

CAREERS

TURNING POINT Engineer moves into robotics to develop better prostheses **p.521**

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The Brandenburg Gate in Berlin presides over a city that hosts three universities deemed excellent in a federal initiative.

GERMANY

Excellence revisited

The second phase of the German Excellence Initiative is helping scientists and universities. But sustaining its gains in the long term could be a challenge.

BY QUIRIN SCHIERMEIER

Peter Fierlinger talks with disarming modesty about his achievements and aspirations. It is easy to forget that the 34-year-old neutron researcher can already look back on a remarkable career exploring hot topics in fundamental physics. “A wunderkind? Heaven forbid, I was rather a late bloomer,” he says. “I guess I was in the right place at the right time.”

For Fierlinger, the right place was the Technical University of Munich (TUM) in Germany, where he leads a high-profile research group studying the origin and structure of the

Universe. The right time was four years ago, when the TUM physics department offered him a tenure-track position. The department was growing after an injection of money from Germany's Excellence Initiative, a government-funded €4.6-billion (US\$5.6-billion) scheme to make Germany's university research system more attractive to international talent and more competitive with systems in the United Kingdom, the United States and elsewhere. The German science ministry announced awards in the initiative's second phase last month, and many more researchers stand to benefit.

At a time when recession and debt crises have prompted other countries to freeze or cut

public spending on science, the awards have helped to buoy German research. The programme has created 17,000 science jobs at all levels, says the German Research Foundation (DFG), the country's main funding agency. Supporting postdocs has been a particular goal. And much of the money is being used for hiring and to attract foreign talent. But the initiative is set to end in 2017. To ensure that its impact lasts and that job gains are permanent, the government and universities will have to find ways to keep making big investments.

The TUM was one of the winners in the Excellence Initiative's first round, in 2006. Alongside the Ludwig Maximilian ▶

► University (LMU) in Munich, Karlsruhe University (now part of the Karlsruhe Institute of Technology), the Free University of Berlin and the universities of Konstanz, Freiburg, Heidelberg, Göttingen and Aachen, the TUM also received an award for ‘future concepts’, to fund a campus-wide programme of development and improvement. The initiative also funded graduate schools and large-scale research collaborations — ‘excellence clusters’ — across all disciplines. A substantial portion of the money went towards salaries and recruiting.

The second phase of awards spreads cash across 99 separate projects at almost 40 institutions (see ‘Excellence all round’), including large-scale projects at universities from Bremen in the north to Konstanz in the south — each offering job opportunities. There are now 43 clusters of excellence: 31 carried forward from the first phase, and 12 new ones, with projects including the Immune Sensory System in Bonn, BrainTools in Freiburg and Systems Neurology at the LMU.

Future-concepts awards at six institutions have been renewed, and new awards have gone to a further five — the Technical University of Dresden, the Humboldt University in Berlin and the universities of Bremen, Cologne and Tübingen. Each institution gets an extra €12.5 million per year; only universities that have at least one initiative-funded graduate school and one excellence cluster are eligible.

The financial bonus from the future-concepts award may not in itself be exceedingly generous on the scale of funds available in some other countries. But the competition as a whole has rejuvenated German science by, among other things, stimulating new research proposals and encouraging scientists to increase collaboration across departments and disciplines.

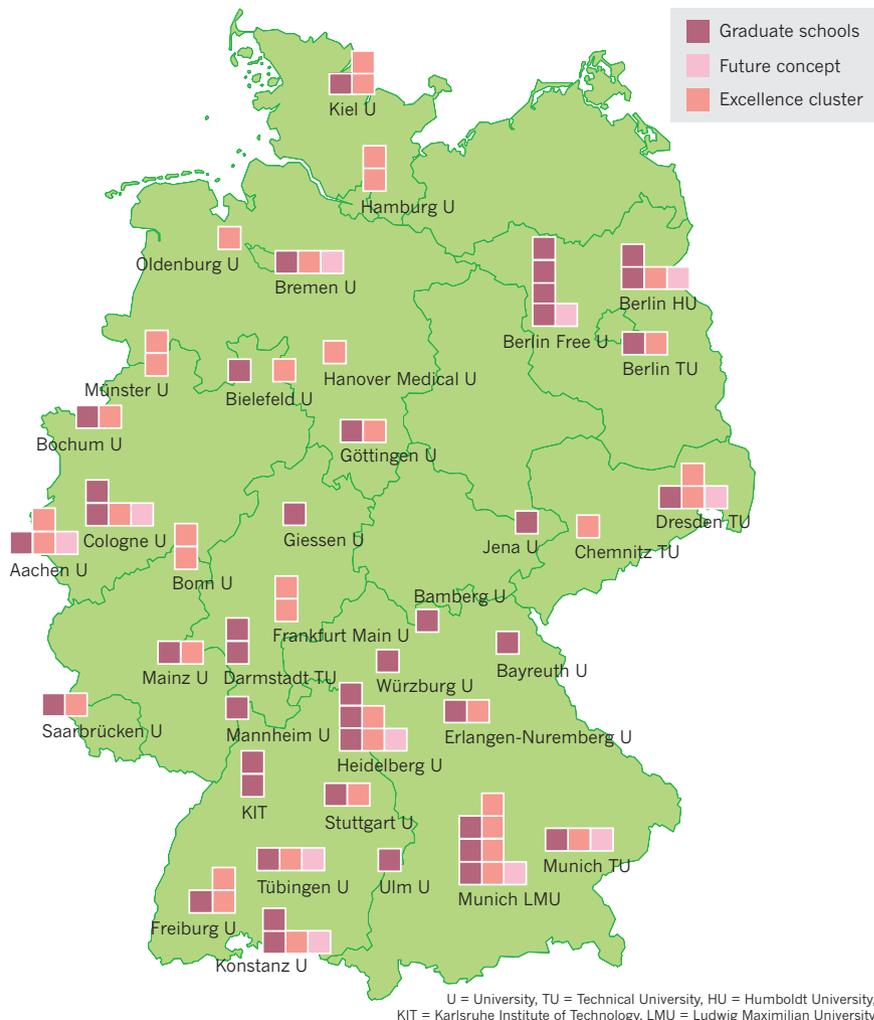
WINNING FORMULA?

When it became law in 2005, the initiative had its share of critics. Some argued that the German system was better left alone, or that elite institutions should be allowed to evolve on their own without orchestrated government support, says Jan-Hendrik Olbertz, president of the Humboldt University. The scheme’s excessive paperwork was an irritant for many; scientists at candidate universities had to contribute to applications. But Olbertz says that this “exercise in institutional governance” has forced Germany’s entire academic elite to think hard about which parts of its science and higher-education system work well, and which do not.

German universities have not historically tended to have US- and UK-style postdoc positions, and it has become apparent that this is a severe impediment to recruiting international talent. “We’re of similar size but we have five times fewer postdocs than the University of Cambridge in Britain,” says Wolfgang Herrmann, president of the TUM. “If we want to offer young scientists better career prospects, and we certainly do, this must urgently change.”

EXCELLENCE ALL ROUND

This year, the second phase of Germany’s Excellence Initiative granted federal funding to research projects (‘excellence clusters’, not all shown), graduate programmes and campus-wide improvement strategies (‘future concepts’) at universities around the country.



SOURCE: DFG

Furthermore, in the German system, scientists have traditionally been promoted on the basis of habilitation: a qualification after the doctorate, which requires a second dissertation. Habilitation is no longer mandatory (see *Nature* 450, 452–453; 2007), but still exists, and under the rule of *Hausberufungsverbot*, academics cannot become assistant professors at the university at which they were habilitated. There is also much less emphasis on a cumulative publication record in Germany than in the United States, and less of a defined career structure.

Under the Excellence Initiative, some universities are shaking up that system. The TUM, for example, has ceased to appoint junior professors, who usually cannot earn tenure at their host university. Instead, it has set up a tenure-track programme that provides a seamless path from fixed-term postdoc or assistant-professor positions to tenured associate professorships and full professorships.

The initiative has also helped to spur more careful thinking on early-career progression and mentoring programmes. In one scheme

at the TUM, young scientists will be coached in personnel management.

The DFG says that the initiative has attracted talent to Germany: between 2005 and 2009, the number of foreign scientists at German universities and research institutes increased by one-third, and many German-born scientists working abroad have returned. Several universities have stepped up recruitment — the TUM, for example, opened a liaison office in São Paulo, Brazil, this year.

SUSTAINABLE SUPPORT

The TUM’s streamlined recruitment policies, which now include considerably more room for negotiating salaries, enabled Fierlinger’s return to Europe from Stanford University in California, where he had spent two years as a postdoc. “I wouldn’t have thought it in the first place, but the Excellence Initiative has really become a self-fulfilling prophecy,” says Fierlinger, who received tenure in 2010. “Germany has become a much more attractive science destination.”

But the initiative could also mean that

Germany will soon face a surplus of postdocs or young scientists — already a problem in countries such as the United States. The number of postdocs alone suggests that many of the young scientists who have been recruited in recent years will not find scientific jobs in Germany, especially once the initiative's funding has run out.

There are efforts under way to support non-academic career paths. Many of the universities that have received initiative money have set up scientific-career training programmes. Young scientists can also get extra guidance in subjects ranging from patent management to business administration, notes Oliver Baron, managing director of the Center for Integrated Protein Science Munich (CIPSM) at the LMU — one of the research clusters selected for extra funding in the initiative's second phase.

Still, it is unclear what will happen after the initiative ends. Universities might suffer, particularly in poorer states such as Berlin and Brandenburg. At risk is the initiative's main goal — creating universities of international repute. And if there is no follow-up funding, scientists at centres such as the CIPSM or the Courant centres, set up at the University of Göttingen to promote independent research, could lose their jobs.

At universities such as Göttingen, administrators are starting to look for options to preserve what the initiative has helped them to build up — whether that is funding for hiring, collaborative projects or graduate programmes. And federal minister of education and research Annette Schavan has proposed that, in the interest of fairness, universities that won funding only in the second phase of the scheme should be granted another round of money.

Schavan also hopes that a planned amendment to Germany's constitutional law will help. The law, soon to be considered by parliament, would allow the federal government to co-finance universities permanently, rather than leaving it to state governments (see *Nature* **483**, 245–246; 2012). The change could pave the way for a federally funded university modelled on the Swiss federal institutes of technology in Zurich and Lausanne.

While administrators and policy-makers ponder the future of funding, Fierlinger is more concerned with truly universal questions. Five years of hard work, he hopes, might turn a fundamental property of neutrons into a gauge of how matter and antimatter are distributed in the cosmos. Administrators and scientists hope that another five years of the Excellence Initiative will be enough to establish lasting change and benefits. ■

Quirin Schiermeier is *Nature's* Germany correspondent.

TURNING POINT

Robert Gregg

Robert Gregg works at the boundary between engineering and medicine. A postdoc at the Center for Bionic Medicine at the Rehabilitation Institute of Chicago in Illinois, Gregg received a 2012 Burroughs Wellcome Fund Career Award at the Scientific Interface in May for his work developing robotic control systems for prostheses. He explains how he will use the funds when he joins the bioengineering and mechanical engineering departments at the University of Texas, Dallas, next year.



A. E. SCHULTZ

Which came first — an interest in robots or in prosthetics?

I did a degree in electrical engineering at the University of California, Berkeley, and had an internship studying control principles of robotic walking. That sparked my interest in robots. I loved the Terminator movies and, at first, I was following the 'cool factor'. I went to graduate school at the University of Illinois at Urbana-Champaign because it had a leading programme on control theory about the intelligence behind machines. I never intended to build killer robots, but I didn't understand until later how this research could help people.

How did you realize the potential for medical applications?

In my last year at graduate school, I was thinking about where I wanted to take my career. Then my father was diagnosed with heart failure. I had to take 2–3 months off while he waited for a transplant. The doctors told me about a surgical robot they were using; that helped me to realize that people could benefit from my research. So I decided to pursue biomedical engineering.

How did you get your postdoc?

I won one of five Engineering into Medicine fellowships at the Northwestern University Clinical and Translational Science Institute (NUCATS) in Chicago. It was a one-time opportunity funded by the American Recovery and Reinvestment Act of 2009, and happened at the right place and time for me. NUCATS was looking for people who could translate engineering principles into medical or biological research. It was the biggest turning point of my career: I was able to apply ideas from robotics and control theory to improve the performance of prosthetic devices. I'm experimenting with a prosthetic-leg controller that moves joints based on measurements of pressure to the sole of the foot. The wars in Iraq and Afghanistan have brought attention

to the needs of amputees, but amputations are necessitated most frequently by disease, especially cardiovascular disease and diabetes.

What was most difficult about switching research cultures?

Moving into biomedicine was a leap, because no one in the field knew of my engineering research. I had no reputation in prosthetics and no knowledge of it, really. But the most difficult part was learning how to communicate with clinicians. The same words can mean completely different things. For example, 'control' means the intelligence behind a machine to an engineer, whereas clinicians use it to describe study patients who do not receive the experimental treatment.

Was the search for a job after your postdoc difficult?

This spring was a whirlwind. The market is rough — I applied for 35 faculty positions and it looked like nothing would pan out. Then I was approached by the University of Texas, Dallas. I also learned that I was a finalist for the Burroughs Wellcome award, which comes with US\$500,000 to finish a postdoc and start a lab. In a two-day period, I got the award and the offer to start at Dallas in June 2013.

How does the award help your career?

It will let me hire personnel in biomedical and mechanical engineering, and to start off with expensive research. I am eyeing a treadmill that costs more than some houses. It measures the forces that human feet transfer to the ground, to analyse the performances of prostheses. I think of my lab as a start-up company — I have investors; now I have to prove that my vision for robot-assisted walking can be achieved. ■

INTERVIEW BY VIRGINIA GEWIN