The missionary from Munich

Germany's network of national research centres is trying to reinvent itself. Alison Abbott talks to Rudi Balling, the dynamic biologist charged with revitalizing one of the country's scientific underachievers.

Any research institute with the word 'national' in its title should be some thing special. Especially if it is in Germany, a country with a reputation for scientific excellence. But curiously many of Germany's 16 national research centres are failing to live up to this billing.

Ask researchers from outside the country to identify a leading German research centre and the chances are they will name one of the prestigious institutes run by the Max Planck Society. It is unlikely, however, that anyone will mention the National Centre for Biotechnological Research (GBF) in Braunschweig.

But biologist Rudi Balling has plans to change all that when he takes over the reins at the GBF later this year. At 47, Balling will be the youngest director a German national research centre has ever had. This is no coincidence — Balling's appointment is part of a broader push by all of the centres to rejuvenate and modernize themselves. "We very much need young directors," says Detlev Ganten, director of the Max Delbrück Centre for Molecular Medicine in Berlin, and chairman of the Helmholtz Association, the umbrella organization that oversees the national research centres.

Reversing the decline

Germany's first national research centres were established in the mid-1950s to support nuclear research (see table). Later additions focused on other specific missions, mostly in applied science. But as political opinion swung against all things nuclear in the 1980s, the nuclear centres shifted their efforts towards environmental research. In doing so, they lost focus. Some other centres, including the GBF, failed to keep pace with developments in their fields.

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German unification brought a flurry of activity, as three new centres were created in the former East Germany — including the Max Delbrück Centre. But expansion eastwards did not solve the fundamental problems. Although there are islands of excellence — the German Cancer Research Centre (DKFZ) in Heidelberg, for instance, boasts leading groups in molecular biology, and the DESY in Hamburg remains one of the world's premier centres for high-energy physics — the general story has been one of slow decline.

Over the past decade, the staffing budgets for all the national research centres have been cut by one-and-a-half per cent each year. Politicians have accused many of the centres, with their ageing populations of tenured research staff, of being out of tune with the needs of modern German society. In this context, Balling's appointment is significant, because he has already initiated a turnaround at the National Research Centre for Environment and Health (GSF) in Munich, in his current role as director of its Institute of Mammalian Genetics.

Spend a few hours in Balling's company, and the impression that comes across is of a scientific version of the film star Robin Williams. He is quick-talking, humorous and energetic. Balling also has the knack of being in the right place at the right time. After completing a PhD in nutrition at the University of Bonn in 1985, he moved into developmental biology. In 1987, he joined Peter Gruss, director of the Max Planck Institute for Biophysical Chemistry in Göttingen, who was the first to clone members of two key families of development genes, *Hox* and *Pax*, in the mouse.

Balling's job was to find out what the genes controlled, and he became the first to assign a definite function to one of these genes in a vertebrate. He showed that

Germany's national research centres

Name	Abbreviation	Founded	No. of staff	Location	Research areas
Research Centre Jülich	FZJ	1956	4,200	Jülich	Materials, energy, informatics, biotechnology, environment
Research Centre Karlsruhe	FZK	1956	3,508	Karlsruhe	Physics, energy, biotechnology, environment, microsystems engineering
GKSS Research Centre Geesthacht	GKSS	1956	750	Geesthacht	Environment, materials
Deutsches Elektronen-Synchrotron	DESY	1959	1,550	Hamburg	High-energy physics
Hahn Meitner Institute	HMI	1959	678	Berlin	Materials, solar energy
GSF — National Research Centre for Environment and Health	GSF	1960	1,500	Munich	Health, environment
Institute of Plasma Physics	IPP	1960	980	Garching	Plasma physics
German Cancer Research Centre	DKFZ	1964	1,594	Heidelberg	Cancer research
National Centre for Biotechnological Research	GBF	1968	575	Braunschweig	Biotechnology, health, environment
German National Research Centre for Information Technology	GMD	1968	1,200	Bonn	Informatics
German Aerospace Centre	DLR	1969	4,500	Cologne	Space, aeronautics
National Research Centre for Heavy-Ion Research	GSI	1969	700	Darmstadt	Heavy-ion research
Alfred Wegener Institute for Polar and Ocean Research	AWI	1980	620	Bremerhaven	Polar and oceanic research
UFZ Centre for Environmental Research Leipzig-Halle	UFZ	1991	620	Leipzig	Environment
Max Delbrück Centre for Molecular Medicine	MDC	1992	700	Berlin	Medical research
GeoForschungsZentrum Potsdam	GFZ	1992	585	Potsdam	Earth sciences

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Balling: sitting on a scientific "gold mine".

overexpression of the *Hoxa-7* gene leads to a change in the characteristics of vertebrae in mice. "It made people aware of the power of mouse genetics," he says. Later, Balling's work on a mouse *Pax* gene led to the first association of the gene family with a human inherited disorder: Waardenburg syndrome, which is characterized by skull abnormalities, often accompanied by deafness.

His big break came in 1993, with the post at the GSF. At that time, the pressure on the centre to justify its existence with a credible mission was at its height. But Balling arrived with a clear concept of how to modernize his department.

"I found strange radiation labs, with a bit of genetics, and big old animal houses with well-trained and motivated staff," Balling recalls. This set-up was designed to serve the GSF's original mission of investigating the biological effects of radiation — "old-fashioned risk assessment", Balling calls it. But he realized it could also serve "modern-style risk assessment — the study of genetic disposition". He encouraged the GSF to refocus its efforts onto the genetic influences underlying the varied ways individuals respond to drugs and toxic chemicals — the emerging fields of pharmacogenomics and toxicogenomics. He added programmes in developmental genetics and human genetics, and launched a genome analysis centre.

One of Balling's most significant achievements is his conversion of part of the GSF's animal facilities into a large-scale mutagenesis screen to support research into gene function. This screen — one of only two in the world on such a scale — uses chemical mutagens randomly to generate mutant mice. Tens of thousands of mice are screened every year. By correlating their particular abnormalities with the genes that are mutated, scientists can investigate what these genes normally do. The screen is supported by the German Human Genome Project, which was launched in 1995, just at the right time for Balling to begin his project on the scale he felt was needed.

Not surprisingly, given the proliferation of new projects, Balling's department has increased from 30 scientists to more than a hundred. "I wanted to expand as fast as possible, because to my mind critical mass is everything," he says.

Focusing on the future

Balling now wants to bring a similar approach to the GBF. "Things have to change," he explains. "More than ever we have to justify our existence, and you need a strong mission to do this, which also has to be unique."

The GBF was founded in 1968, primarily to develop biological processing technologies. But as the cutting edge of biotech research has moved away from the big fermenters that were the GBF's forte, the centre has found itself in need of a fresh focus. Balling believes he can provide one.

While many of the world's biologists prepare for the post-genomic era, in which the main task will be unravelling the functions of newly sequenced genes, Balling's vision for the GBF is to surf the next wave — genome–genome interactions. Specifically, Balling plans to develop an interdisciplinary approach to host–pathogen interactions. He wants to forge links between the GBF's currently disjointed departments, using genetics and genomics as the common ground. He aims to address questions about individual susceptibility to both disease and antibiotic resistance, and to investigate what happens when two genomes — for example, from a bacterium and a human — meet and fight it out.

The potential is enormous, Balling claims. The GBF already has many of the right tools, including sequencing and proteomics facilities, courtesy of the German Human Genome Project. A brand new mouse facility has opened recently, and the GBF shares a campus with the German Collection of Microorganisms and Cell Cultures, and one of Germany's only academic facilities certified to prepare proteins or DNA for clinical use. "It's like sitting on a gold mine," says Balling.

Critical to the success of Balling's initiative, however, is the need for more genomic information on bacteria. Fortunately, the German Human Genome Project will next week announce a microbial genome programme. As ever, it seems, Balling finds himself in the right place at the right time.

But will the GBF's gain be the GSF's loss? Ganten thinks not, because Balling has taken care to develop the careers of the scientists he is leaving behind. "Rudi is a very generous person and is leaving many of the projects he established at the GSF in the hands of even younger colleagues," says Ganten. "The GSF will survive very well."

Rewarding excellence

The Helmholtz Association is also planning changes which it believes will strengthen the entire research centre network. It wants to concentrate resources in the hands of the most dynamic researchers across all the national centres. At present, each centre receives 90 per cent of its core research funding from the federal government, and distributes this budget among its scientific staff. Instead, the association wants to pool most of the federal money into six programmes covering areas considered to be national priorities: life sciences, energy, basic physics, transport, environment and space. Researchers from across the entire network of national research centres would then compete for these funds.

By placing the future of Germany's national research centres in the hands of scientists such as Balling, and moving funding into competitive research grants, Ganten believes the Helmholtz Association is well on the way to enacting the reforms that have been demanded. "In response to political pressure, we have changed the orientation of many of our research centres," he says.

Ganten is now looking to the politicians to reward the centres for these changes. "We have been suffering too many cuts in budget for too many years," he claims. "Now we are more agile, but we really do need more money to ensure that our efforts are productive." ■

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- **http://www.helmholtz.de**
- **http://www.gbf.de/index-uk.html**
- **http://www.gsf.de/gsf/englisch/index.html**

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