THE MONEY CRUNCH

The Future University: Leaner And Meaner?

At the California Institute of Technology, money from the U.S. government is a looming presence. Federal funds make up over half of the total budget, while tuition accounts for a mere 5%. "We are in the business of doing research," says Caltech's vice provost, physicist David Goodstein, and "essentially our only customer is the government."

But that customer may be buying a lot less in the future. Universities face the possibility of major cuts from the federal government, which supports about 60% of all university research (see chart). "American higher education in general, and research universities in particular, are both under threat and under attack," proclaims Jack W. Peltason, who last month stepped down as president of the University of California (UC).

The threat comes from budget cuts, says Peltason: A congressional resolution passed earlier this year could slice funding for civilian research and development by as much as 30% by 2002, according to a recent report* from the American Association for the Advancement of Science (AAAS, the publisher of *Science*). And the attack, Peltason adds, is coming from a "growing chorus of criticism" from Congress and from the media, which portray professors as too busy doing research to teach. Attacks also come from Ph.D.s who find their diplomas no longer guarantee a good job.

Although the federal budget ax has yet to fall, the prospect has many research universities thinking hard about solutions. "Either the organism changes," says Goodstein, "or it dies." Industry restructuring—downsizing, greater efficiency, and improving customer satisfaction—is the model being adopted by several. Everything from which academic departments to keep to what faculty expenses can be covered by grants is under scrutiny. Some schools are developing closer collaborations with industry, and virtually all are scouring the landscape for new sources of money.

Many schools, however, are doing little to adapt, says anthropologist Robert Adams, former provost of the University of Chicago. One reason is that the federal funding crisis is still a matter of speculation. Another, he notes, is that "no one wants to be first, because that says they're in bigger trouble than the rest."

Some influential leaders, like D. Allan Bromley, science adviser in the Bush Administration and now dean of engineering at Yale University, believe that some universities will eventually have to face the possibility of getting out of the Ph.D. business. "We overbuilt the Ph.D. production apparatus," particularly in the 1960s, he says. In the coming years, he predicts, "the number of Ph.D.-granting institutions will contract substantially. Even the most prestigious universities cannot aspire to every department or subfield."

Not all university leaders are so pessimistic. Cornelius Pings, president of the Association of American Universities, says universities, many of which have been around for over a hundred years, have faced hardship before and survived. "While we may have to do with less," he says, "these institutions have changed [in the past] almost beyond recognition, and there's no reason we can't do it again."

Taking the plunge. A glimpse of how universities can respond to cuts can be seen among the few that have already done so, reacting not to federal rollbacks but to state budget squeezes. One such school is the University of Michigan. Faced with severe state budget cuts in the 1980s, the university adopted the slogan "smaller but better." Then-President Harold Shapiro, now president of Princeton University, says the school decided to cut selectively rather than across the board. The geography department, for example, was axed after an internal review determined that it was of marginal academic quality—a decision which created an uproar among the faculty, although departmental transfers prevented any layoffs.

Michigan's Institute for Mental Health Research was also closed, and budget cuts ranging from 25% to 40% sliced into the schools of natural resources, art, and education. But other areas, such as the engineering and business schools, were beefed up. The medical school received a new hospital, and the physics department was offered five new faculty positions. The idea, says campus historian Nicholas Steneck, was to build excellence in areas that could generate money, either by attracting federal research dollars or by other means.

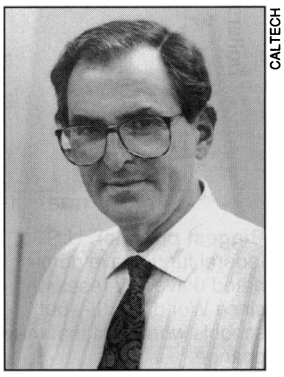
This strategy seems to have worked: Michigan is now the second-largest university recipient of federal research dollars in the United States, and it has just raised $850 million in donations. "Michigan today, despite the adjustments," says Shapiro, "is a better university than before."

Some faculty members agree that the university is stronger in areas such as science, but not all concur with Shapiro's overall rosy assessment. "I don't think he'd get many people who work around here to say the university is better than it was due to this retrenchment," says Rhoads Murphey, a history professor who had a joint appointment in the now-defunct geography department. He says he can understand the decision to close that department. But Murphey claims that the "university is being destroyed in bits and pieces" by the continued process of funding the professional schools at the expense of "the heart of any university," namely the arts and sciences. Entire areas of scholarship are not covered, he says, and university leaders don't understand the problems because they now come primarily from the professional and engineering schools.

Another university that has responded dramatically to hard financial times is the UC system—the nation's largest. In just 4 years beginning in 1990, state support was cut by $340 million, or almost 20% of its annual contribution. The university responded by increasing student fees by 125%, eliminating 1000 faculty positions through early-retirement incentives, cutting salaries, and downsizing administration (*Science*, 20 May 1994, p. 1074). "For the moment," says Peltason, "we are—just barely—hanging on," adding that a recent upturn in the California economy may mean "the free fall is over."

Downsizing, however, is just one part of the story.

For more info on this topic, see *Science*'s Next Wave World Wide Web site: **http://sci.aaas.org/nextwave/**



CALTECH

"Science collapsing is not out of the question."
—David Goodstein

* "Interim Report on Congressional Appropriations for R&D in FY 1996," AAAS Directorate for Science and Policy Programs.

PRINCETON

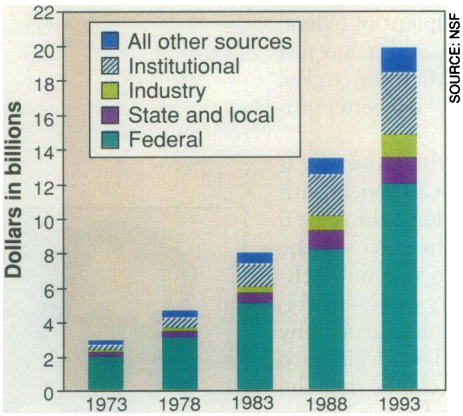
"I think it's underappreciated how many adjustments have been made."
—Harold Shapiro

Changes in funding mechanisms are also in order. At the Massachusetts Institute of Technology (MIT), for example, research grants will soon be off-limits for faculty pay during the academic year. At MIT and many schools, faculty members can reduce their teaching if they have a research grant which can pay their salary during the academic year. MIT is disallowing this practice in order to conserve precious research dollars to fund graduate students.

Industry ties. Just as universities are taking some pages from industry's book, they are also trying to attract industry money. "Industry must and will play a larger role in the support of university research and activity in the coming years," says President Charles Vest of MIT, where 16% of research money already comes from industrial sources. Such support, however, "will not be fundamentally philanthropic," he says.

That's certainly true if the money comes from IBM, which 3 years ago restructured its $25 million program of support to universities and zeroed out its traditional no-strings-attached money for universities. According to James McGroddy, IBM's senior vice president for research, the change is part of a "radical and fundamental redesign" in the relationship between universities, industry, and government, one that will force universities to focus on returning society's investment in their institutions. For instance, he says, the pressure to publish can lead researchers into fields they can wring a lot of papers out of—such as research on gallium arsenide, a complex alternative to silicon for microchips—while ignoring simpler but more economically important areas like flat-panel display screens. That will have to stop, says McGroddy.

University Research Funding, 1973–1993



SOURCE: NSF

Biggest provider. U.S. federal funds have dominated university research since World War II—but schools worry that that may change.

Happy Missouri couple. One long-standing example of a mutually beneficial industry-university agreement is the 15-year-old agreement between Washington University in St. Louis and Monsanto Corp. In exchange for the right to license patents, Monsanto currently gives $6 million a year to support about 50 research projects at the university's medical school, says professor of medicine and program co-founder David Kipnis. Kipnis says the university work is "discovery research" that might give Monsanto leads for new drugs; specific drug design is left to company labs.

To make sure academic priorities aren't skewed, funding is limited to 6% of the total medical school budget, and an outside board of scientists reviews the program every 3 or 4 years. "There's no doubt it's an ideal arrangement," says Nobel laureate Daniel Nathans, president of Johns Hopkins University, who has chaired the review board three times in the last decade. Washington University Chancellor Mark Wrighton adds that the program helps prepare students to work in industry by exposing them to visiting company scientists and industry-related problems while at the same time "taking research at universities and bringing benefits to society more rapidly."

Getting relevant. Showing the value of university research is a recurring theme among leaders looking to preserve industrial, public, and congressional support for higher education. One entity born in 1991 from such concerns is the Center for the Environment at Cornell University in Ithaca, New York, an interdisciplinary program with over 200 faculty members from 49 departments. Rodney Dietert, a professor of immunogenetics and senior fellow at the center, says such centers are capable of solving "high-impact, high-profile" problems that extend beyond the expertise of any one department.

Five years ago, for example, the federal Environmental Protection Agency demanded that New York City improve its water quality. The city turned to the Cornell center. As part of a $40 million project ($5 million of which goes to Cornell), 30 faculty members, including scientists and economists, are working with dairy farmers in upstate New York to reduce agricultural run-off into the city's watershed by implementing new cost-effective techniques such as alternative composting to kill pathogens. That's the kind of visible use of academic research needed to woo back a public disaffected with universities, says Dietert. He admits, however, that funding such centers, which can compete for resources with established departments, is an ongoing problem.

Funding in the future. No one knows yet how deeply the federal budget ax will cut, and skeptics says the 30% figure in the AAAS report is too high. Discounting inflation, budgets for the National Institutes of Health and the National Science Foundation are relatively flat, and the total cut is 17%, mostly in nonuniversity programs, like the Advanced Technology Program of the National Institute of Standards and Technology.

But MIT President Vest remains concerned about the long-term prospects. "The U.S. R&D system and federal role in it are not well understood or appreciated by many members of Congress who are new and have had no responsibility for it," he says. In the battle to balance the budget, Vest says, the result is that in the long term, "research and advanced education will be targets."

If the federal cutbacks do happen, the pickings elsewhere are meager. Tuition has already been stretched to the breaking point—on average, it's risen 9% a year for the past 15 years, well above the general inflation rate. Research contracts with industry make up only 7% of the roughly $20 billion a year spent on university research and development, according to the American Council on Education. Other sources of income, such as profits from patenting and licensing new technology, are generally acknowledged to be low—MIT made just $1 million net profit on rights and royalties last year.

Opinions differ on how well universities have prepared for the possibly stormy seas ahead. Princeton's President Shapiro is an optimist. "I think it's underappreciated how many adjustments have been made, particularly at the state schools," he says. But pessimists like Caltech's Goodstein say universities don't realize the peril they face. A university is like a business with a single funding base, he says, and even a moderate cutback can wipe out profits, kill motivation, and prevent long-term investment: "Science collapsing is not out of the question." Both sides agree, however, that university foundations lie on shifting grounds.

–Paul Selvin

Paul Selvin is a science writer in Berkeley, California.