DNA Banking
– International Efforts

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DNA Bank

DNA Bank is a particular type of genebank that preserves and distributes the DNA samples (genomic, mitochondrial or chloroplast DNA; cDNA, EST, BAC, YAC, PAC, repeat libraries; vectors; probes; primers) and provides associated information.

Background

• Realization that DNA is as important a resource as whole organism
• Availability of large amounts of spare DNA in laboratories
• Improvements in long-term storage of DNA
• Rapid advances in quality, speed and cost reduction of DNA extraction and analysis
Growth of DNA sequence information

Registered base sequences in NCBI/GenBank (1982-2008)

2012: 137,384,889,783 bases; 149,819,246 sequences
The DNA bank stores material collected for purpose of DNA extraction, genomic DNA and associated products from molecular based research.

- Prepares DNA and related molecular information.
- Supplies DNA (total genome/fragments/clones) and related information to users.
DNA Bank - Organization

Material

DNA Extraction (also from other donors), multiplication, storage, supply

Analysis

Data management and communication
DNA banking- opportunities

- DNA banks as complementary conservation strategy
- Central repository for storage, supply and exchange of DNA samples and associated genetic information
- High throughput germplasm characterization, population genetic analysis and improved genebank management
- Association genetics and marker aided selection
- Reference basis for evolutionary and comparative genomic studies.
DNA banking - limitations

- Plant recovery from DNA not possible
- Extraction of pure storable DNA difficult in some species
- Life span of stored DNA may be short
- Resources and policy constraints
- Intellectual property and legal issues
Major world plant DNA banks

1. Australian Plant DNA Bank, Lismore, Australia (http://www.biobank.com)

2. DNA bank, Instituto de Pesquisas, Jardim Botanico de Rio de Janeiro, Brazil Brazil (http://www.jbrj.gov.br/pesquisa/div_molecular/bancodna/sobre_ing.htm)

3. Missouri Botanical Garden, Missouri, USA (http://www.welbcenter.org/dna_banking.htm)


6. National Institute for Agrobiological Sciences, Japan (www.dna.affrc.jp)
The Royal Botanical Gardens, Kew DNA Bank

- The RBG DNA Bank contains approximately 40,000 (2010) samples of plant genomic DNA, all stored at –80°C.
- DNA is databased with information on names, collectors, localities etc. Each sample is vouchered.
- The samples are cleaned to such an extent that they are stable at ambient temperatures for days while in transit. In storage within the bank they are, in theory, stable indefinitely.
- DNA samples can be ordered at nominal price.
- MTA restricts commercial use of the DNA supplied.
RBG DNA Bank – Query Form

DNA Bank Query Form

Fill in at least one of the following fields.

- Family:
- Genus:
- Collector:
- Country:
- Voucher Location:

Search Help
You can search for DNA accessions using any of the five search fields above, alone or in combination. Searches are inclusive, so if for example you select a Genus and a Country you will only get results for that Genus in that Country.
RBG DNA Bank – Order Form
The recipient may only use the Material, its progeny or derivatives for the common good in scientific research, education, conservation and the development of botanic gardens;

The recipient shall not sell, distribute or use for profit or any other commercial application the Material, its progeny or derivatives;

The recipient shall share fairly and equitably the benefits arising from their use of the Material, its progeny or derivatives in accordance with the CBD.

The recipient shall acknowledge Kew, as supplier, in all written or electronic reports and publications resulting from their use of the Material, its progeny and derivatives and shall lodge a copy of all such publications and reports with Kew;

The recipient shall take all appropriate and necessary measures to import the Material in accordance with relevant laws and regulations and to contain the Material, its progeny or derivatives so as to prevent the release of invasive alien species;
RBG DNA Bank – MTA

- The recipient may only transfer the Material, its progeny or derivatives to a bona fide third party such as a botanic garden, university or scientific institution for non-commercial use in the areas of scientific research, education, conservation and the development of botanic gardens;
- The recipient shall maintain retrievable records linking the Material to these terms of acquisition and to any accompanying Data provided by Kew;
- Unless otherwise indicated, copyright in all information or data (“Data”) supplied with the Material is owned by Kew or Kew’s licensors. You may use these Data on condition that they are used solely for scholarly, education or research purposes; that they are not used for commercial purposes; and that you always acknowledge the source of the Data with the words “With the permission of the Board of Trustees of the Royal Botanic Gardens, Kew”;
- The recipient will contact Kew to request prior permission from Kew or, where appropriate, from the provider of the Material to Kew, for any activities not covered under the terms of this agreement.
The Botanical Garden and Botanical Museum Berlin-Dahlem DNA Bank
### DNA-Bank Berlin-Dahlem

#### Genus:
- *Papaver*
  - *Papaver argemone L.*
  - *Papaver nudicaule L.*
  - *Papaver somniferum L.*
  - *Papaver tianschanicum Popov*

#### DNA-Bank number: 00290

#### Name: *Papaver tianschanicum Popov*

#### Family: PAPAVERACEAE

#### Country of Origin: Kyrgyzstan

#### Locality: Tien-Shan, Son-Kol

#### Altitude: 3600 m

#### Collector: Rost

#### Collection number: s.n.

#### Collection date: 21.08.2000

#### Barcode tissue: no silica gel material available

#### Date of DNA-Isolation: 2005-01-01 00:00:00.0

#### Method of DNA-Isolation: Qiagen

#### Published Sequences

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[ww2.bgbm.org/herbarium/dna/default.cfm](http://www2.bgbm.org/herbarium/dna/default.cfm)
The DNA Bank of The New York Botanical Garden (NYBG) serves as the repository for samples of frozen tissue and genomic DNA.

These research materials are used by NYBG scientists, students in the Graduate Studies program, visiting scholars, and interns.

The aim of the DNA Bank is to house samples in plant and fungal groups studied by Garden scientists, as well as other taxa from the diverse geographic regions in which NYBG staff works.

The DNA Bank will accept existing collections from other institutions and individuals provided that they are relevant to and consistent with NYBG goals, acquisition policy, and that a voucher specimen is deposited in an herbarium with an active loan program.
Small samples of plant material, usually young leaves, collected in plastic, zip-lock bags with silica gel as a dessicant.

Voucher specimens for these samples are deposited at the Missouri Botanical Garden and at least one institution in the country from which they originated.

Upon arrival at the Garden, a specimen label is prepared for each sample and they are stored in a cabinet in a walk-in freezer maintained at 0°F (-20°C).
The Australian Plant DNA Bank is a comprehensive collection of DNA from both Australian native and important crop plant species. It also contains transgenic organisms developed through research.

The Bank offers the following services to the scientific community, to assist plant research and conservation:

- DNA extraction, sample archiving and historical documentation;
- Provision of quality genetic material from plant tissue;
- Facilitation of data exchange and technology transfer.
The Bank aims to preserve representative genetic information of the high diversity presented by Brazilian flora, being groundwork for plant conservation and biotechnology.

The goal is to store DNA from Arboretum collections, from relevant species of endangered Brazilian ecosystems, specially the Atlantic Rain Forest, from special taxonomic groups, from existing herbarium sheets and also from different accesses of a rare and/or endangered species.
The DNA stored in the Bank comes from researcher’s expeditions, from the Arboretum collections, from herbarium specimens and from donated plant material and/or DNA.

Plant material is collected in liquid nitrogen or immediately dried in silica gel before DNA extraction (CTAB 2% or MATAB 4%). The DNA is stored at -80°C with the equivalent voucher stored within the herbarium.
DNA Bank at Kirstenbosch, South Africa

- The bank has approximately 4,900 plant extracts in storage at SANBI, with duplicated samples at Kew Gardens, London.
- All records have been entered into a database.
- The DNA bank is available to both national and international researchers as it is a global resource.
Plant DNA Bank in Korea

- "Plant DNA Bank in Korea II" holds over 11,200 plant DNA samples
- Modalities for supply of DNA
Welcome to the National Plant, Fungi and Animal DNA Bank

Written by Wiesław Bogdanowicz

National Plant, Fungi and Animal DNA Bank in Poland is a new initiative of five Polish scientific institutions using DNA barcoding for researching as well as for many practical purposes. DNA Bank stores biological material as a source of DNA samples for the future research projects. The DNA Bank aims to enlarge our knowledge about species of plants, fungi and animals using the up-to-date standards and techniques.

DNA barcoding is a powerful tool which is used to precisely identify species even from small parts of tissue. The life stage of the organism is not important - it can be egg or larva. Precise species identification is essential for research and conservation of biodiversity. It is also fundamental for many other practical and commercial purposes.

This webpage has two aims. Firstly, it is a source of basic knowledge about DNA barcoding for anybody interested in the subject. Secondly, thanks to dedicated database the gathered barcodes of species are stored and presented on the webpage.

Biological Barcodes - new methods of species identification

Written by Wiesław Bogdanowicz

Vast numbers of species are still waiting to be discovered. Although nothing can replace the work of classical taxonomists, biologists now want to speed up and simplify the identification of species by creating catalogs of genetic barcodes.

In the mid 18th century, Swedish naturalist Carol Linnaeus's work Systema Naturae introduced the binomial system (consisting of...
DNA bank

Conditions
Requests for DNA samples will be considered from recognized botanical institutions or departments. DNA samples may only be used for research for non-commercial purposes and should not be given or sold to any third party. Secondary distribution may only be done after receipt of written approval by the Nationaal Herbarium Nederland. The recipient should acknowledge the Nationaal Herbarium Nederland in all resulting publications and send a copy to the Nationaal Herbarium Nederland. The Nationaal Herbarium Nederland reserves the right to refuse any request for DNA samples. Regulations for DNA extractions from NHN herbarium specimens can be obtained from Mr. G. Thijssen (NHN-Leiden), Mr. R.A. Bakker (NHN-Utrecht) or Mr. F. Aleva (NHN-Wageningen).

DNA samples of NHN Wageningen
Information about the DNA samples of NHN Wageningen can be found at NHN WAG website.

DNA samples of NHN Leiden
DNA samples of the following genera are available upon request. The availability of some samples is limited. All requests for these DNA samples will be given due consideration, but we cannot assure availability. Samples can be ordered by filling out the order form.

In future the DNA Bank will be available as part of Brahms ONLINE with convenient search and order functions. In the meanwhile the updated DNA Bank database is available as downloadable Excel files.

Angiosperm families:

- Annonaceae
- Araceae
- Asteraceae
- Bombacoaceae
- Callicurpaceae
- Convolvulaceae
- Cucurbitaceae
- Comaraceae
NHN DNA bank comprises samples of angiosperms, algae and fungi, that are currently under revision at the Nationaal Herbarium Nederland for (inter)national systematic treatments such as Flora Malesiana, Flora Neotropica, Flora of the Guianas, Flora of the Netherlands, Dutch benthic freshwater Algae and Flora Agaricina Neerlandica.
The TCD DNA Bank was established in the Department of Botany, Trinity College Dublin, Ireland in 1998 and linked with the Department's Herbarium, Botanic Garden and Seed Bank to become part of an integrated system for biodiversity evaluation.

It contains almost 3000 accessions of DNA from a wide range of higher plant families (summary of collection as of August 2001).
The DNA Bank is maintaining DNA materials and information that has been accumulated as part of the genome projects of the Ministry of Agriculture, Forestry and Fisheries such as the Rice Genome Research Program (RGP) and the Animal Genome Research Program (AGP).

The biological materials available for distribution include cDNA clones, RFLP markers, PAC/BAC clones and YAC filters.
The DNA Bank provides access to all genomics data derived from the rice, animal and silkworm genome projects including databases and sequence analysis tools.

It also collects and manages all publicly available nucleotide sequence data (from DBJ, NCBI/GenBank, EBI/EMBL) and amino acid sequence/proteins (from PIR, SWISS-PROT, PDB).
Riken Bioresources Centre – Experimental Plant Division

- Arabidopsis full-length cDNA
- Poplar full-length cDNA clones
- Cassava full-length cDNA clones
- *Striga hermonthica* full-length cDNA clones
- Brassica rapa EST clones
- Tobacco EST clones
- Other Plant DNA materials
DNA Bank Network – Initial step

DNA BANK-NET (Adams et al. 1994)

STRUCTURE AND OPERATION OF DNA BANK-NET

At the organizational meeting of DNA Bank-Net, a task force was convened to define the functions of working (DNA dispensing) and reserve (base) nodes in the DNA Bank network. The group recommended the following functions (Adams and Adams, 1992):

Working (DNA dispensing) nodes:

a. Collection of plant material by taxonomists. This may be the primary function of a particular node or be in association with other organizations such as universities, botanic gardens, etc.
b. DNA extraction by molecular biologists or trained staff.
c. Long-term preservation of DNA-rich materials and/or extracted DNA in liquid nitrogen.
d. DNA analysis/gene replication by molecular biologists or trained staff.
e. Distribution of DNA (genes, gene segments, oligonucleotides, etc.).

Reserve (base) nodes:

a. Long-term DNA preservation in liquid nitrogen and monitoring of potential DNA degradation.
b. Act as genetic reserve buffer for working nodes.
DNA Bank Network – initial step

DNA BANK-NET NODES

WORKING NODES
(Dispensing nodes)

- Plant collecting, Herbarium Vouchers
- Initial field notes and ethnobotanical data
- Storage of DNA Rich Materials (leaves, shoot tips, etc.)
- Extraction and Storage of Genomic DNA
- PCR Amplification of DNA using primers supplied by users
- Distribution of Plant Genes

RESERVE NODES
(Base nodes)

- Plant collecting, Herbarium Vouchers
- Initial field notes and ethnobotanical data
- Storage of DNA Rich Materials (leaves, shoot tips, etc.)

Primers → Genes
Biology, Biotechnology, Paleobotany
Users
Banking DNA for Biodiversity Genomics

The main focus of the DNA Bank Network is to enhance taxonomic, systematic, genetic, conservation and evolutionary studies by providing:

- at-cost availability of non-human DNA material,
- high quality, long-term storage of DNA material on which molecular studies have been performed, so that results can be verified, extended, and complemented,
- complete on-line documentation of each sample, including the provenance of the original material, the place of voucher deposit, information about DNA quality and extraction methodology, digital images of vouchers and links to published molecular data if available.
DNA Bank Network

Costs and access

DNA samples are available on demand. A small fee is charged to cover extraction, storage, documentation, handling and shipping.

DNA donations to be incorporated into the network are accepted free of charge. You are guaranteed free access to the samples you deposit.

It is possible to block the release of your donated DNA to other scientists for a limited period of time.

For further information about the network you are invited to visit our website. Soon you will be able to query our databases and order DNA samples.

www.dnabank-network.org
If you have questions or if you would like to support the DNA bank project please contact us under:

contact@dnabank-network.org

Network activities

In the molecular field we are conducting tests to optimize DNA extraction and the elaborated process of long-term sample storage, focusing on new and suitable protective additives, storage at higher temperatures and rehydration of lyophilized DNA.

Our current emphasis lies on acquiring new samples of the flora and fauna of Germany and Central Europe to build up our DNA core collection.

In future projects, we intend to focus on organisms of selected geographic regions, on preservation of DNA specimens of extinct or endangered species as well as DNA from type specimens.

DNA Bank Network

A service to facilitate research on biological diversity

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Fried Universität Berlin, 2005
Dr. Birgit Gunnewicko
Dr. Holger Zechmeister
DNA bank – A model network

Graner et al. 2006
A National DNA Bank Network

- Adequate foresight and planning for scope of DNA bank
- A national coordinated effort with options for international linkages
- Identify various hubs, roles and responsibilities
- Commitment of financial and human resources
- Standardized protocols, vouchers and associated information
A National DNA Bank Network

- A database of all collections, their details, supplies and vouchers
- Access to database
- Legal issues related to sample ownership and exchange to be worked out and documented
- International networking. Policies for acquisition, exchange.
DNA Banking – International Standardization

- Global standardisation and international coordination of efforts
- Address operational issues such as data storage and management
- Quality assurance and control
- Compliance with international agreements and treaties governing
- Access and transfer of samples to third parties for research
Thanks