Bourne, a professor of electrical and computer engineering who established the Sloan Foundation's Asynchronous Learning Network web while at Vanderbilt University in Nashville, Tennessee. He's brought the grant to Olin, where he'll help the school participate in a 40-school consortium for online education. "That would have been a much riskier experiment," agrees Milas. "I don't think we would have felt comfortable doing it."

Initially Olin will offer 4-year degrees in only three areas—mechanical, computing and electrical, and general engineering. The length of the program was stipulated by the trustees, Miller told a recent gathering at NAE. "We're not entirely at peace with it," he adds, referring to ongoing discussions about a fifth year, "but industry seems to like it." He also expects to expand the number of programs to meet demand, noting as examples the growing popularity of bioinformatics and bioengineering. The faculty structure also sets Olin apart: It will have no departments. Miller says that maintaining a unified faculty will help prevent the school from becoming captive to an outdated curriculum structured around narrow subdisciplines. "The allegiance to tradition is strong," he says. "Many courses haven't changed in decades because the faculty took them, and they assume that their students should, too."

The use of 5-year, renewable contracts instead of tenure is similarly aimed at ensuring what Miller calls a "culture of continuous improvement." "Olin College isn't staking its future on the absence of tenure," says Miller, "but I suspect that it plays a role in the lack of innovation at other schools." Faculty members say they had few qualms about coming to an institution that doesn't offer tenure, and that engineers don't require the same sort of protection from the vagaries of politics as do liberal arts professors. "Those who are most successful don't need it, and those who need it shouldn't have it," says Daniel Frey, an assistant professor of aerospace engineering and another MIT émigré.

The big attraction for most Olin faculty members is the opportunity to write on a blank slate, with talented students and sufficient resources. "Universities are built for homeostasis," says Lynn Stein, a former MIT assistant professor who hopes to integrate computer science into systems engineering and design courses in a way that she says wasn't possible at MIT. "The research is constantly changing, but the educational system stays the same."

Olin officials say they're still searching for the right balance between specialized training and a broad undergraduate education. "I hope that Olin will be sufficiently radical," says Henry Riggs, president of the new Keck Graduate Institute for the Applied Life Sciences, a member of the Claremont (California) Colleges consortium. "For instance, why specialize in the same few majors that engineering has been stuck with for years?" says Riggs, an engineer and past president of Claremont's Harvey Mudd College, whose rapid rise to academic excellence since its founding in 1955 Olin officials hope to emulate. "Why not provide a more well-rounded education in the arts and sciences and leave specialization to graduate school?"

Olin will explore those and many other issues during the next academic year, as its student-partners combine on-campus seminars with two monthlong experiences abroad. Miller says he doesn't expect to get it right the first time, but he's counting on the faculty and students to keep Olin from becoming "just another engineering school."

"It's a brave and courageous experiment," says Wulf. "I'm not sure how big an impact one small school will have. But they are asking a lot of the right questions."

—JEFFREY MERVIS

PORTUGAL

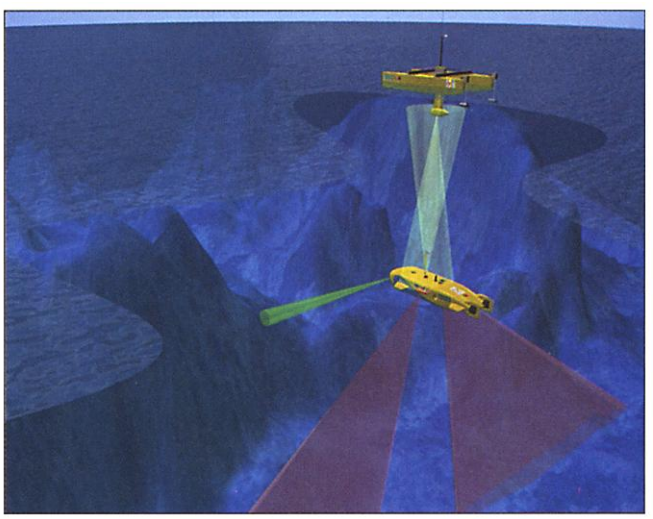
Money and Charisma Help The Science Tide Come In

New funds from the central government and the E.U., in the hands of an activist science minister, are helping revive a once-proud scientific tradition

LISBON—Five centuries after Vasco da Gama sailed around the Cape of Good Hope, pioneering a trade route between Western Europe and India, Portugal is again making waves in ocean science. Based in this renowned port city, the Institute of Systems and Robotics (ISR) is a leader in underwater robotics, working jointly with top-tier labs from California to Vladivostok. ISR's latest project—a novel master-slave pair in which a robotic catamaran controls an autonomous underwater vehicle (AUV)—is winning praise from foreign experts. The Portuguese AUV team is "world class," says Samuel Smith, director of the Advanced Marine Systems Lab at Florida Atlantic University in Dania.

ISR's success is one facet of Portugal's speedy transformation from a scientific backwater to a force to be reckoned with. "Twenty years ago, science virtually didn't exist in Portugal," says Cecília Leão, research vice rector at the University of Minho (UM) in Braga. But steady cash infusions from the European Union (E.U.), which Portugal joined in 1986, and reforms initiated by Science Minister José Mariano Gago, a physicist who took office in 1995, have pulled Portuguese science up by its bootstraps. The number of Ph.D. scientists in Portugal has swelled from 1700 in 1987 to 8000 in 1999, and funds for peer-reviewed grants have doubled in the last 4 years. Public research spending as a percentage of gross domestic product has nearly tripled since 1986, to 0.63%—still low compared with the research superpowers, but higher than that of Ireland, Italy, and Spain.

More help is on the way: The government is about to launch a pair of 6-year science and technology (S&T) programs, totaling $1.4 billion, that will upgrade scientific equipment and Internet connections and spur research commercialization. And even though E.U. funding for capacity-building projects will dry up in 2006, government officials feel that the country is finally on the right track. "The opportunity for Portugal to become a scientifically advanced country is within reach," says Luis Magalhães, president of the Portuguese Science and Technology Foundation (FCT), the country's main granting agency.



CREDIT: ISR

Leading the way. A unique master-slave catamaran and autonomous underwater vehicle, both remotely operated, will be tested off the Azores this spring.

Age of enlightenment

Such a statement would have been ridiculed during the long dictatorship of António de Oliveira Salazar. "For 50 years, we had a government that despised new knowledge," says Manuel Nunes da Ponte, director of the Institute of Chemical and Biological Technology in Lisbon. Salazar saw intellectuals as a threat to his iron-fisted rule and expelled dozens of professors. "Certain fields, like psychology, could not be taught," says Gago, who as a student leader was exiled to Paris in 1970. One of the very few notable researchers to work in Portugal during the dictatorship was neuroscientist António Egas Moniz, who won a Nobel Prize in 1949.

Even the April 1974 revolution that toppled the Salazar regime failed to lift science out of the doldrums. That didn't happen until 1990, when the government, tapping E.U. infrastructure funding, launched Ciência. It was a 4-year, $380 million applied science program that provided stipends for young researchers and gave many institutes the means to buy badly needed equipment. "It was a major jump in our history," says João José dos Santos Sentieiro, director of ISR, which used the money to collaborate on Europe's first civilian AUV.

Basic research continued to suffer, however, until Gago was lured back from CERN, the European laboratory for particle physics near Geneva, in 1995 to become the country's first science minister. Gago reversed the tilt toward applied research and won increases that have lifted R&D budgets from $477 million in 1995 to $707 million in 2000. Gago also spread the money across many fields. "It was such a novelty to see money going into the humanities," says UM English literature researcher Ana Gabriela Macedo. "People were in shock."

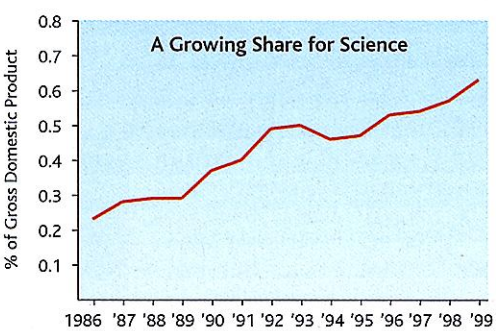
To help tackle deeper flaws in the science system, Gago hired Magalhães, a mathematician at Lisbon Technical University, to run the new FCT. The duo put their colleagues on notice: Mediocrity would not be tolerated. The first step was to appoint foreign experts to review grant proposals and entire institutes. The exercise allowed directors to justify dissolving weak labs and reassigning staff.

The country's most important privately funded research center, the Gulbenkian Institute of Science, experienced the most radical overhaul. The institute was founded in the 1960s by the Calouste Gulbenkian Foundation, named after an Armenian oilman who lived much of his life in Portugal and who left $2.6 billion to fund the arts, a mission later expanded to cover the natural sciences. In the dark years before Portugal joined the European Union, the institute was considered a lone bastion of strong biological research. But it had slipped badly by the early 1990s.

Rejecting a proposal to transfer the institute to the state, the foundation chose instead to ship out the entire staff, many of whom were hired by universities. "The foundation did not want to have this institution doing research anymore; they wanted to just do teaching," says António Coutinho, an expatriate immunologist who had set up a graduate studies program at the Gulbenkian while working at the Pasteur Institute in Paris.

Coutinho, however, managed to persuade the foundation to create a new institute from the ashes of the old. Asked to lead the transformation, Coutinho retired from the Pasteur and hired a cadre of young researchers on 3- and 5-year contracts to study everything from viral pathogenesis to mouse genetics.

Selling science. Science Minister José Mariano Gago, right, has won support from Prime Minister António Guterres, left, and others for big boosts in Portugal's science budget.



The Gulbenkian reopened in 1998. "Coutinho has a free hand to shape the institute, and he's done a great job," says Kai Simons, director of the Max Planck Institute for Molecular Cell Biology and Genetics in Dresden.

Such radical restructuring wasn't possible with Portugal's 12 national labs, which consume 15% of the country's R&D budget in areas ranging from mining to tropical research. Although international panels have called for a major overhaul, one prominent scientist is even more critical: The labs "have grown fat and totally useless." But the political impact of massive layoffs meant that "eliminating a national laboratory was never an option," says Magalhães. Instead, the government has instituted reforms that impose greater accountability on the labs and demand a minimal return on investment.

The next step

Blocked from gutting the existing national laboratories, Gago and Magalhães decided to anoint new ones. In 1999, they invited public institutions—apart from the national laboratories—and private nonprofits to compete for 10-year contracts to carry out "research of interest to the state," says Magalhães. Last November, four centers were selected as "Associated Laboratories," guaranteeing each millions of dollars to hire scientists and fund their work. The projects range from assessing the risks of genetically modified organisms to preventing gastric cancer (46 of every 100,000 Portuguese develop the disease, by far the highest incidence in Western Europe). The money is helping to lure talent from abroad: Da Ponte's institute, for instance, is poised to bring on a senior scientist from Max Planck among 25 new hires.

This year, the FCT will extend the program to materials science, coastal research, information technologies, and social sciences. In an allied initiative, the science ministry later this year plans to unveil a new biomedical institute, which Gago calls "our own NIH."

Although many scientists praise the associated lab program for allowing top-notch institutes to hire young scientists on long-term contracts, some academics are nervous. "The structure will compete with universities," contends UM bioengineer Manuel Mota. He worries that over time the associated labs will accumulate just as much dead wood as the national laboratories. Others hope the government will confer elite status on top universities, too. "My deep wish," says UM's Leão, "is to adapt the model to the university system," including making a commitment to full-time researchers.

Many scientists say the most urgent need now is to upgrade equipment bought a decade ago under the Ciência program. "We are working with hardware that will probably break down soon," says Mota. To address that concern, the government will unveil a National Program for Scientific Equipment, to run through 2006, as part of its billion-dollar S&T programs.

A generation ago, such a fantastic sum for Portuguese science would have been at best a dream. Now, says da Ponte, "the new generation has the freedom to do research in a way that the older generation never had."

–RICHARD STONE

CREDITS: (TOP TO BOTTOM) MINISTRY OF SCIENCE AND TECHNOLOGY OF PORTUGAL; (SOURCE) FCT