elshaus admonishing him about the importance of CIS, concluding: "[O]ur concern is that the recent management of the program may be so seriously degrading the system as to amount to a de facto decision to close CIS down."

The private sector panel expressed a similar concern by clearly recommending against scrapping CIS. "We felt that EPA should not get out, but should get its management act together," one panelist told *Science*. The panel recommended that the system continue to be managed by EPA but implemented by another federal agency, such as the National Library of Medicine, or by a professional society or a private vendor. This would entail continuing to make policy decisions within EPA, but moving the daily operating decisions elsewhere.

The panel also strongly recommended against fragmenting the system and said that the government must continue to make chemical data publicly available, despite the unlikelihood of the system becoming wholly self-supporting. Doubts about whether CIS could survive in the private sector to serve its intended purpose there were voiced by the panel and are shared by others familiar with the system. The panel noted that some data bases, despite their intellectual value, could not survive without subsidy.

The prevailing sentiment at EPA, where a decision about the future of CIS is promised soon, seems to be that users ought to pay the full price for the system and that the private sector will provide the best candidate for running it. However, there is widespread concern that this solution may not square with what the system's users want and need. Some observers are dismayed to see a government scientist's entrepreneurial brainchild come to such an end.—**JEFFREY L. FOX**

Mathematicians Waking Up to Reality

For more than 13 years hard times in mathematics went unremarked, but now the situation is changing

A committee established by the National Research Council to look at the state of mathematics funding recently unearthed what it termed "startling facts." Over the past 15 years, the committee said, mathematics has been grossly underfunded and resulting problems are now "near boiling point" (*Science*, 15 June, p. 1189). But the most surprising fact of all is that during the years that math funds were nearly cut off few complaints were heard. How is it that serious funding problems in a major field like mathematics could have gone unremarked for so long? The answer seems to have as much to do with the peculiarities of mathematics research as it does with the political naïveté of mathematicians.

The problems the committee enunciated are beyond dispute. In 1983, there were as many mathematicians as physicists and chemists in academic institutions, but only 60 mathematicians were receiving federal support. In contrast, 1200 physics students and 2500 chemistry postdoctoral students were supported by government funds. Only 20 percent of academic mathematicians who list research as their primary or secondary activity have federal support whereas 50 percent of chemists and 70 percent of physicists do. The amount of funds devoted to math research is only two-thirds of the level in 1968, measured in constant dollars, but the number of research mathematicians has doubled.

In its report, the committee wrote, "We are seriously concerned. Morale at many of the major mathematical science departments is low, and promising young persons considering mathematical careers are put off." Surprisingly, however, the committee members do not think that mathematics research has yet deteriorated. The reasons for this are not entirely clear. Some say there is a long delay time—that mathematics research is riding on the abilities of senior investigators and that the bad effects of more than a decade of neglect will eventually show up. Isadore Singer, a mathematician and committee member from the University of California at Berkeley, disagrees, saying that mathematicians are still being trained and are still doing research but they are spending disproportionate amounts of time teaching. Somehow, they still manage to do research but, Singer says, "On balance, things aren't too good when that happens."

The committee was established several years ago through the efforts of Singer and of mathematician Kenneth Hoffman of the Massachusetts Institute of Technology who saw the direction things were going. The two approached the National Research Council and requested that a committee, made up mostly of nonmathematicians, look into the matter. "We felt it was in the national good to have people outside of mathematics look at the situation," Singer explains. The council set up a committee under the chairmanship of Edward E. David, Jr., president of Exxon Research and Engineering Company.

The problems with mathematics funding began in the mid-1960's, the committee reports, when the Defense Department began cutting off research support for projects that had no immediate applications—which included nearly all of pure mathematics. In 1971, the federal government drastically reduced the numbers of fellowships available to support graduate students and postdoctoral fellows. This reduction could only be made up by funds from the National Science Foundation (NSF). But NSF steadily decreased the amount of money it supplied to mathematicians.

The sharp decline in mathematics funding did not show up in federal budget reports, however, because mathematics was subsumed under the classification "mathematics and computer science" until 1976. In the Defense Department budgets, mathematics and computer science are still lumped together and together they had the greatest increase in funds in the period from 1973 to 1983. Yet mathematics funding as distinct from computer science declined. In addition, applications of mathematics to other fields of science were often labeled "mathematics research" in federal support data, thereby disguising the fact that support for pure mathematics research had slowed to a trickle.

At first, the universities stepped in to help pay for mathematics research. But in the mid-1970's, the universities themselves began having financial difficulties and could no longer continue this arrangement. It was then that the financial

squeeze on mathematicians became evident. Teaching loads increased by 60 percent so that a mathematician in a research institution now teaches two or three courses a semester. Graduate students could no longer get a respite from teaching in order to concentrate on their research for even a semester. "Graduate students have to teach in order to live," says Heini Halberstam, head of the mathematics department at the University of Illinois. At Illinois, graduate students in mathematics teach 6 hours a week one semester and four hours a week the next. Of the 200 graduate students, about ten each year get the luxury of a semester off from teaching.

Yet, says Hoffman, mathematicians did not complain very loudly because many of them could still do their research. "In a theoretical area, cutbacks in graduate student research or support don't get the same reaction as they do in an experimental field where graduate students are needed to do research," he remarks. As money got tighter, Hoffman says, "There were fewer postdocs, fewer visitors. People kept thinning out their grants, cutting out research associates and visiting scholars until in 1980 the average NSF grant was $2000 for 2 months of summer research. And this was for the most distinguished scholars." At the same time, says Hoffman, mathematicians were faced with overwhelming teaching burdens as enrollment in undergraduate math courses kept increasing, due in part to the popularity of computer science and engineering majors. With no additional money, the math departments could not hire new faculty members.

Other sciences also had financial difficulties but, Hoffman notes, "These problems could be dealt with in other fields because money could be shifted. Mathematicians had nothing to shift. Their NSF grants were used almost entirely for summer salaries." Hoffman contends that the desperate financial straits of mathematicians should be obvious even to the casual observer. "You can walk into the math department at any major university and you can detect a markedly different level of support," he says. "Secretarial help doesn't exist. There is a complete absence of postdocs. Graduate students are all teaching assistants."

One reason this situation continued, according to Hoffman, is that mathematicians traditionally have not been politically astute. "There has been a lack of political cohesion. A lack of awareness of how to operate politically is part of the problem," he remarks. In addition, Hoffman says, some mathematicians had a disdain for the very idea of competing for government funds.

Now, Hoffman says, the situation is changing, in part because it has become so intolerable that even the politically reticient mathematicians are being forced to speak up and in part because the committee's report documents such an astonishing case of neglect of math research. "There has been a real movement," Hoffman says. The mathematicians, "have a pretty powerful case." The committee recommends that the federal government increase its spending for mathematics research from the current $80 million a year to $180 million a year over the next 5 years—an increase of 18 percent a year. "We are asking for more support for graduate students and postdocs and for more research support," committee chairman David says. "Equity is not the issue. The issue is, Is there enough math to balance work going on in the other sciences? Our answer is that math is in a poor state of health and needs help."—GINA KOLATA

France's New Technocrats

A cabinet reshuffle has put strong supporters of science and technology in three important posts

Paris. In reshuffling his cabinet in mid-July, French President François Mitterrand has dealt a new hand to the research community, with some unexpected cards in it.

By selecting the former minister for industry and research, Laurent Fabius, as his new prime minister, President Mitterrand has shown his determination to give the third government under his presidency a firm technocratic stance. The 37-year-old Fabius, a long-time protegé of the president's, has lost few opportunities since being appointed to the cabinet last year to state his faith in high technology as the key to economic success and his belief in the rapid modernization of French industry.

This impression is confirmed by Fabius's decision to appoint as his successor at the ministry Hubert Curien, previously the president of France's space research agency, the National Center for Space Studies (CNES). Curien was one of the principal guiding lights behind the successful development of the launcher Ariane, now firmly established as a commercial competitor to the U.S. space shuttle.

A surprise decision, however, has been the reinstatement of Fabius's own predecessor at the ministry, Jean-Pierre Chevènement, into the French cabinet as the new minister of national education, a post which includes responsibility for both schools and universities. Chevènement, the leader of a left-wing group within the Socialist party, resigned in March 1983 in protest at the government's economic policies, and has since remained a fierce critic of some of the directions Mitterand has been taking.

As a flamboyant and outspoken minister of research and technology, appointed by Mitterrand immediately after the Socialist victory in the general election of 1981, Chevènement won considerable support from an initially skeptical scientific community. This was primarily a result of his success in obtaining greater political visibility for science, and in particular for securing a substantial increase in the civilian research budget, which rose from 1.8 percent of the gross national product in 1980, the last year of the previous administration to 2.15 percent in 1982.

He enjoyed less success, however, when Mitterrand added responsibility for industry to his ministerial brief. Chevènement's commitment to a strong interventionist role for the government, although generally acceptable as a strategy for funding research programs, met with increasing resistance from the heads of many of the country's nationalized industries.

Fabius, who significantly reversed the title of the post to minister of industry and research when he took over the position, has frequently insisted that, despite the general financial austerity