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**REPORT**

**of**

**UNEP/Unesco/ICRO/WFCC  
MEETING/WORKSHOP**

**held in**

**Department of Microbiology,  
University of Queensland**

**7-22nd July, 1975**

**for the purpose of discussing the preservation of  
genetic pools and the establishment of regional  
collections of microorganisms in developing countries.**



REPORT ON UNEP/UNESCO/ICRO/WFCC MEETING/WORKSHOP

Brisbane July 7 - 22, 1975.

The Meeting was opened on 18.7.75 at 10 a.m. by the Vice-Chancellor  
University of Queensland, Professor Zelman Cowen.

Participants:

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and Cultural Organization (UNESCO)  
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and members of the Staff of the Department of Microbiology and others.

Apologies were received from Mr. J.H. Oswin, the Australian Ambassador to Unesco; Mr. Guy Gresford, Department of Foreign Affairs, Canberra who was absent overseas; Mr. Paul Kelloway, Assistant First Secretary of the Australian Development Assistance Agency, Canberra.

The Meeting was opened by the Vice-Chancellor who reviewed the developments leading up to the establishment of the WFCC World Data Center in Brisbane and expressed the appreciation of the University to the Directors of Unesco and UNEP and CSIRO for the assistance which had been given to aid the development and the honour conferred on the University and its staff by the choice of the Department of Microbiology in the University of Queensland as a venue for the Meeting; and the pleasure of the University at being able to participate.

Dr. DaSilva, conveyed to the Meeting the greetings of the Director General of Unesco and the apologies of Dr. Tom Burgers who had been unable to attend. He outlined the part played by Unesco in the development of research and extension of microbiology in relation to social and economic problems facing the nations of the World, emphasising the importance of the preservation and distribution of microbial strains of economic importance and the provision for

documentation of information on such cultures. He also stressed the need for the development of culture centers in developing countries and for support activities in the training of personnel for the administration of such centers. He sought the advice of participants on the best mode of development of these services.

Dr. Olembo conveyed the greetings of the Executive Director of UNEP, Mr. Maurice Strong and the Deputy Director, Dr. Tolba. Speaking on behalf of UNEP he supported the remarks of Dr. DaSilva and outlined the origin of the United Nations Environment Programme and its relationship to other U.N. agencies. He stressed that UNEP was not just another agency of the U.N. He indicated that UNEP arose from the deliberations of a Conference in Stockholm in 1972 when representatives of Governments and non-Governmental bodies reached the decisive conclusion that a new mechanism was required to cope with the problems of the deteriorating environment if the biosphere was to be saved for this and future generations. The main function of UNEP was to coordinate the various activities which were being conducted by numerous agencies. This included the need to support existing activities in Culture Collections and to extend these particularly in the area of selection and maintenance of strains of microorganisms beneficial to mankind. To this end UNEP sought the advice of such bodies as the Microbiology Panel of the International Cell Research Organisation which was already advising Unesco in this area.

He indicated that UNEP had agreed to support the continuing activities of the WFCC Data Center in Brisbane but also sought to extend the services on a world wide basis by the development of a series of centers to be known as Microbiological Resources Centers or MIRCENS. These MIRCENS would best be developed on a regional basis to minimise duplication and cost and overcome serious legal problems which often

ensue from national developments.

He urged the Meeting to consider these problems and to prepare resolutions which could be further considered at the forthcoming Third International Conference on Culture Collections in Bombay in March, 1976. He further indicated that UNEP was concerned with Unesco in the dual task of supporting MIRCENS and in training the personnel in developing countries not only the organisation of regional collections but in the usage of cultures maintained in the Centers.

In the latter regard UNEP is associating with another U.N. organisation - the Food and Agricultural Organisation (FAO) whose interests lie in the utilisation of microorganisms both directly and indirectly in food production. He cited as an important example the use of Rhizobium strains to obviate the need for expensive nitrogenous fertilisers. He urged the meeting to give consideration to the development of centers of maintenance and distribution of rhizobia - the WFCC Data Center being already engaged in documentation processes in this area.

In a subsequent talk he dwelt on the philosophy of UNEP, particularly in the area of energy conservation.

Professor Fabian Fernandes conveyed to the meeting a message of greeting from the Chairman of the ICRO Panel on Microbiology, Professor Roger Porter, and assured the meeting of the continued support for the operations of the Data Center and culture collection activities generally.

Professor Skerman concluded the opening meeting by thanking the Vice-Chancellor for his support and Dr. Olembo and Dr. DaSilva and Dr. Fernandes for their addresses.

The opening sessions were followed by a number of papers which are referred to in three groups.

- 1) Addresses by Unesco and UNEP and ICRO representatives
- 2) Addresses by Directors of culture collections in developed countries and a representative of the Commonwealth Department of Health.
- 3) Addresses by participants in developing countries
- 4) Resolutions.

ADDRESSES BY UNESCO, UNEP AND ICRO REPRESENTATIVES:

Dr. DaSilva - Unesco

Dr. DaSilva dealt briefly with the origin of Unesco. He emphasised that programs are formulated and submitted to a General Conference of Unesco where approximately 133 member states considered the proposals in open debate.

In 1961 Unesco established the International Cell Research Organisation (ICRO) to advise Unesco on the various proposals which have been put before it. It has 8 Panels - including one in Microbiology. Since the establishment of the United Nations Environment Programme in 1972 and the subsequent collaboration of Unesco and UNEP, this panel has become known as the UNESCO/UNEP/ICRO Panel on Microbiology, currently under the Chairmanship of Professor Roger Porter of Iowa, U.S.A.

In general, Unesco cooperates where possible with other International Agencies such as the International Federation of Institutes of Advanced Studies (IFIAS), the World Federation for Culture Collections (WFCC), the International Organisation for Biotechnology and Bioengineering (IOBB), and Universities.



Through ICRO it has organised the Global Impacts of Microbiology Conferences and has established 85 training programs in various fields of biology.

The training courses are aimed at two objectives - the training of young scientists in the new and existing technologies and, through them and in association with advanced institutes, to upgrade the technology of the developing countries. To date 2045 participants have taken part in 85 training courses.

Unesco has also cooperated with the International Biological Program - the basis for the current Man and Biosphere Program - particularly in the area of Rhizobium documentation and distribution.

Through the WFCC it has established the World Data Center for Microbiology which serves both the developed and developing regions.

Unesco also collaborates with WHO in non-clinical areas of investigation and there are also Unesco/WHO/ICRO courses, and with UNIDO in the area of industrial development, and is also directly involved with the United Nations University (UNU). Its interests are not limited to scientific work. As the name implies it is concerned with education and culture with the social implications. In microbiology it publicises the microbe at two levels - one the Unesco Courier (July 1975) aimed at a lower age level, and the other at the advanced age level with more formal documents.

Dr. Olembo - United Nations Environment Programme

As UNEP has only recently been founded little knowledge of its structure and purpose has been made known to the public. UNEP arose

from a U.N.-sponsored conference held in Stockholm in 1972 - attended by delegates from both Governmental and non-Governmental organisations concerned with the dramatic changes which have occurred to the biosphere - particularly in the past 45 years.

While the geochemical cycles of the World appear to maintain a balance, man's actions in the biosphere are progressing towards self-annihilation.

The Stockholm conference was the first U.N. sponsored conference to which representatives of non-governmental agencies were invited to participate and many more invited to submit ideas. The WFCC for example submitted a detailed document on the need for preservation of microbial cultures - particularly those of use to mankind in the fight against starvation and disease.

UNEP is not an operating agency as is the case with Unesco, WHO, FAO, UNIDO etc. Its purpose is that of coordination of existing efforts and as a motivating agency where it is obvious that action needs to be taken in the biosphere but for which no provision is made in programmes of existing agencies.

The Headquarters are in Nairobi - a developing area. Administratively UNEP consists of three Sections.

- 1) The Secretariat, headed by the Executive Director and a team of scientists.
- 2) Environment Coordinating Board - the arbitrating mechanism to which the Secretariat refers questions such as where, if anywhere, amongst the UN agencies a particular problem is being investigated and to what extent each agency covers the problem. It then seeks to coordinate the activities of the various agencies and if sections remain uncovered, takes action to

see that the uncovered section is attended to, either by funding existing agencies to extend their programs or by instituting additional programs outside these agencies.

To make it functional the Environment Coordinating Board has on it all the Heads of the Cooperating Agencies - i.e. Unesco, FAO, WHO, UNIDO, IAEA, UNCTD etc. In this way the isolation of each organisation is reduced as they exchange information on involvement in common problems.

3) The Environment Fund. Each UN agency has its own programs and sources of finance - the latter being committed in the main to programs to which each agency has a mandate. To expand these programs at the request of UNEP or for UNEP to develop programs with other agencies when UN agencies are unable to assist, it is necessary to have a Fund from which costs can be met.

The Fund is contributed to on a voluntary basis by interested countries - not on a pro rata basis per nation as are the general funds of the U.N.

In all there are about 100 scientists in Nairobi whose task it is to evaluate needs in all areas of the biosphere.

The scientific advisory aspect of UNEP originally functioned under four Divisions.

Division 1: Geophysics and Global Pollution which is concerned with the coordination of investigations into ways and means of combating existing problems of global pollution.

Example: Rehabilitation of the Mediterranean Sea.

Division 2: Ecosystems and Natural Resources concerned mainly with the preservation and maintenance of existing resources.

Example: Forests and reforestation.

Division 3: Social and Economic Program concerned with human population and the relationship of these to the environment

Example: Population control, housing, urbanization and waste disposal.

Division 4: Technical Assistance and Training (now abolished)

This division was concerned with extending direct technical assistance to developing countries. It was dissolved because it would have converted UNEP into another operating agency and destroyed its primary role as a coordinating body. It has not wholly abandoned interest in technical assistance and training but has chosen to give aid through the existing operating agencies.

The location of UNEP Headquarters in Nairobi has helped to balance attitudes between developed and developing countries. Whilst the former are undoubtedly responsible for the major pollution problems of the world, the developing countries are the ones with the bulk of undisturbed natural resources. The former are concerned primarily with the curative problems while the latter have the important role of preserving the existing assets. It is obvious that each has a lot to gain from contact with the other.

Professor Fernandes - I.C.R.O.

Prof. Fernandes discussed the origins, objectives and successes of the Global Impacts of Applied Microbiology (GIAM) Conferences. These conferences had their origin in representation by Japan to the 12th General Conference of Unesco for promotion of research on microorganisms and their application. In 1964 Unesco allocated a special budget for a

program in microbiology and set up a Microbiology Panel of the International Cell Research Organisation to guide the programs for GIAM Conferences.

Four GIAM Conferences have been held -

GIAM I in Stockholm in 1963

GIAM II in Addis Ababa in 1967

GIAM III in Bombay in 1969

GIAM IV in Sao Paulo in 1973

At GIAM I it was resolved that future GIAM Conferences should be held in developing countries and this resolution has been followed. This decision made possible the attendance at these conferences of a majority of representatives of developing countries and brought specialists from developed countries into immediate contact with the people and problems of the developing areas. Movement from one area to another has progressively laid emphasis on specific regional problems in those areas and provided direct access of the majority of microbiologists in the particular areas to associate with and exchange information with visiting scientists. WHO associated with Unesco in the convening of GIAM II.

GIAM I and II were organised by the ICRO/Unesco Committee. Subsequent conference organisation has been placed in the hands of local organising committees acting under advice from an International Advisory Committee (IAC). This action has presented the host country with enormous problems in organisation and financing but has caused the motivation of local scientists in their national affairs and involved national leaders in a way no other approach would have achieved.

At GIAM III the first of a series of training programs was introduced under the title of "Microbial Physiology and Genetics" with

16 participants selected on a global basis. A GIAM III fellowship was instituted at the University of Bombay as a result of this Conference, and a system of Unesco/ICRO Fellowships was introduced for young scientists in applied microbiology. A Unesco/ICRO/IFIAS fellowship scheme is being designed now.

With GIAM IV in Sao Paulo, the World Federation of Culture Collections - which evolved from the Section on Culture Collections of IAMS - held its first conference in association with GIAM, and also arranged a training program in culture collections.

#### Benefits of GIAM Conferences:

The value of a conference can only be measured by the benefits which ensue. These have been several. In a general sense they have created an awareness of the place of microbiology in the socio-economic field at high governmental and non-governmental levels. Lack of such awareness in the past has been the major cause of inaction.

They have brought together large numbers of scientists from developing countries in a way which international conferences in developed countries rarely do. They have familiarised the visitors with the problems of the areas and in this way incited research into specific problems. They infuse a sense of responsibility amongst local scientists to look critically into the pressing needs of the nation.

#### CONTRIBUTIONS FROM CULTURE COLLECTIONS IN DEVELOPED COUNTRIES:

The Meeting was fortunate to attract in the persons of Dr. Richard Donovan, Dr. James Shewan, Dr. Evrik Afrikian, and Dr.

Kazuo Komagata, speakers associated with four of the largest culture collection organisations in developed areas.

Dr. Donovanick: American Type Culture Collection

Dr. Donovanick discussed the organisation of the American Type Culture Collection at 12301 Parklawn Drive, Rockville Maryland 20852, U.S.A. This is the largest all-purpose culture collection in the world. Its catalogue contains data on 15000 strains of algae, bacteria, bacteriophages, fungi and protozoa, almost 600 strains of viruses, rickettsias and chlamydiae and 134 cell lines. It is a private, non-profit organisation.

The Collection is fully equipped for both maintenance and research and operates on a non-profit basis. It acts as a repository for patent cultures in the USA.

Recently steps were taken to incorporate a data storage and retrieval system which is planned as the basis of a National Microbiological Data Center.

In a statement on aid to developing collections, Dr. Donovanick indicated that with the present developments at the ATCC it should become an ideal place for the training of personnel in the management of culture collections. The ability to aid in training programs is at present severely limited by lack of space.

He stressed the costs of operating a major culture collection. The ATCC is a non-profit organisation and receives no formal government support. Its costs must be met by sale of cultures and grants obtained from Federal and Private Institutions. For purely culture collection

activities (not including research) it must generate an income of \$1,000,000 representing US\$40 per specimen. Fees of this magnitude are only charged to private industries. The ATCC thus has to subsidise sale of cultures to educational institutions from other grants. In addition it exchanges cultures on a gratis basis with other culture collections.

Dr. Shewan: Torry Research Station, Aberdeen, Scotland

Dr. Shewan discussed the organisation of the National Collection of Industrial Bacteria (NCIB) and the National Collection of Marine Bacteria (NCMB), both located at the Torry Research Station. The Institute was established in 1929 as one of three constituent laboratories of the Food Investigation Organisation (FIO) of the U.K. Government's Department of Scientific and Industrial Research. Its primary purpose has been the study of fish preservation. It now functions under the direction of the Ministry of Agriculture, Fisheries and Food. It has a staff of 208 manning 8 scientific sections one of which is microbiology. The two culture collections constitute one of three integrated units of the Microbiology Section. Other national collections in the UK are the National Collection of Type Cultures (NCTC), Colindale; the National Collection of Plant Pathogenic Bacteria (NCPPB), Kew; The National Collection of Dairy Organisms (NCDO), Reading; the Commonwealth Mycological Institute, Kew; the National Environmental Research Council Center for Algae and Protozoa (CAP), Cambridge and the National Collection of Yeasts (NCY), Nutfield.

The NCMB comprises 1500 strains including an important collection of bacterial pathogens of cold-blooded animals. The NCIB houses over 3500 bacteria of industrial importance. It is a recognised depository for patent cultures about 20 new ones being added each year.



The two collections despatch approximately 6000 cultures to universities, colleges, schools, research laboratories and hospitals each year and accede about 100 new cultures.

Research is on taxonomy and culture preservation.

The institute is recognised by the University of Aberdeen as an institute for training of higher degree students for which it is very well equipped.

On the subject of aid to developing collections, Dr. Shewan indicated that the NCIB and NCMB - and other Government sponsored culture collections in the UK - provide cultures at a nominal cost - the bulk of cost being subsidised by the Government - largely through personnel in the culture collections being employed primarily on other research activities for which the collections were a necessary adjunct. Division of the UK collections amongst various centers on the basis of expertise aided this.

All foreign orders for cultures now cost £ 6 each which includes packaging and mailing charges. This does not represent the true cost of the cultures. Reduced rates are charged to Educational Institutions in the UK.

The collections can assist with provision of experience in training of people solely by attachment to a specific research project. No charge is made if the student is able to provide his own means of support. This is a substantial form of aid. Cooperation between collections and universities is another possible source of assistance.

Space limits this type of assistance to a maximum of 2 at any one time.

Dr. Komagata: Applied Microbiology in Japan and the Japan  
Federation for Culture Collections.

Dr. Komagata reviewed the coverage of microbiological industry in Japan stating that the present annual production of Japanese microbial industry had attained a level of about two billion yen (US\$6,700,000) and employed about 3000 scientists. All aspects of microbial research from isolation to produce production and utilisation were studied.

The Japanese Federation of Culture Collections was established to promote research on microorganisms in 1951. Its members are 17 institutes having culture collections in the fields of applied and medical microbiology. About 85000 strains of bacteria, yeasts, fungi and actinomycetes are preserved and about 13000 strains distributed annually to users in Japan and abroad.

The Osaka University annually conducts a training course in fermentation microbiology.

In a statement on aid to developing collections Dr. Komagata indicated that cultures are usually provided free of charge, by Government Institutes, to institutes in other countries. A charge of \$10 is sometimes made to private organisations. The institutes for Fermentations, being privately funded, charge for the supply of cultures.

On provision of training Dr. Komagata referred to the course on microbiology made available through Unesco/ICRO long-term (12 months) postgraduate courses, which provided training to 14 participants each from Asia. Assistance from the Japanese Government, cosponsorship by the Japanese

National Commission for Unesco, the Universities of Fukuoka, Kyoto, Osaka, Sendai and Tokyo, cooperating organisation from Society of Fermentation Technology, Japan and the International Committee on Economic and Applied Microbiology of the International Association of Microbiological Societies (IAMS) contributed to the development and implementation of the courses. It provides for the training of 13-18 students and they receive a certificate at the end of the course - no degrees are issued. The course is a training course primarily for Asian students although others have been accepted.

Professor Afrikian: The USSR Culture Collection

Professor Afrikian was deputising for Dr. V.J. Kudriavzev, Director of the All-Union Collection of Non-Pathogenic Microorganisms. The Collection was founded in 1958 by the Presidium of the USSR Academy of Sciences.

The collection works in close association with leading taxonomists in other institutes in USSR.

In developing the collection special emphasis has been placed on the multiple representation of strains of species collected from different ecological situations.

To coordinate the work of numerous collections in the USSR the All-Union Collection has compiled and circulated a comprehensive review of "Methods for the Preservation of Culture Collections of Microorganisms" published in Moscow by "Nauka".

Studies on preservation methods have shown that preservation under mineral oil and lyophilisation are the most useful methods.

The collection has five major subdivisions dealing respectively with yeasts, filamentous fungi, bacteria, actinomycetes and mycophilic fungi. The collection maintains 7000 cultures covering 402 genera and 2120 species. The All-Union Collection acts as a Courier Service for all foreign requests for cultures from the Soviet Union.

STATEMENT ON QUARANTINE REGULATIONS - COMMONWEALTH OF AUSTRALIA

Mr. S.J. Navaratnam - Quarantine Office, Commonwealth Department  
of Health, Canberra, Australia

Microbial cultures are prohibited imports to Australia under legislation which is administered by the Department of Health in Canberra. Persons wishing to import cultures must first obtain a permit to import the cultures. The main concern is control over importation of pathogens of man, animals and plants but the requirement to obtain a permit is a general one. Applications are made in a single copy only on a form labelled Q39 available from all Quarantine offices.

Applications are normally made direct to the Quarantine Office in Canberra but may be made through state offices. In either case the relevant state office is advised of the nature and the approximate date of arrival of cultures. Permits may be granted for continuing imports.

Approval, if given, is issued on a form Q41 made out to the importer and stating conditions applying to the importation. For example

distribution within Australia may be forbidden and cultures may have to be destroyed on completion of the purpose for which they were imported. The original of this approval form is sent to the importer and copies to the local customs office and one to the Quarantine Office.

Where pathogens are requested the appropriate authorities in the state or states concerned may be consulted before approval is given. All precautions are taken to avoid the introduction of exotic contaminants with the named cultures.

Where permission is sought for importation of plant pathogens the application has to be seen and endorsed by a culture representative of the Quarantine Office in each state, before it is forwarded to Canberra for the normal Commonwealth Quarantine processing. Each request for a plant pathogen is considered by a Committee of three consisting usually of a representative of the Quarantine Office, the Chief Plant Pathologist in the state and one other from CSIRO or a University. Decisions to permit importation must be unanimous and may be subject to strict limitations on the area, mode and time of usage before the culture is destroyed.

#### CONTRIBUTIONS FROM PARTICIPANTS FROM DEVELOPING COUNTRIES

Each participant was asked to prepare two papers - one dealing with regional problems of a microbiological nature and the other with the facilities of their institutes. The dual objectives were to obtain the participant's viewpoint on the needs of their region and some assessment of the state of development of the institutes from

which they had come. The following statements have been condensed from the two statements submitted by each participant.

#### SOUTH EAST ASIA

Dr. Sundhagul (Thailand): Provided a detailed review of the present status of development of microbiology in Thailand with specific emphasis on the non-medical aspects - a development which has stemmed largely from the activities of a working group on microbiology set up by the Science Committee of Thailand's National Commission to Unesco in 1974. Her report reflects a well-planned division of interests between the main institutions concerned, the majority of which appear to be equipped at least up to standards of most developed countries, for both research and culture maintenance.

The Thai institutions work in close collaboration with other South East Asian Institutions under a program established by Unesco as the Regional (S.E. Asian) Network on Microbiology. The countries involved are Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Thailand, Vietnam and Hong Kong. The Secretariat is at Mahidol University, Bangkok.

The major problems of the whole area are centered mainly on protein production and processing of protein foods - particularly soybean and fish-quality control, spoilage and waste treatment. Increasing interest is being taken in development of pure culture fermentation processes; microbial genetics in food fermentation; microbial spoilage and deterioration; aflatoxins and other mycotoxins; Rhizobium inoculation for legumes; microbial protein production; fuels from microorganisms.

Dr. Saono - Treub Laboratory, Bogor, Indonesia: Dr. Saono noted a severe lack of proper forms of communication within and between scientific institutions in Indonesia.

Research in Universities is mainly basic and aimed at educational work - applied research being conducted by various Governmental and non-Governmental agencies.

In the second of a series of five-year Development Plans, science and technology will be used to better advantage in planning and also to accelerate the implementation of national development.

One important field in research and development, which is one of the national research programs under the direction of the Minister of State for Research, is the inventory and evaluation of human and natural resources, including the development of appropriate technologies. Research, inventory and evaluation of natural resources includes: (1) soil and water resources (2) resources of the flora (3) aquatic resources, and (4) energy and mineral resources.

The scientific work force in relation to tasks to be accomplished is relatively small.

Under the terms of the second of the five-year plans of development, Agricultural Microbiology dominates the microbiological specialisation.

Areas of research include - crop conservation, fish conservation, single cell protein, rhizosphere microorganisms, animal diseases, marine phytoplankton, food fermentation (Taoco, tape and kecap), nitrogen fixation (symbiotic and non-symbiotic) compositing.

Most of the 31 institutes maintain their own culture collections.

Dr. Shaw - Papua New Guinea:

A Veterinary Research Laboratory was established at Kila Kila near Port Moresby in the middle 1950's. It also acts as a quarantine center.

Research in non-medical and veterinary problems commenced in 1955 with the establishment of plant pathology services at Konedobu near Port Moresby. A Rhizobium service was instituted there in 1956 and is continuing. This was followed by other institutes at Popondetta (1963) Kerwat (1965) and the University of Papua, Port Moresby (1967), the University of Technology, Bulolo (1969), the Highlands Agricultural Training Institute, Mt. Hagen (1973). With the exception of Konedobu, in the majority of these, microbiological work has been minimal.

At the Plant Pathology & Rhizobium Laboratory at Konedobu the plant pathological work has involved continuing surveys, identifications and advisory control work and investigations, in the field and laboratory, of diseases caused by fungi, bacteria, viruses and nematodes of the subsistence food crops, supplementary foods and vegetables, plantation and other cash crops, leguminous shade and grown covers, pasture and forest species, ornamentals etc. The microbiological work has included problems of moulds on stored food and other substrates, poisonous and edible mushrooms, entomogenous fungi, bacteria and viruses, algal problems etc. The Rhizobium Supply Service involves the free supply and maintenance of Rhizobium cultures to growers, and related research on leguminous and non-leguminous symbionts and on asymbionts.



Research on aflatoxins of fungi is proceeding at the Agricultural Chemistry Section at Hohola, near Port Moresby.

Amongst the other institutes interest centers on diseases of cocoa and cacao, viruses of legumes, mycorrhiza of eucalypts.

Leguminous crops include peanuts, soya beans, wing beans, chick beans, and pigeon peas. About 1/3 benefit from inoculation, 1/3 do not, the remaining 1/3 being problem areas.

Culture collections do not play a prominent part in the institutes.

Mr. Moslehuddin - Bangladesh:

As the country as a political institution was established in 1971 there has been little development. Microbiology is not taught as an independent discipline but forms part of courses in biochemistry, soil science, botany, medicine and agriculture.

Research in microbiology is concentrated in:

- (1) The Institute of Nutrition and the Department of Biochemistry, Dacca University - production of antibiotics, alcohol,  $\beta$ -carotene, utilisation of petroleum products, conversion of cellulose materials.
- (2) Departments of Soil Science and Botany, Dacca University - Rhizobium and Neurospora.

- (3) Laboratories of Bangladesh Council of Scientific Industrial Research, Dacca - citric acid from molasses, fish spoilage, food yeast, gluconic acid and acetic acid and fat from molasses, lactic acid, acetone-butanol, yoghurt (Dadhi), bacteriology of water and air, fresh water fish, microbiology of pineapples, mangoes; aflatoxins.
- (4) Agricultural University, Mymensingh, Bangladesh - fuel gas from cowdung.
- (5) Jute Research Laboratory, Dacca - flax retting.
- (6) Atomic Energy Commission Laboratory, Dacca - citric acid and alcohol.

#### NORTH AFRICA

Dr. Gibriel, Egypt: Microbiological Institutes of Educational and Research nature have been established at the University of Cairo (1908 - Science and Agriculture); Alexandria (1942 - Science and Agriculture); Ain-Shams (1950 - Science and Agriculture); Assiut (1957 - Agriculture) and Azhar (1961 - Agriculture).

Microbiological institutes of a purely research nature include - the Agricultural Research Center established at Giza before 1950 by the Ministry of Agriculture and the National Research Center established in 1956 at Dokki, Cairo.

Purely educational centers are being developed under the supervision of the older universities at Zagazig (agriculture), Mansura (Science) and Tanta and Kafr El-Sheik (agriculture).

Other centers in North Africa exist in the Universities of Khartoum (Sudan - agriculture); Tunisia (Tunisia - Science); Algeria (Algeria - Science) Kustania and Wahran (Algeria - Science).

Microbiological research is mainly of an applied nature concerned with problems in soils, plant pathology and food microbiology.

Studies have been concerned with -

- (1) problems of nitrogen supply
  - (a) Rhizobium on clover, beans, cowpeas, horse beans, peanuts and the effect of such factors as sulphur amino acids, boron and molybdenum, aromatic compounds, sodium salts, pesticides and plant associations on the host-Rhizobium complex.
  - (b) Azotobacter and blue green algae as nitrogen fixing organisms.
- (2) Rhizosphere microflora
- (3) Effects of irrigation
- (4) Plant diseases (potatoes, beans, wheat, tomato, cucurbits, artichokes and vines).
- (5) Food microbiology (fish, pickles, dehydrated onions, dried milk and other dairy products, single cell protein, acetic, glutamic and lactic acids).
- (6) utilisation of waste products and use of urease to improve quality of Red Sea fish.

Dr. Okafor - Nigeria: There are six Universities in Nigeria: Nigeria (at Nsukka - Science), Benin, Ife, Lagos and Ahmadu Bello (Science Microbiology in Biological Science degree), Ibadan (Medical Microbiology). The only B.Sc. Degree in Microbiology is issued by the University of Nigeria.

The principal research activity is in food microbiology - particularly local fermentations.

There are four Government Research stations in Nigeria. One - the Federal Institute of Industrial Research - is concerned with the utilization of agricultural products and particularly fermentation of maize, cassava and palm wine.

Federal and state agricultural institutes are concerned with Rhizobium.

#### SOUTH AMERICA

Dr. Valdes - Mexico: Of primary concern in Mexico is the relief of a serious nitrogen deficiency by the use of Rhizobium inoculation of legumes. The National Institute of Agricultural Research has 8 centers and 35 experimental fields distributed over the country. Responses have been very erratic and the causes are being sought. The inoculum is produced by commercial manufacturers and the method of use may not be the most suitable. No inoculants are available for tropical legumes.

Five other institutions are conducting some research on Rhizobium. The predominant legume crops are beans, soybeans, chick pea, alfalfa and peas.

Other studies include the relationship of Azotobacter to crop production and the production of single cell protein (yeasts) from methanol, ethanol and petroleum products.

Mycorrhizas are studied by 4 institutes and phytopathology by 5.

Production of amino acids from solid waste products and humification of wastes are studied by the Gualajana (South) University.

Dr. Franco - Brazil: Soil microbiology in Brazil is almost totally concerned with biological nitrogen fixation. The large amount of available arable land has lessened the need for intensive research on soil improvement to date.

The soya bean (Glycine max) and bean (Phaseolus vulgaris) and temperate forage legumes are the main interest crops.

Centers concerned with Rhizobium research are -

In Parana State - The Institute of Biology and Technological Research (I.B.P.T.)

In Nth Parana State - The Agricultural Research Institute (IAPAR)

In Sao Paulo State - Soybean Research Center, operated by the Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA); Nuclear Center for Agricultural use (CENA) and the Instituto Agronomico de Estado de Sao Paulo (IAESP).

In Rio de Janeiro - The Universidade Federal do Rio de Janeiro City - Microbiology Institute; "Km 47" - a part of EMBRAPA, and the Universidade Federal Rural do Rio de Janeiro (UFRRJ).

Recently an International Cooperative program in  $N_2$  Fixation was supported by the UFRRJ, EMBRAPA and CNPq (National Research Council) to provide the facilities and an Advisory Committee with scientists from U.S.A., England, Australia and Canada.

The aim of the program is to develop basic research in nitrogen fixation under tropical conditions and to train - to Ph.D. level - students from developing tropical countries, mainly from South America.

At Rio de Janeiro, besides the two centers already described the city Council is starting a program for processing sewage sludge and wastes to make fertilizer.

In Brasilia eventually there will be a very important soil microbiology center for "Cerrado" soils. A small group is already working in nitrogen fixation there.

More attention has been given to food spoilage and processing and plant pathology all over the country than soil microbiology.

Besides Argentina and Uruguay, there is a very good program in nitrogen fixation in the Centro Internacional de Agricultura Tropical (CIAT) in Cali-Colombia. They have been forming a Rhizobium collection for tropical legumes - mainly Stylosanthes sp. and P. vulgaris.

The culture collection at "Km 47" contains 1000 organisms principally Azotobacter, Beijerinckia, Derxia and Rhizobium spp. The collections generally are small and poorly maintained.

STATEMENTS BY PARTICIPANTS FROM DEVELOPING COUNTRIES ON THE INSTITUTIONS  
IN WHICH THEY ARE EMPLOYED

Dr. Sundhagul of Thailand outlined the organisation of the Applied Scientific Research Corporation of Thailand. It was established in 1963. It is largely an autonomous body acting outside the Thai Civil Service.

It carried out research in its own right but also has the almost unique capability within the country of being in a position to coordinate research programmes involving government departments and other government organisations. It provides a centralised service for documentation and scientific data.

Research is carried out by multidisciplinary teams drawn from the four main institutes and 6 auxiliary services.

Each program is continually monitored from the commercial-economic viewpoint - emphasis being on applied scientific research and training.

Amongst research programs of microbiological interest are -

PAST

1. Microbial Ecology and Microbial Deterioration in tropical dry-evergreen forest ecosystem.
2. Waste Recovery through microorganisms
3. Traditional food fermentations (fish and fishery products)
4. Microbial culture collection

PRESENT

1. Waste recovery through microorganisms
2. Traditional food fermentations (soybeans and cassava)

3. Microbial culture collection
4. Industrial fermentation process and designs (saccharification and alcohol production)
5. Microbial protein production
6. Microbial products for agriculture (Rhizobium inoculation)
7. Research consultancy in microbiology

The Microbial Culture Collection program commenced in 1967 with the collection and identification of air-borne and soil-borne microorganisms. Since 1972 several strains of industrially important organisms have been accessed from local and foreign sources. At present the collection holds 400 cultures of which 100+ strains have industrial applications. They are maintained on agar slopes, under paraffin oil and in the lyophilised form.

The staff consists of one (acting) curator, 2 technical assistants and one laboratory assistant. A yeast taxonomist is employed on a part time basis. Identification capability is limited to yeasts and fungi. The ASRCT maintains link with CBS in the Netherlands and the Natick Laboratories in Massachusetts and the USDA Laboratory at Peoria.

The laboratory is reasonably well equipped for routine culture maintenance. It would make good use of a micromanipulator, multiple inoculator and below ambient temperature incubator.

The Culture Collection has been chosen as the center for maintenance and distribution of cultures being studied for soybean fermentation under the Australian/ASEAN Technical Assistance Programme.



Dr. Saono - The Treub Laboratory of the National Biological Institute,  
Bogor, Indonesia.

A Visitor's Laboratory was established by Melchior Treub in 1884 in a former Military Hospital building in Bogor Botanic Gardens. The present laboratory was constructed in 1914. Research was botanical and conducted by Visiting Scientists in 1958 at which time the Dutch withdrew from Indonesia. There was a recession in activity till 1966 during which time local scientists were being trained in Indonesia and overseas. In 1962 the name was changed to that of National Biological Institute and now acts under the Indonesian Institute of Sciences which in 1967 replaced the Ministry of National Research.

The Institute has four sections -

(1) Plant Pathology and Genetics; (2) Microbiology; (3) Phytochemistry and (4) Plant Physiology.

The main function is to conduct basic non-taxonomic research on tropical flora, with stress on problems which have a direct or indirect importance to the welfare of the country.

Amongst the research activities of the current five-year program is that of applied microbiology in plant protein production and the utilization of agricultural wastes and byproducts.

The microbiological program covers symbiotic N-fixation by edible legumes, and free-living organisms; microbiology of traditional foods and composting of agricultural wastes.

The staff includes 6 microbiologists. Most basic instruments required are available. Spare parts are often difficult to procure.

Glassware and many chemicals peculiar to microbiological work are difficult to procure.

The culture collection of the laboratory is managed by 1 part time staff member and 1 full time and 1 part time technician. Its main interests are on general, agricultural and industrial microbiology, but with more emphasis on the last 2 specializations. Its main function is as a repository of non-pathogenic microorganisms obtained from the laboratory research activities. These cultures may be distributed free of charge through exchange or at cost of materials and mailing. The collection is at present being overhauled.

The Treub Laboratory had recently acquired a freeze-drier and is converting all cultures to the lyophilised form. It could be considered as a possible regional center.

The laboratory cooperates with other institutes and assists in training in areas relevant to the five year program.

The laboratory is participating in the Australian/ASEAN program on soybean and protein rich foods.

Dr. Shaw - Plant Pathology & Rhizobium Laboratory, Konedobu, Port Moresby.

The laboratory staff provides for 6 pathologists, 1 rhizobiologist and 4 laboratory assistants. The latter have received only in-service training.

Some facilities are shared with other laboratories (typing, photographic, library).

The laboratory is located beside the Chemistry Section for easy consultation. The laboratory is well equipped for most microbiological work. Fungal cultures are maintained in the laboratory herbarium. Rhizobium cultures are held on media, under oil or freeze-dried. These form the main cultures supplied by the laboratory since 1955, some 22,000 cultures being issued since that time - mainly to South East Asia and the South Pacific.

The laboratory could act as a center for storage and distribution but is currently deficient in laboratory and office space, (even for existing equipment).

The staffing situation is also problematical in view of the recent proclamation of independence of Papua New Guinea. Facilities for training of the indigenous population are poor, but may be aided by the recent establishment of a Faculty of Agriculture at the University. It will also be aided by the development of second and technical education.

Food microbiology is of minor importance in PNG because very little food is stored.

Mr. Moslehuddin - Bangladesh Type Culture Collection, Dacca.

This collection is the only one in Bangladesh. It is located in the Institute of Nutrition, University of Dacca and is supported by the University of Dacca and the Bangladesh Council of Scientific and Industrial Research.

Established in 1967 by Prof. K. Ahmed it holds 470 cultures of fungi and bacteria, 252 of which have been isolated from soils and water. Many have been imported. Provisions for staff and space appear to be satisfactory but other facilities are extremely poor and the collection is in great need of outside support.

Limited research has been on antibiotic producing organisms; production of beta-carotene and spore bearing bacilli.

Dr. Gibriel - Faculty of Agriculture, University of Ain-Shams.

The University is located in the suburb of Abbasiyah in Cairo. The Faculty of Agriculture however is located in the Nile Delta at Kalubia. Agricultural Microbiology is located there, but there are microbiological units in other departments such as Food Science which covers Dairy Technology and Food Technology. Food Technology has an academic staff of 5 - one being a microbiologist. There are 8 teaching assistants and 15 graduate students. Technical staff is inadequate.

The general requirements for isolation and maintenance of cultures are available including freeze drying equipment.

There is no organised culture collection and no staff for effective maintenance, but the basic needs are available for such an organisation if support was available. Properly trained staff would be a necessity.

Dr. Okafor - University of Nigeria, Nsukka

Founded in 1960 its Department of Microbiology gave service courses to Agriculture and Science and admitted students to honours in 1970. Courses are very broad, covering bacteriology, algology, mycology, protozoology and elements of virology. Emphasis is on applied aspects dealing with food, water, soil, industrial and medical microbiology.

The Department has 19 teaching members and nine fully qualified technologists. It is well equipped. Steps have been taken to import a wide range of cultures to form the basis of a culture collection.

The Department seems well suited as possible center for storage and distribution of cultures.

Dr. Valdes - Department of Microbiology of the National School of  
Biological Sciences (ENCB)

The Department has a staff of 18 who are concerned with aspects of soil microbiology, microbial ecology, general microbiology, microbial genetics, mycology and phytopathology. Studies on Rhizobium commenced in 1970. This has involved internal teaching and research; lectures at other university centers; conduct of intensive training courses on Rhizobium at several foreign institutions (Cali-Colombia; Campo Grande, Brazil; Brazil Department of Agriculture at Porte Alegre), and field experimentation with agronomists at the Postgraduate College of the Universities of Chapingo and Guerrero.

Equipment for culture collection work is limited. Each laboratory in the department maintains its own cultures. No one individual is responsible for the cultures. Cultures are stored under mineral oil or lyophilised. The Department could act as a Center for culture distribution provided it had support for staffing and equipment. The basic expertise is available.

Dr. Franco - University of Agriculture - EMBRAPA - RJ - Km 47 - Soil Section

The University is located 70 Km from Rio de Janeiro. EMBRAPA is the organisation responsible for agriculture, soil science and food technology.

The staff includes 6 agronomy engineers, 2 with masters degrees in microbiology. One other is also majoring in microbiology. There are 10 support staff. There is no culture collection curator.

The culture collection has more than 1000 cultures maintained under oil. There are no freeze-drying or refrigeration facilities although these are now being purchased. The laboratory prepares peat support cultures for Rhizobium for farmers for tropical forage legumes, soybeans and beans.

#### PHILIPPINES

Dr. I.C. MacRae who formerly held a position with the Rockefeller Rice Research Institute at Los Banos presented a paper on behalf of Professor Flordeliz Uyenco who was unable to attend.

The culture collection of the University of Philippines was commenced in 1968 with microfungi and algae. In 1971 the National Research Council of the Philippines approved a proposal for the "establishment and maintenance of a culture collection of bacteria and microfungi in the U.P." The collection concentrated on cultures useful to industrial processes and environmental studies. In 1972 it was transferred to the University of Philippines Natural Science Research Center, UPNSRC. The UPNSRC provides funds for personnel as counterpart to an ASEAN grant of A\$20,000,000, renewable every three years, to be utilized for equipment, supplies, books, journals and training of personnel. The ASEAN support is geared to making the CC (1) a repository for protein-rich microorganisms; (2) center of studies for the improvement of food microorganisms; (3) a center for the screening of microorganisms for possible sources of proteins.

It contains 1730 isolates and publishes its own catalogue.

The Culture Collection is well equipped and can act as a distributing center for microorganisms.

Dr. Fernandes:

Referring to the Culture Collection situation in India, Prof. Fernandes remarked that -

"The maintenance or storage of cultures isolated and studied throughout the country, requires a critical study. While a few institutions have culture collection facilities with industries maintaining their own strains for their private use, there is no national consciousness among microbiologists regarding the importance of maintenance of the gene pool

of isolated and characterised microorganisms. Particularly, in many a University or a research institution, the isolated strains of microorganisms are lost with change of interest in research activity or with the retirement of the author."

The World Directory of Collections of Cultures of Microorganisms lists 12 collections from India.

#### SUPPORT PAPERS

To broaden the interest of the Conference a number of support papers were delivered by visiting culture collection curators and by the WFCC Data Center staff.

These included the following topics:

##### Dr. J. Shewan:

1. A Comparative Study of Some Pseudomonas-like Bacteria
2. Microbiological Research on Food in the United Kingdom

##### Dr. Kazuo Komagata:

1. Taxonomic Studies on Coryneform Bacteria
2. Interrelation of the Yeasts

##### Prof. Evrik Afrikian:

1. Growth Requirements of Entomogenous Bacteria and the Nature of Some Bacterial Diseases of Insects
2. The Classification of Entomogenous Bacteria



Prof. F. Fernandes:

1. Microbiological Research Activities (non-medical) in India and the Third International Conference on Culture Collections.

Prof. V. Skerman and Mr. B. Leveritt:

1. The WFCC Data Center

ANALYSIS OF NEEDS OF CULTURE COLLECTIONS

The discussion was extensive but informal. In general the bases for the discussion were the institutional statements of the participants and the statements on aid from the major culture collections. The participants were guided in their discussion by the vast experience and expertise of the observers from the existing major culture collections. It was strongly urged that the establishment of regional culture collections must be based on a national desire that a collection is worthwhile and necessary for the region for its future.

The discussion was the background to much of the material presented in the resolutions and in fact the resolutions may be regarded as the summation of the feeling of the meeting through all the papers, discussions and analyses both formal and informal.

Further comment:

1. There are a number of countries in South Asia of which there is very little known of their microbiological activities. In addition to India and Bangladesh which are represented it would be necessary to survey the needs of Iran, Afganistan, Pakistan, Sri-Lanka, Burma and Nepal.

2. The needs of West Africa are vastly different to those of North Africa and the representatives from Africa urged that more than one regional center should be established in Africa because of the size of the continent and the difference in needs. Ideally in the long term up to four centers should be considered.

3. Again the representatives from South America stressed the problems associated with the size of their continent and communication. Ideally it was felt that at least two centers should be established with one in Central America and one perhaps in the east of South America. However, ideally in the long term the needs of the Western and Southern countries of South America should be surveyed for the possibility of two further centers to cover their needs.

#### RESOLUTIONS

A Resolutions Committee was appointed to receive written submissions during the course of the Meeting. The Committee collated the submissions and prepared a consolidated statement for consideration. Professor Fernandes agreed to chair the Resolutions Committee and the subsequent meetings at which the resolutions were discussed. He was assisted materially by Dr. Doelle of the Department of Microbiology of the University of Queensland.

The resolutions as finally accepted by the meeting were as follows:

#### RESOLUTIONS:

1. This meeting wishes to place on record the excellent services given by Prof. Skerman and his staff of the Department of Microbiology at the University of Queensland, in the successful organisation and execution

of the UNEP/Unesco/ICRO/WFCC Workshop/Meeting held in the Department of Microbiology during July 7 - 22, 1975.

2. Recognizing the importance of this Workshop/Meeting we recommend that such Workshop/Meetings should be organised at regular intervals under the sponsorship of UNEP/Unesco/ICRO/WFCC.

3. This Meeting further recommends:

3.1 that Regional Microbial Culture Collection Centers, hereafter referred to as Centers, be established in Southeast Asia (at least 1 center), South Asia (at least 1 center), Africa (at least 2 centers), and Latin America (at least 2 centers). The places of these Centers be selected on the basis of feasibility studies carried out by UNEP/Unesco/ICRO/WFCC, bearing in mind the needs of the region, for example, waste recycling, nitrogen fixation, food production and fermentation. These feasibility studies should involve the preparation of

- a) a list of Institutes, Departments etc. with microbiological sections in the various regions
- b) a list of those institutions willing and competent to set up a culture collection of microorganisms relevant to that region

3.2 that each Center shall have Advisory Board consisting of one (1) representative of each of the participating countries in the region, selected by the Microbial Culture Collections of that particular country.

3.3 that one of the functions of the Board should be to serve as the point of contact for the region.

3.4 that each Center be given the status equivalent to that of other research units in the institution selected.

3.5 that each Center be absorbed into the general framework of the WFCC and liaise with any agencies set up by the WFCC for the furtherance of activities of culture collections including the World Data Center and other branches of its network when the latter has been established.

3.6 that the first step of a Center should be the collection of microorganisms of special interest to the region leading to a general collection in the framework of the WFCC.

3.7 that support should be given to ensure that each Center is headed by a well-qualified person.

3.8 that consideration should be given by UNEP/Unesco to the problems of acquisition of initial microbial and chemical reference reagents, equipment and/or replacement parts for use in each Center.

3.9 that the Centers should seek assistance from well established existing culture collections, and the latter be encouraged to be of assistance to these Centers.

3.10 that there should be a ready exchange of information and material between the Centers themselves as well as with the well established and recognized Culture Collections in the other countries.

4. This Meeting further recommends that regional training courses in research and management should be conducted for the training of culture collection personnel in the particular region, in which the participation of qualified experts from other countries should be encouraged.
  
5. Fellowships should be made available to the developing countries for the training of promising scientists in the field of culture collections.
  
6. This Meeting also recommends that UNEP/Unesco consider the provision of financial support to the Data Center Network for the purpose of acquiring and circulating literature - or copies thereof - (restricted to literature covering the areas of interest of the Centers in developing countries) for circulation amongst the Regional Collections.

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Prior to the Meeting for which the main body of this report is submitted a Workshop was conducted in modern methods for the examination of cultures. During the course of this Workshop several of the papers referred to in the foregoing report were read and discussed. This arrangement proved highly desirable from the point of view of familiarising participants with each other and with each other's problems and proved an excellent foundation for later debate.

The Meeting/Workshop was relieved by social events and a brief tour of some of the leading agricultural areas of South East Queensland.

V.B.D. SKERMAN

17 November, 1975.