The German Funding System of Research

I. Germany’s Main actors in Research

II. Public Funding of Research by the Federal Ministry of Education and Research (BMBF)
   “German Innovation Initiative for Nanotechnology”

Dr. Rosita Cottone
„Division 511: Nanomaterials, New Materials“
Federal Ministry of Education and Research (BMBF)
Homepage: http://www.bmbf.de

MRNT Paris, 22th November 2004
Public Financing of Research in Germany

Federal Government

Project Funding
- Competitive thematic programmes for Industry and Science
  - ICT
  - Nanotechnology and Materials Research
  - Health, Biotechnology
  - Environment
  - Space Research
  - Transport

Horizontal and Structural Programmes
- SME Support and Infrastructural Measures
- International Co-operation

Länder (States)

Institutional Co-Funding
- MPG 50:50
- HGF 90:10
- WGL 50:50
- FhG 90:10

Institutional funding of higher education institutions (Universities and Universities of Applied Sciences)

Thematic Programmes

Horizontal and Structural Programmes

Competitive project funding in **basic research** in higher education sector via DFG 58:42
Public Financing of Research in Germany

Source: Bundesbericht Forschung 2004
Total R&D Expenditures in Germany in billion € (2001)

Source: Bundesbericht Forschung 2004
Public Institutional Funding of German research organisations (2003)

Institutional Funding (in Mio €)

- MPG
- HGF
- DFG
- Fraunhofer
- "Akademien-programm"

Institutional Funding Breakdown:

- German Academy Leopoldina
  - Basic Res.: 1563 Mio €
  - Basic Res. & Appl. R.: 1261 Mio €
  - "Akademien-programm": 936 Mio €

Institute for Advanced Study Berlin

- Leibniz Gemeinschaft
  - WGL: 701 Mio €

- DFG
  - Basic Res.: 394 Mio €

- Fraunhofer Gesellschaft
  - Applied Res.: 4 Mio €
Main Actors in German Research

- **359 Higher education institutions:**
  - **Universities:** 99
  - **Universities of Applied Sciences:** 187

- **Max Planck Society (MPG)**
  - 78 institutes
  - € 1.2 billion

- **Leibniz Science Association**
  - 79 institutes
  - € 0.94 billion

- **Fraunhofer Society (FhG)**
  - 55 institutes
  - € 1.0 billion

- **Helmholtz Association of National Research Centres**
  - 15 national research centres
  - € 2.2 billion

- **Research and development in companies**
  - € 35.3 billion
Main Missions of the DFG

The Deutsche Forschungsgemeinschaft (German Research Foundation) is the central, self-governing research organisation that promotes basic research at universities and other publicly financed research institutions in Germany. The DFG fosters excellence by competition.

**Research Funding:** the DFG serves all branches of science and the humanities by financing research projects and facilitating cooperation among researchers.

**Promoting Young Researchers:** It devotes particular attention to the education and advancement of young researchers.

**Internationality:** The defined responsibilities of the DFG include the cultivation of contacts between German and international scientific communities.

**Policy Advice:** It advises parliaments and public authorities on questions related to science and research matters.

**Interdisciplinarity and Networking:** it provides measures to promote the exchange of information between scientists and academics and collaboration between researchers from various disciplines.
Scientific Fields and Instruments of the DFG

**Scientific Fields 2003 (in %)**

- Natural Sciences: 25.1%
- Engineering: 22.6%
- Biology and Medicine: 37.5%
- Humanities and Social Sciences: 14.7%

Overall funding*: 1,177.7 Mio €

* data: individual grants, funding for young researchers & coordinated programs

**Instruments 2003 (in Mio €)**

- Individual grants: 413.9
- Prizes: 17.2
- Coordinated programmes: 714.0
- International cooperations: 63.5
- Boards & committees: 2.1
- Infrastructure: 415.7

*Source: DFG*
Funding instruments of the DFG

Programmes

- Individual Grants Programme/Research Grants
- Sabbaticals
- Short Courses and Summer Courses
- Priority Programmes
- Research Units
- Clinical Research Units
- Collaborative Research Centres
- DFG Research Centres
- Humanities Research Centres
- Research Training Groups
- Scientific Library Services and Information Systems
- Scientific Instrumentation and Information Technology (HBFG and Major Equipment)
- Central Research Facilities
- Conference, Lecture and Information Trips
- International Scientific Events
- Roundtable Discussions and Colloquia

Scientific Prizes

- Gottfried Wilhelm Leibniz Programme
- Heinz Maier-Leibnitz Prize
- Eugen und Ilse Seibold Prize
- Bernd Rendel Prize
- Albert Maucher Prize
- Communicator Award
- EURYI Award

Funding Initiatives

- Research Fellowships
- Temporary Positions for Principal Investigators
- Emmy Noether Programme
- Heisenberg Programme
- Mercator Programme
- Scientific Networks
- Empirical Research in Education
- Humanities Research
Structure of the DFG

General Assembly (GA)
- Establishes directives, approves annual report and account
- Announces members of the Executive Committee and Senate
- GA members are from institutions of higher education, research institutions, academia, associations

Senate
- Decides on Research Strategy and Policy
- Advises government offices
- Coordinates national and international cooperation
- Consists of 42 scientists and academics, 3 of them as permanent guests

Executive Committee
- Manages daily affairs of the DFG
- Consists of President, Vice President, President of the Stifterverband, Secretary General

Joint Committee
- Financial Aspects of research support, annual budget
- Research policy and programme planning on the basis of decisions of the Senate
- Consists of 39 senators, each 16 votes of the states and the Fed. Gov. and 2 votes of the Stifterverband

Review Board
- Evaluates all reviews and recommendations
- ~577 scientists

Peer Reviewers
- Review grant proposals
- Consists of ~9000 national and international scientists

Executive Board
- as defined by §26 BGB
- President Secretary General

Head Office
- Conducts the daily business

Source: DFG
The DFG Procedure of Review – Evaluation - Decision

Review Board

Peer Reviewers

grant proposal

peer review

quality assurance

reviews

drafts recommendation

recommends

overall examination

Head Office

formal examination

selection

Source: DFG
The Max Planck Society (MPG)

- **Independent non-profit research organisation** (status of registered associations) with the **primary goal to promote basic research in 78 institutes** located throughout Germany with appr. 12,300 employees (among them 4,200 scientist and scholars) and about 9,600 doctoral candidates, post-doctoral fellows and guest scientists and scholars from abroad.

- The MPG performs **high quality basic research** in the interest of the general public in the **natural sciences, life sciences, social sciences, and the humanities** and **takes up new and innovative research areas** that German universities are not in a **position to accommodate or deal with adequately**. These interdisciplinary research areas often do not fit into the university organisation, or they require more funds for personnel and equipment than those available at universities.

- **In 2003 total MPG budget** amounted up to €1,24 billion. The Federal Government and the Länder provided jointly (50:50) about **€ 935 million for institutional funding**.
• An international evaluation on behalf of the BLK in 1999 confirmed an outstanding importance of MPG with regard to the scientific reputation (e.g. 15 nobel prize winners, over 12000 scientific articles per year), internationalization, mechanisms of research support and the promotion of young researchers from GER and abroad (support of doctorate and post-doctorate students, awards, exchange of personnel, inter-institutional Research Initiatives, junior research group, etc.).

• Technology transfer of the MPG is supported by the Garching Innovation GmbH which main task lies in seeking out inventions and know-how in the Max-Planck-Institutes and exploiting them by the conclusion of sales, licence and option agreements with industry at home and abroad. GI also organizes the collaboration between inventors and lawyers of patent law; it informs industry about new patent. The returns from the contracts go to the Max Planck Society.

• Advising researchers who are developing start-up companies and negotiating the participation in these companies are also among Garching Innovation’s diverse interests. Up until now 39 companies stemming from Max Planck Institutes have been spun off.
Hemholtz Association of National Research Centers

- 15 Research Centers
- 250 Institutes
- 24,000 Employees
- 8,500 Scientists and Engineers
- Total budget in 2004 amounts up to €2.2 billion
Profile and Mission of the HGF

- HGF institutes with six scientific research fields/strategic programmes:
  - Earth and Environment: €303 Mio.
  - Health: €332 Mio.
  - Key Technologies: €114 Mio.
  - Structure of Matter: €431 Mio.
  - Transport and Space: €275 Mio. (€495 Mio. in others)

- Mission of HGF: pursuing long-term basic research with orientation towards applications on behalf of the state and society.

- The Federal Government and the Länder share around 70% of the total budget in a ratio of 90:10. The remaining 30% of the budget is acquired by the Helmholtz Centers in the form of contract funding.

- Since 2002 Helmholtz scientists develop research programmes for each of these fields. International experts review these programmes (after 5 years). Their evaluation forms the basis for the programme-based funding given to Helmholtz research. Within the six research fields, Helmholtz scientists co-operate with each other and with external partners - working across disciplinary, organisational and national borders.
Programme-based funding aims at focusing the scientific work on research programmes and consequently restructuring the financing. **Funding goes therefore to scientific programmes rather than to the centres.** This support policy is based on two guiding principles:

- Co-operation across institutional and disciplinary borders
- Competition for research funds.

**Programme proposals by Helmholtz scientists**

**Programme evaluation by international experts**

**Recommendations by Senate Commission**

**Funding recommendations by Senate**

**Financing by Federal Government and Länder**
The President of the Helmholtz Association is equipped with an Initiative and Networking Fund which amounts to €25 million each year. The three core areas for funding allocations are:

- **Networking with universities**: for joint research projects with universities creating virtual institutes or joint collaborative centres.

- **International networking**: fund provides support for coordination and leadership responsibilities in FP6 and integrating excellent research groups from Eastern Europe and CIS countries.

- **Promoting young scientists**: So far set-up of 20 excellent Junior Scientist Teams in close collaboration with universities.

Further informations under [http://www.helmholtz.de](http://www.helmholtz.de)
WGL represents **80 non-university research institutes** and **service facilities** (55 research institutes, 7 research museums, 18 scientific service facilities) which employ about 12,500 staff (5,300 academics and 1,400 Ph. D. students).

After the German reunification in 1990 the scientific and research infrastructure of the former German Democratic Republic had to be incorporated into the Federal Republic's system. In the course of this process **34 former Eastern German institutes** were integrated into **47 so-called “blue list institutes”**, followed by an intensive **re-organization** and **re-orientation** of the new Leibniz Society.

**Total WGL budget** raises up to of **€943,5 million** (in 2003). €730,8 million were jointly provided by the federal government and the Länder (50:50).

The tasks undertaken at WGL institutes cover fields of science-driven basic research to applied research. The institutes are grouped into **five sections**. They cover **humanities and education**, **economic and social sciences**, **life sciences**, **physical sciences**, and **environmental research**.
• The Leibniz Institutes are demand-oriented and interdisciplinary centers of competence. They regard themselves as co-operation partners for industry, public administration and politics; scientific collaboration with universities, MPG and FhG is particularly close and intensive.

• In November 2000 the German Science Council (Wissenschaftsrat) evaluated all Leibniz Institutes confirming that they contribute considerably to Germany’s research potential. In addition, every institute is assessed externally at regular intervals by independent experts.

• The senior advisory board is the Senate, which was set up in 1998 and whose members include representatives of the federal and “Länder“ governments, presidents and chairpersons of the major German science organisations, leading external academics and representatives from industry and trade unions.

Further informations under http://www.wgl.de
The Fraunhofer Society

- The Fraunhofer Society maintains over **80 research units** at more than 40 different locations throughout Germany. The FhG institutes undertake **applied research of direct utility to private and public enterprise** mainly in the fields of ICT, energy, micro-electronics, production and environmental technologies. The FhG carries out publicly funded pre-competitive research. This forms the basis of the contract research projects conducted for customers.

- A **staff of some 12,700**, predominantly qualified scientists and engineers, works with an **annual research budget of over one billion euros**. Of this sum, two thirds are generated through contract research. The remaining one third is contributed by the Federal Government and the Länder (90:10).

- The FhG has a **distinctive profile** within the German research environment. **Research of practical utility remains the focal objective of all activities**, whether these involve contract research, pre-competitive research, consulting services or studies.

- **Collaboration with the universities** guarantees the close link to basic research and contributes to the recruitment of young scientists (**joint appointments** of university professorships, **honorary professorships** at FhG institutes).

Further informations under http://www.fhg.de
II. Public Funding of Research by the Federal Ministry of Education and Research (BMBF)

German Innovation Initiative for Nanotechnology
Aims and tasks of the BMBF

- **Strategic orientation and support of R&D**
  - strategic short-midterm project funding in targeted programmes (key technologies)
  - strategic institutional funding (mid-long term promotion of basic and applied research and state preventive research in HGF, WGL and FhG) in conjunction with the Länder

- Setting up a competitive (financial) framework for basic research (DFG, MPG ...) in conjunction with the Länder

- Systemic approach to innovations for economic growth and employment by
  - networking, technology transfer
  - SME
  - entrepreneurship

- Fostering European and international co-operation

- Bridging education (primary and secondary education, vocational training, higher education ...) and R&D
  - awareness building for R&D
  - innovations in education (modernisation, adaptation to international structures)
  - careers for young scientists (Junior Professorships, young scientists support activities,...)
BMBF Budget – Responsibilities (Developments 1998-2004)

All-day school programme €1 billion

BAföG loan part €445 million

BMBF budget (Epl. 3) 2004: €8.261 billion

BAföG €951 million - 11.31%

Intercompany training centres (UBS), Training Places Programme East (ALO), Upgrading training assistance (AFBG) €327 million - 3.89%

University construction funding (HBFG) €925 million - 11%

Space, IT, mobility and transport, biotechnology, environmental technology, etc.; FhG €2.982 billion - 35.51%

Health research, regional sustainability, global environmental aspects, marine and polar research €1.287 billion - 15.29%

Basic scientific research, MPG, DFG €1.856 billion - 22.08%

Ministry €77.2 million - 0.92%
• Project management agencies (PT) are Helmholtz Centers or specific units at other research institutions charged of scientific-technological and administrative tasks related to BMBF’s and BMWA’s project funding.

• PTs recruit highly qualified staff which mediate between the scientific community/industry and the ministries.

• PTs advise applicants and are involved in the preparatory phase of the funding decision process, the project surveillance and quality control.

• Further activities include the participation in the set-up of new funding programmes, the organisation of workshops or conferences and other PR activities and the consultation of national applicants for participation in the European Framework Research Programme of EU COM (NCPs) and international co-operation (international bureau of the BMBF).
Richard Feynman: “smallness“ allows new functionalities

1959: „There is plenty of room at the bottom“
Funding of Nanotechnology by the Federal Ministry of Education and Research (BMBF)

http://www.bmbf.de/publikationen/
## Public Funding of Nanotechnology in GER

<table>
<thead>
<tr>
<th>Nanotechnology project funding</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMBF project funding</td>
<td>88,2</td>
<td>123,8</td>
</tr>
<tr>
<td>BMWA project funding</td>
<td>24,5</td>
<td>24,5</td>
</tr>
<tr>
<td>Institutional funding</td>
<td>144,2</td>
<td>144,8</td>
</tr>
<tr>
<td><strong>In total 2003 (in million Euro)</strong></td>
<td><strong>256,9</strong></td>
<td><strong>293,1</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institutional Funding</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFG Deutsche Forschungsgemeinschaft</td>
<td>60</td>
</tr>
<tr>
<td>WGL Wissenschaftsgemeinschaft G.W. Leibniz</td>
<td>23,6</td>
</tr>
<tr>
<td>HGF Helmholtz-Gemeinschaft</td>
<td>37,1</td>
</tr>
<tr>
<td>MPG Max-Planck-Gesellschaft</td>
<td>14,8</td>
</tr>
<tr>
<td>FhG Fraunhofer-Gesellschaft</td>
<td>5,4</td>
</tr>
<tr>
<td>caesar</td>
<td>3,3</td>
</tr>
<tr>
<td><strong>In total 2003 (in million Euro)</strong></td>
<td><strong>144,2</strong></td>
</tr>
</tbody>
</table>
Germany’s International Position in Nanotechnology

Industrial sector
• About 400-500 companies in GER
• Additional 400-500 in Europe
• ~ 1000 US companies
• ~ 500,000 employees
• Further positive trend

Patents/Publications
• Good position of GER in the nanosciences
• Industrial commitment has to be increased

World market
• At present ~ 100 billion Euro

Funding
• So far: a coherent initiative is missing in GER
• Collaboration between Federal Ministries, Länder, DFG, and other research organizations has to be improved
• EU and US more visible internationally

Conclusions:
• Need for a consistent funding strategy which focuses and clusters competences
• Product-oriented development by networking of major players
• Funding of projects with industrial coordination
Nanotechnology framework programme

Strategic reorientation of the national funding strategy focusing on 3 main objectives

Conquer new markets to create new jobs

Provide support for young scientists and promote education and training

Consider social demands and ethical aspects
Implementation of risk assessment and public dialogue
Instruments for Implementation

- Lead Innovations
- Accompanying Measures
- Clustering of Resources
Clustering of Resources
Centers of Competence and other Organisations

Centers of Competence
- NanOp
- NanoMat
- Nanotechnologie
- Kompetenzzentrum Nanoanalytik
- HansenNanoTech
- CG-NanoBioTech
- CeNTech
- CC-NanoChem

Examples of local and regional networks
- CeNS
- CFN
- NanoBioNET
- CINSAI

Research and sponsorship organisations
- Bundesministerium für Bildung und Forschung
- Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V.
- Fraunhofer Gesellschaft
- Leibniz Gemeinschaft
- Deutsche Forschungsgemeinschaft
- HELMHOLTZ Gemeinschaft
- FhG
- Bundesministerium für Wirtschaft und Arbeit

Deutschland. Das von morgen.
Instruments for Implementation

- Lead Innovations
- Clustering of Resources
- Accompanying Measures
Accompanying Measures in Nanotechnology

- Innovation Supporting Measures
- Young Scientist Competition
- National Contact Point (Participation in FP6)
- NanoTruck (www.nanotruck.net)
- Identifying Trend Qualifications in Nanotechnology
- SME-specific funding activity NanoChance
- Technology Assessment
- Strengthen International Co-operation
3 ongoing studies focusing on:

- Potential of nanotechnology for health
- Economic potential of nanotechnology
- Effects on sustainability by use and development of nanotechnology-based products
Instruments for Implementation

- Lead Innovations
- Clustering of Resources
- Accompanying Measures
Characteristics of Lead Innovations

- Positive effect on **economic growth and employment**
- Orientation towards **value-added chains** with high economic potential (e.g. in electronics)
- Create **new jobs and strengthen the innovative potential** of industry (SME)
- „Enhancing strong points“ (e.g. automotive industry)
- Conquer **new markets** (e.g. nanotechnology-based pharmaceuticals)
- Orientation towards **social demands** (e.g. safer and cleaner cars, health)
- **Networking and clustering** of present and future activities (projects and infrastructure)
- **Risk assessment** (e.g. safety of nanotechnology-based materials)
How is funding of Lead Innovations organized?

- Determination of economically important areas asking for solutions using nanotechnology
- Analysis of areas to identify topics appropriate for the instrument ‘Lead innovation’
- Set-up of an appropriate funding activities with active participation of industrial partners
- Publication of announcement (call for proposals) by BMBF
- Evaluation of proposals by peer review
- Funding
BMBF-Lead Innovations in Nanotechnology

- **NanoFab**  
  Ultra-precision, high-throughput manufacturing for nanoelectronics

- **NanoLux**  
  Efficient light sources for innovative lighting applications

- **NanoMobil**  
  Nanomaterials and nanotechnology in the car

- **NanoforLife**  
  Nanomaterials and nanobiotechnology for life sciences and health
BMBF-Lead innovation NanoFab

300 mm wafer technology - 143 Mio €
- World leadership developed in Germany
- Basis for the nanoelectronics industry in Saxony

Lithography (production technology) - 100 Mio €
- 157 nm lithography
- EUV lithography
- European co-operation partners are becoming world market leaders

Mask technology - 80 Mio €
- drawing American investors to Germany
- combining research and production

Pictures (top to bottom): Infineon Technologies AG, Munich, Carl Zeiss AG, Obercochem, Leica Microsystems AG, Wetzlar
Nanotechnology for energy-saving lighting systems
The aim of future lighting technology: **More efficient lighting yield**

(conventional bulb: 95% of the energy is converted into heat)
worldwide market volume for lighting: 12 billion € (in Germany 20%)
NanoMobil is 90 % Nano + Material + Chemistry

Sustainability
- Low-lubrication cylinders, PEM cell
- Corrosion protection, EMC
- Catalytic, nano-porous filters
- Glare-free windows
- All-round glazing

Safety
- Light weight construction, H₂ storage
- Sensors, vision, environment, interior

Comfort
- Easy-to-clean surface bodywork design
- Effect-switch paint
- Textile conditioning

Source and picture: Deutsche Automobilindustrie
Health is one of the most important basic social values

Demographic changes and availability of new diagnostics and therapies are bringing about a cost explosion in the health system (in Germany 225.9 billion € in 2001).

Potentials of nanotechnology in medicine:

- Development of new diagnostics and therapies (e.g. nano-particles for the treatment of cancer, improved imaging processes)
- Reduction of undesired side effects through specific material delivery and lower dosage (drug delivery system, “theranostics”)
- Long-term: cost reductions in health care through lower manufacturing costs, better prevention, longer-life implants, reduction of side effects
NanoforLife Process

Structuring > Thematic focussing > Implementation

2003
July  December

2004
June  December  January

2005

WS Lead industry

WS drug delivery

WS med. imaging

WS reg. Medicine

Technology Analysis / Documentation

Literature, Conferences, Interviews, ongoing funding activities, FP6

Feedback

Kick-Off event
Deadline proposals
Reviewing process
Start of Funding in 2005

BMBF-announcement NanoforLife

Lead industry  SME  Scientific Community  associations, CCN, funding institutions, etc.
Summary

- The new BMBF funding strategy is more than a classical framework programme
- Implementation of application-oriented lead innovations under industrial coordination
- The total funding budget will be provided by various divisions of the BMBF (cross-border character of nanotechnology)
Thank You For Your Attention!