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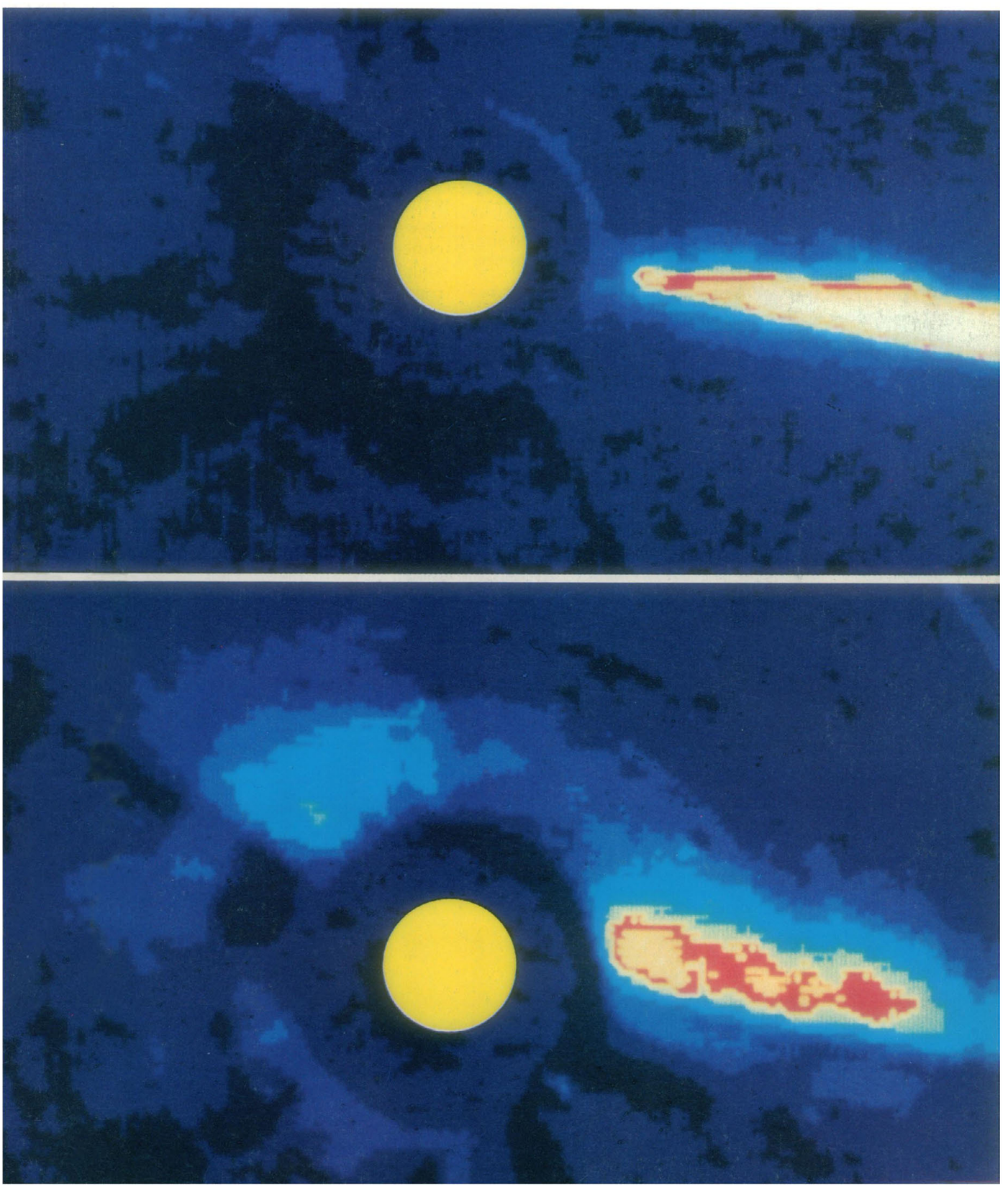

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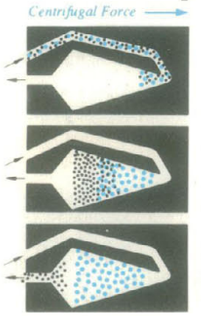

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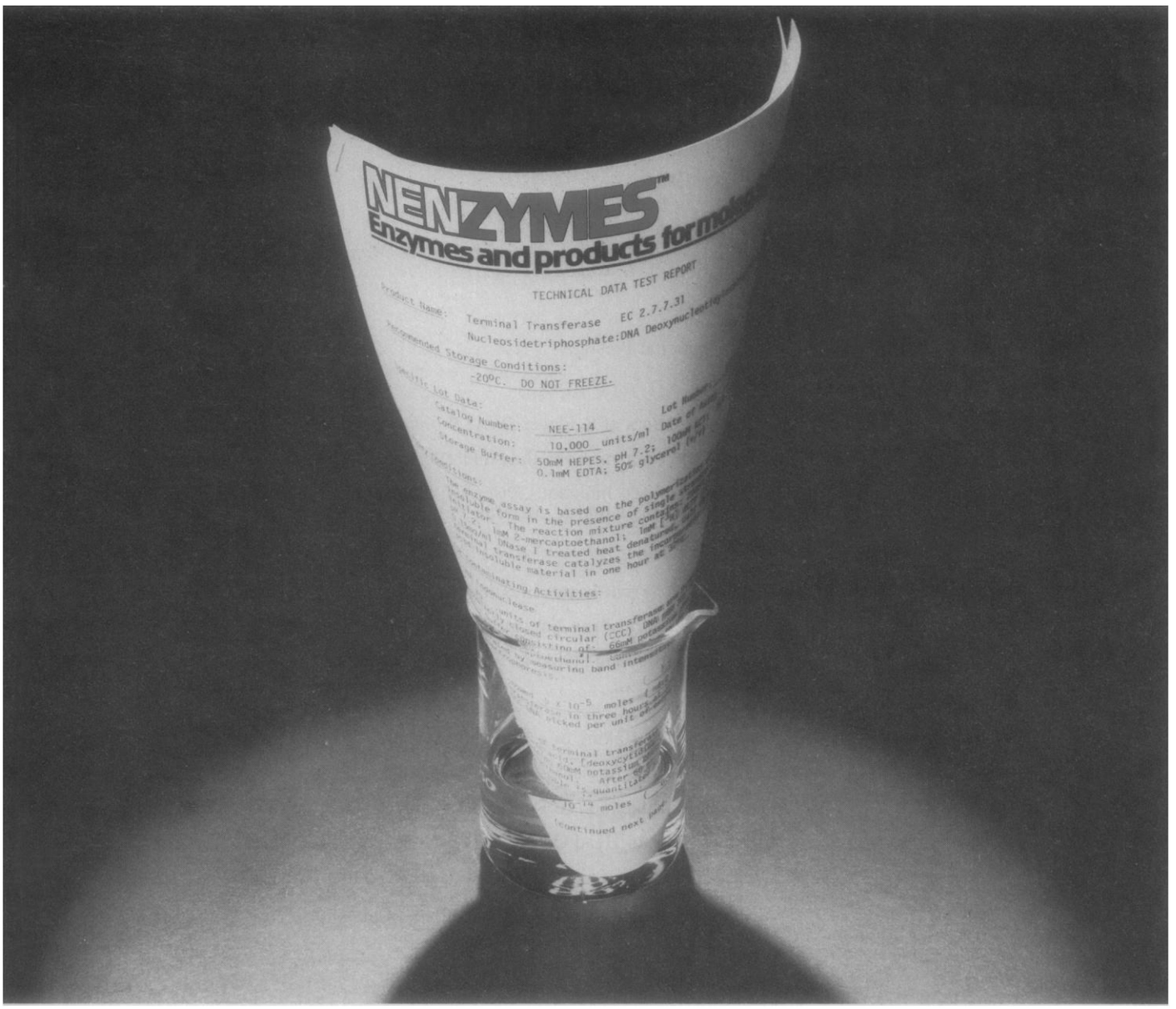

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COVER

Comet Howard-Koomen-Michels (1979 XI) collided with the sun between 2200 and 2300 hours (Universal Time), 30 August 1979. (Upper frame) Recorded at 2049 UT by a satellite coronagraph, the comet is seen falling toward the sun with the coma at 3 solar radii elongation. (Lower frame) Collision's aftermath at 0821 UT, 31 August, with cometary debris scattered millions of kilometers into the solar corona. The central portion of each frame, out to 2.5 solar radii, is shadowed by the coronagraph's occulting mechanism; the solar disk has been added in photographic processing. See page 1097. [Computer color enhancement by S. A. Mango, Digital Image Processing Laboratory, Naval Research Laboratory, Washington, D.C.]

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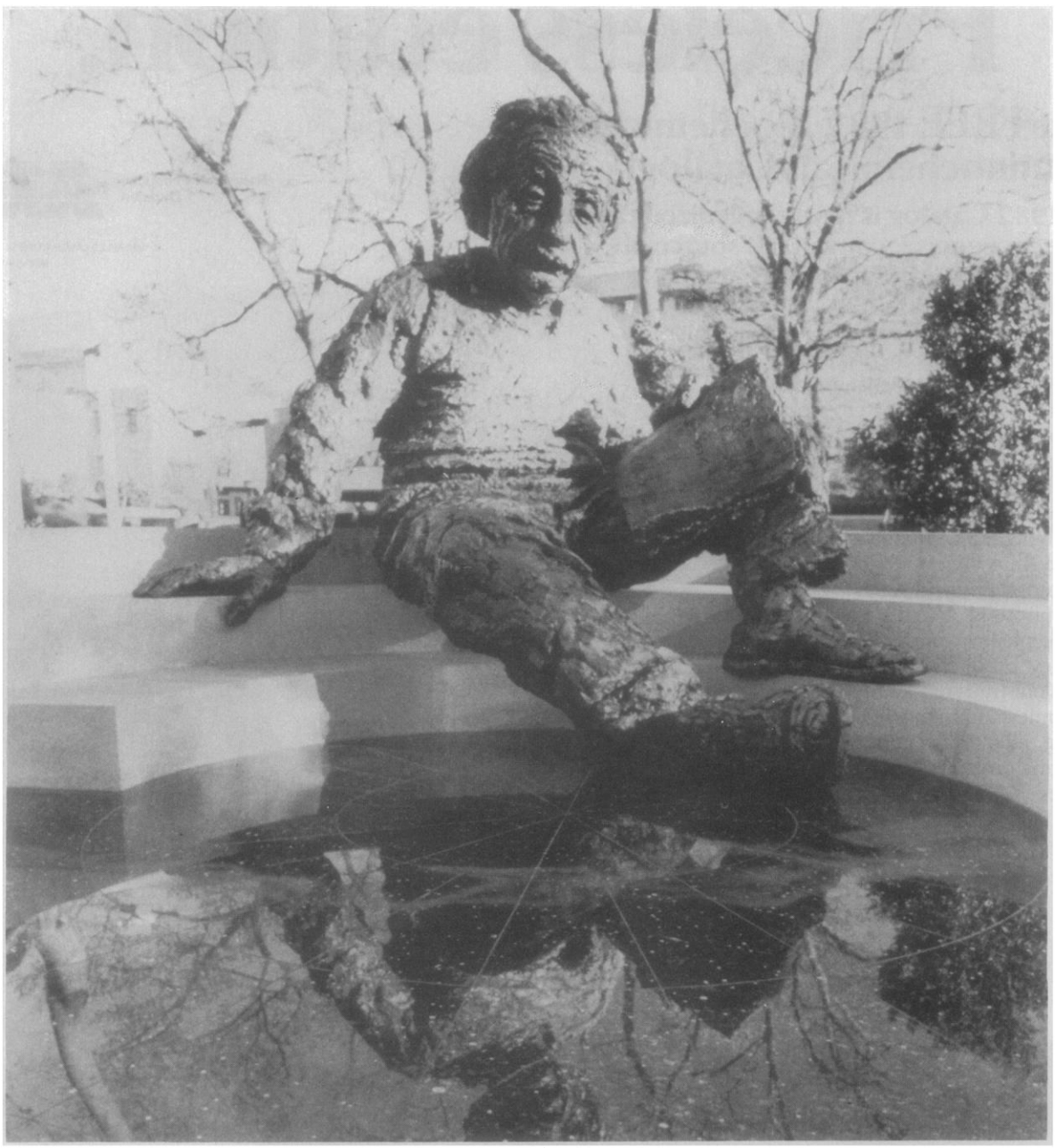

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LETTERS

Crisis in NIH Funding

One of America's great strengths, developed over the last three decades, is its research capability in the basic biomedical sciences. We present below several proposals designed to conserve this strength, which is being eroded as a consequence of inflation, reduction in moneys available for direct costs of research, and by present policies for funding research grants. We wish to emphasize the great need for long-term stability of research programs, even at more modest levels of support, to preserve U.S. research capacity.

Few would doubt that remarkable recent achievements in treatment of disease derive from biomedical research supported by the National Institutes of Health (NIH). This biomedical research continues to offer the most cost-effective means to relieve suffering and to permit delivery of improved health care services. Moneys spent on biomedical research have usually been returned to the economy through increased productivity of individuals who have benefited from improved health or the prevention of disease, development of new drugs, or stimulation of other economically effective programs.

The scientific community manifests a potential for meritorious but unpursued research as evidenced by the large number of grant applications endorsed with high priority by NIH peer review that remain unfunded. The talent of many excellent scientists, with records of past innovative research accomplishment, is now being wasted.

Failure over the past decade of biomedical budgets to keep up with inflation has now, quite suddenly, grown to crisis proportions. Severe competition for NIH grant money, resulting from greatly accelerating cost of research, growth of the scientific community, designation of newly targeted research areas, and the sharp rise of administrative costs, has so strained governmental research budgets that only projects with truly exceptional priority scores are now being funded. Obviously, appropriation by the U.S. government of additional funds for research could solve this problem. We intend to continue to keep our government officials informed of the urgent need for an increased allocation of dollars for biomedical research. However, we also recognize the nation's present economic difficulties and the resulting belt tightening that we must accept on a temporary basis. In any case, action is required immediately before ongoing research groups and programs are irrevocably dismantled and before essential new projects become postponed indefinitely. Current policies for funding research grants should be reevaluated immediately to prevent further erosion of our national scientific research potential.

Scientists are now spending an inordinate part of their time writing and rewriting grant proposals in order to receive a priority sufficient for funding. Simultaneously, due to inflation and an increasing number of quality applications, the relative availability of funds compared to current needs has declined, inexorably raising the priority score required for funding. The increased number of initial and new applications has put additional strain on the review process so that more researchers are needed to evaluate these proposals, most of which will remain unfunded. Thus, scientists must spend an even larger part of their time writing proposals and reviewing others, time better spent on research.

We agree that the best scientific investigators and targeted programs must continue to be funded. We also believe, however, that in a situation where funding is clearly inadequate, the present system of priority scoring permits some groups to attract a disproportionate percentage of the available funds. America's strong leadership in biomedical science is related, in large part, to our past generous support of a variety of research ideas whose outcomes were most unpredictable at the time of funding. Quite a few of these ideas, which formed the foundation of many subsequent advances, were unpopular at their inception. Scientific excellence can best be perpetuated when there is a breadth of research accomplishment that serves as the basis for future outstanding achievement. Although we favor peer review, this process cannot be expected to discriminate with accuracy between projects receiving close numerical scores. Forcing out large numbers of talented and productive independent researchers leads inevitably to an undesirable centralization of basic research in fewer laboratories. The unwillingness of many talented newer faculty members and younger scientists to continue their research career because of the extreme competition for funding of research constitutes a severe economic and intellectual loss to our country for which it will ultimately pay dearly.

We strongly endorse the funding of only high-quality research, as judged by peer review, but we also believe that more grants approved by peer review

should be funded. When the NIH granting system began in the 1950's some 90 percent of all approved applications were funded. Now most NIH institutes can pay only about 15 percent. These temporal fluctuations and declining support for quality applications suggest an obvious need to reevaluate policies to support a higher number of worthy investigators. We have considered various alternatives, and none are easy or ideal. However, because of the present crisis we feel a decision must now be made on a revised procedure for funding.

1) We recommend the development of a "sliding scale," depending on the priority score that peer review groups assign to applications: those with top-priority scores would receive 100 percent of *study section approved* budgets; others would receive only a proportion of their approved budgets, depending on priority scores. However, only those applications with very respectable priority scores, that is, encompassing about half of all *study section approved* applications, should be eligible for this formula-based partial funding. This procedure would require considerable belt tightening for many investigators but is still preferable to the absence of any support. Obviously, investigators will not be able to meet all of their original research objectives with only partial funding. Our proposal would permit them to attain at least some of their research goals through the use of their own ingenuity and to continue as productive investigators. Obviously, study sections will have to scrutinize budget requests with great care to maintain standards. Finally, if an ongoing project cannot be continued, a more gradual phase-out system should be instituted that will allay some of the trauma.

Furthermore, this proposal would alleviate for competent scientists the unnecessary hardships and anxieties which the present procedure generates. The Veterans Administration and other scientific institutions already use a sliding scale system for funding research grants. This procedure permits a diversity of research rather than limiting it to few laboratories.

Several additional approaches also merit consideration:

2) The present system for allocating indirect costs should be reconsidered at once. A reduction in nonproductive business practices should reduce administrative costs which now devour an ever-increasing percentage of funds earmarked for research. The nonuniform allocation of expenses to indirect or direct costs and the exceedingly disparate indirect cost rates among institutions

create confusion and excessive and unnecessary accounting requirements and thus needlessly raise the costs of conducting research. Consideration should be given to returning to a fixed and reasonable indirect cost rate, such as that in force before 1966 (see K. T. Brown, *Science*, 24 April 1981, p. 411).

3) Large center grants and program projects, valuable for multidisciplinary programs, also support investigators already funded for other research; such funding might be reexamined to determine how much of this type of support we still can afford in a time of crisis. Allocation of shrinking funds to such large proposals and contracts occurs at the expense of individual independent research projects which most scientists feel are of greater value to our national research efforts.

4) A dollar limit could be placed on total support for an individual investigator's laboratory.

The sliding scale now appears to be particularly attractive, but all these ideas should be considered, and a combination of them may be worth trying. In any case, our objective is to initiate a review of current funding procedures and to support a larger fraction of highly meritorious research proposals.

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Department of Pharmacology, School of Medicine, George Washington University, Washington, D.C. 20037

*The authors are, respectively, president and chairman of the NIH grants committee of the Association for Medical School Pharmacology (AMSP), an organization composed of chairmen of departments of pharmacology in medical schools of North America. Most members of ASMP contributed to this document, which was initially presented on 10 January 1981 and adopted in essentially its present form on 21 May 1981 by ASMP. Since that time, the situation described above has clearly deteriorated even further.

Health Effects of Radiation

On 4 January, at the AAAS annual meeting in Washington, D.C., a session was held on the health effects of radiation featuring a group of speakers who have published few papers on that subject in refereed scientific journals in the past several years. The principal paper by one of the speakers (*1*) has drawn more than 20 scientific critiques (*2*); its results also have been rejected by committees of the National Academy of Sci-

ences (*3*) and other prestigious national and international commissions (*4*) with membership broadly representative of the scientific community. None of those offering these critiques appeared on the AAAS program.

In presenting this group of speakers, the AAAS has performed a distinct disservice to the scientific community it purports to represent. What is worse, it has served to mislead the American public by appearing to give the support of the scientific community to the work of this group.

BERNARD L. COHEN
Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, Pennsylvania 15260

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2. J. A. Reissland, "An assessment of the Mancuso study" (Publ. NRPB-79, U.K. National Radiological Protection Board, Didcot, Berk., 1978); T. W. Anderson, *Health Phys.* **35**, 743 (1978); A. Brodsky, testimony before the subcommittee on health and the environment, U.S. House of Representatives, Washington, D.C., 8 February 1978; B. L. Cohen, *Health Phys.* **35**, 582 (1978); *ibid.* **38**, 712 (1980); S. M. Gertz, *ibid.* **35**, 723 (1978); E. S. Gilbert, "Methods of analyzing mortality of workers exposed to low-levels of ionizing radiation" (Report BNWL-SA-634, Battelle Pacific Northwest Laboratory, Richland, Wash., May 1977); testimony before the subcommittee on health and the environment, U.S. House of Representatives, Washington, D.C., 1978 (available as Document PNL-SA-6341 Rev., Battelle Pacific Northwest Laboratory, Richland, Wash., 1978); E. Gilbert and S. Marks, *Health Phys.* **37**, 791 (1979); *ibid.* **40**, 125 (1981); J. W. Gofman, *ibid.* **37**, 617 (1979); G. B. Hutchinson, B. MacMahon, S. Jablon, C. E. Land, *ibid.*, p. 207; D. J. Kleitman, "Critique of Mancuso-Stewart-Kneale report" (prepared for the U.S. Nuclear Regulatory Commission, Washington, D.C., 1978); S. Marks, E. S. Gilbert, B. D. Breitenstein, "Cancer mortality in Hanford workers" (Document IAEA-SM-224, International Atomic Energy Agency, Vienna, 1978); R. Mole, *Lancet* **1978-I**, 582 (1978); "Staff committee report of November 1976" (Nuclear Regulatory Commission, Washington, D.C., 1976); "Staff committee report of May 1978" (Nuclear Regulatory Commission, Washington, D.C., 1978); *The Windscale Inquiry* (Her Majesty's Stationery Office, London, 1978); D. Rubenstein, "Report to the U.S. Nuclear Regulatory Commission" (Nuclear Regulatory Commission, Washington, D.C., 1978); L. A. Sagan, "Low-level radiation effects: The Mancuso study" (Electric Power Research Institute, Palo Alto, Calif., 1978); B. S. Sanders, *Health Phys.* **34**, 521 (1978); F. W. Spiers, *ibid.* **37**, 784 (1979); G. W. C. Tait, *ibid.*, p. 251; "Problems in assessing the cancer risks of low-level ionizing radiation exposure" (Report EMD-81, General Accounting Office, Washington, D.C., 1981).
3. Committee on Biological Effects of Ionizing Radiation (BEIR), *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation* (National Academy of Sciences, Washington, D.C., 1980).
4. The International Commission on Radiological Protection has met several times since publication of reference 1 and has pointedly stated that there is no new information available that would suggest altering its recommendations. If any degree of credence were given to reference 1, it would be urgent to change these recommendations. The U.S. National Council on Radiation Protection and national commissions in all other countries have acted similarly.

Erratum: In the cover legend for the issue of 5 February, the second sentence should have read, "Fire is used periodically in the life of pine stands to manipulate understory vegetation and to reduce the risk of wildfire by controlling litter buildup."

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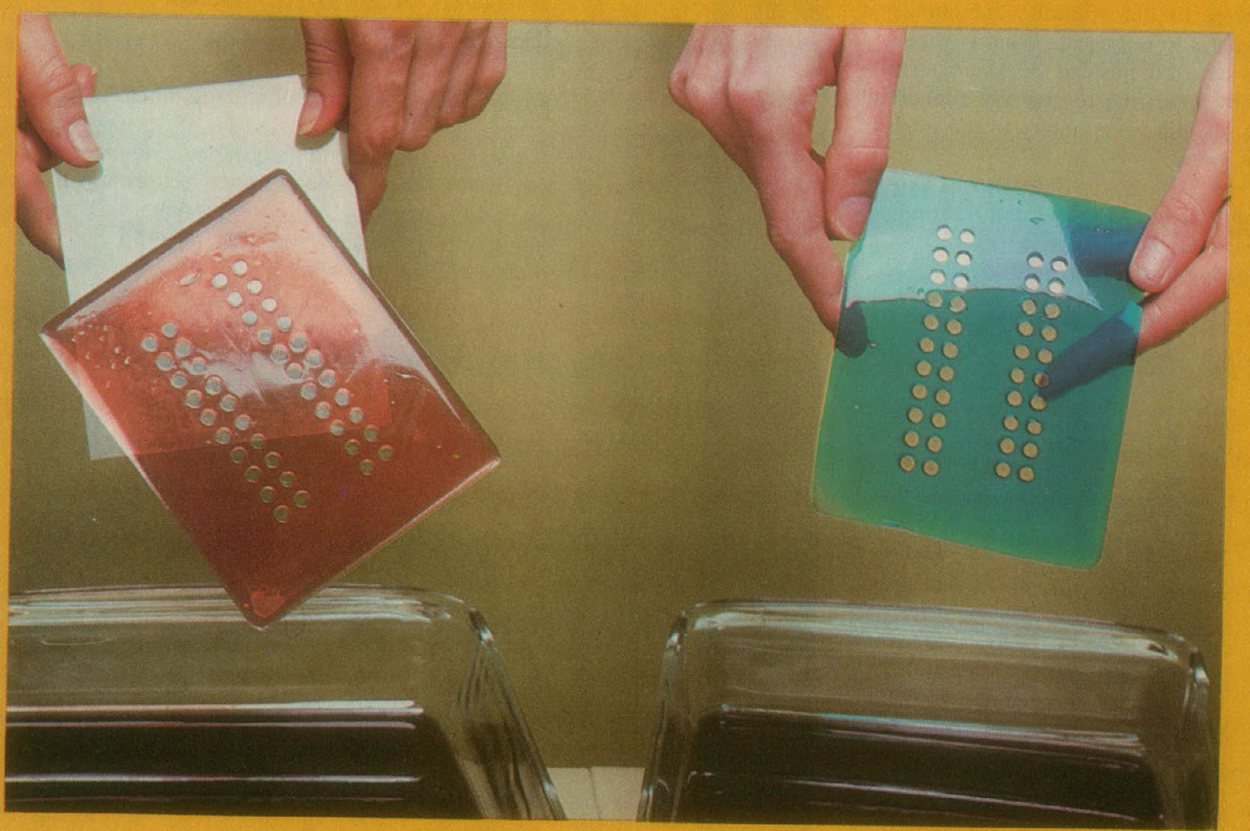

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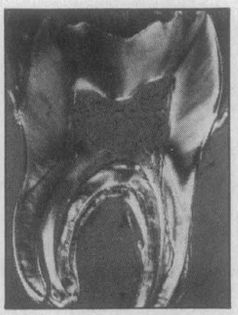

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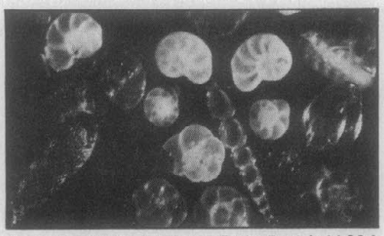

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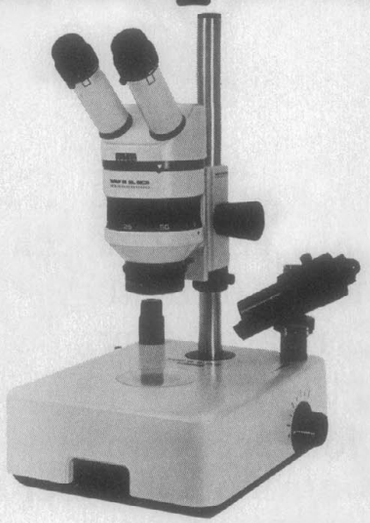

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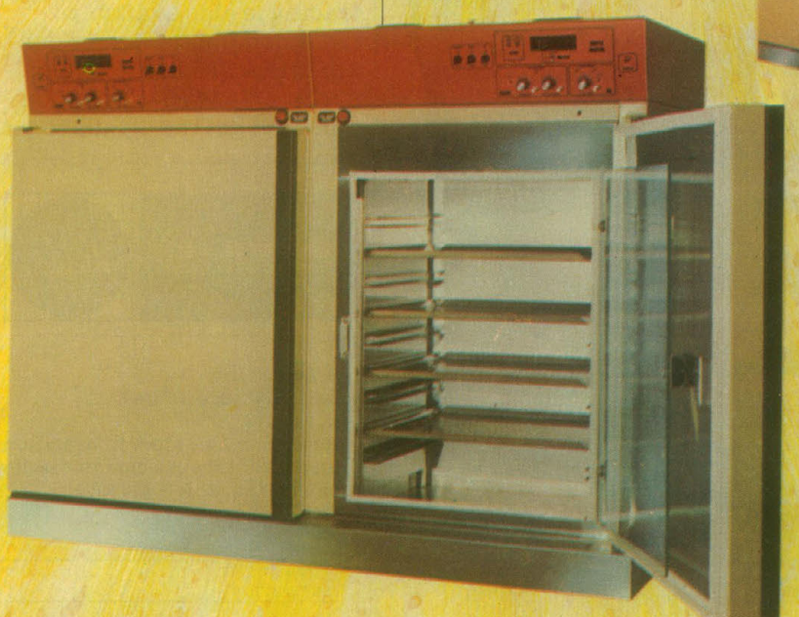

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26 February 1982, Volume 215, Number 4536 **SCIENCE**

Fostering National Prestige

Prestige is an important factor in human interaction at all levels but especially in foreign affairs. In these troubled days when our alliances are under strain prestige is especially important. Without it even a trillion dollar defense program will lack credibility. Insofar as the buildup lacks credibility it will be a waste of money, for an object of the game is to convince the other fellow that an attack would be too risky.

A decade ago the United States enjoyed tremendous respect for its highly visible successes in civilian science and technology, but preeminence has been lost in some areas and is eroding in others. Failures of our ability to compete have been conspicuous in the automobile and steel industries. The troubles and delays with the space shuttle have detracted from our stature. In contrast, U.S. science has remained a major source of international prestige. However, instead of fostering this valuable asset, the Administration compiled a sorry record during its first year.

Budget cuts in many fields of science translated into severe cuts in terms of constant dollars. Months of uncertainty about budgets had a demoralizing effect. The 12 percent meat-ax cut proposed in September indicated a complete insensitivity to the many important roles of science. From the standpoint of international affairs one of the worst decisions was to curtail our activities in the glamorous field of planetary exploration. Abandonment of our share of the solar polar mission has raised doubts that persist about the reliability of U.S. commitments.

In a recent visit to France and Germany I found a different atmosphere for science than in the United States. Morale was high. New ideas, new approaches, and new equipment were evident. While much attention was focused on immediate needs, there were long-range plans to achieve world leadership. This was particularly true in France, where a new government is determined to improve capabilities in science and technology.

The official French policy for science represents a quickening of a trend already in being. As a minister under Valéry Giscard d'Estaing, Pierre Aigrain had charted a course in which support for science was to increase by 6 percent per year beyond inflation (*Science*, 1 August 1980, p. 545). Apparently in parliamentary testimony before a committee headed by Socialist Jean-Pierre Chèvenement, Aigrain had been persuasive. In any event, after the Socialists took office Chèvenement, one of the most powerful figures in French politics, chose to take responsibility for science and technology. In the interval since the May 1981 election he has maneuvered successfully to expand his dominion over R & D wherever they are governmentally sponsored. He has taken control of their budgets. He has announced plans to increase spending on R & D for the next 5 years at the rate of 8 percent per year or more over inflation. The program is likely to be implemented. For a time before the election, the selection of François Mitterrand as the Socialist nominee was in doubt. Efforts by Chèvenement were crucial in obtaining the nomination for Mitterrand. One of Chèvenement's activities during the past 8 months has been to arrange and conduct a big public relations campaign for science and technology. Large meetings were held in the provinces, culminating in a gathering in Paris on 13 to 16 January attended by 4000 of the most influential political, industrial, educational, and union leaders of the country.

There is a strain of anti-Americanism in French attitudes, or perhaps more precisely a determination to be independent of foreign dominance. This attitude has already led to a bid for world leadership in nuclear energy which many regard as successful. It has also led to development of the Ariane satellite launcher, which will be used to place many communications satellites in orbit. The French are embarking on a major effort to strengthen education in science and technology at all levels. As part of the program they plan to install computers in each of the more than 10,000 high schools of France.—PHILIP H. ABELSON

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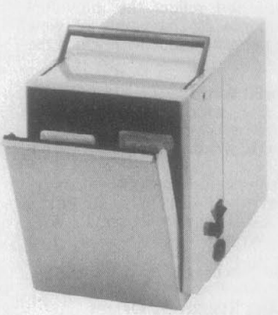

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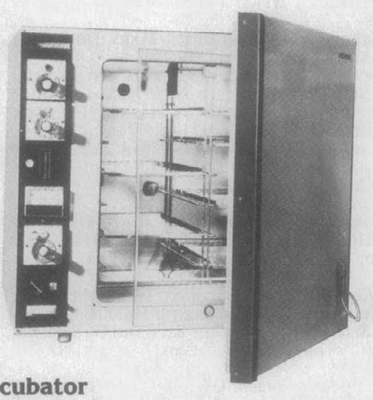

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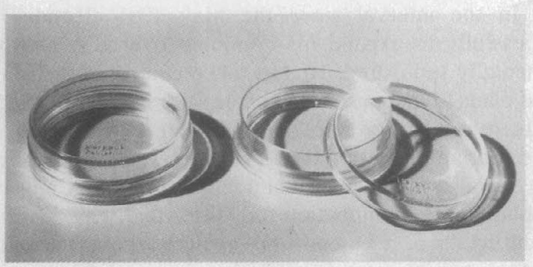

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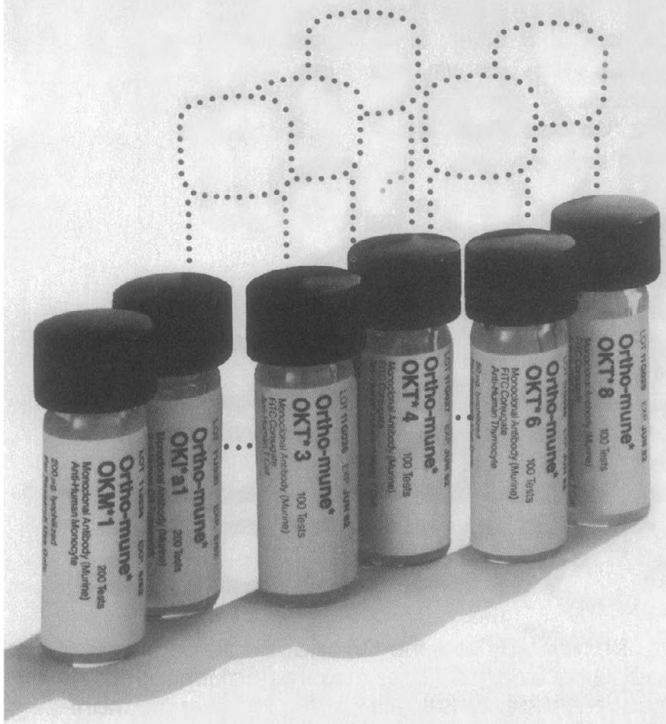

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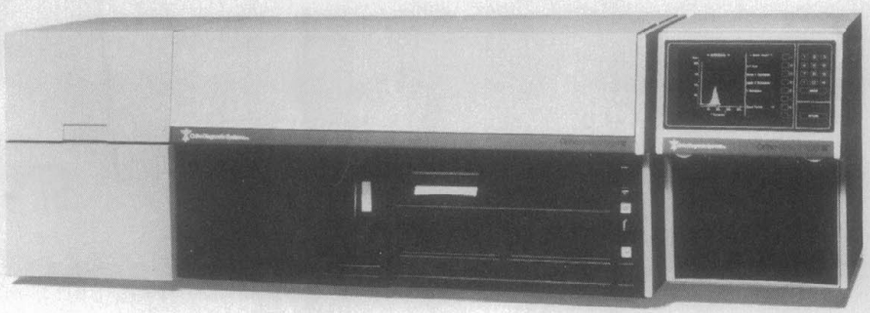

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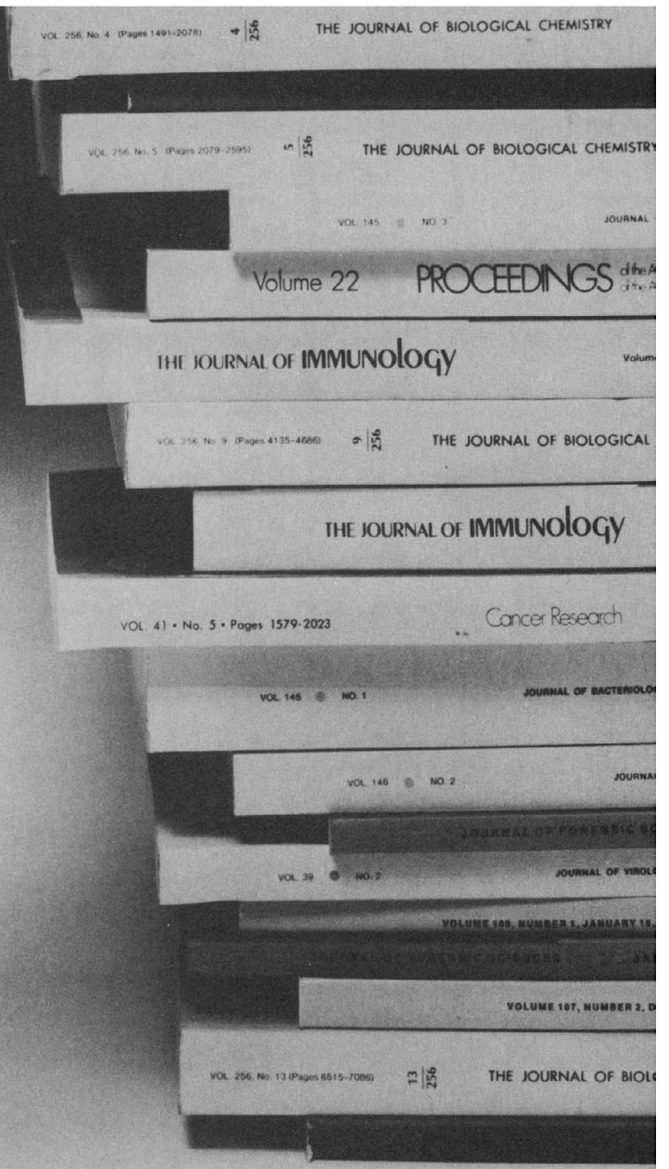

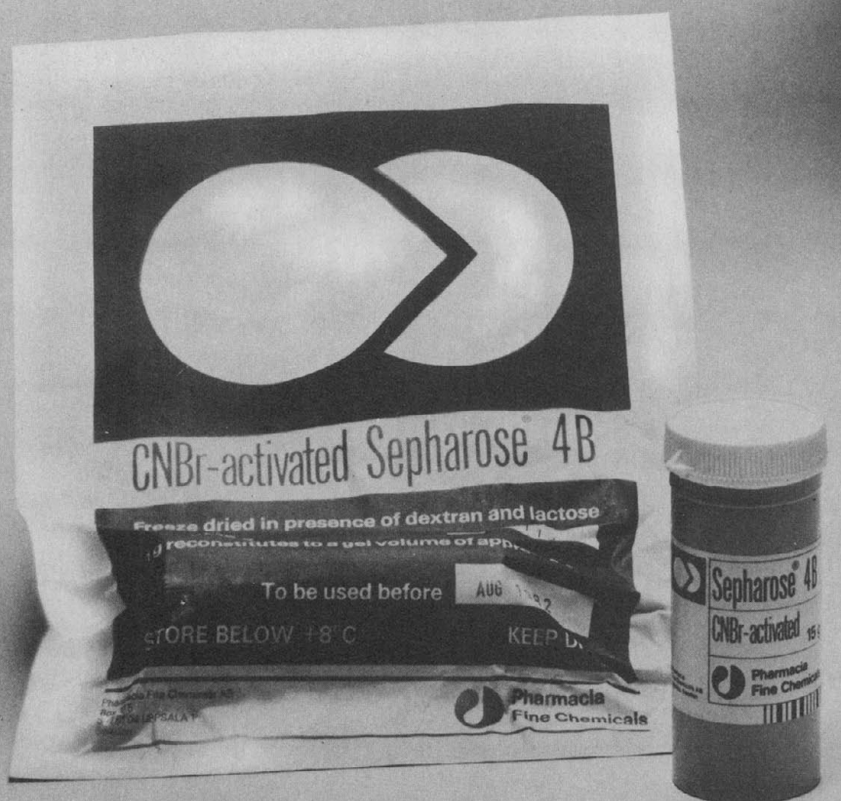

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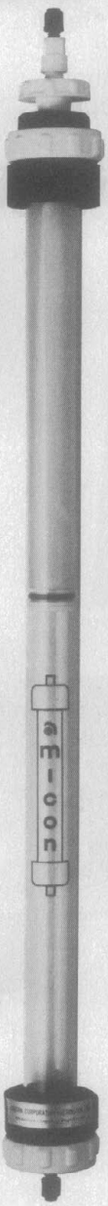

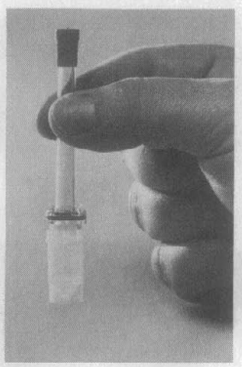

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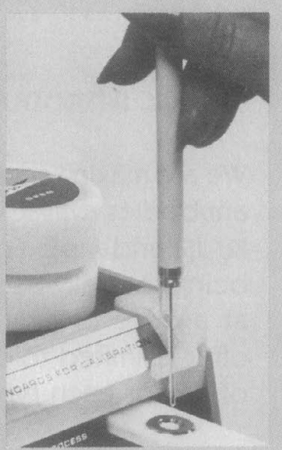

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