GERMANY AND FRANCE

Europe's Science Powerhouses Face Limits to Growth

Last autumn, thousands of students from the science departments of the University of Rouen in northern France took to the streets demanding that the government hire more teachers and fill a $2.4 million gap in the university's budget—a shortfall that had left many teaching laboratories without supplies and even the library's photocopiers without paper. Although the government agreed to some of the demands, by the end of November students all over the country were demonstrating against conditions at their overcrowded, underfunded universities. Indeed, it was the science students' protests that kicked off the wave of strikes that rocked the country last December.

While their counterparts across the French border were demonstrating, students at the Technical University of Berlin also had plenty to complain about—for example, the battle for a seat in a lecture hall. With over 1000 students in some introductory courses, the losers end up sitting jammed together on the floor or following the lecture on video from neighboring rooms. And there is little chance the overcrowding will ease: The university faces yet another year of staff and budget cuts plus a freeze on building. Many campuses across Germany face similar prospects—meaning, says physicist Jörg Hüfner, pro rector at the University of Heidelberg, that "things will get even worse before they get better."

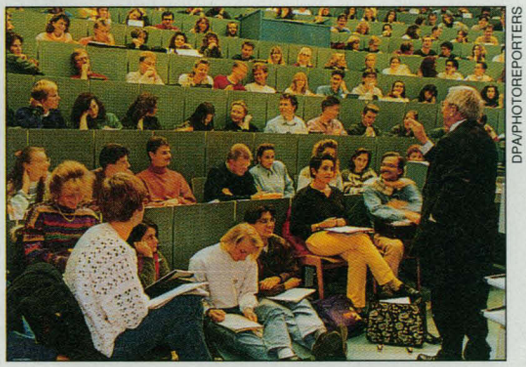
With France and Germany both in the midst of serious economic recessions—and Germany pouring billions of dollars into building up its former communist east—continental Europe's major scientific powerhouses are struggling to stop the downward spiral of their once-proud public university systems. In both countries, the problems of coping with more and more students on stagnant or declining budgets dominate university agendas, crowding out issues like innovations in teaching. "We are at the bursting point," says physicist Daniel Bloch, president of Joseph Fourier University in Grenoble, France.

How have the continent's two champions of science arrived at such a sorry state? The roots of the problem go back to the late 1960s, when powerful student movements in both countries led to reforms—and a changed public consciousness—that opened their universities to a far broader segment of society. France guaranteed virtually free admission to anyone with a *baccalauréat*, the country's demanding high school diploma. And in Germany, where universities were already open to graduates of the equally demanding "Gymnasium" schools, the tradition that a university education is useful only to a small elite began to break down fast.

Following these changes, student numbers started growing dramatically. At first, both countries increased faculties and funding and even built several new campuses. But in recent years resources have lagged far behind student numbers—so much so that France and Germany now each spend less public money per student than nearly all other major industrialized nations, according to a recent study by the Paris-based Organization for Economic Cooperation and Development.

The plight of French and German universities has turned the education of budding scientists into a Darwinian test of survival. "You can get a very good university education in Germany," says one biology student. "But you do it against the system, not with it." Véronique Jamet, an undergraduate archaeology student at the Sorbonne in Paris, agrees. "You must fight all the time for everything," she says.

Thus first-year courses that should raise students' interest and preparedness for their chosen field are more typically "large, anonymous lectures and cookbook-style labs," says a German graduate student in biology, echoing the comments of most students who spoke with *Science*. "I had no contact with my professors. ... It was very hard to feel motivated," he says. As students advance the anonymity declines, but they then face other problems. In France, students are under pressure to complete their degrees in the prescribed 4 years, with tough exams all along the way. Germany's problems lie in the opposite extreme: There is far less formal structure and students go at their own pace, often with years between exams—German graduates are among the oldest in Europe.



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Space constraints. Overcrowded lecture halls are a chronic symptom of the pressures German students have to endure.

Although these flawed systems are ripe for reform, both countries have a big barrier to innovation: Most decisions about funds, staff, and even degree requirements are made by government ministries. Universities do not have the authority—or the incentive—to find their own remedies. "The [government's] desire that all universities function the same way sometimes stops universities from experimenting," says Alain Gaudemer, president of the University of Paris's Orsay campus. "It is very constraining."

It also leaves them little room to tackle another big problem affecting education: Faculty members are hired, promoted, and rewarded according to their success in research and landing grants, not for good teaching—a strong disincentive for them to invest extra time and effort with students. What's more, in France and Germany there is no real quality control in education: Professors are civil servants with lifelong tenure and few penalties for poor performance, and serious evaluation of teaching is a rarity. And this lack of recognition is dispiriting for committed faculty who do their best to teach masses of students on shoestring budgets.

As the university crisis in both countries deepens, so does the realization that solving it will take sweeping changes. "A university should be free to develop its own profile," says mathematician Karl-Heinz Hoffmann, chair of Germany's Science Council, the country's highest scientific advisory body. "There should be more diversity and clear areas of emphasis."

In the following pages, *Science* takes a closer look at the problems and solutions specific to Germany and France as they struggle to reconcile painfully squeezed budgets with rapidly growing student numbers.

–Patricia Kahn and Michael Balter

For more on young scientists in Europe, see *Science*'s Next Wave at http://sci.aaas.org/nextwave/