



CULTURE COLLECTIONS: SOME TECHNICAL INFORMATIONS

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Introduction

The use of microorganisms and cell cultures to solve agricultural, food, health, energy and environmental problems has considerably increased world wide. Similarly one of the priority of the developing world is the production of food and energy through the development of agriculture and biotechnology. For all this, there is an ever growing need for a constant source of supply of microorganisms and germ-plasm. Therefore, national and international germ-plasm bases are required for maintaining the genetic resources once these have been acquired and assembled, be they aquacultures, microbes, plants, seeds or animal cells that are of past, present or potential importance. Such gene banks can function as resource and information centres for the general support of biology, microbiology and biotechnology in the region. Consequently, there is a growing awareness for the value of microbial culture collections in the conservation of genetic resources and biodiversity in both the developed and the developing world. The culture collections collect, keep and preserve the newly isolated strains, genetically engineered strains, strains with plasmids and other useful microorganisms, cell cultures and germ-plasm in a systematic and well organized manner.

The leading World's Culture Collections, mostly in the developed world, are well established and offer a broad range of services for biology, biotechnology and industry. However, many collections especially in the developing world are not well organized and are inadequately funded. Due to this problem many regionally useful species of microorganisms and germ-plasms which mostly occur in tropics may become extinct. Many publically supported culture collections of microorganisms are therefore being supported either to provide services to their own institutions, country or region. A variety of publications offer advice and guidelines to provide assistance to establish service and research collections at national, regional or international level (see [Selected](#)

[Bibliography](#)).

Preservation

Cultures are collected and maintained throughout the world for a variety of reasons by teaching and research laboratories; by industrial laboratories; medical laboratories and by the gene banks. However, despite this fundamental importance of a reliable supply of pure and stable cultures, culture preservation is often afforded low priority and is often carried out with inadequate equipment and staffing. Similarly where culture maintenance is not a primary function, almost no time is devoted to develop or assess different preservation methods. This important function is mainly conducted by major service culture collections which have a full commitment to the preservation of cultures and their accumulated expertise is of great value to others.

Preservation although desirable, is but one of the most severe and potentially selective condition to which a culture can be exposed. Many WFCC-Technical Information Sheets provide technical details on the methodology of preservation along with details on source of equipment and materials, relevant literature and references. The methods are mostly simple and can be carried out with inexpensive and readily available equipment. In this booklet various successful preservation methods have collectively been listed which have been developed and used by those experienced in culture maintenance of a broad spectrum of biological material. Although the preservation methods described in this booklet provide reliable information on how to preserve cultures successfully nevertheless, continued monitoring of viability levels, genetic stability and purity must be carried for the cultures to serve as completely reliable inocula for experimental, industrial or educational purposes.

Documentation

Microbiology and biotechnology not only need viable and stable cultures but also organisms which are properly named and documented. Organisms with defined properties can be used as reference and production strains. Thus the systematic name of an organism is the key to a wealth of useful ecological, medical, genetical and biochemical data. It facilitates the identification and management of microbiological data. All major service culture collections generate a quantity of essential and useful information about their holdings which is now systematically recorded in their catalogues using computers. Strain data stored in a computer, allows the search and retrieval of scientific information and strain related data.

The World Data Centre (WDC, RIKEN, 2-1 Hirosawa, Wako, Saitama 351-01, Japan) for microorganisms in Japan houses the master copy of the World Directory of Collections of Microorganisms and it provides information on collections and their holdings world wide and especially to the Third World. The WDC makes several databases available through the MSDN network (Microbial Strain Data Network, Institute of Biotechnology, Cambridge University, Cambridge CB3 0JX, U.K.). The MSDN provides a Directory to sources of

information on microorganisms and culture cells. In order to make their holdings widely known, Collections are encouraged to register with the WDC.

International activities

The interaction and collaboration between culture collections through national, regional and international network is now rapidly increasing. The World Federation of Culture Collections (WFCC) promotes and coordinates such activities through its various committees (Education, Patents, Standards, Endangered collections, Postal quarantine and Safety, Publicity). These committees provide information that may be of assistance to new and established Collections. The WFCC booklet on "Guidelines for the establishment and operation of collections of cultures of microorganisms" lists such principles which may be applied to any culture collection regardless of size or economic standing. The Committee on Education has produced educational video tapes and published a series of books called "Living Resources for Biotechnology", as separate volumes on bacteria, filamentous fungi, yeasts and animal cells. In the framework of this Committee and with support from the UNESCO the Technical Information Sheets (TIS) have been published over technical matters related to culture collections. TIS are now being collectively reproduced in this book and are relevant to developing countries where the role of gene banks is not always recognized. The requests for free copies of new TIS should be addressed to WFCC Education Committee (contact: Dr. K. A. Malik, DSM, Mascheroder Weg 1b, D-3300 Braunschweig, Germany).

In order to have better access to the wealth of information available in European Culture Collections and to publicize, various information networks and databases such as Microbial Culture Information Service (MiCIS) and Microbial Information Network Europe (MINE) and Information Centre for European Culture Collections (ICECC) have been founded. The European Culture Collections Organization (ECCO), established in 1981 has now 41 member collections and it provides a chance for the curators to meet annually to discuss collection related problems in Europe. The European Community (EC) strongly supports these activities in Europe. For more details see ICECC Newsletter (contact: Dr. Dieter Claus, ICECC, Mascheroder Weg 1b, D-3300 Braunschweig, Germany). There are several regional federations of culture collections (USFCC, UKFCC, JFCC, AFCC,) which promote collaborative actions in the world. Many culture collections function as International Depository Authorities (IDAs) and are able to provide necessary information to patent processes and the microorganisms and cell cultures used in patent applications.

Training

The expertise developed at the collections, enables the collection staff to give advice on taxonomy, identification, isolation, culturing, maintenance, preservation, supply, deposition and the usefulness of their holdings. Over the

last two years the Committee on Education with the financial support from IUMS and UNESCO has started a targeted training for individuals about to assume added responsibility in service collections. This programme is particularly appropriate for scientists in developing countries who would not normally have the opportunity to visit well established collections in Europe and learn what standards are possible to attain. The training covers policy, strategy, international relations, funding matters and staffing. The trainees recruited so far have visited established collections with the purpose of discussing and observing policy, procedures, funding, services and research activities. They have benefited from new experiences and contacts leading to the promotion of services in their own regions.

In order to benefit from WFCC activities the collections and individual senior staff within Collections are encouraged to join the WFCC (contact WFCC Secretary). The WFCC holds a major international congress every four years which provides a unique forum for the consideration of all aspects of culture Collections. Training schemes and courses are mostly coupled with such congresses. For more details and WFCC future activities see WFCC Newsletter (contact: Dr. Dagmar Fritze, DSM, Mascheroder Weg 1b, D-3300 Braunschweig, Germany). There is a continuous increase in UNESCO sponsored international postgraduate courses which are organized by some of the developed Member States and are mainly designated for young scientists especially from developing countries (for more detail see the UNESCO Directory of International Long-term Postgraduate Training Courses in Science and Technology). In its world wide training of microbiologists programme UNESCO Courses in Czechoslovakia (contact: Dr. Z. Rehacek, Institute of Microbiology, Videnska 1083, 142 20 Prague 4, Czechoslovakia), France, Japan, Portugal and Spain are worth mentioning. For more details see MIRCEN News (contact: Dr. E. J. DaSilva, Div. Scientific Research and Higher Education, UNESCO, F-75007 Paris, France). In Germany, GBF's International Training Programme in Biotechnology (Contact: ITP Course Director, GBF, Mascheroder Weg 1, D-3300 Braunschweig, Germany) has been established to provide annual training to the scientists from Third World countries in the methods of modern biotechnology for application in developing countries.

MIRCEN Network

The UNESCO and WFCC have collaborated for the establishment of MIRCENs, an international network of Microbiological Resources Centres. Today, there are 22 MIRCEN centres world wide which participate in a global collaborative network particularly for the beneficial applications of microbes in agriculture and biotechnology. The MIRCENs provide working platforms for the world's culture collections with various objectives. The world's culture collections, particularly from the developed countries are a feeding channel to the MIRCENs network and a constant source of supply for their working tools the "microorganisms and cell cultures".

Today, world wide collaborating laboratories of MIRCENs are mainly involved in promoting the collaborative research and training in agriculture and biotechnology, which is of particular interest to their regions.

In the region of the Arab States, the MIRCENs promote research and training courses on the conservation of microbial cultures and biotechnologies of interest to the region. With the active co-operation and support of WFCC and UNESCO, specialized courses have been organized in Egypt, Sudan, Libya, Morocco and Iraq. In the region of Southeast Asia, the MIRCENs with their co-operating laboratories in the Philippines, Indonesia, Singapore, Malaysia, Hong Kong and Thailand are actively promoting research in biological nitrogen fixation and in fermentation technologies.

In the region of Africa, MIRCENs at Kenya, Malawi, Ruwanda, Sudan, Tanzania, Uganda, Zambia, Mali, Nigeria, Senegal are participating to promote research in Rhizobium technology and on biological nitrogen-fixation.

In Latin America the MIRCENs at Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay, Guatemala, Mexico and Nicaragua are participating in biotechnological studies and the Central American MIRCEN at the Caribbean has achieved the status of a Secretariate of the International Organization for Biotechnology and Bioengineering. Nitrogen-fixation in Latin America is being promoted through the MIRCENs at Brazil, Argentina, Chile, Colombia, Venezuela and others.

From the developed part of the world the MIRCENs in Australia, Canada, Germany, Japan, Sweden, UK and USA are significantly contributing to the development of scientific activities and provide a platform for discussions, meetings and trainings for the MIRCEN network.

During its fourth extraordinary General Conference and 22nd General Conference, UNESCO, has specifically called for the extension of the MIRCEN network in the developing and developed countries.

SELECTED BIBLIOGRAPHY

Alexander, M. T. & Brandon, B. A. (Eds). (1986). Packaging and Shipping of Biological Materials at ATCC. American Type Culture Collection. Rockville Md. USA

Batra, L. R & Iijima, T (Eds)(1984). Critical Problems of Culture Collections. 71 pp. Osaka:Institute for Fermentation.

Collins, C. H (1990). COSHH (Control of Substances Hazardous to Health

Regulations 1989) and the microbiologist. *Letters in Applied Microbiology* 10: 109-112

Da Silva, E. J., Burgers, A. C. J. and Olembo, R. J. (1977). UNESCO, UNEP and the international community of culture collections. In *Proceedings of the Third International Conferences on Culture Collections*. 14-19 March, 1977 (F. Fernandes and R. C. Pereira, Eds.) pp.107-120. University of Bombay, Bombay.

Doyle, A., Kirsop, B. E & Hay, R (1990). *Living Resources for Biotechnology: Animal Cells*. Cambridge University Press. Cambridge.

Guide to the Deposit of Microorganisms under the Budapest Treaty; World Intellectual Property Organization Geneva, Second edition, 1989, ISBN 92-805-0195-x

Hawksworth, D. L. (1990). *WFCC-Guidelines for the establishment and operation of collections of cultures of microorganisms*. Simworth Press, Surrey, U.K.

Hawksworth, D. L. (1985). Fungus culture collections as a biotechnological resource. *Biotechnology and Genetic Engineering Reviews* 3:417-453

Hawksworth, D. L. & Kirsop, B. E. (Eds) (1988). *Living Resources for Biotechnology: Filamentous Fungi*. Cambridge University Press. Cambridge.

Hawksworth, D. L & Schipper, M. A. A. (1989). Criteria for consideration in the accreditation of culture collections participating in MINE, the Microbial Information Network Europe. *MIRCEN Journal* 5: 277-281

Hill, L. R & Kirsop B. E. (Eds) (1991). *Living Resources for Biotechnology: Bacteria*. Cambridge University Press Cambridge

Hill, L. R. and Krichevsky, M. I. (1986). International Strain Data Network. *MIRCEN Journal* 2, 341-347.

Jong, S-C (1989). Microbial germplasm. In: *Biotic Diversity and Germplasm Preservation* (L. Knutson & A. K. Stoner, eds). 2410273. Kluwer Academic. Dordrecht.

Kirsop, B. E. and Doyle A. (eds.) (1991). *Maintenance of Microorganisms and Cultured Cells*. Academic Press London.

Kirsop, B. E & Kurtzmann, C. P. (Eds) (1988). *Living Resources for Biotechnology: Yeasts*. Cambridge University Press. Cambridge.

Kirsop, B. E & Snell, J. J. S. (Eds). (1984). Maintenance of Microorganisms. A manual of laboratory methods. Academic Press. London.

Malik, K. A. (1987). The role of culture collection in the stability and preservation of microorganisms, In: 12eme Colloque organise par la Section de Microbiologie Industrielle et de Biotechnologie de la SFM, Societe Francaise de Microbiologie, Stabilite et Conservation des Microorganismes, J. Amen, P. Tesson (Eds), 118-150

Malik, K. A. (1988). Preservation of biotechnologically important microorganisms in culture collections, in: Progress in Biotechnology vol. 4 (A. Blazej and J. Zamek Eds.), Elsevier Science Publishers, Amsterdam, 145-186.

Malik, K. A. (1991). The role of culture collections to safeguard nature's microbiological resources In: Environmental Biotechnology (Blazej, A. and V. Privarova eds.) pp 359-367. Elsevier Science Publishers, Amsterdam.

Malik, K. A. (1991). Maintenance of Microorganisms by simple methods. In: Maintenance of Microorganisms and Cultured Cells (Kirsop, B. E. and Doyle A. eds.) pp.122-132 Academic Press London.

Malik, K. A. & Claus, D. (1987). Bacterial culture collections: their importance to biotechnology and microbiology. Biotechnology and Genetic Engineering Reviews 5: 137-197

Malik, K. A and Lehnberg, B. (eds.). (1991). Laboratory Manual "Training Course on Culture Collection and Strain Management". DSM-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Braunschweig

McGowan, V. and Skerman, V. B. D. (Eds) (1982). World Directory of Collections of Cultures of Microorganisms, 2nd edn. World Data Centre ofr Microorganisms, Brisbane.

Nakamura, L. K (1989) Culture Collections guidelines, United State Federation for Culture Collection, Newsletter 19 (2): 1, 4-6

Takishima, Y, Shimura, T. & Sugawara, H (1989). Guide to World Data Center on Microorganisms with a list of Culture Collections I the World. Saitama: World Data Center on Microorganisms. Japan.