of the U.S. atomic bomb

The university community is trying to reverse this trend by revamping and broadening courses. But, like their colleagues in other former Soviet-bloc countries, they are short of money. The government here is trying to convert the country rapidly into a Western-style market economy, and inevitably, part of that process involves cutting back on the once-generous university funding. So, in many cases, the reaction of Hungary's universities has been to follow the example of their students: Go to industry.

At Budapest Technical University, the country's best known and most highly regarded higher education institution, the administration recently convened an "external senate," made up of 17 chief executive officers from companies in the city and surrounding area. This panel advises the university on curriculum and the direction of science programs but does not, Gordos says, interfere with academic freedom—they just advise. "Even if CEOs don't understand science, they know the application of science, and they [want] courses that allow students to apply scientific knowledge," Gordos says. "We are moving from curiosity-driven science to market-driven science."

The aim is twofold: to make science education more relevant to Hungary's developing economy, and to prepare students for scientific research work in industry. Those jobs are more plentiful and higher paying than academic posts—an incentive to would-be scientists whose professors have had to drive cabs at night to supplement an average salary of about $200 a month. According to Gáspár, it is "definitely to the university's advantage that the private sector gets involved," because it helps financially. But he does not think the business people should gain control over the curriculum.

Corporations and foundations are, however, beginning to contribute more than just advice. Some are donating cash to the university, mainly for equipment, Gordos says, something that is "entirely new for Hungary." Other local businesses are getting actively involved in training students: sending visiting lecturers to science classes and inviting students to spend some time working in industrial research labs. A student who spends some time working in an industry lab will have a better background for postgraduate work in research, says physicist Ernö Szmola, managing director of the GE-Tungsram lighting company here. It also helps them dismiss an old communist-era mentality, he adds, where research data were not shared and therefore not used to the full. "They were used to hiding the information. Information was power," Szmola says.

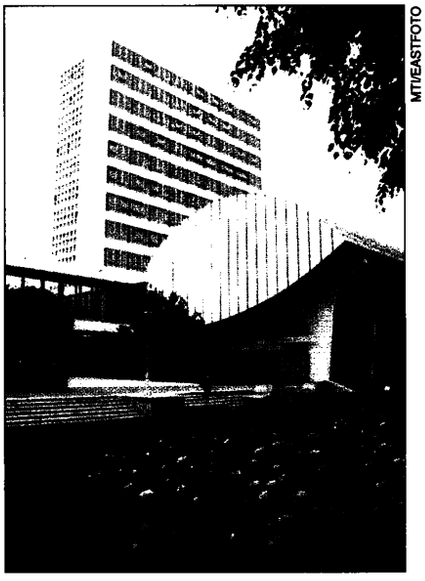
Meanwhile, across town another kind of financial support has led to the creation of an entirely independent graduate school—a first in the former communist bloc. The Central European University was founded in 1990 by George Soros, the Hungarian-born financier now living in the United States who has been a major supporter of scientists in the former Soviet Union. "Central European University has as its goal to teach things that were neglected under communism," says program assistant Sander Bremer. For the most part this means the humanities, but last year for the first time 60 students from 30 countries (chosen from 500 applicants) have begun a master's program in environmental science and policy.

Many of the students already have a master's degree, and some even have Ph.D.s, Bremer says. But after a year studying the science, law, policy, and economics of the environment, they will return to their home countries to apply a science that was ignored under Soviet rule. This new discipline is perhaps especially needed now to repair the damage done by the antiquated plants of the communist era and also keep an eye on newcomers keen to take advantage of lax environmental laws. "I saw what happened to Hungary after it was opened [to the West]. Western companies came here, and they didn't care too much about the environment," says Igor Pastirk, a Yugoslav physical chemist on the environmental science program. He plans to meld the two disciplines in his work when he returns to Belgrade, perhaps in the area of atmospheric chemistry.

With the heavy hand of communism removed from Hungary's education system and the new government maintaining a hands-off approach, educators are quietly confident that with a little help from industry and international foundations, they will keep science alive. "We are a little bit hopeful. We think there is light beginning to come up at the end of the tunnel," Gordos says. "But the tunnel seems so long."

–Susan Milligan

Susan Milligan is a writer based in Budapest.



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Outside help. Budapest Technical University calls on the expertise of local business.

Czech Republic: Grad School Bridges Old Divisions

PRAGUE—This beautiful medieval city, a crossing point between western and eastern Europe, is in the midst of a renaissance. After 45 years of Soviet domination, the city of Kafka and coffeehouses is now a magnet for writers, artists, and entrepreneurs. And Prague's Charles University—one of Europe's best from the 14th to the early 16th centuries—is also undergoing a profound transformation as it struggles to regain its place in international science.

It is a colossal task that involves building up research after decades of neglect and overhauling the system of training scientists, particularly at the doctoral level. Beyond the material problems of equipment and money, this means pulling together deeply divided faculties mistrustful of coordination imposed from above. "Our current fight is to bring people together," says Jan Herget, vice dean of one of the five medical faculties at Charles and co-founder of one of its major reforms—a U.S.-style graduate program that is unique in the Czech Republic.

The former Czechoslovakia's communist leaders adopted a policy of divide and rule for science. Most research was carried out at institutes run by the Academy of Sciences, while universities were mostly pure teaching establishments. "We were expected to teach and also to prepare students ideologically," Herget says. "Divisions between faculties were very big. Many

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

hardly spoke to each other."

After the "Velvet Revolution" of November 1989, the country set about reinventing its system of science, particularly by strengthening basic research at the universities. Although money and equipment were serious problems at first, a new, well-functioning grant system gave research a big boost. While Charles welcomed its new research role, it stopped short of some major reforms, keeping the large staff mainly intact and the 16 faculties separate and independent, even the five medical schools. In contrast, the Academy of Sciences carried out a tough evaluation, which led to a 50% staff cut and closure of one third of its institutes—moves that helped it survive as the country's stronghold of research. It lost the right to grant degrees, however, contributing to a climate of "tension and enmity" between universities and academy institutes, says a Charles researcher.

The old structures have left Charles with some big problems. One is that single fields are represented in many faculties—for example, there are chemistry departments in the natural sciences faculty and all five medical schools, which are spread around Prague and barely interact. Most departments are "highly overspecialized," says Zdenek Pertold, vice rector for academic affairs, "one of our most difficult problems." And faculties guard their autonomy fiercely, making Charles "like 16 states in one government," says Ivan Wilhelm, vice rector in charge of development.

What's more, each faculty runs its own Ph.D. program with its own standards—a key obstacle to revamping doctoral education across the board, says Milan Elleder, who heads Charles's Center for Inherited Metabolic Diseases. Some faculties, especially in medicine, simply renamed the Soviet-era Candidate of Sciences degree, which did not require original research, and few offer courses or allow for lab work outside the faculty—narrowing students' training and making it hard for them to do research in academy institutes. There is "strong opposition" to changing the system, says Elleder.

Three years ago, says Herget, "we decided we couldn't stand it anymore." So he, Elleder, physiologist Ladislav Janský, along with Bokuslav Oštádal and others from the Acadamy of Sciences conceived the "Postgraduate School in Biomedicine"—a program that draws on active researchers from different faculties and academy institutes to offer students a set of courses and a broad palette of research opportunities leading to a Ph.D. based on original work. Rather than waiting for formal approval, they simply lined up enough support to start—from the university, the Ministry of Education, and a core of researchers—and declared themselves in business. "It wasn't official; we just decided to do it," says Elleder. "It's an informal coalition of the willing."

They also got crucial support from abroad. The first 20 students spent 3 years at the Downstate Medical School in New York, which allowed the program to get started quickly. The European Union's Tempus program helped with books, journals, and travel funds for students and teachers. And Charles graduate Wilhelm Ansorge, now at the European Molecular Biology Laboratory in Heidelberg, Germany, and several coworkers organized a course that has become a regular event and has already trained about 40 Charles students and staff in DNA sequencing technologies.

Last December marked a milestone when Petr Klement became the first medical student to graduate. For his project tracing a genetic disease to mutation in a key mitochondrial enzyme, Klement worked both at the university pediatric clinic, where he screened patients, and at the Academy of Sciences' Institute of Physiology, where he did the analysis—especially satisfying, says Elleder, as a symbol of "collaboration between former rivals." Such cooperation is growing: A quarter of biomedicine graduate students now do thesis work in academy institutes and many more outside their "home" faculty.

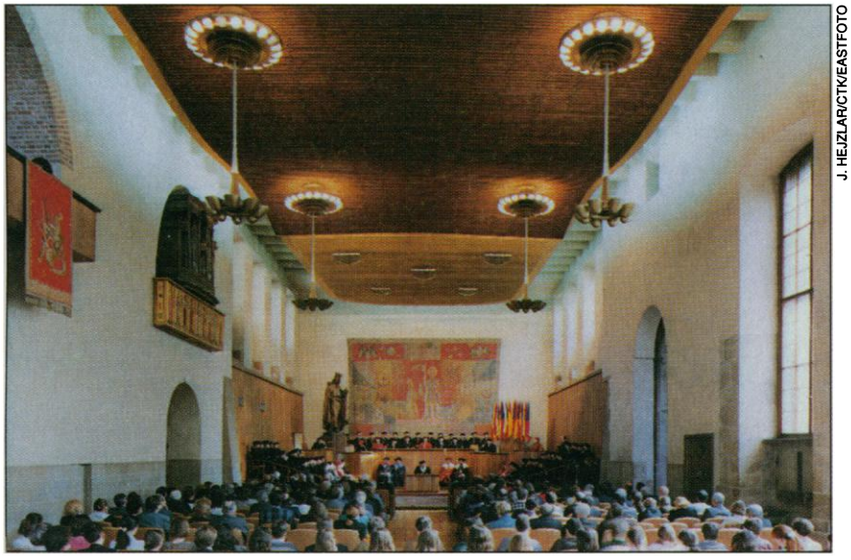
Vice Rector Pertold is trying to extend the graduate-school idea throughout the university, but he faces a hard fight. "Our 16 faculties are independent," he says. "We have to persuade them to participate, show them that coordination and synergy don't trespass on their academic freedom."

But despite progress in revamping graduate education, another problem is becoming more and more threatening: science's rapidly sinking attractiveness. Graduate student numbers are down 25% since 1989, while the brain drain from universities to the private sector, and to the West, is up. The main reasons are abysmal university salaries and the scarcity of scientific jobs in the country's still-floundering industry. "Students see no future," says chemist Martin Smrčina. "There's no motivation for them to go into science."

This can also be discouraging for young faculty members like Smrčina. After 1½ years at Cornell University, he turned down a well-paying job offer in the United States to return to Charles in its time of transformation. But he is impatient with the slow pace of change. "What we need most is new ideas and projects to get more students, to get them more involved," he says. And, while he sees that the problems facing science in the Czech Republic are "very hard to solve, ... sometimes it feels like we are treating the patient for cough when the body has cancer."

Elleder thinks the university can diagnose and treat its ills—provided it can muster the collective will to do so. "Czech intellectual potential is great," he says. "We might again become a top place in the world. But it requires general consent to do this."

–Patricia Kahn



J. HEJZLAR/CTK/EASTFOTO

Grand tradition. Charles University struggles to regain its place in international science.