National Biological Resource Centers:
The principle and Roles for Microbiology Community

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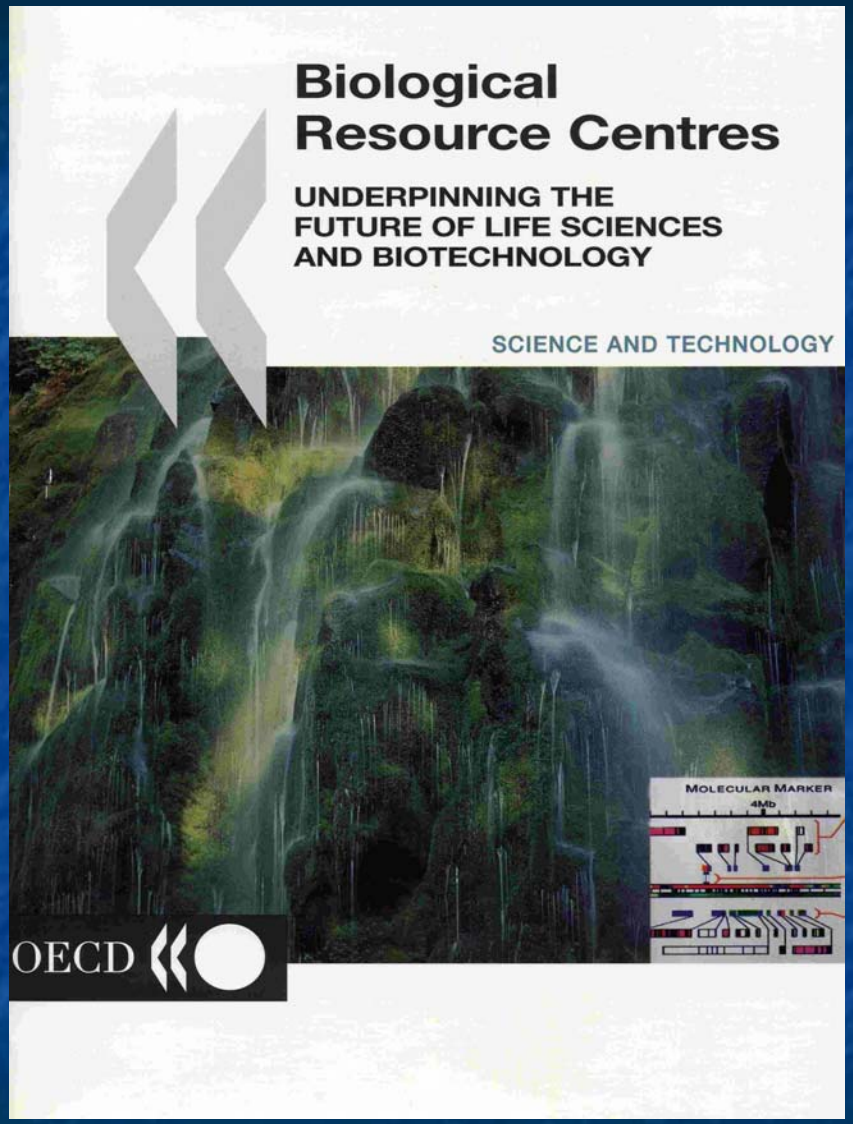


Biological Resource Centres (BRCs)

Underpinning the future of life sciences and biotechnology

OECD 2001

Definition of BRC by OECD

Biological Resource Centres are an essential part of the infrastructure underpinning biotechnology. They consist of service providers and repositories of the living cells, genomes of organisms, and information relating to heredity and the functions of biological systems. BRCs contain collections of culturable organisms (*e.g.* microorganisms, plant, animal and human cells), replicable parts of these (*e.g.* genomes, plasmids, viruses, cDNAs), viable but not yet culturable organisms cells and tissues, as well as data bases containing molecular, physiological and structural information relevant to these collections and related bioinformatics.

(Definition based on the one adopted at the 1999 Tokyo Workshop on Biological Resource Centres, where the concept of BRCs as an outgrowth of conventional pre-genomics ex situ collections of biological materials was developed – and incorporating scientific developments since 1999.)

Biotechnology Strategy Guidelineof Japan

a Background of Establishment of Biological Resource Center

Biotechnology 戦略大綱 = BRC設立背景

2000 1st Life Science Summit

2002 The BT Strategy Council in the Cabinet

2002 BT-Strategy Guidelines

Outline of Biotechnology Strategy Guidelines

December, 2002

PART 1. Overview

Three strategies paving way to improvement of “Living”, “Eating”, and “Inhabiting”

Aggressive promotion of biotech strategy based on 50 action directives, 88 basic action plans and 200 detailed action plans

PART 2. Action Plan and Future Image

Section 1 Action Plan “Bio-Action Plan 2002” (1)

Three strategies aimed at big advancement

Strategy 1: Massive realization of R&D

Always working to lead world’s research by one step

Strategy 2: Fundamental strengthening of industrialization process

Making industrialization process concrete to benefit all citizens with biotech results

Strategy 3: Utmost pursuit of public understanding

System-making for allowing people to decide fairly and make sections

English translated by JBA

Strategy 1 Massive Enhancement of R&D (1)

- Promotion and support of scheme at universities, etc. aimed at increased human resource supply and quality improvement through inculcation of variegated biotech human resources.
- Concentrated investment into medicine/pharmaceuticals, microorganism/bioprocess, function food/agri-bio sectors.
- Promotion of cooperation between biotech and other sectors such as infotech and nanotech.
- Focused investment into biopool, bioinformatics.
- Improvement of biogenetic resources, these being the R&D infrastructure, with resource-holding countries in a harmonized yet strategic manner.
- Promotion of clarification of relations between SNPs and cancer, lifestyle diseases, triggering of senility, and SNPs' and to clarify and treatment agent reaction through large-scale patient sampling aimed at realize tissue-engineering medicine, etc.

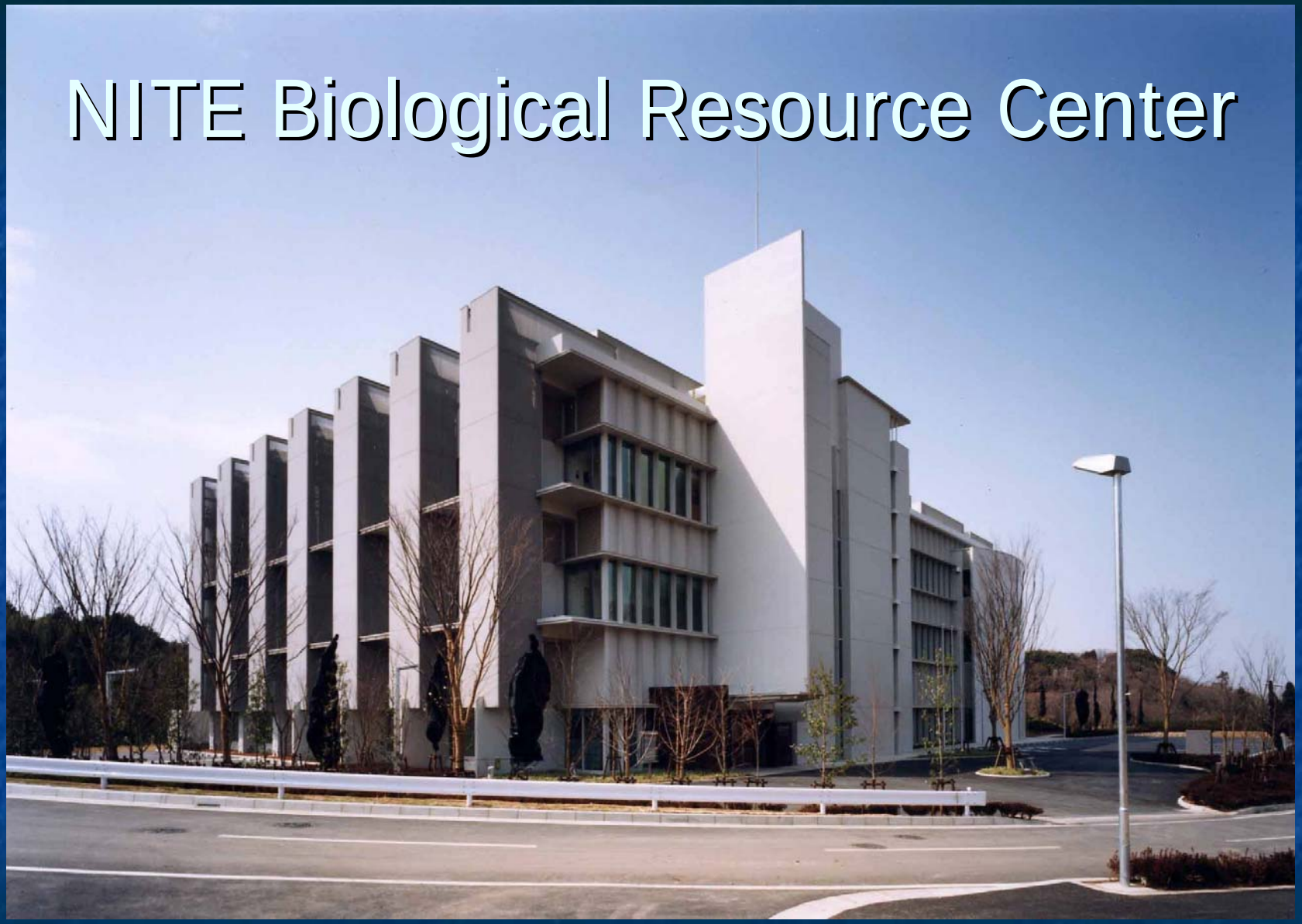
English translated by JBA

Strategy 1 Massive Enhancement of R&D (2)

- Promotion of post-genomic research through measures on protein structure/function analysis and on genomic analysis, etc. aimed at realizing development of dramatically new drugs, etc. using biotech.
- Promotion of functional analytical research on proprietary genomes for dramatically new plant variety development, creation of hardly rice crops resistant against adverse environment based on the rice genome research results.
- Promotion of development for technology which produces new energy, etc. using biomass, etc., waste processing technology using biotech, and technology for remediation of environment such as that of soil and water purification and assessment technology as to harmful substances, etc.
- Promote R&D as to establish production technology for dramatically new product using bioprocess and energy efficient production system that has lower environmental load.

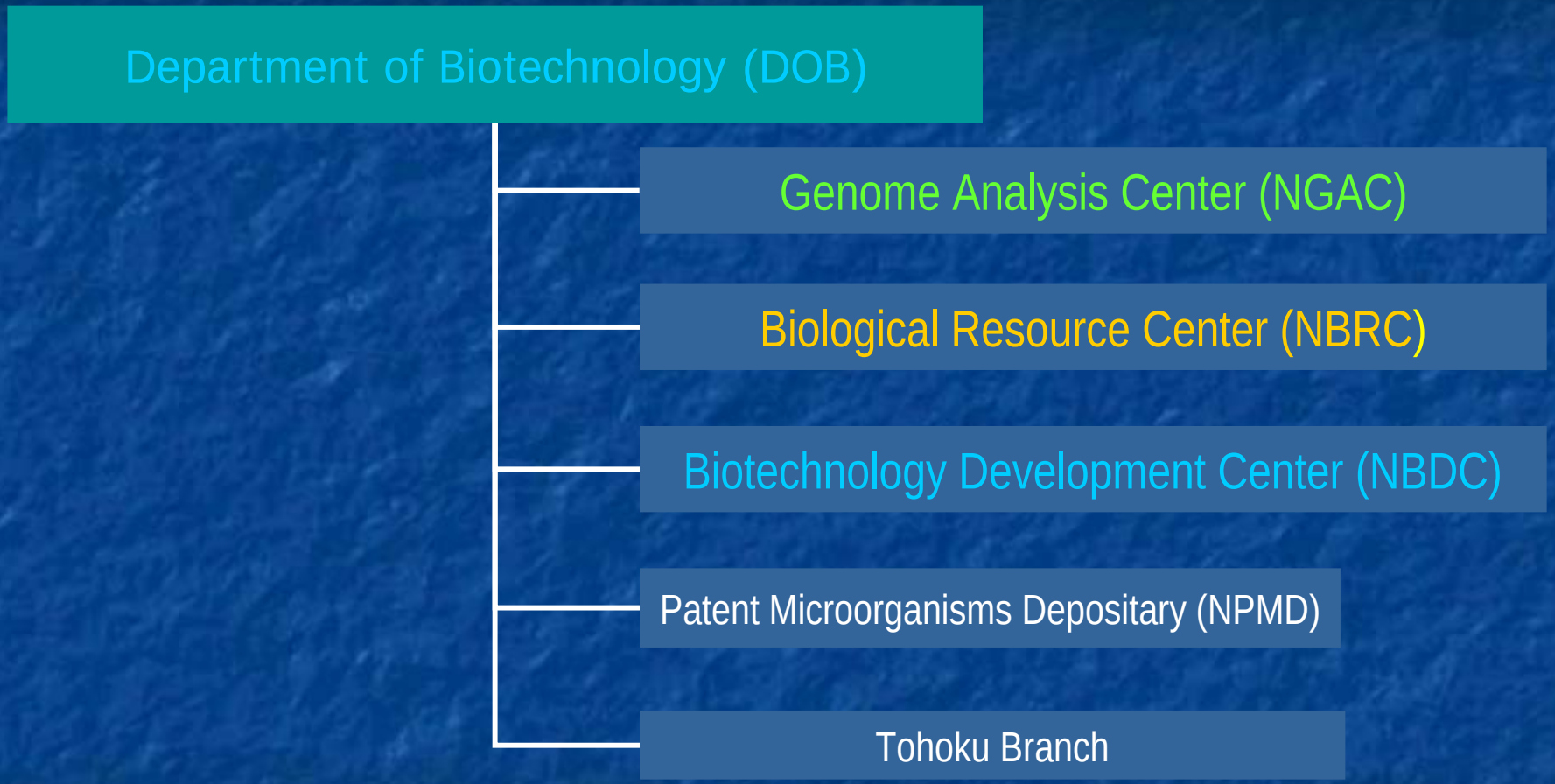
English version referred to JBA

NITE Biological Resource Center



Inaugurated in April 2002

Organization of NITE-DOB



The roles of three Centers of NITE-DOB

Genome Analysis Center:

- Analysis of the genomes of *Aspergillus oryzae*, *Desulfovibrio magneticus*, *Brevibacillus brevis*, *Rhodococcus erythropolis,* etc.
- Public release of the genomic data of these organisms on DOGAN

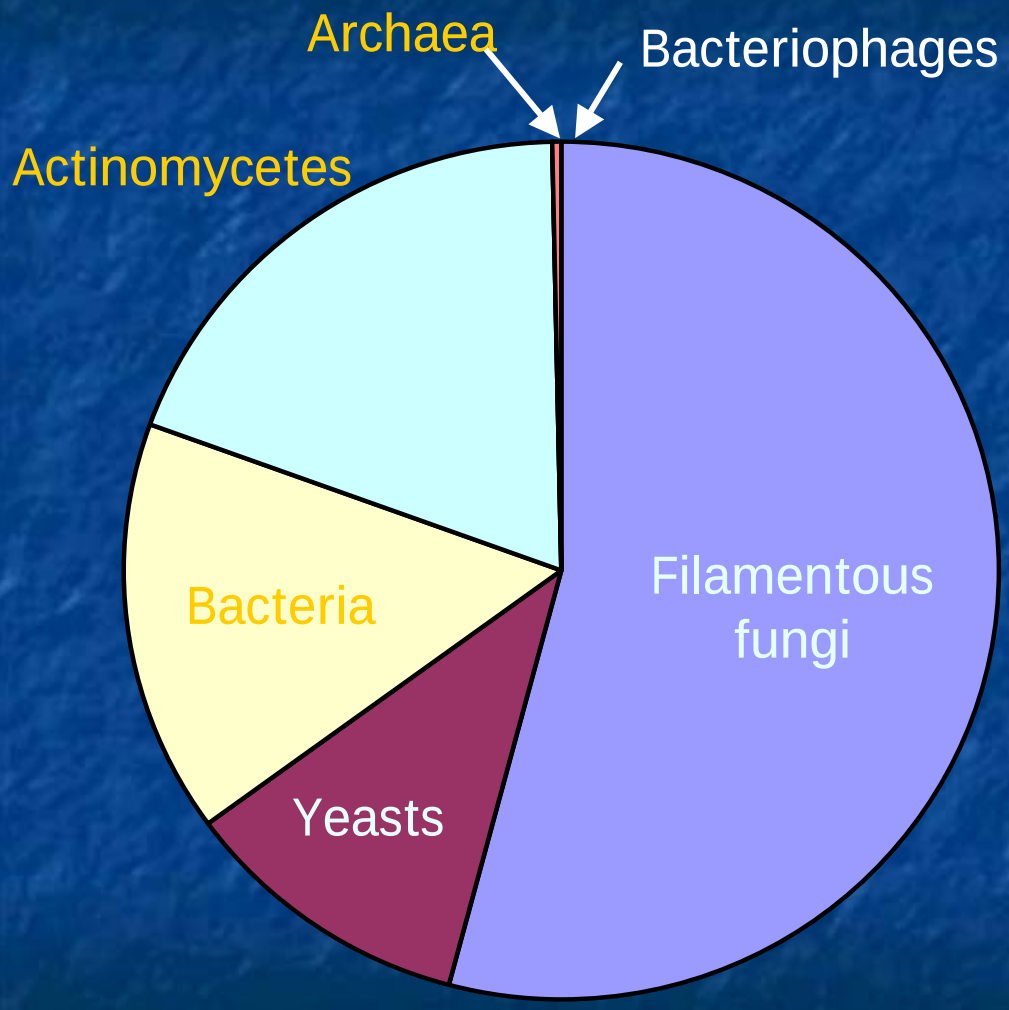
Biological Resource Center:

- Collection, analysis and distribution of filamentous fungi, yeasts, bacteria, archaea, actinomycetes, genes, cDNAs, etc.
- Release of the data for their general features & growth conditions.

Biotechnology Development Center:

- Exploration of microbial genetic resources; development of their classification (novel & hard-to-grow microorganisms, etc.)
- Collaboration with external institutes to stimulate uses microbial materials

Microorganisms held in NBRC



Total	35,750 strains	
Filamentous fungi	19,381	(54.2%)
Yeasts	3,879	(10.9%)
Bacteria	5,523	(15.4%)
Actinomycetes	6,841	(19.1%)
Archaea	58	(0.2%)
Bacteriophages	68	(0.2%)

（As of March 31, 2006）

Essential Functions of BRC:

Collection, Preservation and Supply of:

1. Reference organisms for quality control and standardized tests
   - Needs of specification of strains by national or international regulations
2. Taxonomic type strains of prokaryotes (bacteria, archaea) and yeasts
   - According to the Bacteriological Code of Nomenclature
   - Living culture of fungi derived from type according to the Botanical Code
3. Materials for research and development
   - Characteristic for BRC and the original country for screening sources

Reference Organism Supplier for Quality Control

Top sales best 10 (21% of total sales)

No.	NBRC No.	Strain Name Specific purpose	Sales
1	**3972**	***Escherichia coli*** Test organism for Japan Drug Standards, antibacterial activity test	227
2	**13275**	***Pseudomonas aeruginosa*** Test organism for Japan Drug Standards, antibacterial activity test	167
3	**13276**	***Staphylococcus aureus*** subsp. ***aureus*** Test organism for Japan Drug Standards, antibacterial activity test	156
4	**1594**	***Candida albicans*** Reference strain for antifungal activity test	145
5	**3134**	***Bacillus subtilis*** subsp. ***subtilis*** Reference strain for antibacterial activity test	144
6	**12732**	***Staphylococcus aureus*** subsp. ***aureus*** Test organism for Japan Drug Standards, antibacterial activity test	124
7	**9455**	***Aspergillus niger*** Reference strain for antifungal activity test	101
8	**3301**	***Escherichia coli*** Host strain for DNA recombination	81
9	**12708**	***Kocuria rhizophila*** Reference strain for drug resistance test	59
10	**3836**	***Bacillus cereus*** Screening for oxytetracyclin	56

NBRC Certified by ISO9001:2000

NITE Biological Resource Center

(December 2006)

WFCC members with certification or accreditation

- **AGO** - Arocrete Group Co., Taiwan
- **BIOCEN (BioCC)** - Centro Nacional de Biopreparados, Cuba
- **CABI Genetic Resource Collection**; UK
- **CCCM** – Czech Culture Collection of Microorganisms, Czech Republic
- **CCRC** - Culture Collection and Research Center, FIRDI, Taiwan
- **CECT -** Coleccion Espanola de Cultivos Tipo, Spain
- **CIP** - Collection de l´Institut Pasteur, France
- **DSMZ** - Deutsche Sammlung von Mikroorganismen und Zellkulturen, Germany
- **ECACC -** European Collection of Cell Cultures, UK
- **ICLC** - Interlab Cell Line Collection; Italy; GMP
- **IFM Quality Services Pty Ltd**, Australia
- **IHEM** – Insitute of Higiene and Epidemiology, Mycology, Belgium
- **LMBP** – Plasmd collection, Belgium
- **LMG** – University of Gent, Belgium
- **MUCL** – Mycology, University Louvain la Neuve, Belgium
- **NCIMB** - National Collection of Industrial, Food, Marine Bacteria, UK
- **NCPV** - National Collection of Pathogenic Viruses, UK
- **NCTC** - National Collection of Type Cultures, UK
- **NCYC** - National Collection of Yeast Cultures, UK

From Dr. David Smith

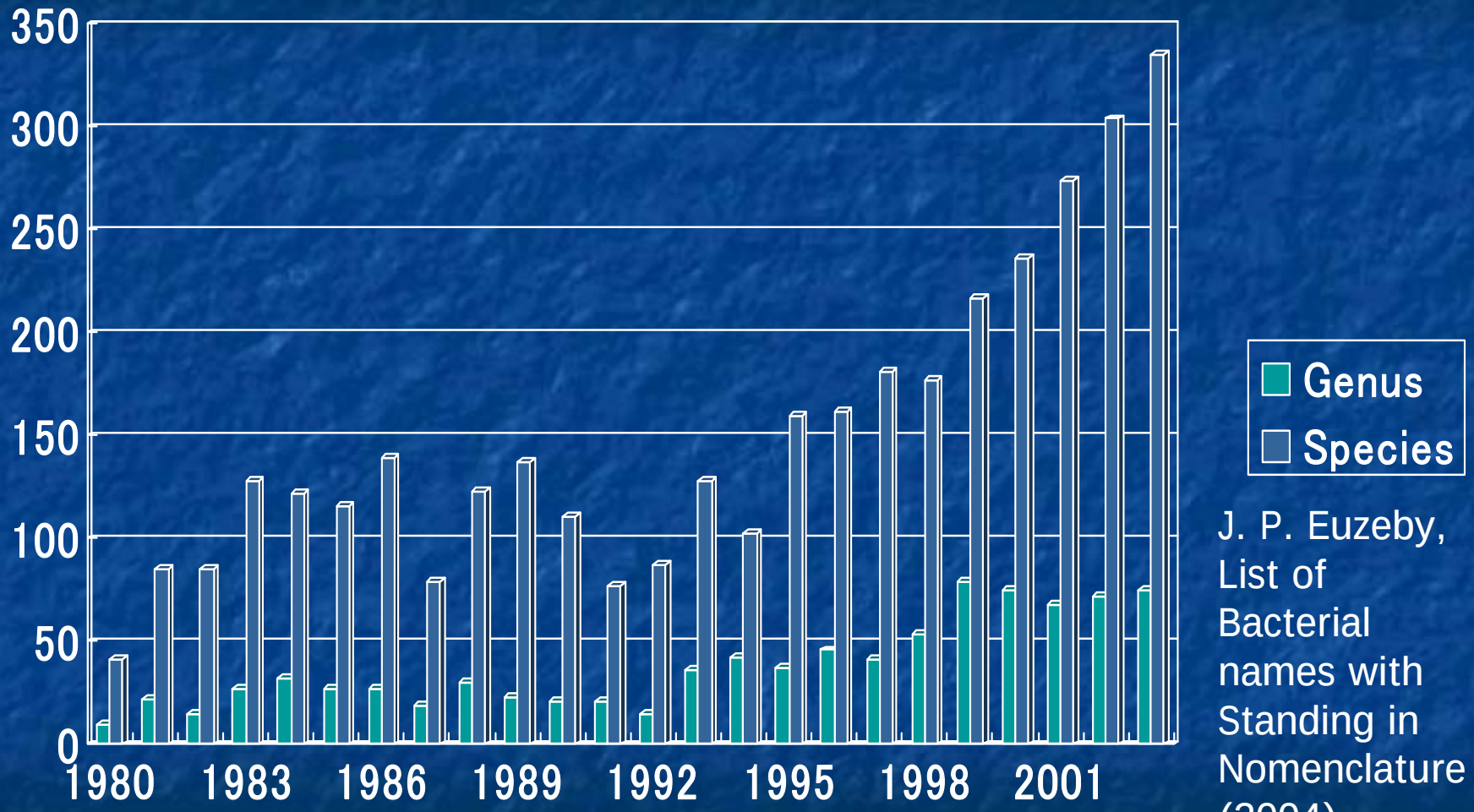
Depository of Taxonomic Type Strains

Taxonomic Type Strains of Prokaryotes

All type strains must be indicated at each occurrence in the text, tables and figures by a superscript capital T (e.g. NBRC 13546^{T} =IJSM 0819^{T}). The Code requires the designation of a type strain for a new type species and recommends the deposition of a culture, the type strain. Type strains of culturable species must be deposited in at least two or more public culture collections from two or more countries and accession numbers must be provided. An extensive listing of culture collections is available on line.

(Instruction to the authors, IJSEM)

The number of genera and species of prokaryotes published validly

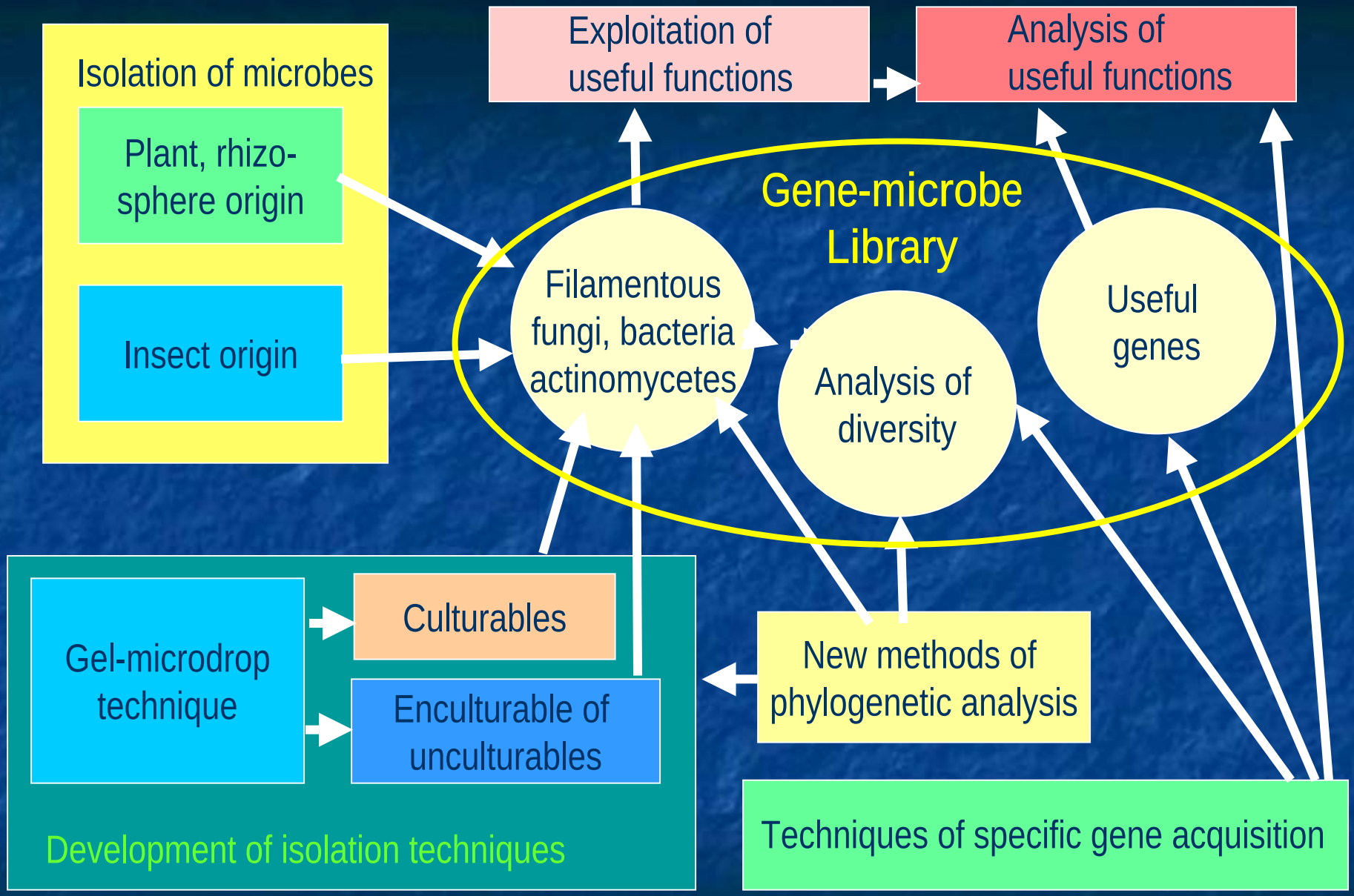


J. P. Euzeby, List of Bacterial names with Standing in Nomenclature (2004)

Supplier of Materials for Research and Development

Enrichment of microbial resources in the BRC

- Exploitation of hardly accessible sources such as oversea resources
- Development of cultivation techniques of hard-to-grow microorganisms
- Isolation of genes from hard-to-cultivate microorganisms



Scheme of the acquisition and evaluation of Novel microorganisms and their genes

International Cooperative Program between Culture Collections

A Case between National Center for Genetic Engineering and Biotechnology (BIOTEC) of Thailand
and
National Institute of Technology and Evaluation (NITE) of Japan

MEMORANDUM OF UNDERSTANDING (MOU)

BIOTEC of Thailand

and

NITE of Japan

on

Joint Program on the Conservation and Sustainable Use of Biological Resources

Signed on 18 February, 2005

Project Agreement 1

between
BIOTEC of Thailand
and
NITE-DOB of Japan
concerning

a Joint Project between BIOTEC Culture Collection (BCC) and NITE Biological Resource Center (NBRC)

Signed on 18 February, 2005

Objective

The Project aims at promoting transfer of the microorganisms kept at the BIOTEC Culture Collection (BCC) and the NITE Biological Resource Center (NBRC) in order to promote conservation and sustainable use of the biological resources in Japan and Thailand in accordance with the Convention on Biological Diversity.

Procedures

1. Microorganisms shall be listed in the catalogues of Parties with the name of the country of origin attached. Parties may distribute Microorganisms to a third party as detailed in Article 4.
2. The distribution of Materials to a third party shall be accompanied by Material Transfer Agreement-1 or MTA-1, the format of which is attached to this agreement.

Project Agreement 2

between

BIOTEC of Thailand

and

NITE-DOB of Japan

concerning

a Joint Project for Cooperative study of microorganisms focus on taxonomy and application between BIOTEC Culture Collection (BCC) and NITE Biological Resource Center (NBRC)

Objective

The Project aims at conducting collaborative research on the characterization of microorganisms kept at the BIOTEC Culture Collection (BCC) and the NITE Biological Resource Center (NBRC) in order to promote conservation and sustainable use of the biological resources in Japan and Thailand in accordance with the Convention on Biological Diversity.

Working Group Members

Sub-Project 1
Taxonomic study of acetic acid bacteria isolates isolated from Thailand

Sub-Project 2
Study of saprophytic and endophytic Xylariaceous fungi in Thailand

Sub-project 3
Taxonomy of yeasts isolated from natural environment in Thailand

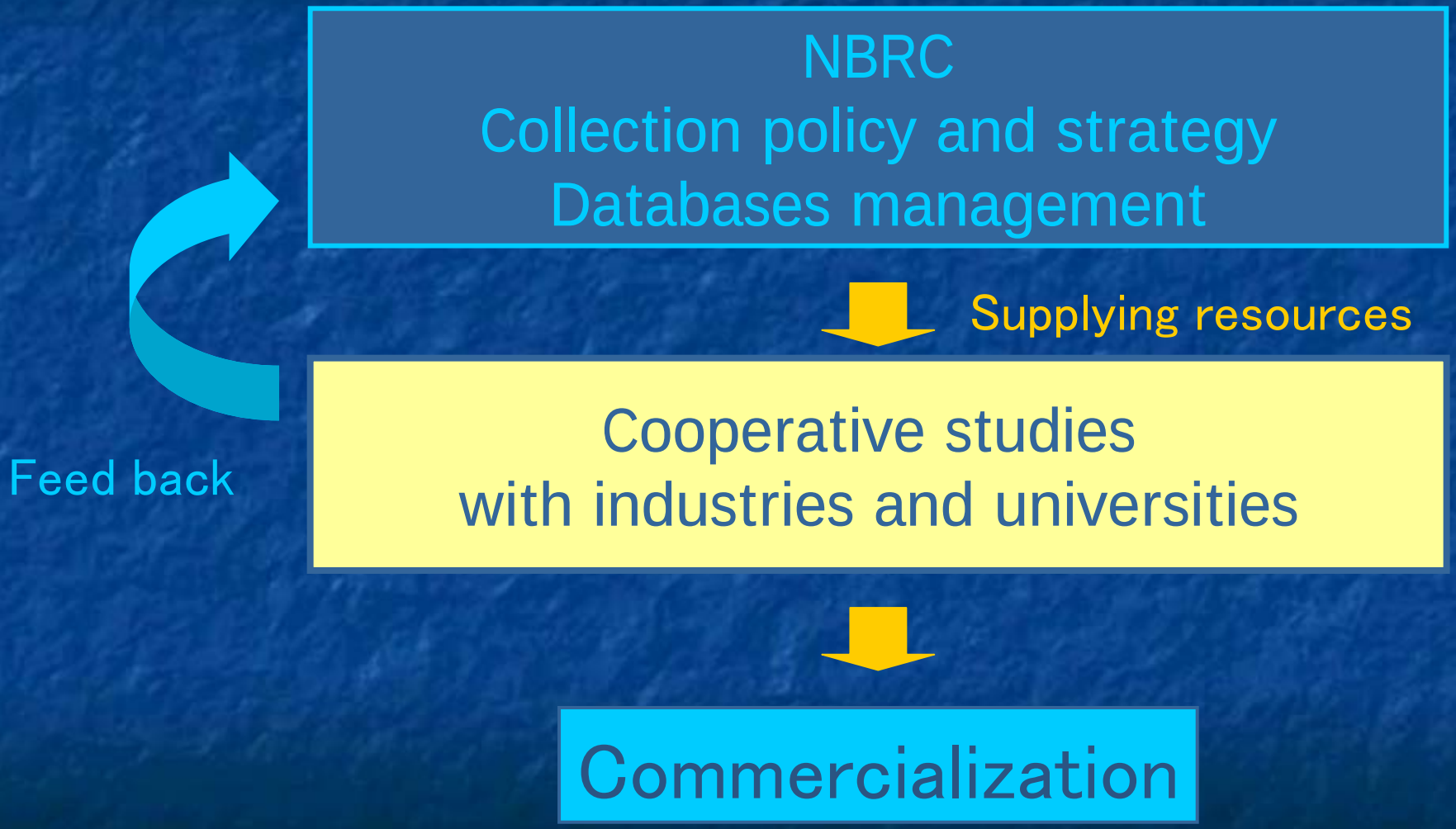
international collaboration at BIOTEC, Thailand

Study of saprophytic and endophytic Xylariaceous fungi in Thailand

Endophytic fungi
Expert from Japan side

Saprophytic fungi
Expert from Thai side

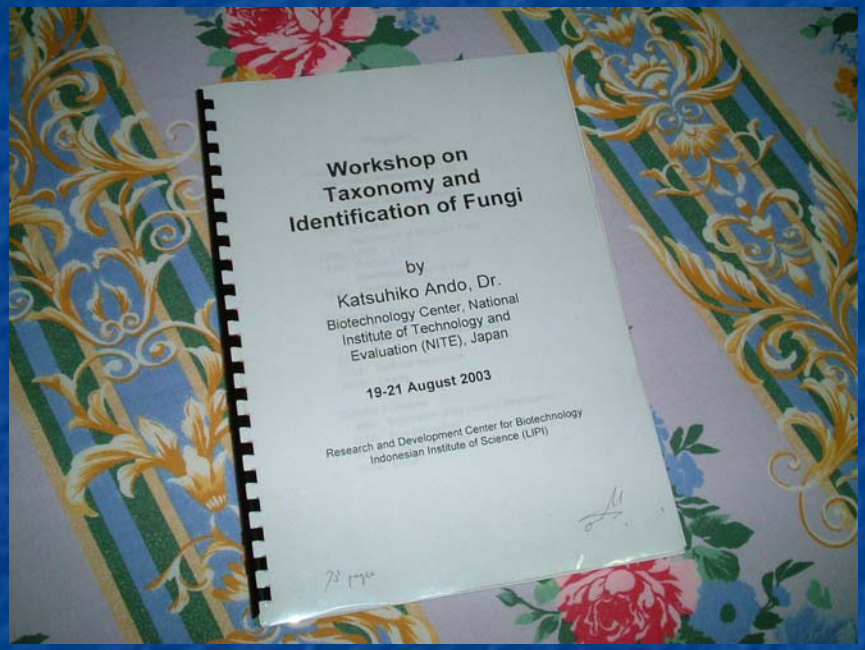
Cooperative researches to promote industrial utilization of bioresources and their information



Capacity building through international cooperative researches

- Isolation techniques
  - Development and enrichment of microbial resources
  - Recognition of microbial diversity
- Taxonomy of microorganisms
  - Recognition of microbial diversity
  - Technology for traceability
  - Enrichment of information accompanying resources
  - Appropriate identification techniques for biosafety
- Preservation techniques
  - Expansion of capacity of collection
  - Maintenance with quality
  - Management of resources

On-site workshops for laboratory work through cooperatove studies



At LIPI Indonesia in 2005

JICA Bioindustry Training Course

Organized by JBA

Domestic Network among BRCs/CCs in Japan

- Effective coverage of microbial diversity
- Standardization
- Public acceptance
- Recommendation to policy decision makers
- Enhancement of JSCC activities

World Federation for Culture Collections

http://www.wfcc.info/

The WFCC is a Multidisciplinary Commission of the International Union of Biological Societies (IUBS) and a Federation within the International Union of Microbiological Societies (IUMS).

The WFCC is concerned with the collection, authentication, maintenance and distribution of cultures of microorganisms and cultured cells. Its aim is to promote and support the establishment of culture collections and related services, to provide liaison and set up an information network between the collections and their users, to organize workshops and conferences, publications and newsletters and work to ensure the long term perpetuation of important collections.

Asian Consortium for the Conservation and Sustainable Use of Microbial Resources (ACM)_

Aim of ACM___

- Framework for international cooperation to encourage microbiological researches
- Development of microbial resources characteristic for each country
- Construction of the mechanism for academia and industry to utilize microbial resources
- Establishment of BRC network
- Establishment of international standards for biological material transfer and benefit-sharing
- Improvement and share of standardized techniques

The 1st ACM Meeting @Tsukuba

ACM was established at Tsukuba Meeting on 10th October, 2004

Profile and Activities of ACM

Member countries = 12

Cambodia, China, Indonesia, Japan, Korea, Laos, Malaysia, Mongolia, Myanmar, Philippines, Thailand, and Vietnam

Organization

Chairperson:
Ms. Wanchern Potacharoen (BIOTEC, Thailand)
Vice-Chairs:
China (Next host),
Indonesia (Host after the next)
Secretariat:
NITE-DOB

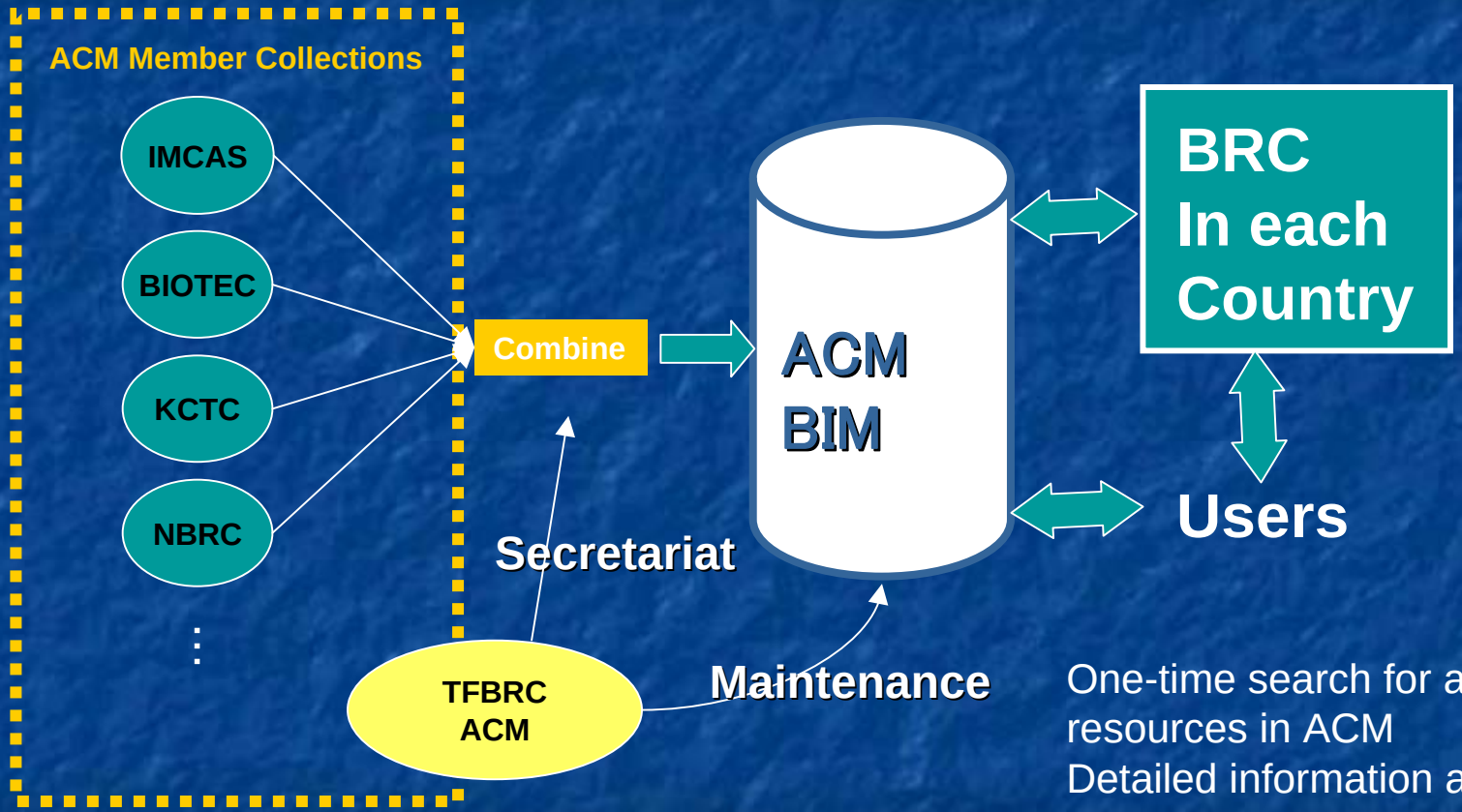
Action plan

- Annual Meeting
- Information exchange through seminars and workshops
- Promotion for public acceptance and social infrastructure

Task Forces

- Asian BRC Network TF
  Chair: Ken-ichiro Suzuki (NBRC)
- Human Resource TF
  Chair: Prof. Indrawati Gandjar (University of Indonesia)

Construction of a Prototype of Common Database for the Network among Member BRCs



One-time search for all microbial resources in ACM
Detailed information and consultation are available from each collection

CONCLUSION & PERSPECTIVE

- BRCs are the depository and the supplier of qualified materials with appropriate information.
- Each BRC is expected to be the center of excellence for the study of biodiversity and taxonomy in the country.
- BRCs are also expected to be the authority to assign the control level and to transfer the materials.
- Each BRC is an essential component with their own originality and specialty in the national and international network.