Gottfried Wilhelm Leibniz 1646-1716 "theoria cum praxi"

86 non-university research institutes and service facilities

Research activities of Leibniz Institutes range from pure fundamental research to the investigation of highly applied issues

Institutes are assessed at regular intervals by external experts

5 Sections
- Humanities and Education
- Economics, Social Sciences, Regional Infrastructure
- Life Sciences
- Mathematics, Natural Science, Engineering
- Environmental Sciences

Budget: 860 Million €
Grants: 244 Million €
Staff: 13,930
Scientists: 6,347
PhD Students: 1,604
Research Mission

IPK is a research centre that deals with questions of modern biology, mainly by studying cultivated plant species.

Its research aims at the generation of novel knowledge, the discovery of basic principles of plant performance and the development of enabling technologies.

These are considered to be of paramount importance for the targeted utilization of biological diversity for the sustainable production of food, feed and renewable resources.
Population growth and agricultural production

Data from Bruinsma, 2009
FAO Expert Meeting, Rome

World population

- 1961/63: 38%
- 2005/2007: 49%
- 2050: 85%

Cereals production

Meat production

Data from Bruinsma, 2009
FAO Expert Meeting, Rome
Renewable energies

Quelle: OECD/IEA World Energy Outlook 2004
Global Change

Zebisch et al. 2005 Klimawandel in Deutschland
Increase in arable land by 2050

Data from Bruinsma, 2009
FAO Expert Meeting, Rome

120 mill ha (7%)
Arable land per caput (ha)

Competing demands
- Population increase
- Urbanization
- Industrial use
- Biofuel production
- Land conservation
- Climate change

Bruinsma, 2009
FAO Expert Meeting, Rome
Interdisciplinary Approaches by Integration of

Cell Biology
Biochemistry
Physiology
Molecular Genetics
Cytogenetics
Taxonomy
Bioinformatics
Research Areas

Conservation and Utilization of Crop Plant Diversity

Dynamics of Plant Genomes

Integrative Biology of Plant Performance

Improvement of seed, in vitro and cryo conservation. Genomics approaches to understand and valorize genetic diversity.

Understanding genome diversity on a structural and functional level.

Use of high throughput technologies to study plant performance at a cellular and organismic level.
Conservation and Utilization of Crop Plant Diversity

- Optimization of the conservation management
  - Completion of the collection
  - Optimization of conservation procedures/seed longevity
  - Development of genebank related information systems

- Taxonomy and evolutionary biology
  - Taxonomic research
  - Adaptation, speciation and domestication

- Development of strategies for an improved utilization of genetic resources
  - Development of resources (populations, markers, maps)
  - Evaluation/phenotyping
  - Trait mapping, gene isolation
  - Analysis of allelic diversity (allele mining)
<table>
<thead>
<tr>
<th>Flagship projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Seed development and physiology in cereals, legumes and Brassicaceae</td>
</tr>
<tr>
<td>- Formation and evolution of plant centromeres</td>
</tr>
<tr>
<td>- Evolutionary and molecular analysis of sexual and apomictic reproduction</td>
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<tr>
<td>- Genetic principles and molecular mechanisms of heterosis</td>
</tr>
<tr>
<td>- Genetics of non-host resistance in cereals to fungal pathogens</td>
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<tr>
<td>- Effect of plant nutrition on phytohormones and morphologic differentiation</td>
</tr>
<tr>
<td>- Physical mapping and whole genome sequencing in barley</td>
</tr>
</tbody>
</table>
Infrastruc{}ture

Genomics
DNA

Transcriptomics
RNA

Proteomics
Proteins

Metabolomics
Metabolites
Phenotypic analysis
Bioinformatics@IPK
Coordinator: Falk Schreiber

DATA INSPECTION
Svetlana Fiedler

GENEBANK DOCUMENTATION
Helmut Knüpffer

SYSTEMS BIOLOGY
Björn H. Junker

PLANT BIO-INFORMATICS
Falk Schreiber

BIOINFORMATICS & INFORMATION TECHNOLOGY
Uwe Scholz
The Federal ex situ Genebank Conservation, Service, Research
The Federal ex-situ Genebank

Mission

- **Collection, conservation and documentation** of plant genetic resources

- **Research** on cultivated plants and their wild relatives and related species

- **Distribution** of plant material for research, breeding and education
National Strategy for Agrobiodiversity

- secure and enlarge infrastructure for PGR conservation
- develop approaches and strategies for utilization of PGR
- enhancement of international collaboration

Integration at the EU level

- ECPGR
- AEGIS
- Framework 6,7
The Federal ex-situ Genebank

<table>
<thead>
<tr>
<th>Collections</th>
<th>Accessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals &amp; Grasses</td>
<td>64.104</td>
</tr>
<tr>
<td>Legumes</td>
<td>28.250</td>
</tr>
<tr>
<td>Vegetables</td>
<td>18.538</td>
</tr>
<tr>
<td>Oil-/ Fiber plants</td>
<td>9.737</td>
</tr>
<tr>
<td>Medicinal-/ Spice plants</td>
<td>5.951</td>
</tr>
<tr>
<td>Mutants</td>
<td>2.684</td>
</tr>
<tr>
<td>Forage plants</td>
<td>12.406</td>
</tr>
<tr>
<td>Potatoes</td>
<td>5.874</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>146.966</strong></td>
</tr>
</tbody>
</table>

Total Collection
- 146,966 Accessions
- 2,649 Species
- 779 Genera

Reference Collections
- 391,000 Herbarium sheets
- 90,000 Seeds & Fruits
- 49,000 Spike-Samples

22,350 Safety Duplicates
Ex-situ Conservation

- **Cold room storage**
  e.g. cereals, legumes

- **Field conservation**
  e.g. fruit trees, *Allium*

- ***In-vitro* culture**
  e.g. potatoes, *Allium*

- **Cryo conservation**
  e.g. potato
Distribution of Seeds and Plant Material

2008/9: 22,799 Samples

Durchschnittliche Bearbeitungsdauer 2008/2009: 8,5 Tage ab Eingang SMTA
Certified Quality Management
documentation, transparency, know how

- Primary cultivation
- Characterization
- Reference vouchers
- Harvest/drying
- Germination test
- Storage
- Distribution
- Multiplication
- Research
- Human Resources
Along the biodiversity value chain

Conservation of Biodiversity

Research into Biodiversity

Utilization of Biodiversity