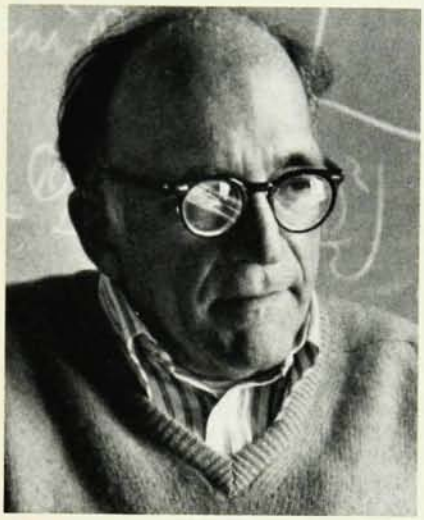
Automatic science budget cuts provoke appeals to Congress

This has been a winter of discontent in Washington for scientists. Congress's passage, on 11 December, of the Balanced Budget and Emergency Deficit Act (more commonly known by its Senate sponsors—Phil Gramm of Texas, Warren Rudman of New Hampshire and Ernest F. Hollings of South Carolina) may prove to be a turning point for US science policy. A three-judge panel of the US District Court found one of the law's key provisions unconstitutional and this ruling awaits a Supreme Court decision, which is not likely to be handed down before summer.

Even so, the first budget-cutting imperatives went into effect on 1 March. Under the automatic procedures of Gramm–Rudman–Hollings (or simply GRH, as the law is often called on Capitol Hill), $11.7 billion was whacked from the fiscal 1986 budget. Of that sum, a disproportionate $2.5 billion came from R&D programs, some 67% of this from the Defense Department alone because of the size of its budget. The proportions of spending cuts agreed to by the Congressional Budget Office and White House Office of Management and Budget meant that the civilian agencies had to trim 4.3% across their budgets for the rest of fiscal 1986, compared with DOD's deeper cuts of 4.9%.

Sequestrations. Enacted when Congress failed to meet its own goal for reducing the national deficit, GRH calls for the Federal budget to be in balance by 1991. On 1 February President Reagan issued the order for the 1986 cuts, which are known officially as "sequestrations"—meaning things set aside or confiscated. The Department of Energy was among the few agencies to comply quickly enough for GRH reductions to appear in the printed version of the fiscal 1987 budget. DOE's Office of Energy Research found its $1.8 billion budget for basic energy research, magnetic fusion and national laboratories pared by $70 million. Because 1986 operating and construction budgets already are down from 1985 levels, further reductions involve hard choices, such as cutting down on staff and limiting the use of facilities.



DRELL

The National Science Foundation was similarly hit by spending cuts of 4.3%. In consequence some $60 million was deducted on 1 March from its 1986 research budget of $1.4 billion. Two days later NSF director Erich Bloch informed his staff that he was seeking approval from Congress to reprogram the GRH reduction formula. For one thing, about one-third of the agency's 1986 funds had already been spent or at least committed. What's more, Bloch sought to keep to the NSF levels originally requested for mathematics research, the international deep-ocean-drilling project and several programs to increase participation of women and certain underrepresented minorities in science and engineering. He considers these programs essential because they constitute either high priorities or legal obligations.

In addition, Bloch directed the agency to protect grants for graduate students and postdoctoral fellows as well as university instrumentation and equipment. To maintain the full $11 000 living stipend for some 550 research students, he reduced the cap on graduate-fellowship cost-of-education allowances from $6000 per year to $5250 and thereby met the stringent conditions of GRH. In the end, NSF cuts of 4.3% were upped to 4.8% to make up for the programs that would not be pared a whit. That wasn't all: On 13 February Bloch sent an "important notice" to university and college presidents on the subject of GRH's impact on NSF. In it, Bloch informed academic leaders that "we intend to make the necessary 1986 reductions with as little disruption as possible and to spread their effect as equitably as possible," respecting the agency's priorities, of course. But because the sequestrations happen at midyear, he went on, the adverse effects of GRH are "somewhat greater than might otherwise be the case."

Renegotiations. In fact, Bloch wrote, in carrying out the law "we must either reopen FY 1986 awards already made or absorb reductions greater than 4.3% in the year's remaining activities. Either course of action involves a degree of inequity and hardship." Truth to tell, Bloch had already authorized NSF program officers to slash up to 10% from grants, contracts and cooperative agreements that had been funded for the first time or renewed. Program officers were instructed to be tough on new proposals, declining some that would be considered "otherwise worthy of support" and generally preparing for GRH actions that may occur from now to 1991, the year the Federal budget is supposed to be in balance. Bloch also indicated that the agency may have to reopen awards already made for fiscal 1986 to achieve reductions in line with the revised spending levels.

Worse was still to come. "If the President's budget is not met," Bloch wrote in his memo, "the reductions facing NSF in fiscal 1987 could be much greater than this year. Under such circumstances, the adjustments we are making this year would be inadequate. Increments on continuing grants, always contingent upon the availability of funds, would have to be renegotiated. We would be forced to consider a number of additional actions, such as elimination of principal investigator salary support, limits on indirect cost rates or on some components of indirect costs, and larger cost-sharing requirements. Such changes in our practices

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On the importance of Federal investment in research

This statement, signed by the leaders of 28 science, mathematics and engineering societies, went to all members of the Senate and House budget committees on 24 March:

The undersigned presidents of societies, whose members comprise the full spectrum of American science, engineering and mathematics, feel compelled to express our concern over the possible consequences of an inadequate investment in research. We are fully aware of the threat posed to the nation by rapidly growing deficits, and we have only the most profound respect for the willingness of Congress to assume the responsibility for reversing this alarming trend. No amount of spending reduction, however, can succeed in reducing the deficit without the revenues produced by a healthy economy. No element is more vital to maintaining that health than investment in fundamental research.

It is sometimes assumed that the practical exploitation of fundamental research results requires many years, and research projects can therefore be deferred without serious consequences. Experience tells us otherwise. Although the practical application of the fruits of basic research may in some instances require many years, they are more frequently exploited almost immediately, as with the discovery of x rays and nuclear fission. However, when research projects are deferred for even short periods, the effects can and do persist far longer. In the absence of support, researchers must turn elsewhere, and once lost can only be reassembled with great difficulty. Moreover, the unique invention that has kept the United States at the forefront of world science is the integration of fundamental research with the training of new scientists and engineers. The deferral of research in a given area therefore has an immediate effect on the training of researchers in that field, thus compounding the problem of reestablishing the lost momentum.

Our economic competition will not be idle during the years that are lost. The new reality to which the United States must adjust is the development of a world economy in which emerging nations have become major producers . . . for a world market. If we are to maintain or improve our standard of living, we are compelled to develop new products. In our impatience for practical results, however, we have allowed the division of resources between research and development to get dangerously out of balance. Regardless of the resources we commit, the pace of development must slacken in the absence of new science—and the budget for basic research in this country is today only about 13.6% of the Federal budget for research and development.

We therefore urge Congress to sustain a healthy growth in fundamental research as an essential component of a deficit-reduction plan. Any of us would be happy to meet with you and other members of the committee to discuss our concerns.

would significantly affect our grantees and contractors."

At a press briefing on 13 February, the day he mailed the notice, Bloch candidly expressed his anxiety—and a strategy for overcoming it. "We hope that clear and reasonable minds will prevail in universities and in Congress," he said. "It's going to be more competitive than ever in academic science and engineering." The outlook for NSF research budgets, Bloch forecast, "looks negative for the next few years." What to do? The science and engineering community needs to make itself heard on Capitol Hill, Bloch declared. "I think grass-roots action is more important than cranking up the professional science and engineering associations. Among scientists and engineers, we talk about the importance of research, what we need so that we can do our jobs, the significance of our work to the nation's security and to the general society, but we don't visit members of the Senate and House in their offices and we rarely invite them to our campuses and laboratories."

Wouldn't this appear self-serving, Bloch was asked. "Farmers come through as self-serving," he replied, "and they get a lot of money out of the government." As Bloch sees it, "science has to move out of the shadows."

Implications. The implications of GRH for basic research also were the prime topic for 400 science and engineering leaders who assembled in Washington on 26–27 February at the behest of the Government–University–Industry Research Roundtable of the National Academy of Sciences and National Academy of Engineering. Their conclusion: Unless actions are taken soon on Capitol Hill and within their own institutions, the situation for academic research is likely to get much worse. The report of the day-and-a-half conference concludes with a euphemistic communiqué: "We seem to be in for a protracted period of national belt-tightening, and research seems likely—sooner or later and in one way or another—to feel the pressure. If the Federal deficits are eliminated over the next five years without substantially increased Federal revenues, the impact on research funding could be cataclysmic. Given these circumstances, the scientific and engineering world must help set the national agenda in ways designed to serve the national interest most effectively."

The point has been made more robustly by Roland Schmitt, vice-president for research at General Electric and chairman of the National Science Board, which approves policy at NSF: "Gramm–Rudman is a symbol of a very serious problem. Even if the Supreme Court kills it, it will rise from the grave to force us to make some painful choices for the sake of our academic research system." Schmitt identified only two ways of funding academic research during a prolonged period of fiscal stress: Reallocate the budgets of those national laboratories that are known to have uncertain or unpopular missions, and redirect the development funds of certain R&D agencies such as the Defense Department for the benefit of basic research.

Frank Press, president of the National Academy of Sciences, said participants at the conference seemed to conclude that universities could possibly "fine tune" their research programs and management actions to cope with a 4.3% cut by the mission agencies in fiscal 1986, but a succession of research reductions of, say, 15% each year would cause a system breakdown.

To protect basic research in the GRH era, the Roundtable participants agreed they should:

- Persuade research managers at Federal agencies, principally DOD and NASA, which award most of their funds to applied R&D, to better appreciate the dependence of new technology on basic research. "Frankly," said Schmitt, "a campaign is required there." Shifts as small as 1% or 2% from Federal R&D budgets into academic basic research could make a difference, though most people at the conference agreed that attempts to transfer science funds across agency lines—from DOD to NSF, for instance—are bound to suffer fierce "turf battles."
- Change the attitudes of academic scientists who are reluctant to send proposals for basic research to agencies that normally support applied R&D. Nonetheless, the assumption that traditional R&D agencies abhor pure science is generally true, says Robert A. Frosch, a former NASA administrator who now is research vice-president at General Motors: "The problem is not overdrawn."
- Urge research universities to submit to critical self-examination with a view toward reallocating their limited financial resources to advance basic research. A report of the conference notes that in a discussion of tradeoffs, university administrators addressed, "perhaps for the first time in years, fundamental questions . . . such as substantially streamlining research management, rethinking the numbers and roles of research universities and Federal laboratories, and increasing international cost-sharing for expensive re-

search facilities.... Efficiencies in university research must be found. 'Business as usual' is not an option open to research universities. Hard choices must be made.... These include elimination of weak programs, streamlining of administrative procedures and pooling of resources. The word 'management' is an unhappy one with many university faculty members, but it is a word that was used frequently in this conference and one that will be used more often in the future." One issue requiring better academic decision-making was raised by Peter Likens, president of Lehigh University, who observed that universities must find more financial support for undergraduates and graduate students to make up for the serious loss of Federal funding.

The Roundtable participants did not go so far as to call for lobbying Congress and the Administration for the sake of science, probably because most have ready access to the Washington establishment on their own or through influential friends.

Complacency. Sidney D. Drell of SLAC, President of The American Physical Society, took a more outspoken position. On 28 February, a day following the Roundtable, he sent an "Urgent appeal to members and friends of APS to support basic science." In his letter, which went to all 535 members of Congress as well as to agency research chiefs and physicists, Drell asserts that "the science community seems dangerously complacent" at this early stage of GRH reductions affecting R&D programs. As Drell sees it, the situation for fiscal 1987 is far less certain and potentially far more serious. "Although the President's asking budget for FY 1987 includes healthy increases for science, few expect the President's budget to be adopted.... There is little doubt that Congress will restore many programs that have been eliminated.... To do so, they will quite naturally look to those areas that have fared relatively well. The danger for basic science is great.

"I therefore urge that all members and friends of The American Physical Society undertake the responsibility of informing their elected representatives of the need to invest in scientific research—a need that is even greater in times of economic stress," he argues. "Even as we send that message, we must demonstrate the unity of the scientific community. It would be unfortunate if we appear to be pleading only for those projects in which we have a personal stake. I recommend that in your contacts with members of Congress you stress the value of science rather than of particular projects.... The time is short.... We must [make] clear that the science we love for its beauty is also the foundation of our material well-being."

Taking his own advice, Drell exhorted the leaders of other scientific and engineering societies to sign a declaration of deep concern about the economic and social consequences of inadequate investment in research (see box on page 50). Drafted principally by Robert L. Park of the APS Washington office, and signed by the presidents of 28 professional societies, the statement was delivered to members of the Senate and House budget committees on 24 March. Among the societies (and signers) are:

American Institute of Physics (Norman F. Ramsey)
American Astronomical Society (Maarten Schmidt)
Acoustical Society of America (Floyd Dunn)
American Physical Society (Drell)
American Vacuum Society (J. H. Singleton)
American Association of Physics Teachers (Robert Beck Clark)
American Crystallographic Association (William L. Duax)
American Geophysical Union (Charles R. Drake)
Optical Society of America (Jean Bennett)
American Meteorological Society (Joseph Smagorinsky)
American Association for the Advancement of Science (Gerard Piel)
Institute of Electrical and Electronic Engineers (Bruno O. Weinschel)
American Chemical Society (George C. Pimentel).

—IRWIN GOODWIN

Greater investment in chemistry, says panel, will pay bonuses

Last October, five months before the release of the Brinkman physics survey described in this issue, the National Academy of Sciences released a similar report on chemistry. Entitled *Opportunities in Chemistry*, it was prepared over a three-year period by a committee headed by George C. Pimentel of the University of California, Berkeley.

The major recommendation of the Pimentel report is that the Federal government should spend much more money to support research on chemical reactivity, catalysis, chemistry of life processes, chemical aspects of the human environment and chemical behavior under extreme conditions of pressure and temperature.

"Existing patterns of funding are anachronistic and inadequate," the Pimentel report says in support of its principal recommendation. "Average grant sizes are too small.... Business and industry employ more doctoral chemists than the sum of those employed in the biological sciences, mathematics, physics and astronomy combined. Yet we find that the average Federal investment in the crucial human resource in chemistry is only one-fifth as much per PhD as in other comparably important disciplines."

The report goes on to argue that the "Federal investment in chemistry should be raised to be commensurate with the practical importance of chemistry." Specifically, the report says that:

PIMENTEL

- ▶ NSF should increase its support for chemistry 25% per year in fiscal 1987, 1988 and 1989 and increase grant size to encourage young investigators, enhance shared instrumentation programs and provide added funds for dedicated instrumentation.
- ▶ DOE, to compensate for its current allocation of only 5% of its budget to chemical sciences, should increase funding for chemical research that is relevant to energy by a factor of 2.5 over the next five years, starting with an increase of $22 million in fiscal 1986.
- ▶ DOD should resume spending 5% of its budget on basic research, as it did in 1965, and one-quarter of DOD funding for university-based research should go to the chemical sciences.
- ▶ The US Department of Agriculture should increase support for extramural research in chemistry.
- ▶ The Environmental Protection Agency should greatly expand its "tiny exploratory research program," with emphasis on reaction pathways, sensi-