worldwide notice ordering all Army medical facilities "to suspend from immediate use and issue all Abbott intravenous solutions." The Army and the FDA differed in their actions, according to one medical officer, because the Army wasn't depending solely on Abbott products. And "because in the military services we never take a chance with a product that might be faulty."

On 19 March, Sidney Wolfe, a Washington internist and member of the Medical Committee for Human Rights, heard from a physician friend in New York. Wolfe's friend claimed that the extent of the infections caused by the Abbott solutions in his hospital exceeded the number claimed by government officials. He also claimed that the FDA-recommended precautions did little to reduce the incidence of blood poisoning.

After investigating the problem, Wolfe contacted Ralph Nader, who agreed to send a joint letter to Edwards demanding a ban on the product. The letter sent the following Sunday (21 March) alleged that ". . . there is a clear mandate from the data the CDC has collected to order Abbott intravenous products off the market and thereby *insure* the end of this epidemic of blood infections and death."

Nader and Wolfe were particularly critical of one of the FDA precautions that read: "At the first suspicion of septicemia which might be associated with contaminated intravenous fluid, all existent IV apparatus should be removed. . . ." Claiming that "it is a form of malpractice to wait until a patient develops evidence of the blood infection," the letter said, "the recommendation is a cowardly repudiation of the ethic of preventive medicine."

In response to an appearance on national television news by Nader and Wolfe publicizing their letter, Edwards defended his 13 March decision. But the next day he essentially followed their recommendation and banned the use of all Abbott I.V. solutions, except for emergency situations.

Listing the reasons for the change of decision, Edwards included new evidence regarding the extent of the epidemic, availability of alternative suppliers, and the ease by which bacteria can find their way into the I.V. solution. After 13 March, while evidence of new cases of blood poisoning was pouring into CDC headquarters, the three investigators who had located the contamination were working 20 hours a day trying to find the mechanism of the contamination. They found that one need only twist the cap, not shake the bottle as they had thought, to release the bacteria. Thus they concluded that the Abbott solutions were unsafe under any conditions.

Abbott Laboratories issued a press release stating that "it will co-operate with the FDA" and emphasizing that the I.V. solutions represented only 8 percent of the company's total sales last year. Beyond that, however, company officials refuse to discuss the matter.

Even though all the pieces of the puzzle weren't in place until the third week in March, FDA officials clearly had sufficient information to take action and save lives before then. One might ask why FDA officials believe that a strong association between a product and a serious infection is insufficient reason to take action against the product. Or, why, at the very least, they had not investigated the availability of alternative supplies of the I.V. solutions at the first suspicion of the Abbott products.

Only a congressional investigation can provide the answer to those questions, since FDA tends to regard the specifics of its regulatory decisions as privileged information.

—ROBERT J. BAZELL

# Research Grants: New Awards Bore Brunt of NIH Cutbacks

Measuring the breadth and depth of the current recession in federal support for science and its impact on the conduct of basic research has proved to be a baffling task at best. Even now, as the budgets of some major federal research agencies creep upward again, there remains a dearth of "hard," quantitative information about the financial health of American science—even from the agencies themselves.

For the most part, the recession in sciences remains evident chiefly in terms of anguished anecdotes from the nation's campuses telling of curtailed research and discouraged graduates. But anecdotes have a way of sounding very much like special pleading, especially when contrasted with seemingly small cuts in the overall budgets of research agencies. As a result, they have provided only a poor composite picture of the fiscal situation.

In the partial vacuum of objective information, however, a small unpublished study by an ad hoc committee of the National Academy of Sciences appears to provide a fresh and important new glimpse into the making of the research slump.

Conducted last year, the study focused on the National Institutes of Health (NIH) and its support for new research and grant renewals, particulary in chemistry. The study shows in great statistical detail that money for these purposes from the various institutes declined by an average of 20 percent, and that the NIH unit with perhaps the deepest commitment to basic research—the National Institute of General Medical Sciences (NIGMS)—lost fully half of its money for new research and renewals in 1970. The study indicates that such a sharp decline, coupled with termination last June of the NIH predoctoral fellowship program, understandably traumatized the research community. And in important ways the study helps to reconcile the anecdotes with the budgets.

The five-man committee* which conducted the inquiry was headed by Virgil Boekelheide, a professor of chemistry at the University of Oregon and chairman of the National Research Council's division of chemistry and chemical technology. Although results of the study have not been published yet, a few copies of data which the NIH gave to the committee and a summary statement are circulating around Washington. And some top

* Other members were Ronald Breslow, Columbia University; John D. Roberts, California Institute of Technology; Henry Taube, Stanford University; and Frank Westheimer, Harvard University.

Academy officials are known to feel that the committee's findings deserve much wider dissemination than they have received so far.

Restricted as it was, the inquiry nonetheless produced lessons of interest to the research establishment at large and, some committee members feel, to congressmen and budget planners as well. Briefly summarized, the study documents the chain of events whereby seemingly small cuts in an agency's overall budget are amplified into a drastic reduction of money both for new research and for grants which have the misfortune to come due for renewal at a time of fiscal surgery. Data which NIH gave to the Academy committee also confirms what most grant administrators probably already know all too well: Readily available budget statistics, as opposed to those which NIH went to considerable trouble to produce for the Academy, simply do not reflect the kinds of financial fluctuations which researchers experience.

### Launched Last April

The Academy's chemistry section decided to appoint its committee and launch the inquiry last April, and it did so for three reasons. First, NIH has long been the leading supporter of chemistry research in the nation's universities. During the mid-1960's roughly a third of some $60 million spent annually on chemistry research came from NIH, and half of that originated in the NIGMS. Before April, Boekelheide said in an interview, chemists around the country were becoming increasingly alarmed at the number of worthy projects being discontinued and the number of new "high-priority projects" not being funded by NIH. The decline seemed so dramatic in fact that several eminent chemists were moved to wonder whether NIH had decided to abandon basic chemistry research and to "discriminate" against grant applications relating to chemistry, a possibility that had "portents of sheer disaster," Boekelheide said. The fear turned out to be plausible but untrue. But suspicions of bias were only bolstered by a survey which Kenneth Wiberg, the chairman of Yale University's chemistry department, conducted among 550 physical organic chemists (of whom he was one). While physical organic chemists represent only a small slice of academic chemistry, Wiberg reasoned that their problems ought to be symptomatic of everyone else's. And their problems proved grim indeed: From 185 responses, Wiberg determined that, between fiscal years 1968 and 1970, his subspecialty had lost more than a third of its support from NIH and more than half from the Defense Department. The latter slice was attributable to the so-called Mansfield amendment, which required that basic research supported by the Defense Department be closely related to the agency's mission.

Meanwhile, Boekelheide said, chemists' complaints to their congressmen were being duly forwarded to NIH, which in turn responded with statistics showing no substantial fall-off in research support. Nevertheless, the decline was plainly evident to chemists sitting on NIH grant review panels. To them it began to seem as if few of the applications they approved for funding were actually receiving money. That suspicion was confirmed by information that came from a long and plaintive correspondence about research cuts which Stanford University biochemist Carl Djerassi carried on in 1969–70 with an assortment of NIH officials, congressmen, and colleagues. At one point, a packet of NIH data relayed to Djerassi by Representative Charles Gubser (R–Calif.) showed that out of 28 grants approved by one NIH biochemistry review panel only one was funded. "Ordinarily this kind of information doesn't become available until 2 years later," Djerassi told *Science*. "It was the first firm indication of what was going on at NIH, and it really got this committee started."

In April, the Academy committee contacted Robert Q. Marston, the director of NIH, who promised his agency's his full cooperation with an examination of its funding practices. The committee then submitted six detailed questions focusing on awarding of new and renewing of old research project grants, rather than on the overall NIH budget, which had actually increased (though not in step with inflation) from $1.1 billion to $1.52 billion during fiscal 1968–70, the period of the most severe fiscal crunch for new research. Further, to confirm or allay fears of bias against chemistry, the committee wanted to know how many grant applications each NIH study section had approved and how many ultimately were funded between 1964 and 1970.

To produce such information, NIH had to compose a special "query program" to cull the data from its computers. "It cost us a lot of money to give them all that data," said one high-level administrator at NIH. "If it had been anyone else asking, well, I don't know. . . ."

### New Research Declines

The Academy committee received its answers in mid-September. And by the time it finished sifting through the sheaf of printouts, it had concluded that 1970 was indeed as bad a year for new research as the anguished anecdotes had indicated. The NIH data showed that its money for new grants in all fields of science peaked at $135 million in 1967 then fell to $117 million in 1969. But in 1970, money for new grants dropped another $22.5 million to a "catastrophic low," committee members said, of $95 million—an amount substantially below that available in 1964. This stringency was readily apparent in the ratio of grants approved to grants actually funded. In 1964, NIH funded 3623 out of 3930 grants that its study sections approved. But during 1970 NIH's overall score declined to 2420 grants funded out of 4938 approved—a rate of about 50 percent.

But the ratio of approved to funded grants was by no means uniform among the institutes. By far the hardest hit was the NIGMS, which supports about 15 percent of academic chemistry. The NIGMS absorbed $7 million of the $22.5 million overall reduction in new research and consequently found itself able to pay for only 19 percent—176 out of 924—of its approved grants. Toward the end of fiscal 1970, things grew grimmer, as the NIGMS ended up funding only 9 of the 183 grants considered worthy by its advisory council in March 1970.

It soon became known, as one biochemist puts it, that "assignment of a grant application to the NIGMS meant death for that project."

### Major Effects of Minor Cuts

The committee found it puzzling that new research should have to undergo such radical surgery when congressional appropriations for NIH have remained fairly stable, and when the Office of Management and Budget (OMB) imposed only "minor" cuts on NIH as a whole. The answer, committee members agreed, was that the various institutes tended to regard in-house research, administrative budgets, and continuing extramural grants as sacrosanct—thus leaving new research at the bottom of the priority pile. Since only about 20 percent of an institute's annual budget goes into new and renewed research, a

cut of 6 or 8 percent applied to the institute as a whole becomes a cut of 40 to 50 percent when borne almost exclusively by the new-research segment.

In an interview, Boekelheide said it was understandable that NIH should wish to honor its "moral commitments," but that congressmen and budget planners should realize that such an "amplification" of small budget cuts can seem from the campus all too much like a major retreat from the support of fundamental research. (Continuing grants also suffered harshly, if not equally, in 1970. NIH negotiated 10 to 15 percent cuts in most of its 7106 continuing grants, resulting in an additional $38.4 million saving and, as one NIH official put it, "untold disruption" of research.)

The NIH data revealed no sign of discrimination against chemistry; the fiscal crunch proved as blind and unremitting as Justice herself. But Academy committee members did feel that termination of the NIH predoctoral fellowship program last June worked an unfair hardship on chemistry, which each year claimed a 30-percent share (or about 2000) of the fellowships. These awards went competitively to individuals, unlike training grants that go to institutions which then select their students.

Chemistry's inordinate share of fellowships indicated the extent to which it had hitched its fortunes to the NIH. Researchers apply where the money is, of course, and NIH always had more than the next leading supporter of chemistry, the National Science Foundation (NSF). And not only were NIH grants larger, but they tended to run longer than those from NSF.

But there are a good many chemists who concede that much of the work supported by NIH, while at least remotely relevant to health, nevertheless really belonged under NSF. By that reasoning, chemistry has been something of a stepchild to NIH, and thus might conceivably become the least favorite in the midst of a recession.

### Relevance Questioned

During the times of radical budget slicing last year, some institutes did in fact question whether applications for chemistry research grants assigned to them were relevant to their missions, according to Ronald Lamont-Havers, the NIH associate director for extramural research and training. "As soon as you start cutting off funds, everyone becomes concerned with relevance," he told *Science*. "It was pointed out that the act of accepting an application meant that it was relevant to health . . . we had to make sure that we were preserving a basic science base, that basic science was being funded even if it might not have immediate relevance to particular missions." Still, he said recently, NIH has been concerned since the early 1960's about an overlap with NSF. He notes delicately that when the budget squeeze began, "We were prepared to look at some of these overlap problems and we have toyed with the idea that more should be done by NSF. But we haven't made any move in that area."

The Academy's inquiry leaves unanswered the question of how much damage chemistry's financial plight last year actually inflicted on the conduct of basic research. Out of about 500 chemistry research applications approved for funding by the NIGMS, some 420 were turned down. But no attempt was made to learn how many of the losers found money from other sources, or on the other extreme, how many abandoned chemistry altogether. Nor is reliable quantitative information available on graduate and postdoctoral enrollment in university chemistry and biochemistry departments last fall, although an American Chemical Society survey now under way should yield that information sometime within the next few weeks.

Whatever its limitations, the Academy inquiry served at least to elucidate the emotional impact of "small" budget cuts, if not to measure its effect on the conduct of research.

"But there's no denying that 1970 was a very bad, traumatic year," Lamont-Havers says. The situation is improving now, and NSF sources estimate that federal support for chemistry research will climb this year to its 1968 level of $68 million. What's more, the President's 1972 budget contains $29.5 million for NSF chemistry projects, which, if Congress appropriates this sum and the Office of Management and Budget decides to spend it, will exceed NIH expenditures for chemistry for the first time in nearly a decade.

If the squeeze is easing, the lessons remain. "In this particular field," Lamont-Havers comments, "and in that particular year—1970—times were certainly hard. And it's a good indication of what might have happened across the board if budget cuts had continued."

—ROBERT GILLETTE

# RECENT DEATHS

**E. Lucy Braun**, 82; professor emeritus of plant ecology, University of Cincinnati; 5 March.

**Gilbert H. Cady**, 88; retired head, coal section, Illinois State Geological Survey; 25 December.

**Herbert B. Dorau**, 73; former professor of economics, New York University; 17 January.

**Ernest C. Evers**, 54; professor of physical chemistry, University of Pennsylvania; 18 January.

**Eugene M. K. Geiling**, 79; former professor of pharmacology, Howard University; 12 January.

**Raphael R. Goldenberg**, 66; professor of surgery, College of Medicine and Dentistry of New Jersey at Newark; 17 December.

**Morris M. Leighton**, 83; retired chief, Illinois State Geological Survey; 7 January.

**Elek J. Ludvigh II**, 61; professor of ophthalmology, Wayne State University School of Medicine; 15 January.

**Earl A. Martin**, 80; professor emeritus of biology, Brooklyn College; 5 February.

**Arnold T. Nordsieck**, 60; head, physics department, General Research Corporation, California; 19 January.

**Doris G. Phillips**, 45; professor of economics, California State College, Fullerton; 14 January.

**John W. Rice**, 79; professor emeritus of bacteriology, Bucknell University; 29 January.

**John Runnstrom**, 82; cell biologist and member of the Swedish Medical Research Council; 22 January.

**Carl L. Scheckel**, 36; senior research scientist, pharmacology department, Hoffman-La Roche Inc.; 17 January.

**Leonard Schiff**, 55; retired head, physics department, Stanford University; 19 January.

**Charles B. Tompkins**, 58; professor of mathematics, University of California, Los Angeles; 11 January.

**Frank L. Verwiebe**, 72; former professor of physics, Montgomery College; 26 January.

**John G. Woodruff**, 72; retired professor of geology, Colgate University; 19 January.

*Erratum*: In Recent Deaths, 5 March 1971, page 882, the date of death for James B. Mead should read 14 December instead of 11 January.

*Erratum:* In the report "Lactate dehydrogenase isozymes: Further kinetic studies at high enzyme concentration" by Thomas Wuntsch, Raymond F. Chen, and Elliot S. Vesell [**169**, 480 (1970)], 14.0 m*M* NAD in line 2 of the heading of Table 1 should read 14.0 $\mu$M NAD.