



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

16893-E

Distr.
LIMITED

IPCT.67(SPEC.)
5 July 1988

ORIGINAL: ENGLISH

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Workshop on Biotechnology for Latin America
and Caribbean Countries ("Biotechnology:
An Opportunity for Latin America and the Caribbean")

Havana, Cuba, 8-12 February 1988

R E P O R T *

Prepared by
the UNIDO Secretariat

* This document has been reproduced without formal editing

v.88-26457

Unprecedented developments in the field of genetic biochemical engineering during the course of the last few years have generated an immense interest in the industrial usage of living organisms. The term biotechnology was coined to encompass applications of this advanced technology in such diversified fields of economic activities as the food, chemical, pharmaceutical, energy and environmental industries. Since 1981 UNIDO has been actively involved in the major issue as to how the new technologies could be used for the benefit of developing countries in order to help solve some of their problems and to advance their industrialization process.

Cuba has participated in this work of UNIDO from its inception and has established its own biotechnology centre, namely the Centro de Ingeniería Genética y Biotecnología, and has been undertaking immense efforts to broaden its basis for biotechnology research and production in selected fields. Cuba is prepared to share its experience with other developing countries, especially with those of the Latin American and Caribbean region.

To this end a joint workshop organized by UNIDO and the Centro de Ingeniería Genética y Biotecnología took place in Havana, Cuba, from 8 to 12 February 1988, oriented towards new research work of developing countries in the region, and co-operation amongst themselves and with the international community.

The objectives of the workshop were:

- (i) To facilitate the transfer of know-how in the genetic manipulation of micro-organisms with the aim of contributing to the industrial and socio-economic development of Latin American and Caribbean countries;
- (ii) To discuss and analyze existing and planned national programmes in biotechnology in the Latin American and Caribbean regional context;
- (iii) To enhance information transfer and technology development through the dialogue of policy makers, scientists and industrialists from different countries in the Latin American and Caribbean region;
- (iv) To discuss and orient biotechnology research in Latin America and the Caribbean in the light of the industrial needs of their countries and to establish links between research and industry;
- (v) To assess the state-of-the-art and exchange knowledge in the field of biotechnology and genetic engineering through presentations in recent technical/scientific advances;
- (vi) To improve and upgrade capabilities of researchers in biotechnology in the Latin American and Caribbean region.

UNIDO organized the participation of about 40 internationally recruited scientists; among them were experts, International Centre for Genetic Engineering and Biotechnology (ICGEB) representatives and country representatives from Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Panama, Trinidad and Tobago and Venezuela. The list of participants is attached as Annex I. The host government arranged for the participation of a number of Cuban scientists and researchers who presented lectures at the workshop on various topics on the subject, as well as on the state of progress of their research work. The programme of the meeting with names of speakers and titles of their presentations is attached to this report as Annex II.

At the opening ceremony, Mr. Ernesto Melendez from the Comité Estatal de Cooperación Económica, made a statement on behalf of the Government of Cuba, which was followed by statements of Mr. Fernando S. Souto, Deputy Director General. Department for Industrial Promotion, Consultations and Technology, UNIDO; Dr. K. K. Tewari, Head of the New Delhi component of the ICGB on behalf of Dr. I. Gunsalus, Director of the ICGB and Dr. M. Limonta, Director, Centro de Ingeniería Genética y Biotecnología, Havana, CUBA.

For an efficient deliberation and focus on the subjects of discussion, it was decided to form four working groups in order to better concentrate on the various specializations in the field of biotechnology and the country representations. The four working groups were the following:

- Group 1 - Plant biotechnology
- Group 2 - Human application of biotechnology
- Group 3 - Microbiology - biomass conversion
- Group 4 - Formed by representatives from Latin American and Caribbean countries.

International and Cuban experts presented their work in the most recent technological advances and made proposals for a more intensive co-operation among institutes and countries 1/. These proposals were then discussed by the working groups in more detail.

The Chairmen of the Groups reported on their findings, conclusions and recommendations during the last plenary session of the workshop. The participants of this session took note of these reports without in-depth deliberations due to time constraints. The reports of the Groups follow.

1/ It is intended to publish the lectures at a later stage.

Group 1

Report on plant biotechnology

Chairman: Dr. Krishna K. Tewari

Vice-Chairman: Dr. S. Pérez

Members of the plant biotechnology group of the workshop represented a cross-section of scientists engaged in research problems related to the eventual application of modern molecular biology to the broad field of agriculture. Drs. Pérez, Duncan and Scragg are actively involved in using tissue culture technology for the mass propagation of plants. Dr. Estrella has expertise in genetic manipulation of plants. Drs. Kennedy and Van den Boss have made extensive contributions to the important field of biological nitrogen fixation. Dr. Rudulier has been an active scientist in the field of osmo-regulation. Dr. Brown has been working on the detection and detoxification of heavy metal toxicity. These speakers met with the Latin American interest groups and, in mutual consultation, have come forward with the following recommendations.

The most important general interest area for Latin America and the Caribbean was concluded to be the improvement of crops. It was recognized by the group that plant molecular biology can be used for various biological activities but the group's main goal was to be more specific. With this in view, the crop improvement programme was divided into the following sections.

(1) Biological fertilizers

The group recommends that plant-microbe interactions should be the subject of intensive study. Emphasis should be placed on indigenous species. These studies may identify micro-organisms that are most suitable for interaction with local flora. Both algae and nitrogen fixing bacteria could be studied in this programme. Introduction of effective associate systems for nitrogen fixation, such as Azolla (from Asia) and Sesbania (from Africa) could be tested in certain regions.

(2) Pest and disease resistance

Pests and diseases are problems in Latin American and the Caribbean, as everywhere. It was the feeling of the members that research on pathogenic pseudomonas bacteria could provide a model for a system for phytopathogenicity. Other important diseases are of viral origin; it was also recognized that insects are significant vectors of disease. These are both appropriate areas of research.

(3) Environmental tolerance

Environmental stress to plants is a major problem in Latin America and the Caribbean. In particular, salinity, ph, water stress and heavy metal contamination are important areas for research.

(4) Seed improvement

The nutritional value of legumes and corn can be improved by the alteration of amino acid content of seeds. The group recommends research on appropriate strains.

In order to achieve the above objectives, it was deemed necessary that the following technologies be made available to Latin American and Caribbean countries:

1. Tissue culture methods.
Special emphasis should be placed on detection and selection techniques. Development of technology for mass propagation of important crop plants.
2. Recombinant DNA and plant transformation techniques.
3. Proteins and nucleic acids chemistry.
4. Manipulation of micro-organisms.

Some general recommendations are made to obtain the technologies and achieve the desired goals:

1. For each of the above technologies, a centre in the region could become a contact centre specializing in the above fields. The contact centre may be designated with the assistance of UNIDO.
2. If the collaborating countries wish to designate institutions in other countries to be the specialist centre, UNIDO should organize a mechanism for the selection of the centres and implement co-operative programmes.
3. There should be an exchange of scientists between the Latin American, European, North American and academically advanced Asian nations. These exchanges should be almost equally divided between the Latin American scientists going abroad and scientists from other nations visiting Latin American countries. The duration of these exchanges at the post-doctoral level should be for a period of two years. Short visits are desirable for senior scientists.

Group no. 2

Report on human applications of biotechnology

Chairman: Dr. Luis Herrera

Vice-chairman: Dr. Vladimir Glisin

Taking into consideration the recommendations of Group 4, dealing with the general strategies with which UNIDO should undertake action in Latin America and the Caribbean, this Committee considered the following as priorities:

1. The acquisition of capabilities for the development of vaccines and diagnostic means through the use of modern biotechnological procedures in accordance with the needs of each country.
2. To consider as common interests for the development of these capabilities:
 - (i) Diseases caused by enteric viruses and bacteria;
 - (ii) Diseases caused by respiratory viruses;
 - (iii) Diseases caused by endemic parasites; and
 - (iv) Control methods for the quality of blood and its derivatives.

Among these aspects, the following were mentioned as specific examples: hepatitis B, rotaviruses, HIV, Shiguella, Salmonella, Leishmania, Trypanosoma and Plasmodia.

These entities are presented as susceptible of being used as models for the assimilation and development of different biotechnologies in the area, and as interests for possible research themes for the ICGEB.

3. The following have been identified as technological aspects of common interest for the development of the medical applications of biotechnology in Latin American and Caribbean countries:

- (i) DNA probes for diagnosis, including the possibility of synthesis of oligonucleotides;
 - (ii) Recombinant DNA technology for the production of vaccines and diagnostic reagents;
 - (iii) Production of monoclonal antibodies and their use in the elaboration of diagnostic kits;
 - (iv) Methodologies of peptide analysis and synthesis, for the structural characterization of proteins and obtaining of bioactive peptides;
 - (v) Methods for mass culture, process optimization and scale up, purification and quality control of processes and products.
4. To facilitate the access to, and exchange of, reagents and biological materials, such as: probes, vectors, strains, antibodies, cell lines and others.

This should be achieved through the identification of contact centres and the establishment of a co-operative mechanism between them so as to promote the development of updated data banks and the distribution of the biological materials already mentioned. UNIDO should assist in establishing such a mechanism.

Further details of the scheme will be formalized later in co-operation with collaborating countries.

Group 3

Report on industrial microbiology and biomass

Chairman: Dr. Julio Delgado

Vice-Chairman Dr. Nigel Brown

This Group was comprised of scientific representatives from Belgium, Chile, Colombia, Cuba, Ecuador, Trinidad and Tobago and the United Kingdom.

During the discussions there was full agreement that there exists a group of essential problems in Latin America and the Caribbean in which the use of biotechnology could play an important role; such topics include animal feed, the improvement of industrial micro-organisms, the complete utilization of sugar cane derivatives, metal bioleaching and oil recovery by micro-organisms.

However, there is a wide range of problems within Latin America and the Caribbean, and both the set of priorities and the levels of scientific skills vary considerably from country to country.

A very important goal was identified as being the establishment of close relations between scientific experimentation and productive industry. In the light of these considerations the following recommendations were made:

1. To the countries:

Each country should develop a biotechnological programme reflecting its national interest. These programmes should be presented to UNIDO as well as to other participating countries.

2. To UNIDO:

In order to identify real market opportunities for biotechnology, interactive discussion meetings should be organized between representatives of scientific institutions and industrial enterprises, these meetings to be held at local, national, regional and international levels as appropriate.

In order to follow up the above recommendations the following immediate actions should be undertaken:

1. By individual countries in co-operation with UNIDO.
 - (a) The development of research and study programmes for the further training of scientific and technical staff as required by each country;
 - (b) The establishment of access to UNIDO's INTIB system for the distribution of technical literature to relevant recipients in order to avoid unnecessary duplication of effort;
 - (c) To facilitate access to and transfer of new technologies through recognized specialized contact centres (methodologies, special skills, elaborate equipment, etc.).

Group 4

Representation of Latin American and Caribbean Countries

Chairman: Dr. Paulo Torres de Carvalho
Vice-Chairman: Dr. Rodolfo Quintero Ramirez
Secretary: Dr. Fernando Acevedo

The following proposals should be considered by UNIDO and should be taken into consideration in the programme of work of the International Centre of Genetic Engineering and Biotechnology:

1. The establishment of a portfolio of experts and other means to help and advise countries in the elaboration of plans, programmes and projects at the national level, according to the needs of each country.

Studies should be carried out on general topics such as:

- (a) The patent and proprietary systems, biosafety and others.
- (b) Promote the interchange of endogenous biotechnological products among countries in the region through several mechanisms: bilateral agreements and multilateral mechanisms. In addition, the creation of a revolving fund for the purchase of biological materials among countries in the region was recommended.
- (c) Support for the long-term training of human resources, i.e., specialized personnel at the post-graduate level and others.

2. Access to UNIDO's INTIB data bank for information on available technologies and implement a similar network among participating countries.

3. Facilitate the access to new methodologies with emphasis on the fields of human health, agriculture and biomass industries. Select and organize co-ordination in the region's Contact Centres where the training and development of new biotechnologies could be done.

One way in which to accomplish these objectives would be the establishment of an annual programme of practical courses to spread the knowledge of the future methodology.

ANNEX I

List of participants

Fernando Acevedo Ronzi
Universidad Católica de Valparaíso
Britannia 222
Valparaíso
Chile

Oscar Aguirre Alonso
Consejo Nacional de Ciencia y Tecnología CONYCI
Oficina Av. Patria No. 850 y
Av. 10 Agosto
Quito
Ecuador

N. L. Brown
The University of Melbourne
Department of Genetics
Parkville, Victoria 3052
Australia

Laura Alicia Buitrón Buitrón
Consejo Nacional de Ciencia y Tecnología
Calle Castro no. 251 E Iquique
Quito
Ecuador

Paulo de Campos Torres de Carvalho
W3 Norte Q513
Edifício Imperador
3ro. Andar Brasília
Secretaria de Biotecnología
Ministerio Ciencia e Tecnología
Brazil

John Davison
International Institute of Cellular
and Molecular Pathology (ICP)
Avenue Hippocrate 75
B-1200 Brussels
Belgium

Edgar J. Duncan
The University of the West Indies
8 Wharfied Place
St. Augustine
Trinidad and Tobago

Ricardo Fournier Angel
Centro Investigaciones en Diversificación Azucarera
P.O. Box 9437
Cali
Colombia

Martha L. Garcia Garcia
COLCIENCIAS Coordinadores Programa Biotecnología
Tr. 9A No. 133-28
Bogotá
Colombia

V. Glisin
Genetic Engineering Centre
Vojvode Stepe 283
P.O. Box 794
Belgrade
Yugoslavia

Oscar Grau
Casilla Correo 111
CP 1876
Bernal
Argentina

Mahabir P. Gupta
Universidad de Panamá
Urb. Hato Pintado
Calle 42 2B
Panama

José Marcelo Heredia Garcia
Dirección General de Normas y Tecnología
Av. Camacho 1488
Casilla Postal 6080
Murillo
Bolivia

Luis Herrera Estrella
Centro de Investigación y Estudios Avanzados del IPN
Unidad Irapuato
Km. 6.8 del Libramiento Norte
Carretera Irapuato-León
Aptdo. Postal 629
Irapuato, Gto. Mexico

Maura P. Iubert
Caribbean Industrial Research Institute
6 Warren Street
St. Augustine
Trinidad and Tobago

Christina Kennedy
ARC Unit of N₂ Fixation
University of Sussex
Brighton BN1 9RC
United Kingdom

Daniel Le Rudulier
Université de Rennes
Avenue du Général Leclercq
Campus de Beaulieu
35042 Rennes
France

Alberto J. Marcipar
Universidad Nacional del Litoral
Chacabuco 892
Santa Fe
Argentina

Oscar Monroy Hermosillo
Industria Química y Bienes de Consumo
Secretaria de Comercio y Fomento Industrial
LANFI
Ave. Ind. Militar 261
Mexico D.F.

V. Moses
School of Biological Sciences
Queen Mary College
University of London
Mile End Road
London E1 4NS
United Kingdom

Rodolfo Quintero
Presidente Masaryk 29-14
Colonia Polanco 015700
Mexico, D.F.

Celina Roitman
Ave. W3 Norte Q513
3ro. Andar Edificio Imperador
Brasilia
Brazil

A. Scragg
University of Sheffield
Wolfson Institute of Biotechnology
Sheffield S10 2TN
United Kingdom

Faustino Siñeriz
PKJIMI
Avenida Belgrano y Caseros (4000)
Tucuman
Argentina

Octavio Elias Sousa Pitti
Universidad de Panamá
Calle Elida Díez H-7
Nuevo Reparto El Carmen
Panama

J.S. Sussenbach
University of Utrecht
Vondellaan 24a, 3521 GG Utrecht
The Netherlands

Marcelo Tejada

Coordinador Programa Andino Biotecnología
Aptdo. Correos Caracas 50/86
Altamira 69011
Venezuela

R.C. Van den Bos

Agricultural University Wageningen
Department of Molecular Biology
The Netherlands

José R. Vicuña Errazuriz

Laboratorio de Bioquímica
Pontificia Universidad Católica de Chile
Alameda 340
Casilla 114-D
Santiago
Chile

Gustavo Viniegra Gonzalez

LANFI
Ave. Ind. Militar 261
Mexico D. F.

B. Williamson

Department of Biochemistry and Molecular Genetics
St. Mary's Hospital Medical School
University of London
Norfolk Place, London W2 1PG
United Kingdom

Arturo Yudelevich

Universidad Católica de Chile
El Bosque 131 Dep. 23
Santiago
Chile

International Centre for Genetic Engineering and Biotechnology (ICGEB)

Irwin C. Gunsalus

Padriciano 99
I-3412 Trieste
Italy

Krishna K. Tewari

University of California
16 Urey Court
Irvine Ca. 92717
USA

Nancy S. Paisley

43 Overlook Road
Livingston
New Jersey
USA

Centro de Ingenieria Genética y Biotecnología, Havana (CUBA)

Centro de Investigaciones Biologicas, Havana (CUBA)

Apartado 6162

Ave 31/190 y 158 CUBANACAN

La Habana, CUBA

M. Limonta

P. López Saura

J. Delgado

S. Péres

L. Herrera Martínez

J. Gaviñondo

S. Barcelona

M. Quintana

A. Silva

G. Padrón

E. Pentón

J. de la Fuente

G. Sierra

O. García

UNIDO

Fernando S. Souto

Department for Industrial Promotion

Consultations and Technology

P.O. Box 300

A-1400 Vienna

Austria

R. Kloepzig

Transfer of Technology Programme Branch

Department for Industrial Promotion

Consultations and Technology

P. O. Box 300

A-1400 Vienna

Austria

ANNEX II

Workshop on Biotechnology for Latin America
and Caribbean Countries

PROGRAMME

Monday, 8 February 1988

9.00 OPENING SESSION

Ernesto Meléndez
President of CECE

Statement of the Government
of CUBA

Fernando S. Souto
Deputy Director General
UNIDO

Statement of UNIDO

K. Tewari
Director
New Delhi component ICGB

ICGB and member countries -
laboratories accomplishments
and prospects

Manuel Limonta, Director
Centro de Ingeniería Genética
y Biotecnología

Cuban Centre for Genetic
Engineering and Biotechnology -
its background and prospects

Group I - Plant biotechnology

(Plenary session)

- | | | |
|---------------|---------------------------|---|
| 11.15 - 12.00 | L. Herrera Estrella (Mex) | Development of genetic engineering for important crops in developing countries |
| 12.00 - 12.30 | S. Pérez (Cuba) | Plant biotechnology in Cuba: Present situation and projections |
| 14.00 - 14.40 | A. H. Scragg (UK) | A strategic assessment of plant cell and tissue biotechnology potentials in Cuba |
| 14.40 - 15.20 | K. K. Tewari (ICGB) | Replication of chloroplast DNA |
| 15.40 - 16.20 | D. Le Rudulier (France) | Osmoregulatory compounds and osmoregulatory genes |
| 16.20 - 17.00 | C. Kennedy (UK) | Expression of nitrogen fixation genes in free-living and symbiotic micro-organisms |
| 17.00 - 17.40 | R.C. Van den Bos (Neth) | Genetic manipulation to increase the efficiency of nitrogen fixing Rhisobium-legume symbiosis |

Tuesday, 9 February 1988

Group II - Human applications of genetic engineering (Plenary Session)

08.30 - 09.10	R. Williamson (UK)	Use of DNA probes to study human inherited and acquired diseases
09.10 - 09.50	V. Glisin (Yug)	Developing countries have the possibility to produce semi-synthetic beta-lactams by the use of rDNA technology
10.20 - 11.00	J.S. Sussenbach (Neth)	The insulin-like growth factors
11.00 - 11.20	L. Herrera Martinez (Cuba)	Production of recombinant human alpha interferon
11.20 - 11.40	J. Gaviñondo (Cuba)	Development of monoclonal antibodies in Cuba
11.40 - 12.00	S. Barcelona (Cuba)	DNA hybridization methods for diagnosis in Cuba
12.00 - 12.20	P. López Saura (Cuba)	Biotechnology, immuno-modulators and health
12.20 - 12.40	Discussion	
14.00 - 14.20	M. Quintana (Cuba)	Production of human EGF and beta galactosidase by DNA recombinant technology
14.20 - 14.40	A. Silva (Cuba)	Heterologous gene expression in micro-organisms
14.40 - 15.00	G. Padrón (Cuba)	Characterization of recombinant proteins by mass spectrometry
15.00 - 15.20	E. Pentón (Cuba)	Recombinant hepatitis B surface antigen vaccine. A challenge for developing countries. The Cuban experience
15.40 - 16.00	J. de la Fuente (Cuba)	Routes to recombinant hepatitis B vaccine production in mammalian cell systems

16.00 - 16.20	G. Sierra (Cuba)	The Cuban experience in obtaining a meningococcal B vaccine
16.20 - 16.40	O. García (Cuba)	Purification of modification and restriction enzymes
16.40 - 17.00	J. Delgado (Cuba)	Increase of invertase secretion in yeasts
17.00 - 17.30	Discussion	

Wednesday, 10 February 1988

Group III - Microbiology - biomass conversion (Plenary session)

- | | | |
|---------------|-------------------------|---|
| 08.30 - 09.10 | J. A. Vicuña (Chile) | Bacterial degradation of a component model of lignocellulose |
| 09.10 - 09.50 | J. Davison (Belgium) | Genetic manipulation of gramnegative bacteria of industrial and agricultural interest |
| 10.20 - 11.00 | I. G. Gunsalus (ICGEB) | Hydrocarbon catabolic pathways: the role of haem oxygenases |
| 11.00 - 11.40 | N. L. Brown (Australia) | Bacterial detection and detoxification of mercury |
| 11.40 - 12.20 | V. Moses (UK) | Microbial systems for oil recovery |
| 12.20 - 13.00 | Discussion | |

Present situation in Latin America and the Caribbean (Plenary session)

- | | | |
|---------------|--|--|
| 14.00 - 14.30 | R. Quintero (UNIDO expert) | Evaluation of opportunities for biotechnology in Latin America |
| 14.30 - 15.00 | O. Grau (UNESCO expert) | The regional programme of biotechnology |
| 15.00 - 15.30 | M. Tejada (Andean Group) | Andean programme on biotechnology |
| 16.00 - 18.00 | Country presentations on biotechnology in: | |

Argentina
Bolivia
Brazil
Chile
Colombia

Ecuador
Mexico
Panama
Trinidad and Tobago

