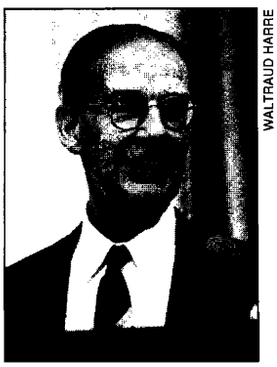
lecture," says TUD's Wolfgang Schwarz, who spends 8 hours each week in seminars and discussions with first-year students—after his 8 hours of lectures.

Back west, Heidelberg's Hüfner has high hopes that this attitude will grow. "Young [staff] see teaching as a more important part of their self-image," he says. And efforts like Heidelberg's 8-day seminar on pedagogy last year—a "great success" with participating young faculty—help in this process of consciousness-raising.

So the good news for students is that university departments around the country will soon be taking a hard look at their teaching. Some are already starting, eager to pre-empt state governments from taking matters in hand as they try to find out why students at some universities need 7½ years to graduate, but 4½ at others. But most universities are still unsure what the evaluation criteria should be and are starting out, while awaiting the results of working groups that are proposing guidelines for future assessments.



WALTRAUD HARRE

"I keep asking, isn't there something else I can try?"
—Günter Tembrock

Models for reform. Whether evaluations will actually make a difference depends a lot on whether the results are taken seriously or languish in a drawer. That is why many eyes are turned to four biology departments in northern Germany that served as the nation's guinea pigs last year when they carried out a self-evaluation, then an external review. At the University of Oldenburg, recommendations included streamlining and integrating curricula, changing exam rules, and drawing advanced students more into problems and projects—for example, in ecology and coastal research, which are departmental strengths.

Biology Dean Peter Janiesch now hopes to make changes quickly, but it remains to be seen if he will succeed. "We want to show that universities can take charge of their own evaluation," he says, and can act on the results, even without government pressure or official sanctions.

But many think change will come only when good work is linked to more resources and vice versa—a notion still "grossly against federal law," says Saxony's Minister Meyer. There is a bit of leeway, however, which a few states are exploiting to the limit, such as allowing discretionary funds to be given out based on a department's teaching record.

Beyond this, reforming universities and preparing them for autonomy means revamping how decisions are made and who makes them. It is a controversial topic that even ended up in court last year when professors in one state challenged a new law which reduced the role of university committees in decision-making and strengthened deans and rectors, who now have little power. Part of the problem also rests with overblown, slow-moving university administrations and the straitjacket of government approval even for small decisions like changing exam rules, which now takes years.

Perhaps most of all, the prospects for change depend on people who do not give up—people such as Humboldt's Tembrock. Described by colleagues as a brilliant teacher, Tembrock supervises 12 research students and focuses his teaching strongly on the big picture—for example, in his lectures on human biology to standing-room-only general audiences. Despite the daunting obstacles to change, "I will not become resigned," he says. "I keep asking, isn't there something else I can try? I call into the forest, and sometimes an echo really comes back."

–Patricia Kahn

FRANCE

An Elite System Struggles With Mass Education

When biologists Michel and Nicole Sicard moved from Paris to the University of Toulouse in 1966, this venerable institution (founded in 1229) did not offer a single course in genetics. "Genetics was only taught in Paris," Michel Sicard recalls. So the pair set up courses in genetics and microbiology—another subject not taught at Toulouse in those days—and they established a biology laboratory that is now part of a major research and training institute. Today, the university's sprawling science and medical campus—called by the separate name of Paul Sabatier University—is in the top ranks of France's 14 universities specializing in the sciences.

But Paul Sabatier's success has not shielded it from the acute problems afflicting campuses throughout France. The transformation in Toulouse has taken place during a period of explosive growth for French universities. The number of students at both undergraduate and graduate levels almost doubled between 1980 and 1995, reaching more than 1.5 million. And, as science is a popular subject and students are almost completely free to choose their fields of study, the number of science students has easily kept pace. At Paul Sabatier, for example, the number of basic science students increased from about 7900 to almost 18,000 over the same period. Increases in government funding, particularly for lab equipment and hiring of new professors, have not kept up with the student boom, however, and that is putting intense pressure on university resources.

"It is difficult to teach effectively with such an enormous quantity of students," says Michel Sicard. To make matters worse, cuts in government research funding have resulted in a rapidly shrinking number of new positions in the universities and France's public research agencies. So science graduates face considerable trouble finding a job. Just a decade ago, says Michel Morange, professor of biology at the University of Paris's Jussieu campus, "the good students had no problems finding a place in research. Now it's not the same."

The growing crisis is forcing educators to question one of the fundamental tenets of French higher education: that universities should be open to all secondary-school graduates. This open-door policy was introduced 25 years ago, into a system of academic training that was designed not for mass education but to pick out the country's best and brightest. The traditional elite structure of universities involves a rigorous, multitiered selection process in which nearly every successfully completed year is marked with the awarding of a special diploma. The inevitable result has been a good deal of frustration among both faculty and students.

Free for all. The stresses in the system are being felt at all levels, but the problems are most acute in the first two undergraduate years, which are referred to as the first cycle. Overall, about 40% of France's first-cycle students either flunk out or drop out without receiving the diplome d'études universitaires générales, a di-

ploma that allows them to continue their undergraduate studies. And while the attrition rate for science students is a somewhat more encouraging 25%, the combination of overcrowding and stiff competition is discouraging. "The first cycle has become very degraded," says Michel Sicard. And Jean-Roch Aubertein, a biology undergraduate at Joseph Fourier University in Grenoble, says that "the professors have so many students that they don't try to have contact with them."

The teachers also feel overwhelmed: "They tell us to teach, but one doesn't know why, how, to whom, and what is the goal behind it," says François Amalric, director of the laboratory of eukaryote molecular biology at Paul Sabatier. And Michel Sicard believes that "we cannot continue to live ... without any discrimination" in university admissions.

Many believe that even the most motivated students suffer because of the overcrowding. "It erodes the creativity of the good students, who are a bit lost in the mass," says Jean Marec, professor of physics at the University of Paris's suburban campus in Orsay. And Jacqueline Godet, professor of genetics and molecular biology at the University of Lyons I, which accommodated almost 27,000 science and medical students in 1995, says that "the possibility of doing courses with small numbers of students diminishes each year."

Another consequence of the open admissions policy, says molecular biologist Claude Gutierrez of Paul Sabatier, is that in order to accommodate the growing student body, more specialized science classes are given "later and later" in the course of a student's studies. Gutierrez—who says he is nevertheless a strong supporter of the policy on social and political grounds—adds that this may benefit the majority of the students, but it's not a good thing for the elite: "I have the impression that the future is in peril."

But Jean-Claude Martin, president of Paul Sabatier—whose offices were occupied by student demonstrators demanding more teaching posts during last November's protests—disputes the widespread view that mass admissions are detrimental to the quality of university teaching and research. In some cases, Martin argues, the influx of students can even stimulate research and attract new faculty. Because of the student boom, he says, "we had to recruit a lot of math professors." As a result, France's giant public research agency, the CNRS, is giving the university money to build a major new mathematics research institute.

Many professors also believe that despite the pressures of undergraduate life, those students most determined to become scientists will still come out on top. "A motivated student can find a way to do very interesting studies," says Dominique Anxolabéhère, professor of genetics at Jussieu. Indeed, while many of the professors and other university-based scientists interviewed by *Science* expressed great concern about the problems, most said they remain confident that their system is still producing excellent researchers, at least for the moment. "The French university is not the sick patient that some think," says physicist Daniel Bloch, president of Joseph Fourier University in Grenoble. And while Amalric brands undergraduate teaching conditions at Paul Sabatier as "scandalous," he maintains that the doctoral students who come through his laboratory are at an "excellent level."

Elitism reigns. One possible explanation for this apparent contradiction may be that, unlike Germany with its emphasis on equality, the French higher education system is not afraid to select the most promising students and give them special treatment. One important ingredient in this process is the "grandes écoles," elite institutions outside the university system that train many of the nation's elite corps of industrial managers, administrators, engineers, and economists. They were left pretty much intact during the upheavals of the 1960s. Entrance into a grande école, some of which date from Napoleonic times, involves a grueling program of preparation and exams usually given in special high schools.

Until fairly recently, very few researchers were trained in these institutions. But about 15 years ago, France's handful of specialized grandes écoles called the Ecoles Normales Supérieures (ENS)—which train high school and university teachers—also began offering programs for future scientists. The normaliens, as ENS students are called, take a large portion of their courses at the universities, where they are mixed with a select group of university students in a special curriculum called the magistère. The magistère includes considerable opportunities to do projects in research labs, a privilege rarely accorded to most other students. The result, says Michel Morange, who directs the magistère in biology run jointly by Paris's ENS and the University of Paris campuses at Jussieu and Orsay, is that "you have three levels of training"—the normaliens, the university students selected for the magistère, and the mass of "ordinary" students.

Although the strict standards used to select normaliens usually mean they are the first to be offered places for graduate studies, some university researchers question whether these students really end up being better scientists. "It doesn't much increase their competitiveness with people who come from the university," says Régis Mache, a professor of molecular biology at Joseph Fourier University in Grenoble who also teaches at the ENS of Lyons. "The grandes écoles are small compared to the universities, and the quality of research is not necessarily any better."

Graduate selection. Whatever route a student takes into graduate studies, once there the selection process is far from over. Before being admitted into a

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

VINCENT KESSLER/SIPA PRESS

Under pressure. Students at the University of Metz protesting budget cuts.

Ph.D. program, a student must complete a first year of evaluation leading to a special degree called the diplome d'études approfondies (DEA). While the success rate for DEA students in the sciences is high—more than 80% nationwide, compared to an average over all fields of 63%—there is yet another hurdle to jump. Many science graduate programs will not accept students who do not have a scholarship from France's education ministry. These ministry grants are relatively generous—about $1400 a month—which no doubt explains why the conservative French government, in its drive to curtail public spending, has been steadily cutting back their number over the past couple of years.

But an equally troubling concern, expressed by many university professors in interviews with *Science*, is that the education ministry seems to be using the grants as a tool to decrease the time students take to complete a thesis. At present, the scholarships are granted for a period of 2 years, with a third year usually given automatically to students who progress well in their work. If a fourth year is needed, the student must apply for help either to industry or, particularly in life sciences, to one of France's medical charities. Some recent actions by the ministry—including a tendency to give third-year grants in 6-month intervals rather than for the full year—are seen as bad omens for the quality of science training.

GILLES BOUQUILLON/GAMMA LIAISON

"I have the impression that the future is in peril."
—Claude Gutierrez

"In earlier days a thesis lasted 5 or 6 years," says Michel Gaillard, director of the laboratory of molecular photophysics at Orsay. Now, he says, "it is extremely difficult to propose a thesis that requires a great deal of experimentation." David Cribbs, an American biology professor at Paul Sabatier, agrees. "You can't do a thesis of international quality in 3 years," he says, adding that the pressure this puts on both professors and graduate students "encourages unambitious, conservative projects."

Despite the government promises won by student protesters last autumn to hire more professors and increase funding, it is clear that the universities cannot continue to expand forever. One solution proposed by a number of university professors is to accelerate a trend—already under way for several years—to direct a certain number of students away from the universities and toward shorter, more specialized programs. "We receive a lot of students here at the university who would have been better off in technical schools," says Gutierrez.

And although direct challenges to the open admissions policy are politically sensitive—especially with the student movement's influence so powerfully displayed in November and December—the writing is on the wall for the current laissez-faire system. In the future, France's science universities can be expected to find new ways to steer only the best students toward research while channeling those not cut out for a scientific career into other fields. "There is no question of reconsidering the free access of students to the university," says Grenoble's Bloch. "But the ultraliberal position, which says that students have the right to do anything they want, doesn't work anymore."

–Michael Balter

UNITED KINGDOM

Universities Feel The Heat of Competition

LONDON—In recent years, Britain's system of higher education has gone through perhaps the most wrenching, radical changes of any in Europe. In an effort to broaden access to what had been one of the most elite university systems in the industrialized world, the Conservative government has promoted an entire tier of colleges to university status, developed nationwide reviews of the quality of research and teaching on offer at each institution, and forced universities to compete with each other to attract—and retain—students. All this while holding down costs: The amount the government spends per university student has actually declined in recent years.

Although this transition has been painful for many faculty members, some believe the reforms were long overdue. A decade ago, only about one secondary school graduate in seven went on to university. And when they got there, they found a system geared more to the needs of research than training scientists. The life sciences at many universities, for example, were divided up into small, narrowly focused departments, forcing students to specialize early and giving little opportunity to diversify outside their major, says Keith Elliott, senior tutor in the undergraduate school of biological sciences at the University of Manchester.

The result, at least in chemistry, says Tom Inch, secretary general of the Royal Society of Chemistry, is that in some cases students found themselves with a degree increasingly ill-matched to the multidisciplinary skills sought by employers. Moreover, undergraduates were pushed through to a bachelor's degree in 3 years, with a Ph.D. often taking the same length of time—and if they dropped out in this hot-house environment, that was considered their loss.

The government's answer to these problems has been nothing if not dramatic: At a stroke, in 1992, the lower status polytechnic colleges were transformed into full-fledged universities—almost doubling the number of such institutions to roughly 88—and the university system was told to provide higher education for a third of all school leavers by the end of the century. The government can force these changes on the universities because it holds the purse strings: Universities receive most of their funding as a block grant from the government. Although universities retain the freedom to distribute their grant once awarded, the government is seeking to increase competition among universities by developing formulae to calculate the amount of each university's grant according to the quality of its research and the cost-effectiveness of its teaching.

The assessment of research has already begun, with a nationwide peer review process carried out every 4 or 5 years, which will include the new universities for the first time this year. The first assessments of teaching quality, which began in 1992, were completed last year, and the next phase is already under way. As part of the