Facts & Figures 2014
At a Glance

Foundation
11 December 1956

Partners
Federal Republic of Germany (90 %)
Federal State of North Rhine-Westphalia (10 %)

Share capital
€ 520,000

Revenues
€ 617 million

Area
2.2 km²

Employees
Total 5,534
Including:
Scientists 1,924
(of which PhD students with a contract 498)
Technical staff 1,700
Trainees & students on placement 335

Visiting scientists
995 from 39 countries

Board of Directors
Prof. Dr.-Ing. Wolfgang Marquardt
(Chairman since 1 July 2014)
Karsten Beneke (Vice-Chairman)
Prof. Dr. Sebastian M. Schmidt (Member of the Board)
Prof. Dr.-Ing. Harald Bolt (Member of the Board)

Supervisory Board
Ministerialdirigent Dr. Karl Eugen Huthmacher
(Chairman)

Scientific Advisory Council
Dr. Heike Riel (Chairman)

Scientific and Technical Council
Prof. Dr. Hans Ströher (Chairman)

All data (unless otherwise stated) refer to the year 2013; as of 31 Dec. 2013.
Short Profile
Forschungszentrum Jülich pursues cutting-edge interdisciplinary research on the pressing issues of our time. With its competence in materials science and simulation, and its expertise in physics, nanotechnology, and information technology, as well as in the biosciences and brain research, Jülich is developing the basis for the key technologies of tomorrow. In this way, Forschungszentrum Jülich helps to solve the grand challenges facing society in the fields of energy and the environment as well as information and the brain.

Forschungszentrum Jülich is breaking new ground in the form of strategic partnerships with universities, research institutions, and industry in Germany and abroad. With more than 5,000 employees, Jülich – a member of the Helmholtz Association – is one of the large interdisciplinary research centres in Europe.
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Research Fields
The goal of research at Jülich is to contribute to a secure, affordable, and environmentally friendly energy supply. Scientists at Jülich are tapping into new green sources of energy and developing new solutions in the areas of renewables, storage technologies, and energy efficiency. Nuclear waste management is also part of Jülich’s portfolio. In addition, researchers at Jülich are concerned with the consequences of human activities for the climate, while simultaneously focusing on plants as one of the most important sources of nutrition worldwide.

Our brain comprises some 86 billion neurons. Understanding the complex processes within it is the key to the more effective diagnosis and treatment of brain diseases. New findings will also facilitate novel approaches to future information systems, the foundation for which is being laid by scientists from various disciplines working together. At the same time, Forschungszentrum Jülich operates supercomputers which it uses for scientific simulations, for example of the development of proteins in the body, the functioning of semiconductors, and the distribution of greenhouse gases in the atmosphere.
Knowledge Management

Creating Knowledge

More than 1,000 scientific publications in peer-reviewed journals every year and designing and operating internationally sought-after tools and platforms – these achievements reflect the performance of scientists at Jülich. Third-party funding accounts for almost a third of Forschungszentrum Jülich’s research funds, supplementing its regular budget.

Imparting Knowledge

Jülich combined its different forms of support for young people in 2013 in a new strategy known as “juelich_horizons”: from introducing children and teenagers to research and innovative concepts for vocational training right up to excellent conditions for early-career scientists and the opportunity for them to set up their own research group at an early stage, for example a Helmholtz Young Investigators Group.
Its competence in key fields of research and its outstanding infrastructure make Forschungszentrum Jülich a much sought-after partner in industry. Current examples testify to this: Jülich scientists are making it possible to diagnose illnesses and diseases using smartphones, they are optimizing biotechnological methods, and they are developing simulation techniques that could replace complex and time-consuming test runs.
When scientists achieve new insights by means of their research, they share this new knowledge with their colleagues in specialist journals. Scientific publications are therefore an important indication of scientific achievements.

Jülich publications in the last five years

<table>
<thead>
<tr>
<th>Year</th>
<th>Peer-reviewed journals</th>
<th>Books, others</th>
<th>PhD theses, habitations</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1,133</td>
<td>526</td>
<td>61</td>
<td>1,720</td>
</tr>
<tr>
<td>2010</td>
<td>1,048</td>
<td>686</td>
<td>100</td>
<td>1,834</td>
</tr>
<tr>
<td>2011</td>
<td>1,363</td>
<td>651</td>
<td>101</td>
<td>2,115</td>
</tr>
<tr>
<td>2012</td>
<td>1,452</td>
<td>688</td>
<td>93</td>
<td>2,233</td>
</tr>
<tr>
<td>2013</td>
<td>1,485</td>
<td>825</td>
<td>104</td>
<td>2,414</td>
</tr>
</tbody>
</table>

Journals in which Jülich researchers published most frequently

<table>
<thead>
<tr>
<th>Journal</th>
<th>Number of publications 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Review B</td>
<td>65</td>
</tr>
<tr>
<td>Applied Physics Letters</td>
<td>45</td>
</tr>
<tr>
<td>Geophysical Research Abstracts</td>
<td>39</td>
</tr>
<tr>
<td>Physical Review Letters</td>
<td>36</td>
</tr>
<tr>
<td>Physical Review D</td>
<td>31</td>
</tr>
<tr>
<td>Atmospheric Chemistry and Physics</td>
<td>28</td>
</tr>
<tr>
<td>Journal of Nuclear Materials</td>
<td>27</td>
</tr>
<tr>
<td>Journal of Applied Physics</td>
<td>25</td>
</tr>
<tr>
<td>Innovatives Supercomputing in Deutschland</td>
<td>25</td>
</tr>
<tr>
<td>PLOS ONE</td>
<td>24</td>
</tr>
<tr>
<td>Nature</td>
<td>3</td>
</tr>
<tr>
<td>Science</td>
<td>3</td>
</tr>
</tbody>
</table>
Forschungszentrum Jülich | Facts & Figures 2014

Accolades

Prof. Rainer Waser was selected as one of the Leibniz Prize recipients in 2013 by the German Research Foundation (DFG). The award is considered the most important German prize for research. The director at Jülich’s Peter Grünberg Institute (PGI-7) and head of institute at RWTH Aachen University conducts research into electronic materials for future data storage systems, logic devices, energy converters, and sensors.

Prof. Knut Urban, JARA senior professor, shared the Frontiers of Knowledge Award with Prof. Maximilian Haider from CEOS GmbH, Heidelberg, and Prof. Harald Rose, senior professor at the University of Ulm. The Spanish BBVA Foundation decided to bestow the award, which is worth € 400,000, on these pioneers of modern electron microscopy.
Platforms and Users

Jülich coordinates the German contribution to the European Spallation Source (ESS), which is scheduled to go into operation in 2019 in Lund, in the south of Sweden.

Jülich Centre for Neutron Science (JCNS)

There are only a few places in the world where neutron beams provide unique insights into matter. JCNS operates instruments at the world’s leading neutron sources (see p. 20) and also grants access to third-party scientists. Furthermore, it refines the methods of neutron research.

Most of the measuring instruments are stationed at Heinz Maier-Leibnitz Zentrum (MLZ) in Garching. JCNS also operates instruments at the world’s most powerful neutron source, ILL’s high-flux reactor in Grenoble, and – as the only research institution outside North America – at the world’s most powerful pulsed neutron source, SNS at Oak Ridge National Laboratory in the USA.

A glimpse into the experimental hall at the research neutron source Heinz Maier-Leibnitz in Garching
Use of the JCNS neutron scattering instruments by external researchers

<table>
<thead>
<tr>
<th>Instrument (neutron source)</th>
<th>Typical applications</th>
<th>Usage (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BioDiff (MLZ)*</td>
<td>Structure of biological macromolecules</td>
<td>159</td>
</tr>
<tr>
<td>DNS (MLZ)</td>
<td>Complex spin systems, soft matter</td>
<td>118</td>
</tr>
<tr>
<td>HEIDI (MLZ)**</td>
<td>Structure of energy and data storage materials</td>
<td>85</td>
</tr>
<tr>
<td>J-NSE (MLZ)</td>
<td>Thermal fluctuations of surfactants and proteins, dynamics of polymer chains</td>
<td>124</td>
</tr>
<tr>
<td>KWS-1 (MLZ)</td>
<td>Complex liquids at interfaces</td>
<td>32</td>
</tr>
<tr>
<td>KWS-2 (MLZ)</td>
<td>Colloids and microemulsions</td>
<td>131</td>
</tr>
<tr>
<td>KWS-3 (MLZ)</td>
<td>Dissolved particles, porous materials</td>
<td>115</td>
</tr>
<tr>
<td>MARIA (MLZ)</td>
<td>Structure of thin magnetic layer systems</td>
<td>61</td>
</tr>
<tr>
<td>PANDA (MLZ)</td>
<td>Spin waves, crystal field excitations, phonons</td>
<td>124</td>
</tr>
<tr>
<td>POLI (MLZ)**</td>
<td>Complex magnetic structures</td>
<td>27</td>
</tr>
<tr>
<td>SPHERES (MLZ)</td>
<td>Dynamics in liquids, phase transitions</td>
<td>120</td>
</tr>
<tr>
<td>IN12 (ILL)</td>
<td>Magnetic excitations, switching behaviour of multiferroic systems, dynamics of amorphous materials and biological model membranes</td>
<td>31</td>
</tr>
<tr>
<td>NSE (SNS)</td>
<td>Molecule dynamics in soft and condensed matter, polymer melts, mixtures of rubber, complex fluids</td>
<td>28</td>
</tr>
</tbody>
</table>

* in cooperation with TU Munich  ** operated by RWTH Aachen University
Jülich Supercomputing Centre (JSC)
JSC operates supercomputers of the highest performance class in Europe and provides support for scientists and engineers at Forschungszentrum Jülich, in German and European universities and research institutions, and in industry when it comes to solving highly complex problems with simulation calculations.

Jülich’s supercomputer JUQUEEN is one of the fastest computers in Europe, achieving a peak performance of almost six quadrillion arithmetic operations per second.

Allocation of computing time to external users
GCS: Gauss Centre for Supercomputing (association of the three national supercomputing centres JSC, HLRS, and LRZ)
NIC: John von Neumann Institute for Computing (national allocation body, funded by the three Helmholtz centres FZJ, DESY, and GSI)
GRS: German Research School for Simulation Sciences (graduate school run jointly by RWTH Aachen University and Forschungszentrum Jülich)
PRACE: Partnership for Advanced Computing in Europe (European HPC infrastructure)
DECI: DEISA Extreme Computing Initiative
DEISA: Distributed European Infrastructure for Supercomputing Applications (European HPC infrastructure, forerunner of PRACE)
The Jülich supercomputers are used extensively by scientists outside Forschungszentrum Jülich. Computing time is allocated by independent science committees.

Computing time by users

**JUQUEEN**
- Forschungszentrum Jülich: 27%
- GCS and PRACE Tier-0: 71%
- GRS: 2%

**JUROPA**
- Forschungszentrum Jülich: 44%
- PRACE Tier-1 (DECI): 4%
- NIC national: 48%
- NIC international: 2%
- GRS: 2%

Research fields of ongoing European projects

**JUQUEEN (PRACE Tier-0)**
- Fundamental Constituents of Matter: 52%
- Medicine and Life Sciences: 8%
- Universe Sciences: 11%
- Computer Science and Informatics: 1%
- Physical and Analytical Chemical Sciences: 15%
- Mathematics: 2%
- Condensed Matter Physics: 11%

*Based on the periods Nov. 2012 – Oct. 2013 and May 2013 – April 2014*
Ernst Ruska-Centre (ER-C)

Forschungszentrum Jülich and RWTH Aachen University jointly operate ER-C as a centre for atomic-resolution electron microscopy and spectroscopy at the highest international level. At the same time, it is the first national user centre for ultrahigh-resolution electron microscopy.

The electron microscope PICO images atomic structures right down to displacements as tiny as 50 billionths of a millimetre – a record resolution that is paving the way for progress in energy research and information technologies.

Users of the ER-C electron microscopes

About half of the time available for measurements on the three Titan microscopes (PICO, TEM, STEM) is allocated to universities, research institutions, and industry by a body that is appointed by the German Research Foundation.

Regional background

- Rest of the world: 20%
- NRW: 18%
- 38% Europe
- 24% Germany (excl. NRW)
Institute of Neuroscience and Medicine (INM)
INM focuses on the structure and function of the healthy and diseased human brain. It aims to understand the changes associated with neurological and psychiatric disorders, and thus improve their diagnosis and treatment. Scientists here work with imaging techniques such as structural and functional magnetic resonance imaging (MRI), positron emission tomography (PET), and hybrid systems combining the two techniques.

The 9.4 T MR-PET hybrid device with a field strength of 9.4 tesla provides unique insights into the brain.

Use of the 3 T MR-PET hybrid scanner in collaborative projects with external hospitals
In 2013, a total of 60 patients were examined from the neurosurgical departments of the university hospitals in Düsseldorf and Cologne as well as from the radiotherapy department of University Hospital RWTH Aachen. In addition, 48 patients from the department of neurology at University Hospital Cologne were examined, as were 8 patients from the department of nuclear medicine and 3 patients from the department of nuclear medicine at University Hospital Düsseldorf.
Institutes and Subinstitutes

- **Institute for Advanced Simulation**
  - Jülich Supercomputing Centre
  - Quantum Theory of Materials
  - Theory of Soft Matter and Biophysics
  - Theoretical Nanoelectronics
  - Theory of the Strong Interactions
  - Computational Biomedicine
  - Theoretical Neuroscience

- **Institute of Bio- and Geosciences**
  - Biotechnology
  - Plant Sciences
  - Agrosphere

- **Institute of Complex Systems**
  - Neutron Scattering
  - Theory of Soft Matter and Biophysics
  - Soft Matter
  - Cellular Biophysics
  - Molecular Biophysics
  - Structural Biochemistry
  - Biomechanics
  - Bioelectronics

- **Institute of Energy and Climate Research**
  - Materials Synthesis and Processing
  - Microstructure and Properties of Materials
  - Electrochemical Process Engineering
  - Plasma Physics
  - Photovoltaics
  - Nuclear Waste Management and Reactor Safety
  - Stratosphere
  - Troposphere
  - Fundamental Electrochemistry
  - Systems Analysis and Technology Evaluation
  - Helmholtz Institute Erlangen-Nürnberg Renewable Energy Production
Nuclear Physics Institute
- Experimental Hadron Structure
- Experimental Hadron Dynamics
- Theory of the Strong Interactions
- Large-Scale Nuclear Physics Equipment

Institute of Neuroscience and Medicine
- Structural and Functional Organization of the Brain
- Molecular Organization of the Brain
- Cognitive Neurology
- Physics of Medical Imaging
- Nuclear Chemistry
- Computational and Systems Neuroscience
- Neuromodulation
- Ethics in the Neurosciences
- Computational Biomedicine

Jülich Centre for Neutron Science
- Neutron Scattering
- Scattering Methods

Peter Grünberg Institute
- Quantum Theory of Materials
- Theoretical Nanoelectronics
- Functional Nanostructures at Surfaces
- Scattering Methods
- Microstructural Research
- Electronic Properties
- Electronic Materials
- Bioelectronics
- Semiconductor Nanoelectronics

Central Institute of Engineering, Electronics and Analytics
- Engineering and Technology
- Electronic Systems
- Analysis
Work at Other Locations

Scientists from Jülich operate top-class research instruments not only on campus but also at several other locations in Germany and throughout the world. In so doing, they cooperate closely with selected partners. In addition, Jülich is active in supporting young talent, and its project management organizations have several branch offices in Germany.

1. Helmholtz institutes for renewable energy
Printable photovoltaics and innovative energy storage using hydrogen provide the focus for work at the Helmholtz Institute Erlangen-Nürnberg Renewable Energy Production (HI ERN). Another of Jülich’s external subinstitutes located on a university campus is the Helmholtz Institute Münster (HI MS). It aims to foster long-term collaboration in battery research.

2. Global experiments with neutrons
The Jülich Centre for Neutron Science (JCNS) operates instruments at the world’s most powerful neutron sources: Heinz Maier-Leibnitz Zentrum in Garching, the high-flux reactor in Grenoble, and at the world’s most powerful pulsed neutron source SNS at Oak Ridge National Laboratory in the USA (see p. 12).

3. Synchrotron experiments in Germany and abroad
The Peter Grünberg Institute coordinates experiments on the electronic and magnetic properties of materials at synchrotron sources in Dortmund, Berlin, Trieste (Italy), and Argonne (USA).
Cooperation par excellence with Aachen
Forschungszentrum Jülich works very closely with RWTH Aachen University in the Jülich Aachen Research Alliance (JARA; see p. 35). In addition, they jointly run the German Research School for Simulation Sciences, an independent school for master’s and PhD students (see p. 25).

Biotechnology Cluster
BIO.NRW with headquarters in Düsseldorf aims to foster technology transfer between research, industry, investors, and politics.

Project Management Jülich
The project management agency with the highest turnover in Germany has offices in Jülich, Berlin, Bonn, and Rostock and works as a largely independent organization on behalf of the German federal government and federal states as well as for the European Commission.

Project Management Organization Energy, Technology, Sustainability (ETN)
Project Management ETN has been working for the federal state of North Rhine-Westphalia for over 20 years. It is financed completely by commissions from the federal state.

International representation
Forschungszentrum Jülich’s India Office in New Delhi coordinates energy and environmental research activities. As a member of the Helmholtz Association (HGF), Jülich is also represented internationally by the HGF’s offices in Brussels, Moscow, and Beijing.
Personnel

A total of 995 visiting scientists from 39 countries conducted research at Jülich in 2013 in addition to the 1,924 scientists employed by Jülich.

Overview personnel

<table>
<thead>
<tr>
<th>Area</th>
<th>Numbers as of 31 Dec. 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific and technical personnel</td>
<td>3,624</td>
</tr>
<tr>
<td>of which scientists incl.</td>
<td></td>
</tr>
<tr>
<td>university students</td>
<td>1,924</td>
</tr>
<tr>
<td>• of which PhD students</td>
<td>498</td>
</tr>
<tr>
<td>• of which undergraduates/postgraduates</td>
<td>110</td>
</tr>
<tr>
<td>• of which scholarship holders</td>
<td>21</td>
</tr>
<tr>
<td>• of which professors (W salary grades)**</td>
<td>104</td>
</tr>
<tr>
<td>• of which W3 professors</td>
<td>47</td>
</tr>
<tr>
<td>• of which W2 professors</td>
<td>47</td>
</tr>
<tr>
<td>• of which W1 professors</td>
<td>10</td>
</tr>
<tr>
<td>Technical personnel</td>
<td>1,700</td>
</tr>
<tr>
<td>Project management organizations</td>
<td>877</td>
</tr>
<tr>
<td>Administration incl. Board of Directors</td>
<td>698</td>
</tr>
<tr>
<td>Trainees and students on placement</td>
<td>335</td>
</tr>
<tr>
<td>Total</td>
<td>5,534</td>
</tr>
</tbody>
</table>

* only employees with a contract paid by Jülich
** excl. members of the Board of Directors

Women as a percentage of total employees

Forschungszentrum Jülich is an equal opportunities employer. It aims to appoint a woman to every third vacant or new scientific position by 2017.
Revenues and Third-Party Funds

In 2013, Forschungszentrum Jülich acquired third-party funds totalling €197.8 million, which was €25.6 million more than the previous year. Most of these funds came from research commissions from industry, the acquisition of funding, and from project management organizations.

In addition, Forschungszentrum Jülich received subsidies from the German federal government (90%) and the state government (10%) totalling €465.2 million including changes in provisions.

Revenue

Third-party funds

- €197.8 million | 32.0%
- €419.5 million | 68.0%

Subsidies from federal and state governments without changes in provisions, of which dismantling projects: €57.4 million

Revenues in 2013 without changes in provisions

(in thousands of euros)

<table>
<thead>
<tr>
<th>Area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU funding</td>
<td>19,459</td>
</tr>
<tr>
<td>National project funding (excl. DFG)</td>
<td>72,180</td>
</tr>
<tr>
<td>incl. transferred subsidies</td>
<td>22,522</td>
</tr>
<tr>
<td>DFG funding</td>
<td>6,879</td>
</tr>
<tr>
<td><strong>Subtotal project funding</strong></td>
<td>98,518</td>
</tr>
<tr>
<td>Contracts, abroad</td>
<td>2,552</td>
</tr>
<tr>
<td>Contracts, Germany</td>
<td>21,069</td>
</tr>
<tr>
<td>Project management organizations</td>
<td>75,689</td>
</tr>
<tr>
<td><strong>Subtotal third-party funds</strong></td>
<td>197,828</td>
</tr>
<tr>
<td>Subsidies from federal and state governments</td>
<td>419,504</td>
</tr>
<tr>
<td>incl. dismantling projects</td>
<td>57,404</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>617,332</td>
</tr>
</tbody>
</table>
Talented young researchers from Germany, Europe, and all over the world benefit from exceptional conditions at Jülich that help them kick-start their career: as PhD students in the institutes, within the scope of one of the various support programmes, or as head of their own young investigators group.

Support for young leaders
Heading a young investigators group offers scientists early independence and superb career opportunities. Forschungszentrum Jülich also participates in the Helmholtz Postdoc Programme. Funding for up to three years enables young scientists to enhance their own research profile directly after their PhD. Another form of recognition is the Jülich Excellence Prize, which is awarded by a panel of recognized experts.

Number of young investigators groups at Jülich
Opportunities for undergraduates, postgraduates, and PhD students

At Jülich, undergraduates, postgraduates, and PhD students are given the opportunity to work on interesting research projects at an early stage. In 2013, 895 PhD students were supervised at Forschungszentrum Jülich. Of these, 310 (35 %) were women and 297 (33 %) came to Jülich from abroad. Forschungszentrum Jülich works together with universities in 22 graduate schools and research training groups. Three initiatives are coordinated by Forschungszentrum Jülich.

The international Helmholtz research school BioSoft provides excellent opportunities for PhD theses in fields where biology, chemistry, and physics intersect.

35 PhD students | 19 supervising scientists
6 PhD theses* | 18 publications by PhD students*

Almost all PhD students at Jülich working in the field of energy and environment are enrolled in the programme at the Helmholtz graduate school HITEC.

155 PhD students | 39 supervising scientists
20 PhD theses*

The German Research School for Simulation Sciences (GRS) is a legally independent subsidiary of Forschungszentrum Jülich and RWTH Aachen University; it offers master’s and PhD students the opportunity to learn the basics of simulation science and conduct top research.

25 PhD theses | 7 supervising scientists
6 PhD theses* | 22 publications*
54 master’s students | 17 master’s dissertations*

INFO Strategic support for young talent
Jülich combined its different forms of support for young people of all ages in 2013 in a new strategy known as “juelich_horizons”: www.fz-juelich.de/juelich_horizons

*completed/published in 2013
Vocational Training and Dual Study Programmes

Vocational training at Jülich
Forschungszentrum Jülich offers first-rate training opportunities and is the largest vocational training centre in the region.

<table>
<thead>
<tr>
<th>Places for trainees</th>
<th>New trainees 2013</th>
<th>Incl. dual study programmes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory technicians</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>Electricians</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>Metalworkers</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Technical product designers</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Administrative occupations</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>Math. and techn. software developers</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>112</strong></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

Dual study programmes
Vocational training plus university studies – this is the essence of dual study programmes. Generally, these programmes take three to four years to complete.

<table>
<thead>
<tr>
<th>University course</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Scientific Programming</td>
<td>Mathematical and technical software developer (MATSE)</td>
</tr>
<tr>
<td>Bachelor of Science or Bachelor of Engineering</td>
<td>Chemical laboratory technician</td>
</tr>
<tr>
<td>Bachelor of Physical Engineering</td>
<td>Physics laboratory technician</td>
</tr>
<tr>
<td>Bachelor of Mechanical Engineering</td>
<td>Industrial mechanic</td>
</tr>
<tr>
<td>Bachelor of Electrical Engineering</td>
<td>Electronics technician for industrial engineering</td>
</tr>
<tr>
<td>Bachelor of Arts in Business Admin</td>
<td>Office communications specialist</td>
</tr>
</tbody>
</table>

Part-time university courses
Biological and chemical laboratory technicians who wish to gain further qualifications while in employment have the opportunity to pursue a part-time, fast-track bachelor’s over four semesters at Hogeschool Zuyd in Heerlen, the Netherlands.
Programme for Children and Young People

About 4,500 children and young people visit Forschungszentrum Jülich every year. School classes can experience the fascination of science in the institutes or at Jülich’s Schools Laboratory, JuLab.

JuLab supports schools by providing a box of experiments as well as organizing training for teachers and offering classroom assistance. It also hosts the regional heat of the annual “Jugend forscht” competition for young researchers and runs research weeks during the school holidays for children and teenagers who are particularly interested and talented.

www.julab.de
International Networks

Whoever shares their knowledge wins in many ways. Forschungszentrum Jülich cooperates with numerous partners from science and industry. In 2013, Jülich was involved in 381 nationally funded projects and 179 EU projects. A total of 65 of these alliances were coordinated by Forschungszentrum Jülich.

JARA-FIT: Creating the basis for the IT of tomorrow

In the German Research Foundation’s (DFG) Collaborative Research Centre SFB 917, scientists from the Jülich Aachen Research Alliance (JARA) are developing and testing nanoelectronic devices made of special materials that could make computers and smartphones even more powerful and energy-efficient. These “memristive” elements are expected to establish a footing in the next few years as data storage systems. When connected to form artificial neural networks, they could even pave the way towards a new generation of intelligent computers.
Exploring the atmosphere with commercial airliners

Civil airliners are predestined to collect climate data in the lower few kilometres of the atmosphere. This region reacts most strongly to climate changes. Five aircraft have been kitted out with instruments to collect data for the IAGOS project. They detect small-scale fluctuations in the concentration of trace gases and record the distribution of water droplets and ice particles. The research alliance initiated and coordinated by Jülich’s Institute of Energy and Climate Research (IEK-8) involves 17 European partners. Between 2011 and May 2014, climate measurements were performed on a total of 3,246 flights.

Accelerating the development of exascale computers

Creating the next generation of supercomputers necessitates the resolution of a number of technical issues. In the DEEP-ER project coordinated by Forschungszentrum Jülich, experts from the Jülich Supercomputing Centre (JSC) are working with 14 European partners to improve the reliability and data transmission speed of computers. Such an “exascale” system is also required for the Human Brain Project in which Jülich scientists play a central role. In this European flagship project, researchers aim to simulate the human brain as a whole in order to improve our understanding of it.
Collaborations in Germany and Abroad

- **ITER**: Components for the international fusion experiment
- **METPORE II**: Metal-supported ceramic membranes for gas separation
- **HPC for Fusion**: High-performance computing for fusion research applications
- **Deep/Deep-ER**: Dynamical Exascale Entry Platform/Extended Reach
- **PRACE 1IP-2IP-3IP**: European supercomputing infrastructure
- **Petaflop computer**: Construction and expansion
- **ESMI**: European Soft Matter Infrastructure
- **ESS**: Redesigning the European Spallation Source
- **ESSM**: European Soft Matter Infrastructure
- **VITI**: Virtual Institute for Topological Insulators
- **GRS**: German Research School for Simulation Sciences
- **POLPBAR**: Experimental setup with polarized antiprotons
- **Helmholtz Alliance on Systems Neurosciences**
- **Simulation Science**
- **Key Technologies**

Information and the Brain

- **Human Brain Model**: Helmholtz Alliance on Systems Biology

Green power plants

- **Nanoelectronics**

Supercomputing

- **Neutron research**

Complex systems

- **ESSM**: European Soft Matter Infrastructure

- **VITI**: Virtual Institute for Topological Insulators

- **GRS**: German Research School for Simulation Sciences

- **POLPBAR**: Experimental setup with polarized antiprotons

- **Helmholtz Alliance on Systems Neurosciences**

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- **Helmholtz Alliance on Systems Neurosciences**

- **Simulation Science**
Industrial Partners

Forschungszentrum Jülich forms strategic alliances with industry in order to transform research results into concrete applications for society at large.

Examples of Jülich’s industrial collaborations

- **Evonik Degussa GmbH**: Solar cells based on printable liquid Si and/or Ge compounds
- **IME Metallurgische Prozesstechnik und Metallrecycling**: Assessment and optimization of the sustainability of rare earths
- **COGEMA**: Product control and qualification
- **BASF SE**: Computing time on the cluster system JUROPA
- **Lufthansa-Technik AG**: Technology development near-net shape coatings (HEBe)
- **MAN Turbo AG**: Oxidation tests on samples
- **MTU Aero Engines GmbH**: Development of an oxidation lifetime model
- **Aixtron AG**: XRF measurements
In 2013, scientists at Jülich collaborated on a total of 294 projects – 218 national and 76 international – with partners from industry.

<table>
<thead>
<tr>
<th>Partner Name</th>
<th>Project Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrium GmbH</td>
<td>Measurement campaigns – planning, design, performance</td>
</tr>
<tr>
<td>Siemens AG</td>
<td>High-temperature crack propagation tests</td>
</tr>
<tr>
<td>V&amp;M Deutschland GmbH</td>
<td>Long-term steam oxidation</td>
</tr>
<tr>
<td>Federal-Mogul Nürnberg GmbH</td>
<td>Development of an image analysis system</td>
</tr>
<tr>
<td>Von Ardenne Anlagentechnik GmbH</td>
<td>Evaluation of ZnO substrates</td>
</tr>
<tr>
<td>GeoS4 GmbH</td>
<td>Pyrolysis measurements</td>
</tr>
<tr>
<td>Gasunie Deutschland GmbH &amp; Co. KG</td>
<td>Ground-radar-supported location of tree roots</td>
</tr>
<tr>
<td>Research Instruments GmbH</td>
<td>Metal-ceramic joints</td>
</tr>
</tbody>
</table>
Scientists working at Jülich are appointed professor in a joint procedure with a partner university. In accordance with the Jülich model, those who are appointed professor are simultaneously seconded by the university to work at Forschungszentrum Jülich.

In the reverse Jülich model, professors whose primary employment is at their university also work at Jülich (secondary employment).
JARA – Jülich Aachen Research Alliance

Close cooperation between Forschungszentrum Jülich and RWTH Aachen University dates back to the first round of the Excellence Initiative in 2007 and is moving forward within the second round of the Initiative which began in 2012. This form of collaboration between two strong partners from research and education is unique in Germany.

Sections
JARA-BRAIN: Investigating psychological and neurological diseases
JARA-FIT: New approaches in information technology
JARA-HPC: Computer simulation with supercomputers
JARA-ENERGY: Energy research for the future
JARA-FAME: Particle physics and antimatter

Facts and figures
Budget: € 500 million
Volume of investments: € 60 million
Funds from the Excellence Initiative: approx. € 13.6 million

The number of joint professorial appointments (W salary grades) increased from 11 in 2006 to 45. In 2013, JARA members produced a total of 1,276 peer-reviewed publications. The number of joint publications in 2013 was 724 (at the time of data collection in May 2014).

Joint support for young scientists
With its structured programmes for PhD students and intensive support and guidance from specialists, JARA offers training opportunities for outstanding early-career scientists. In addition, it has established other programmes such as the Master of Simulation Sciences and offers specialized junior professorships such as the “clinician scientist”. The latter combines clinical and research work at both Aachen and Jülich.
Technology Transfer

Jülich research yields innovations that benefit both industry and society.

Three examples

Developing tyre material on the computer
Scientists from Jülich’s Peter Grünberg Institute have succeeded in simulating the behaviour of rubber tyres on computers. The interest in virtual tyre tests has been heightened by a new EU regulation that requires tyre characteristics to be specified.

Glowing bacteria light the way towards a new company
A genetic addition makes productive bacteria glow so that they can be quickly identified. With € 2.6 million from the GO-Bio competition for business spin-offs, two Jülich scientists have set up their own company to develop the method for biotechnology to market maturity.

Malaria diagnosis on a smartphone
With the aid of nanosensors made from conductive inks, infectious diseases like malaria can be diagnosed regardless of medical infrastructure. In the LIVECheck project, researchers from Jülich are working on an automated process to manufacture the sensors cheaply.
### Patents

**Patent applications and patents granted 2013**

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent applications Germany</td>
<td>41</td>
</tr>
<tr>
<td>Priority applications</td>
<td></td>
</tr>
<tr>
<td>Germany (incl. utility models)</td>
<td>42</td>
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<tr>
<td>Patent applications abroad</td>
<td>50</td>
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<tr>
<td>of which priority applications</td>
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<tr>
<td>Total patents granted</td>
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<tr>
<td>of which technologies for which a patent was granted for the first time</td>
<td>36</td>
</tr>
<tr>
<td>Patents granted Germany</td>
<td>13</td>
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<tr>
<td>Patents granted abroad</td>
<td>85</td>
</tr>
<tr>
<td><strong>Total number of protective rights</strong></td>
<td>17,559</td>
</tr>
</tbody>
</table>

### Licences

**Number of licences**

<table>
<thead>
<tr>
<th>Lizenz</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number</td>
<td>104</td>
</tr>
<tr>
<td>of which new</td>
<td>5</td>
</tr>
<tr>
<td>of which expiring</td>
<td>3</td>
</tr>
<tr>
<td>Total share abroad</td>
<td>30</td>
</tr>
<tr>
<td>Share USA (most important partner country)</td>
<td>11</td>
</tr>
<tr>
<td>Share SMEs</td>
<td>69</td>
</tr>
<tr>
<td>Income from licences 2013</td>
<td>€ 1.001 million</td>
</tr>
</tbody>
</table>

### INFO Patents & licenses

Patents protect inventions. By licensing a patent, the patent holder or patent applicant gives others the right to use the protected invention commercially.
INFO Sustainable campus

Forschungszentrum Jülich believes in sustainable development – not only within the realm of science, but also in its everyday work.

Sustainability Report 2012/2013
www.fz-juelich.de/zukunftscampus
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Brochures and apps
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