively estimated to contain about 12,500 species of flowering plants, and more than 1,100 species of ferns and fern allies.Presumably, the diversity of microflora is just as great relative to other parts of the world. The three levels of biodiversity that it is blessed with, namely ecosystem, species and genetic diversity, have been greatly challenged by rapid development of human origin. However, it still has about 60% of its land area as forest and woodland. It has a National Biodiversity Policy that pledged to conserve Malaysia's biodiversity and to ensure that its components are utilised in a sustainable manner for the continued progress and socio-economic development of the nation.

Scientific Societies actively involved in microbial ecological activities

The *Malaysian Society for Microbiology* was established in 1976 and currently has more than 350 members. Its main functions are to promote, advance and disseminate the scientific knowledge of microbiology and related subjects, to utilise this knowledge with particular reference to the Malaysian region and to foster the highest professional recognition and ethical standing of microbiologists in Malaysia.

Malaysian Society of Soil Science was inaugurated in 1971 to promote the study of science within the context of agriculture and to champion environmental stewardship. Its main objectives are to promote the study of soil science and to create public awareness on the importance of soil conservation within the context of sustainable land management, to review areas of soil study relevant for national development.and to disburse small grants to needy students and to members attending seminars.

There are other societies such as the Malaysian Society for Molecular Biology and Biotechnology and the Malaysian Society of Applied Biology with active members doing microbial ecology research.

Example of microbial research activities

Research projects performed at various institutions varies according to their strength and opportunities available. For example, Universiti Sains Malaysia (USM) has been actively involved in the study of nitrogen fixation and isolation of nitrogen fixation microorganisms from local niches. An active marine research group is on hand at its Muka Head Marine Research Station monitoring the local marine environment. USM has also been involved in a study of microbes from Antarctica especially looking at algae, diazotrophs and fungi. This is actually part of the Malaysian Antarctica Research Programme (MARP) initiated by the Malaysian Academy of Sciences.

The University of Malaya also have in intensely involved with Antarctic research. Besides isolating bacteria and fungi from Antarctica, they are also investigating microalgal biodiversity of the continent. They are also looking at the use of indigenous microalgal resources of Malaysia.

Universiti Putra Malaysia has been traditionally strong in studies involving the effects of locally isolated *Azospirillum* and *Bacillus* isolates on oil palm growth. Bacteria with plant growth promoting factors and alleviation of stresses are continuously being sought. Again, there is a research group dealing with bioremediation of local as well as Antarctic conditions.

Characterization of Selected Harmful Algal Bloom (HAB) Species from Malaysian marine environment are being addressed by Universiti Kebangsaan Malaysia (UKM) and Universiti Malaysia Sabah (UMS). This include the identification and taxonomy of HAB species found in tropical waters as well as its ecology and management. UMS is also actively involved in Antarctic research.

Research Institutions in Malaysia

Malaysia has nearly 20 public universities and almost all the major universities provide a microbiology component within their curricula. Malaysian embarked intensively on research programmes as part of its national agenda in 1987 and it has been successful in the training of human resource in many fields of science including microbiology. All the training are done by the universities. However, participations by governmental research institutions such as Rubber Research Board, Malaysian Palm Oil Board and Malaysian Agricultural Research and Development Institute were instrumental in boosting the level of research in the country. Recently the influx of foreign students has increased to do their graduate study in Malaysian universities with the majority coming from South-east Asia and the Middle East.

Future collaboration

Nitrogen fixation and plant growth promoting bacteria researchers in Malaysia have forged a strong collaborative group with international involvement. The Japanese Society for the Promotion of Science (JSPS) has been involved in this collaboration for the past decade until recently. The strong collaborative feature should be taken advantage of to better understand the status of microbial biodiversity and ecology in the region.

The Malaysian Antarctic Research Programme has also produced a very strong collaborative group dealing with Antarctic biodiversity and ecology. This group is now strengthened by the involvement of the biotechnological researchers who began to look at the topic at the molecular and genomic level.

In conclusion, the atmosphere and spirit of collaboration and networking within Malaysia is great and the potential is enormous. We welcome international research groups to collaborate with us in the field of microbial ecology. The laboratories are very well equipped and organized and research fields span a wide variety of topics with their results published in a wide range of internationally reputable journals.

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What's going on in Asia – The Philippine experience

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Scientific society

In the Philippines, a scientific and professional society involved in microbial ecology is the Philippine Society for Microbiology, Inc. or simply called PSM. It was established on October 14, 1971 at the University of the Philippines at Los Baños, Laguna. It is an organization whose objectives include the following: (1) promotion of scientific knowledge in microbiology or related fields, (2) stimulation of scientific investigations and advancement in the frontiers of microbiology or allied fields, (3) contribution to the development of microbiology education in the Philippines, and (4) recognition and accreditation of members in different specialized fields of microbiology. The academic and accrediting arm of the Society is the Philippine Academy of Microbiology (PAM). Accordingly, the organization requires microbiologists to be accredited by passing an equivalent licensure examination administered by the PAM.

The members are grouped into divisions according to their field of interest or expertise; Basic Microbiology, Food Microbiology, Medical Microbiology, Microbiology Education, Veterinary Microbiology, Agricultural Microbiology, Aquatic Microbiology, Environmental Microbiology and Industrial Microbiology.

The major activities of the PSM include the holding of Cluster Symposia scheduled sometime in November and February and the Annual Convention and Scientific Meeting scheduled every 2nd Thursday in May of each year at a place chosen by the Board of Directors. The PSM also publishes the PSM Newsletter and maintains a website (www.philsocmicro.com) which disseminates information and announcements to the members and the general public.

Research activities

In the field of microbial ecology, scientists in the Philippines are trying to search for microbes that can detect pollutants and their levels in a given area. Some have already used bacteria to treat heavily degraded environments. Researchers are also trying to find the role of microorganisms in the soil and water environments. A few decades ago, most of the studies center on the harmful effects of microorganisms to other living systems that reside in their environments. Today, many are looking at the benefits posed by some bacteria, fungi, microalgae and even protozoa in these settings. The role of biofilms is increasingly becoming more evident as many microbial ecological studies are being published. Among the recent works on microbial ecology in the Philippines are:

-Development of bacterial bioremediation inoculants for dye decolorization / degradation;
-Fungi as organic fertilizers for orchids;
-Fungal consortia for degradation of agricultural wastes;
-Microalgae for bioremediation, and
-Microbial exopolysaccharides

Education

Data and information on this topic were obtained from the Proceedings of the Workshop on Standardization of Microbiology Curriculum and Basic Microbiology Courses in the Philippines by AK Raymundo, LM Tapay, and ES Cabrera (April 2000). From the study, a total of 36 universities and colleges responded to the survey. Twenty-three of them were state schools and 13 were private schools.

As a degree program:

According to the said survey and up to the present, the University of Sto. Tomas (UST) is the only school that offers microbiology as a BS degree program having 18 microbiology courses in its curriculum. The University of the Philippines Diliman (UPD), the University of the Philippines Los Banos (UPLB) and the UST are the only universities offering MS Microbiology in the country and only UPLB offers a PhD in Microbiology program.

As a major field:

From the 36 respondents, 7 schools, (4 state colleges and 3 private schools) offer microbiology as a major field in a degree program. The state colleges are the UPLB, University of the Philippines Visayas (UPV), Iligan Institute of Technology, Mindanao State University (MSU-IIT), and Cavite State University (CSU). On the other hand, the private schools include Ateneo de Zamboanga University (ADZU), Philippine Christian University (PCU) and University of San Carlos (USC).

Four schools (3 state and 1 private) offer microbiology as a major field in undergraduate degree programs. The degree programs are the following: BS Biology (offered by all schools) and BS Food Technology (offered by UPV). For BS Biology, 16 microbiology course offerings were mentioned by the 3 state school respondents with a variety of combinations per institution. For BS Food Technology, there were 2 microbiology courses offered.

MS Biology is being offered by both UPV and MSU-IIT, while PhD Biology by MSU-IIT. UPLB offers both MS and PhD degree programs in Microbiology. For the MS Biology program, there are a total of 19 microbiology courses mentioned. For PhD Biology, there are around 12 microbiology course offerings.

Practical applications

The top food and beverage conglomerates in the country, among them the San Miguel Corporation, Asia Brewery and the various dairy companies, have successfully applied microbiological innovations that merited ISO certifications for them. In recent decades, some of these corporations have also entered into the meat industry and global technologies have been applied from raising the animals to proper treatment of meat for public consumption.

In the fisheries sector, prawn populations have been devastated by microbial infestation. Many fisheries administrators are content in changing the water every now and then in the ponds just to impede widespread infestation. The poultry and animal husbandry industries are also in the same case. The diseases caused by microorganisms still persist (foot and mouth disease, etc.) due to lack of supply of treatment options. Authorities are content with just containing the pestilence in one area rather than solving the problem in their roots.

Many drug manufacturers in the country produce antimicrobials but they do not really go into developing new vaccines. The United Laboratories (UNILAB) has started drug development but they are just beginning and not yet at par with other global leaders in pharmaceuticals. The government's Research Institute for Tropical Medicine (RITM) recently acquired a multimillion-peso vaccine facility but this has not been fully operational. The recent global scare of bird flu apparently has not motivated Philippine authorities to expand vaccine development.

Future aspects/international relations

Many microbiologists especially from the academe have collaborated with foreign counterparts on various research projects. There are institutional academic exchange programs and individual collaborations from meetings in conferences and research visits abroad. The country has many talented minds and capable of absorbing microbiological innovation fast. However, collaborations among academic, research institutions and industries have to be more widespread to benefit especially the small and medium-scale enterprises.

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What's going on in Asia － Water in Singapore

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The Republic of Singapore is a city country, which lies at the tip of the Malayan Peninsula at the crossroads of South East Asia. Singapore, a small island, has a land area of 637 square kilometers and a coastline of 193 kilometers. With a population of 4.3 million, the country's acute land scarcity has meant that very few undisturbed natural areas remain. Therefore, Singapore has severely limited natural resources and the environmental issues she faces are characteristic of a highly-urbanised city. Singapore has invested heavily in making the country as self-sufficient as possible, which can be seen from its development to become one of the most environmentally friendly countries.

Being a small island state, adequate and reliable supply of potable water is imperative to sustain Singapore's economic growth. Thus, water reservoirs, efficient water and wastewater treatment technologies are needed in a priority. Marina Barrage, one of the 15 water reservoirs, is a dam that is built across the Marina Channel, which is the largest and most urbanized catchment at 10,000 hectares or one-sixth the size of Singapore. The barrage, which comprises of a series of nine crest gates, will be built across the 350m wide Marina Channel to keep out seawater. With the barrage in place, the Marina Basin will turn into a body of freshwater through natural flushing and will serve as a water catchment area, meeting more than 10% of Singapore's current water demand. The Marina Barrage is also part of a flood control scheme to alleviate flooding in low-lying areas in the city and it will be an ideal venue for all kinds of recreational activities. Since this reservoir is going to change from seawater to freshwater, research projects are going on to monitor the microbial ecology in this basin and surrounding marine and soil environments where big changes are being expected. There may have interesting microbial ecology findings in such a big engineering work.

In addition to build reservoirs with large capacity, in order to make Singapore's water supply system even more dependable and resilient in meeting future demand for water, the Public Utilities Board (PUB) of Singapore has leveraged on new technologies by developing alternative sources of water such as the NEWater iniative and seawater desalination. The NEWater initiative was implemented in 2003 in which wastewater undergoes biodegradation and stringent purification and treatment process by applying advanced dual-membrane (microfiltration and reverse osmosis) technologies. Currently, NEWater is mainly used for certain industrial manufacturing processes, which require ultrapure water such as for semiconductor industries. A small amount (about 5 mgd) of NEWater is blended with raw water from the reservoirs before undergoing treatment for drinking water usage. The amount will be increased progressively to about 10 mgd by 2011, which equals to 15% of municipal water demand. Complementary to NEWater, Singapore's first municipal-scale seawater reverse osmosis desalination plant opened in September 2005. It is the largest of its kind in Asia and ranks among the most energy efficient ever constructed, enabling it to achieve the lowest desalinated seawater price in the world. At a capacity of 110,000m3 per day, the desalination plant has sufficient capacity to meet around 10% of the national demand.

Both NEWater and desalination water treatment techniques require membrane, however, biofouling on the membrane severely affects the treatment performance and increases the energy cost significantly. To solve this issue, many research projects sponsored by Singapore government are undergoing to either understand the microbial consortia's attaching characteristics or to develop new membrane materials to avoid microorganisms' attachment on the surface. We are expecting to obtain a membrane treatment facility which prevents or at least minimize microorganisms' adverse effects. With the above mentioned alternative sources of water, Singapore has a sustainable supply solution for the long term and could be a model city in water and wastewater management. With the good reputation of water and wastewater management, PUB successfully organized the international conference "Leading Edge Technology on Water" this June.

In order to attract talent people to Singapore, the government of Singapore allocates full-scholarships to attract high quality Ph.D. or master students from worldwide (mainly from China and South East Asia) in diverse disciplines including microbial ecology in the Biological Science Department and environmental microbiology in the Division of Environmental Science and Engineering. After graduation, most of them will be absorbed by the local high technological research institutes or companies to apply the knowledge they learn. The Singapore universities always keep close relationship with top universities worldwide, especially, visiting professor programs are already running by hosting foreign professors to our universities or sending our own professors out for research collaboration. In all, Singapore is planning and willing to become a global city, which will enhance its international relations.

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Present status of microbial ecology studies in Taiwan

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As microbial ecology studies are involved in diverse fields, at present time in Taiwan, in addition to Taiwan Society of Microbiology, results of research were presented in conferences held by different societies. The annual conference of Taiwanese Institute of Environmental Engineering, Taiwan Geosciences Assembly, Taiwan Society of Agricultural Chemistry, and Taiwan Society of Soil and Fertilizer Sciences were the major places to report.

The brief information about these scientific societies is listed below:

1) Taiwan Society of Microbiology
Membership: general member 436; permanent member 207, student member 80. Publications: Journal of Microbiology, Immunology and Infection (Journal; publish bi-monthly)
Meetings: Annual conference; Speeches on special topics
Awards and Grants: Basic Research Award, Clinical Microbiology Award, Pathology Award, Prof. Yen Chi-Jong's Award (5 graduate students)

2) Taiwan Society of Agricultural Chemistry
Membership: general member 346
Publications: Taiwan Journal of Agricultural Chemistry and Food Science; Food Science and Agricultural Chemistry (Journal; publish bi-monthly)
Meetings: Annual conference

3) Taiwan Society of Soil and Fertilizer Sciences
Membership: about 300 (active member about 60)
Publications: Soil and Environment (Journal; publish quarterly)
Meetings: Annual conference
Awards and Grants: Poster awards

4) Chinese Geosciences Union
Membership: individual member 224, group member 16
Publications: Terrestrial, Atmospheric and Oceanic Science (Journal; publish quarterly)
Meetings: Annual conference (Taiwan Geosciences Assembly)

5) The Taiwanese Institute of Environmental Engineering
Membership: about 400
Meetings: Annual conference
Awards: Young engineer award (1 to 3 people); Engineering awards

Some examples of the going on microbial ecology research in Taiwan

Marine ecosystem
Effects of the construction of three Gorges Dam on planktonic community in the East China Sea. Impacts of marine cage culture on the marine environment. Molecular and phylogenetic characterization of endosymbiotic bacteria in the coral community.

Biogeosciences
Effects of sea level, types of forest, season, and depth of the soil on soil microbial communities in Fusan Mountain and Tatachia Mountain of Taiwan.

Environmental science
Establishing sampling methods to determine microorganisms present in the Asia spring sand dust/storm and to determine their effects on terrestrial and marine ecosystems. Microbial diversity in soils near nuclear

power plant before and after its operation.

Geosciences

Microbial community present in different types of terrestrial hot springs and shallow hydrothermal vents near Gueshan island in Taiwan.

Development of new technologies

Carbon isotope fractionation associated with microbial oxidation of natural gas. Use bioimformatic softwares and microchip for detection of environmental microorganisms.

"Microbiology" education in the universities of Taiwan

I will use National Taiwan University (NTU) as an example. Undergraduate students in the Departments of Environmental Engineering and Geology are required to take *General Microbiology and Lab*. Students in medical school are required to take *Microbiology and Immunology and Lab*. Students in Departments such as Agriculture Chemistry, Plant Pathology and Microbiology, and Life Science, in addition to the *General Microbiology* are required to take more microbiology classes such as *Microbial Physiology*, *Microbial Genetics*, and *Advanced Microbiology*. Students who want to learn more about microbiology can take advanced microbiology studies in the graduate school. In NTU *Microbial Ecology*, *Marine Microbiology*, *Environmental Microbiology*, *Fermentation Microbiology*, *Food Microbiology*, *Methods for Microbiology and Biochemistry*, *Special Topics on Microbiology*, etc. are taught in different Graduate Institutes.

International exchange and cooperation:

Each year many young Chinese overseas (mainly from Indonesia, Malaysia, Macau, Hongkong, and India) will come and learn in Taiwan universities. However, in order to promote cooperation with other Asia nations, further exchange with students and faculty members or establish joint research is necessary. At present time not many foreign students in Taiwan, but through the promotion of our Ministry of Education, the number of foreign students is increasing each year. Recently our Ministry of Education also promote dual degree program with foreign universities based on the thought that more students from both sides could benefit from it. Personally I think that find a topics of mutal interest and through this dual degree program, joint research between two sides could be easily carried out.

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What's going on in Thailand?

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Introduction

Since the past decade, Thailand has emphasized on its national research in biotechnology politically and academically. Thailand has its name on a country with high biodiversity, biomass, and its potential impact on plant productivities. This has led many scientists inside and outside Thailand to do their researches in the fields of biotechnology and microbial ecology to provide an (incomplete, though) assessment of microbial diversity and many useful and environmental-friendly products such as food, food packaging, animal foods, etc. At present the Royal Thai Government has allocated more monetary funds to support Thai scientists to conduct their researches related to the national needs in order to help increase the national "know-how". Fortunately, this has brought Thailand to become one of the research-active countries in Asia. We do have many supporting aspects which can be categorized in the following topics:

Scientific Society

At present, the Science Society of Thailand under the patronage of His Majesty the King has played an important role in supporting many science activities such as annual conference, meetings, and symposium. Most of science university lecturers and teachers from schools nationwide are members. The Thai Science Society has many fields of activities in which the members can join and get their sponsorships when organizing their science projects. The society has not yet put the field of microbiology as one of its topic activities. Usually, microbiology and/or microbial ecology are parts of the Biology Division at the Science Society.

Another governmental organization we should mention is the National Centre for Genetics and Biotechnology. The Centre, originally known as NCGEB, was first setup under the Ministry for Science, Technology and Energy. After the establishment of the National Science and Technology Development Agency (NSTDA), BIOTEC became one of the NSTDA centres, operating outside the normal framework of civil service and state enterprises. This enabled the Centre to operate more effectively to support and transfer technology for the development of industry, agriculture, natural resources, environment and consequently the social and economic well-being of Thai people. The NCGEB is also one of the active organizations in biotechnology, microbiology, and microbial ecology fields.

Thailand Institute of Scientific and Technological Research is also supporting Thai researchers in research activities. Grants are available for Thai applicants annually. The fields of research interests are extensive in which Thai scientists in all fields can participate. There are more societies in Thailand that supports researches in microbial ecology, such as The Agricultural Science Society of Thailand under the patronage of His Majesty the King, The Siam Society under the Royal Patronage, Soil and Fertilizer Society of Thailand, and Thai Society for Biotechnology, etc.

Research Activities

In the past decade, many microbiologists and biotechnologists have done many researches in the field of microbial ecology since the government gave supports financially, though might not be full-supports. Most researches are usually done in educational institutes. Universities are the best places to go for the activities in microbial ecology. The names are for examples Chulalongkorn University, Mahidol University, Kasetsart University, Naresuan University, Chiangmai University, Khonkhaen University, Prince of Songkla University, Silpakorn University. To date, many researches from these educational institutes are relevant to environmental issues and the needs for renewable energy; for examples wastewater treatment, soil microbial ecology, biogas production, aquaculture, etc. Since most researches are done within the universities, lecturers (main researchers) usually have international collaboration with other countries such as Japan, China, USA, United Kingdom, France, etc. In addition, some of the researches done in Thailand have been developed into curriculums or programmes for undergraduate and graduate students which help Thailand move forward to being international.

Research funding is available from the Thai Government, the National Research Council of Thailand, The Thailand Research Fund (TRF), and Biodiversity Research and Training Programme (BRT), etc.,

which help support Thai researchers in the field of microbial ecology.

Education

All universities that have microbiology department in their faculty of science usually have at least a course in microbial ecology as a part of their curriculum. Even at the department of biochemistry, some of researches in microbial ecology can be found and well-recognized in some universities.

Majority of students graduated with their major in microbiology are usually further their education at the master level in Thai universities and abroad since they can earn more income and find better jobs nationwide. Students with microbiology degree are still needed in Thai industries; especially ones work with biotechnology and life sciences.

Since most of the programmes offered in Thai universities are taught in Thai, this makes difficulty for foreign students to conduct their study. The Thai Government, especially the Ministry of Education, is very concerned and, therefore, gives a lot of support for universities nationwide to establish their international school or programme in science. At the moment, there are some international programmes available at leading universities which are of interests to those students from other Asian countries such as Laos, Taiwan, Malaysia, Vietnam, Indonesia, India, Sri Lanka, and Pakistan.

Practical Applications

There can be divided into many practical aspects. In Thailand, there are 4 major areas of applications of microbiology; (1) Industrial (2) Environmental (3) Agricultural and (4) Medicinal Practices, which are mentioned below.

For industrial applications, there have been many uses for pharmaceutical industry, mass enzyme production, alcohol, organic acids, amino acids and vitamin industry, etc. These are one of the biggest areas in Thailand that have many experiences with the national 'know-how'.

Environmental concerns are one of the important issues that Thailand has paid its attention. There are both governmental and non-governmental organizations supporting the 'environmental-friendly ideas' to help develop technologies for enhanced environmental protection and clean-up the environment. Waste treatment from industrial and agricultural sources gives so much concern for the use of biological methods to clean up the environment. Therefore, Thailand is one of Asian countries that emphasizes on the use of bioremediation over the past decade.

Since Thailand is considered an agricultural country, microbiology has helped enormous numbers of applications to reduce costs of crop production, improve the quality, and increase the productivity. Bioremediation has been used to reduce harmful chemicals, thus reduce the environmental impacts. Organic farming has applied the knowledge of microbiology, particularly microbial ecology, to help increase value of agricultural products. There are some research developments using beneficial microorganisms such as Nitrogen fixers, Mycorrizal fungi and probiotics, to improve agricultural quality nationwide. In addition, many farmers have used biologically techniques to control plant diseases.

Medical applications in Thailand are concerning the screening of microorganisms (domestic and novel) for new bioactive compounds to solve health problems. Some of the mostly used for isolation useful microorganisms from various natural sources are plants (endophytes), insects (cordyceps), animal dungs (coprophilous), soil, sea water, fresh water and so on.

Future aspects / International relations

Thailand has many good international relations among Asian countries and other parts of the world which help the country to develop collaborations in science and technology. The Thai Government gives fully supports to help promote the use of biotechnology and establishing projects with other countries around the world. This is a big step for Thailand to move itself into the world of science.

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What's going in Vietnam in the field of microbiology

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Scientific society

The Vietnamese Society for Microbiology is one of 114 scientific societies belonging to Vietnam Union of Science and Technology Associations (VUSTA) which was established according to Decision N0 121/HDBT on July 29th 1983 by the Minister's Council (now the Government) of the Socialist Republic of Vietnam. The society for microbiology has involved mainly the scientists working in the field of microbiology in research and training organizations throughout Vietnam. Till now, the society together with VUSTA has held four meetings, five years for each. At the 11th international conference of International Union Microbiology Societies (IUMS) organized in San Francisco, USA, July 23 - 28th 2005, Vietnamese Society for Microbiology was officially admitted as full member of the IUMS.

At the present, the study on microbiology in generally and microbial ecology in particularly has been undertaken in many research institutes and universities in Vietnam.

Considerable achievements in the field of microbiological researches have been published in some international scientific journals or Vietnamese scientific journals such as *Journal of Biology*, *Journal of Biotechnology*, *Genetic and Applications* etc. in English or Vietnamese (for local journals).

One of the events that were organized by the Vietnam Society for Microbiology was the Emerging Infectious Viral Diseases in South-East Asia Symposium held on 5-8th April 2005 in Hanoi, Vietnam with supported by ASM through an International Requests for Assistance (IRFA) grant. Seventy-five Ph.D. and graduate students from Vietnam participated in the symposium, with faculty from Vietnam, the United States, India, Hong Kong, and China. The Vietnamese society is planning to publish the proceedings of the symposium in book form and will include a preface written by ASM.

Research activities

- *Microbial diversity*. Various kinds of microorganisms in Vietnam including eubacteria, archaea, yeast as well as fungi have been classified.

- *Biotechnology of microorganisms*

+ Selection, evaluation and exploitation of new microbial strains for use in agriculture, bio-pharmacy, food processing and waste treatments.

+ Development of microbial fermentation and platform technologies for the effective expression and economical production of recombinant proteins and bio-active compounds.

+ Production of recombinant DNA, proteins being useful in agriculture, bio-pharmacy, medicine, food processing and waste treatment.

- *International cooperation in Asia*:

There have been many research institutions from Japan, China, Korea, India, ASEAN countries etc. cooperating closely with research institutes and universities of Vietnam in various aspects of microbiology study so far.

Education

- Almost the faculties of life sciences in the key universities in Vietnam, the field of microbiology are being as one of the main subjects for students. At some universities there are the research institutes, centers or departments specialized on microbiology. Moreover, Vietnamese microbiologists have had the other chances to train oversea basing on international cooperation programs or Vietnamese governmental scholarships. Annually, there were about several hundreds students and technicians be trained in the field of microbiology in the whole Vietnam.

- Every year, there are many microbiological specialists in developed countries coming to Vietnam to training, introducing modern techniques for more than 200 delegations of local scientists in this field.

Practical applications

- Production of fermented products such as microbial fertilizers, wine, beer, sodium glutamate.
- Medical products are some vaccines and antibiotics.
- Production of bio-products in processing aquaculture ponds, organic enriched waster water.
- Microorganism indicators for soil, water quality.
- Using microorganism to clean oil polluted water.

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Your future aspects / International relations

In comparing with some other fields of biology, the study on general microbiology has rather fast developed in Vietnam. Many achievements have being applied in agriculture, industry and medicine. Vietnam is one of the main countries exporting high agricultural products such as shrimp, rice, fishes, etc. So that the study on utilization of microbial communities (bio-products for example) to clean the polluted water and soils caused by aqua-cultural, agricultural activities is very important. At present, the household garbage's, rubbishes from garment and shoes factories etc. in some large cities in Vietnam are being the big problem. Using microorganisms as a treating method should be needed. The international relations in these fields will be very necessary in the future.

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