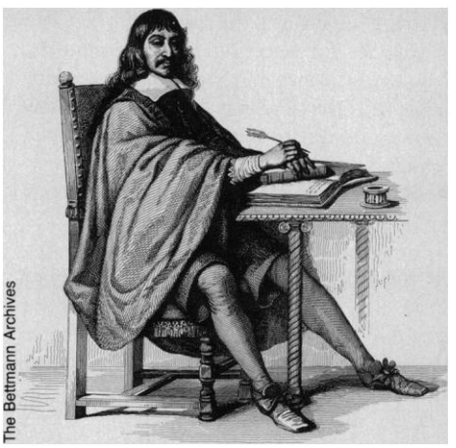
French Mathematicians Push the Panic Button

A lack of university teaching posts is fueling a new brain drain to the United States which, some claim, threatens to erode one of the country's most prized intellectual achievements



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René Descartes. *A legacy in peril?*

Paris

"DESCARTES, c'est la France" announced the title of a best-selling book published last fall by one of France's top contemporary philosophers, André Glucksmann. But although the Cartesian spirit continues to flourish in a country whose top public and private administrators are still explicitly selected on the basis of their capability for intellectual rigor, dire warnings are being voiced about the future of one of Descartes' most prominent legacies, namely French mathematics.

For the moment, France's reputation rests secure. It has won five of mathematics' equivalent of the Nobel Prize, the Fields Medal of the International Mathematics Congress, out of the 30 that have been awarded since the medal was introduced in 1932 (six, if one includes the Belgian Pierre Deligne, who has studied and worked entirely in France). And French mathematics—particularly pure mathematics—is rated more highly than that of any other European country.

According to many French mathematicians, however, a major crisis is looming. A lack of job openings in universities—where more than half of the 2300 mathematics teachers are between the ages of 42 and 49 and only 6% are under 35—compounded by a waning interest in a research career among students, threatens to deprive the subject of the new blood needed to maintain its supremacy.

"Right now, we are still in a kind of golden age," says Martin Anders, a mathematician with the National Center for Scientific Research (CNRS). "But we are also on the top of the curve; in 10 years' time, [many French mathematicians] will be over the hill, and there may well not be enough young mathematicians to replace them."

The problem is compounded by the growing demand for mathematicians in the United States. A significant number of French research workers, frustrated by the situation they face at home, are leaving to take up posts in U.S. institutions. Many of these posts have been created as part of the recent doubling in U.S. government funding for mathematics, following the publication in 1984 of the National Academy of Sciences report, "Renewing U.S. Mathematics: Critical Resource for the Future," by a panel chaired by former presidential science adviser Edward David.

"It is the first time there has been an exodus to the U.S. of this scale, with no movement in the opposite direction, as there was in the 1960s," says researcher Daniel Barsky, former chairman of the mathematics commission of the CNRS, who dates the first significant departures to 1984—the year that the David report appeared. "So far, the numbers taking up permanent positions in the U.S. are relatively small; but they are among the cream of their generation. If nothing is done about it, we could soon find ourselves in a catastrophic situation."

Shortly before Christmas, 1000 mathematicians from universities, schools, and public and industry research laboratories, held an unprecedented 2-day meeting at the Ecole Polytechnique outside Paris to draw public and government attention to their concerns.

"It is essential to generate a new ambition for French mathematics," says Jean-François Méla, president of the Mathematics Society of France, which organized the meeting jointly with the Society of Applied and Industrial Mathematics. "We are heading toward a dramatic scarcity of mathematicians in all categories: research workers, engineers, and high school teachers."

Many scientific disciplines are currently faced with a recruitment bottleneck in universities, where rapid expansion in the 1960s and early 1970s has been followed by a sustained period of level funding and low turnover in teaching staff. But the problems are particularly acute in mathematics.

"The last time we were able to offer a full-time job to a young mathematician was 6 or 7 years ago," says J. Dhombres, professor of mathematics at the University of Nantes. "We had the opportunity this year to recruit an assistant professor, but that was just for 1 year."

The lack of career prospects in research and teaching is said to be one factor discouraging school students from specializing in mathematics-related subjects. Between 1975 and 1986, the total number of high school students taking the baccalaureate, success at which provides automatic right to a university place, rose by 28%. However, the number specializing in mathematics increased by only 13% over this period. Only 500 students are currently taking masters courses in pure and applied mathematics in France's 72 universities, and many of these will be snapped up by well-paid jobs in industry.

The relative decline in the attractions of mathematics as a career can appear surprising to outside observers, given the high social prestige that mathematics continues to enjoy in France. The paradox results from the fact that this prestige is based less on the achievements of mathematics as such than on the way that mathematics has, since the time of Napoleon, been used as the dominant form of selection for high administrative office.

Faith in the use of mathematics, represented in particular in the entrance requirements to the top *grandes écoles* such as the Ecole Polytechnique, remains strong in political circles. "Mathematics provides an effective training in clarity and rigor, which is why it has been able to impose itself as a key element in selection," says a top aide to Industry Minister Alain Madelin.

Many mathematics teachers, however, deplore their subject being used in this way. On the one hand, it means that many of the brightest mathematics students are being encouraged to head for careers in administration or engineering rather than research. Until relatively recently, for example, little research was carried out in the *grandes écoles*, which is one of the reasons often given for a lack of interest in research among many of France's top industrialists.

At the same time, the use of mathematics as a device for selecting future administrators—and the fact that the entrance requirements for the leading *grandes écoles* have come to dominate much of the school curriculum—is seen by many as having contributed to an excessive formalism in the teaching of mathematics.

For some students, this deprives the subject of much of its imaginative creativity, while for others its creates a separation between the contents of mathematics courses and the problems they encounter in the real world.

"Our problem is that the only choice students have in the *lycées* [high schools] is to take a very high level of abstract mathematics or nothing at all," says former research minister Pierre Aigrain, now senior technical adviser to the electronics company, Thomson. Aigrain was referring to a problem that even the Collège de France has described as "one of the most flagrant faults" of the French educational system. "We need to adapt the level of mathematics to each student's taste."

Ironically, these problems were only compounded by the introduction of "new mathematics" into school courses in the late 1960s and early 1970s. The increased emphasis on abstract concepts divorced from concrete reality, which was introduced in order to make mathematics more of an intellectual challenge, may have succeeded for the few; but for many pupils, it only made the subject more alienating, and much time has recently been spent on rethinking the reforms.

For some mathematics teachers, the alienation from their subject among the majority of school pupils, particularly among those who would otherwise like to specialize in scientific subjects, has now gone so far that radical action is required. "To save our scientific education, we should lower and modify the requirements in mathematics in secondary schools," says Jean-Yves Mérindol, assistant professor at the University of Angers.

Yet the traditions are firmly entrenched. When former Education Minister Jean-Pierre Chevènement, for example, tried 3 years ago to introduce wide-ranging reforms into the school system that would have involved significantly reducing the amount of mathematics taken by most pupils—and hence the hegemony which the subject continues to exercise—he was met by protests from some mathematics teachers.

They claimed that he was proposing to reduce their workload primarily as a way to avoid increasing their salaries. "Reducing the number of hours of mathematics classes in the *lycées* stands a good chance of aggravating the problems of teaching the subject, without any guarantee that there would be an improvement elsewhere" says Méla.

Some leading French mathematicians have refused to join campaigns for popularizing their subject. One professor at the prestigious Collège de France, asked why he did not do more teaching, is said to have claimed that mathematics students fell into two categories: those who were bright enough not to need his help, and the rest, whose help he did not need.

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Others, however, argue that this élitism has become counterproductive. Failure to acknowledge the need to guarantee a future generation of both university and school mathematics teachers, it is argued, could have severe economic implications by reducing the supply of the mathematically trained engineers and technicians required by the high-technology companies of the future. Already, some school districts are having to meet a shortage of mathematics teachers by importing teachers from French-speaking parts of North Africa.

At the intellectual level, some claim that, just as the mass emigration of German mathematicians in the 1930s destroyed that country's supremacy in the field, the new brain drain to the United States could eventually devastate what is still known as the "French school of mathematics."

"For very different reasons, the same phenomenon is lying in wait for us, if nothing is done to remedy the situation," says Barsky of the CNRS. A recent survey of mathematicians who had emigrated to the United States found that most quoted a combination of better pay and better working conditions as their main reasons for leaving. But the result, says Barsky, is that "France is subsidizing the United States, in that we are paying for the training of American mathematicians."

The remedies being suggested have a familiar ring: more teaching posts in universities, more long-term planning for research programs, better pay for school mathematics teachers, and so on. Aware of the significant impact of the NAS report in Washington, the two societies that held the recent meeting are planning to produce a "white paper" for the government, listing their grievances and describing the "disaster" that could arise if no action is taken. ■ **DAVID DICKSON**

Breast Cancer Study Vetoed

A key advisory group of the National Cancer Institute last week vetoed a controversial proposal to study the possible link between breast cancer and fat consumption. The action effectively killed the $130-million project, which would have been the most costly experiment ever conducted by the cancer institute (*Science*, 1 January, p. 17).

For the past several months, various cancer institute advisory groups have debated intensely the scientific merits of the plan and whether the institute should fund the project. But at a meeting on 7 January, arguments were put to rest when 11 of 13 members of the institute's board of scientific counselors voted against proceeding with the study. Two members abstained.

The disapproval was based largely on heavy criticism of the proposal by a panel of experts, who evaluated the plan at the board's request. "The hypothesis that dietary fat is a cause of breast cancer among women is plausible, but only weakly supported at present. . . . The [study] as currently proposed should not go forward," the seven experts said in a unanimous report submitted to the board shortly before the meeting. The expert panel also expressed serious doubts that a proper control group could be maintained over the duration of the lengthy study.

According to the proposal, 10,000 women across the nation would follow a low-fat diet for 10 years to test whether it would reduce their risk of breast cancer. An additional 22,000 women would serve as controls.

An important question left unresolved by the committee was what criteria or evidence would be sufficient to ever undertake a randomized clinical trial to test a possible relationship between diet and any type of cancer. David Byar, head of the cancer institute's biometry branch, who supported the breast cancer study, said at the meeting, "How will we begin any trial unless it's a foregone conclusion what the results will be?" The committee did not address his question. ■ **MARJORIE SUN**