'Darwinian' Funding and the Demise of Physics and Chemistry

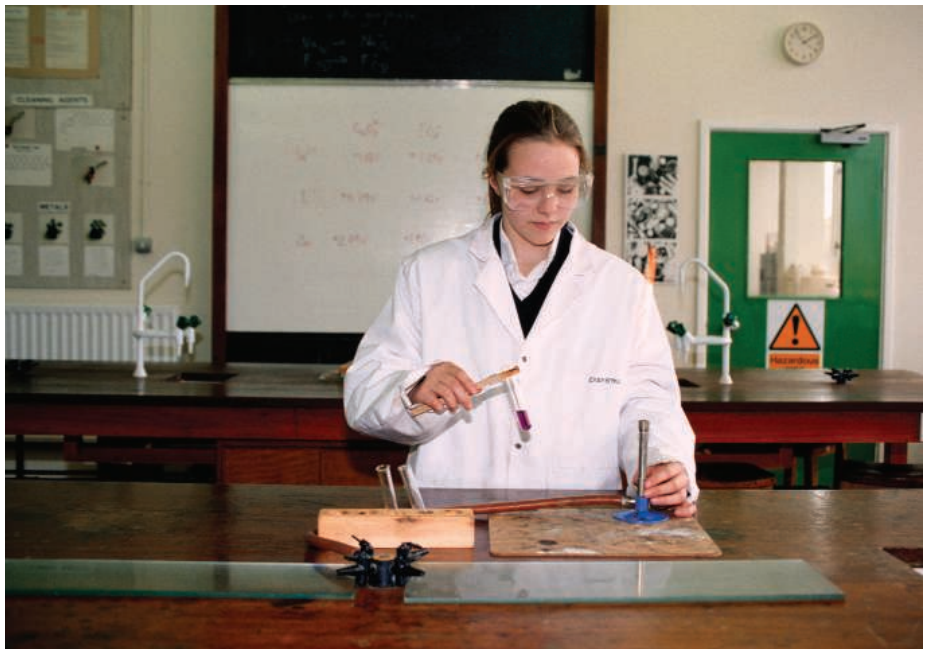
Britain's scheme to favor the highest-scoring research teams—abetted by other changes in society—is decimating chemistry and physics departments

CAMBRIDGE, U.K.—The word "university"—from the Latin *universitas*—suggests the whole, the world, or the universe. But is an institution still worthy of that moniker if it doesn't teach chemistry or physics? Universities in the United Kingdom seem to think so. Over the past decade, they have announced a steady stream of department closures, and now less than half of all U.K. universities offer undergraduate chemistry degrees. Physics has suffered a similar decline. "It's a disaster," says chemistry Nobelist Harry Kroto of the University of Sussex.

Department closures became headline news late last year when Exeter University announced plans to close its chemistry department, and Kroto threatened to hand back an honorary degree from the university. It was a surprising case particularly because Exeter's chemistry department was not failing: Almost all its work met a national standard of excellence, as judged by the 2001 Research Assessment Exercise (RAE), a government scheme that grades university departments. And during the 2004–05 academic year, Exeter had seen a 21% rise in applications to study chemistry. Nevertheless, the university's senate voted in December to close the chemistry department and concentrate on a new school of biosciences and on strengths in physics and sports science.

Ask researchers why this is happening, and they generally respond that the government, which is the main source of money for U.K. universities, is not providing enough for expensive lab-based courses such as physics and chemistry. This public contribution "has never been able to finance science departments to operate at even a minimum level," says Philip Kocienski, head of Leeds University's School of Chemistry. But other forces are at work, too. Demand for physics and chemistry classes has been steadily falling as students are lured into more career-specific courses such as sports science, forensic science, and media studies. And the once cozy world of British academia is now a competitive marketplace in which universities must vie with each other for government research money and attract as many students as possible to maintain their income. Some researchers suspect that current funding policies are designed to weed out the weak and concentrate resources in a smaller number of superdepartments. "It's a Darwinian exercise," says Kocienski.

The government has taken a hands-off approach so far, respecting the universities' autonomy. But the row over Exeter's withdrawal from chemistry has forced the government to rethink its neutrality. In December, then–Education Secretary Charles Clarke asked the Higher Education Funding Council for England (HEFCE) to look into ways to protect five strategic areas of study, one of which includes all of science, engineering, technology, and mathematics. Whether this will halt the closure of physical science departments nobody knows. One thing is certain: No new money will be available.



All alone. Fewer and fewer U.K. high school students want chemistry degrees.

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Get 'em while they're young

No amount of new money would get around one critical fact: Physical sciences are not as popular among prospective university students as they once were. Although absolute numbers of applications have stayed fairly stable, Prime Minister Tony Blair's Labour government has successfully worked to increase the number of students going into higher education. As the total expanded, the fraction going into physical sciences grew smaller and smaller. (In the United Kingdom, students apply to universities to study a particular subject, and they specialize in their chosen major from the beginning.) "There is a serious supply-side problem," says metallurgist Graeme Davies, vice chancellor of the University of London.

What motivates teenagers to choose one course over another is not a simple question, but many blame science's declining appeal on the lack of good role models in the classroom. Britain's school system has long had a problem attracting science graduates into teaching; other careers offer much better salaries and opportunities for advancement. As a result, few high school pupils are taught physics or chemistry by teachers with degrees in those subjects. John Enderby, president of the Institute of Physics (IOP) in London, says the crisis in science departments is "a symptom of the underlying cause: We don't value teachers."

Other social incentives are at work, too. Few high school students see the benefit of studying a basic science. Meanwhile, television has made jobs in forensics, for example, seem glamorous, and universities now offer courses that appear to provide a fast track to that career. Member of Parliament Ian Gibson, former head of biological sciences at the University of East Anglia in Norwich, says university administrators "will teach anything to get students." Gibson, now Labour's chair of the House of Commons Science and Technology Committee, says

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police chiefs have told his committee that they don't want such graduates. What they need are "good chemists and physicists." Simon Campbell, president of the Royal Society of Chemistry, says "it is up to us" to make careers in science attractive.

Follow the money

Attracting students is not enough to keep a department afloat, however, as Exeter's experience has shown. Many believe that government funding policies are quietly changing the shape of higher education by channeling research funding into science powerhouses while leaving other departments to founder.

Government funding to universities is distributed by HEFCE and partner councils in Scotland, Wales, and Northern Ireland. For the current academic year, HEFCE, by far the largest of the four councils, will distribute $11 billion to English higher education institutions, of which $7.2 billion goes in support of teaching and $2 billion for indirect costs associated with research. The teaching portion is divvied up according to how many students the university enrolls and how expensive their courses are to teach. So each humanities student earns a university $6600, while each undergraduate in lab-intensive subjects such as physics and chemistry, for example, wins the university 1.7 times as much ($11,000). Medics, dentists, and vets earn a fourfold boost ($26,000).

Many researchers argue that this extra funding is not enough to cover the costs of lab buildings, materials, and support staff. "Chemistry is expensive to teach," says Campbell, and HEFCE provides "woefully inadequate funding." Enderby agrees: "In all subjects the full cost of teaching is not met, but the shortfall is greatest for the laboratory sciences." HEFCE spokesperson Philip Walker counters that the allowances are based on a study of what universities actually spend. "We have to have a fair and transparent means to allocate the money," he says. In any event, Walker points out, once HEFCE has done its calculations, the money is given to the university as a lump sum. "Universities can allocate the money internally as they want." The implication is that Exeter itself bears the chief responsibility for the choices it made. "Exeter's chemistry department was not a dying animal," says Stephen Chapman, head of the School of Chemistry at Edinburgh University. "It was shot rather than left to die."

Academic cattle market

Departments that find they cannot manage with the teaching grant from HEFCE often end up subsidizing teaching from their research income. But not all departments have this luxury, as HEFCE research grants vary greatly in size depending on the quality of a department's research output. In 1992 HEFCE launched the RAE, its quality-control survey, which it repeats roughly every 6 years. Specialists in each subject rate the research in all university research departments and grade them on a scale from 1 (the lowest) to 5*, the score reserved for departments with "international excellence" in more than half of the work submitted for review. These grades have a major impact on funding, so before each new RAE, departments scramble to hire the hottest new researchers in the hope of bumping up their rating.

Most U.K. research departments cluster around the top end of the scale, with the peak of the curve around the boundary between grades 4 and 5. But following the 2001 RAE, many departments were shocked when the government decided to focus on the top achievers, pushing more of HEFCE's research funding into the highest-rated departments. Since that assessment, departments rated lower than 4 have received no research funding from HEFCE; those rated 5 and 5* get approximately three times as much per researcher as those rated 4. And since 2001, many 4-rated departments, such as chemistry at Exeter, have found themselves fighting for survival.

Although the RAE is a painful process, it's widely credited with having improved the quality of research in the United Kingdom. But many think it may have gone too far, and HEFCE is reviewing the system before the next RAE in 2008. "The RAE aims to starve out the weak, and it's been quite effective. But now it's cutting into flesh rather than fat," says Kocienski. "Vice chancellors are all too ready to use the RAE to cull expensive departments," adds Kroto.

Cooperation not competition?

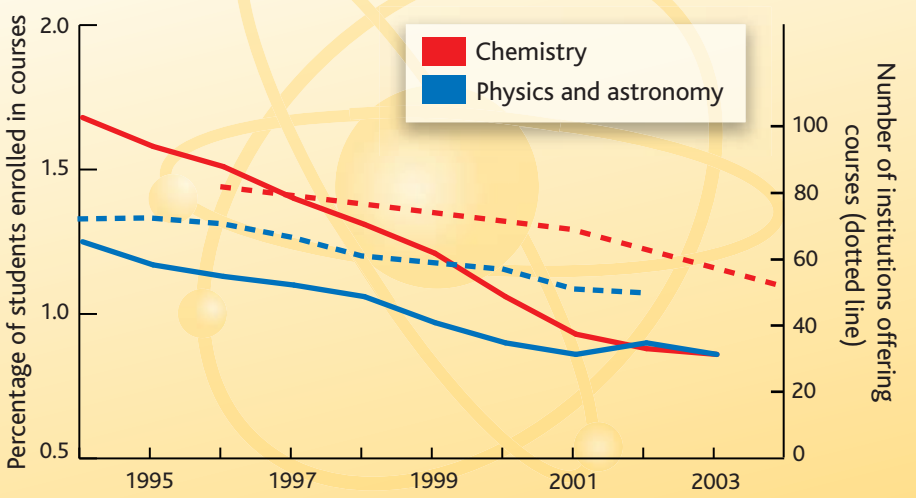
Gibson thinks the current crisis is the result of politicians forcing university administrators to think like business people and make decisions on purely financial grounds. "There is a lack of understanding among academic bigwigs about the needs of chemistry and physics," he says. Kocienski, voicing a pessimistic view, says the current total of about 40 chemistry departments may dwindle further to just 20: "I suspect that the government has this number in mind, too." The physics community is concerned that as closures continue, ever-larger swaths of the country will be left without any physics department. Students may have to travel farther from home to study physics, the IOP warns, and businesses will not be able to work with local researchers on R&D projects.

In Scotland, universities are already trying to counter the trend by taking a pragmatic approach: They are teaming science departments together for greater strength rather than letting the weakest go to the wall. Six Scottish physics departments have formed SUPA, the Scottish Universities Physics Alliance, and chemists from four universities will meld into two superdepartments: EastCHEM and WestCHEM. Each of these bodies will be entered into the RAE as a single department. Last November, these initiatives won $70 million for the next 4 years from Scottish funding bodies. "We have a vision of where we are going in chemistry and physics," says Edinburgh's Chapman. "We're not going to close things because one department is not doing well."

Other changes may be coming. Education Secretary Clarke's decision to consider protecting strategic subjects is a sign that the government may have concluded that it cannot govern higher education by a form of natural selection. "Do we need every department to be world beating?" asks Enderby: "No. Do we need a widespread education in physics? Yes."

–DANIEL CLERY

Physical Sciences' Declining Popularity



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