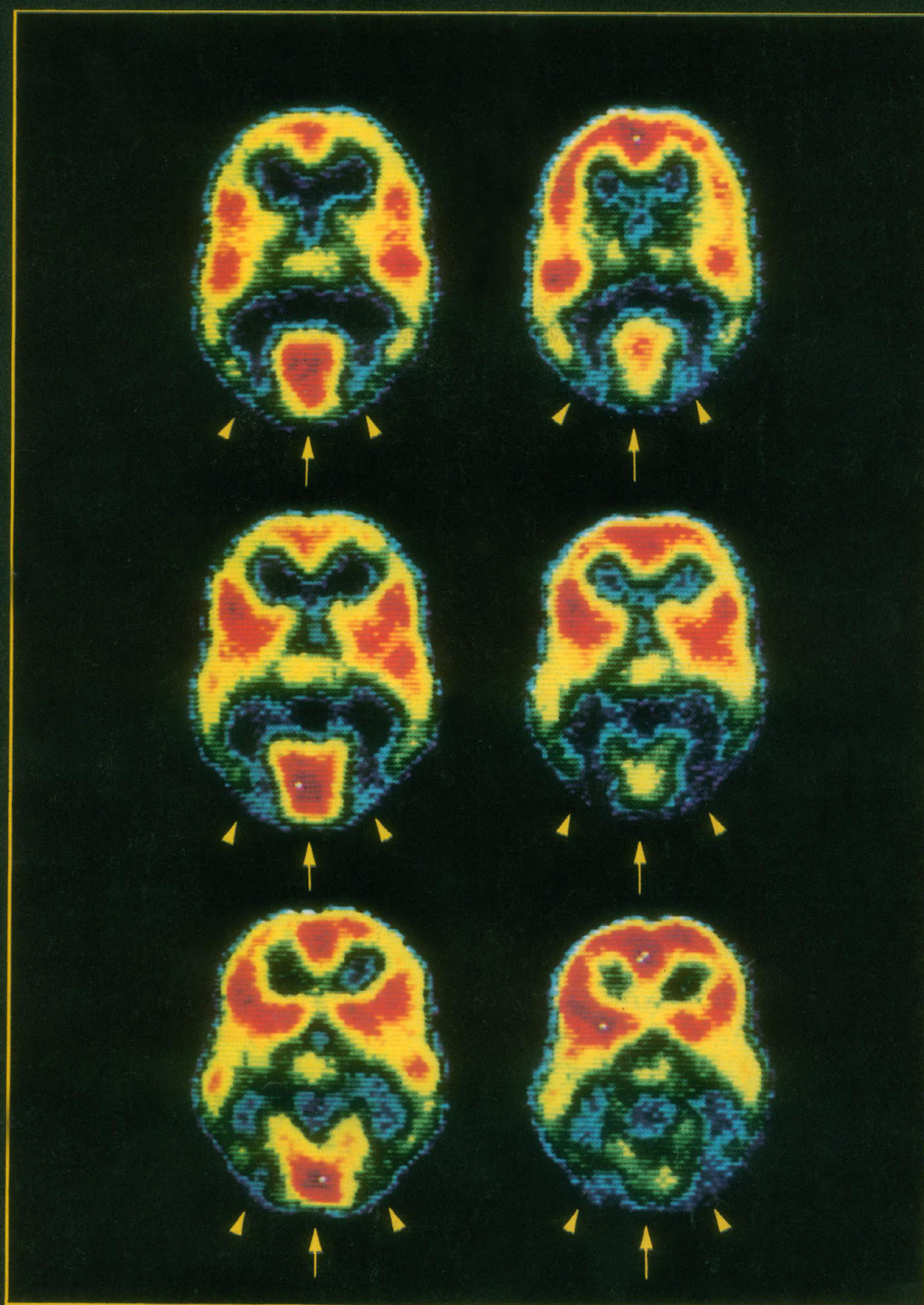


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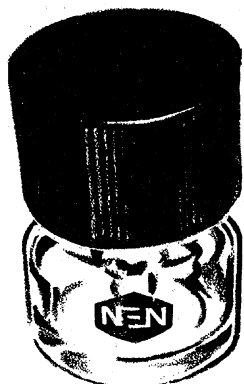
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Cross-sectional positron computed tomography images of glucose metabolism in the brain of a normal human subject with eyes open (images, left) and eyes closed (images, right). Lighter colors correspond to higher metabolic rates. Note higher metabolic rate in the portion of the brain associated with vision (arrows) when the eyes are open as compared to when the eyes are closed. See page 1445. [M. E. Phelps *et al.*, University of California School of Medicine, Los Angeles]

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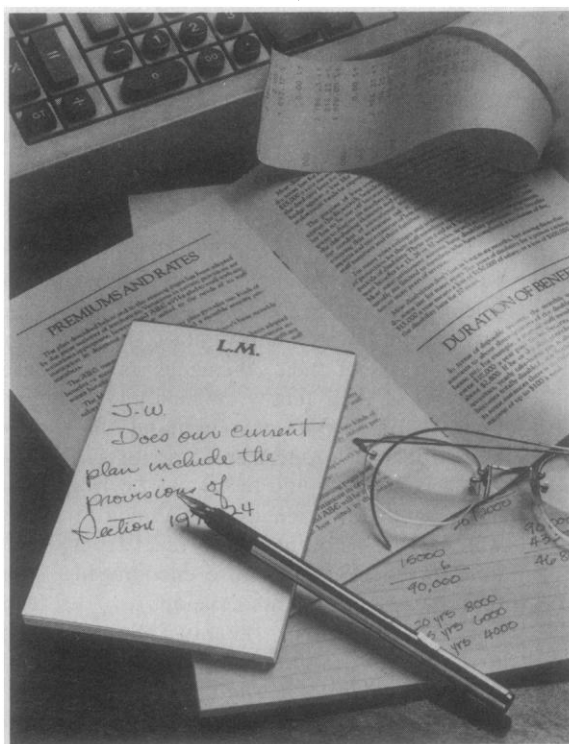
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LETTERS

Equity and Economics

William D. Carey, in his editorial on budget cuts in science "The threshold of pain: Coping with frugality" (27 Feb., p. 879), is quite wrong in stating that "What lies at the heart of the whole matter is the question of equity." Few if any of our fellow citizens will ever ask that science be cut in the name of "equity." They have the common sense to know that the future of science is inextricably linked with both the national economy and the national security. Science is part of the solution, not the problem.

And if science were excessively funded, little enough could be saved in any case. Above all, these cuts have taken place without any consultation with a government science apparatus much less a science adviser.

If the Reagan Administration succeeds this year—or in the coming years—in pulling up important roots of science just to be "equitable," we shall all be the worse off for it. In such circumstances, scientists would be foolish not to defend science; they would betray not so much the interests of their colleagues as the interests of their fellow citizens and of their country. With this in mind, the Federation of American Scientists—which is not now and never has been a trade union for science—is planning to watch events closely and to react from time to time. Scientists are encouraged to write to us as events develop.

JEREMY J. STONE

*Federation of American Scientists,
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AAAS will be heard from when rumors are superseded by fact and the danger can be assessed responsibly and with a sense of proportion.

—WILLIAM D. CAREY

The MX Question

I want to both commend and criticize Eliot Marshall's article (News and Comment, 13 Feb., p. 681) that resulted from his interview with me. Generally the article is excellent and quite accurately represents my views. However, in the discussion of the MX missile, there are two errors of fact. The first is the assertion by an anonymous "submarine fan" that I overstated the weakness of submarines and that the Navy got a retraction

of one of my statements. I have *not* retracted any statements that I actually made about submarine vulnerability, although I have occasionally corrected misquotes or misinterpretations of what I said. I challenge the "submarine fan" to produce the retraction he claims the Navy got. If I am going to be accused of being inaccurate and unfair, the person making that value judgment should be identified as well as the statements he is criticizing.

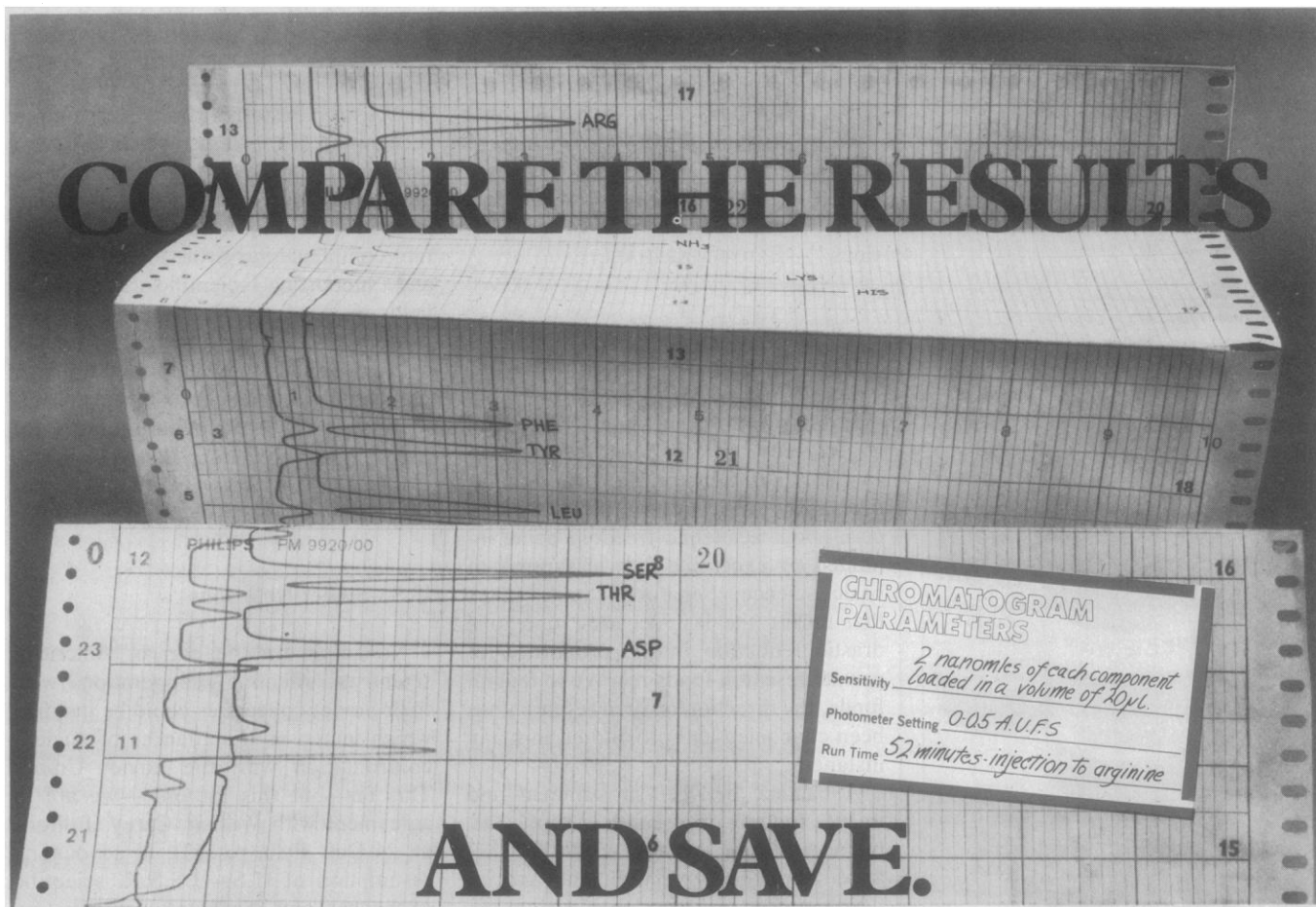
The second error is the bald assertion that I played the good soldier despite my private misgivings about the MX plan. I consider this a serious allegation, and yet it is offered lightly, almost as if it were a compliment, and without a shred of evidence, almost as if it were self-evident. It is, in fact, not true. I proposed the MX program to the Administration, and it is therefore a complete distortion of fact to suggest that my subsequent support of it was done only out of a sense of duty. I consider myself an "arms control advocate" and find that position perfectly compatible with being an MX supporter.

Marshall also suggests I have become "flexible" on the MX question, and that I now believe we could give up on land-based missiles and expand our submarine missile forces. My views on that question are the same as they have been for several years. I believe it is best to maintain a survivable land-based missile force. If for any reason that is not done, the second-best plan is to expand our submarine-based missile force. I have testified many times that there are no technical reasons against expanding our Trident force or adding a SUM-like system to our Trident force (although it is a delusion to think that either of these alternatives would be cheaper than MX). I prefer an MX solution because I am concerned that we cannot be positive that we can maintain forever the present invulnerability of the submarine forces, particularly if we allow the Soviets to concentrate on that problem. Thus I am neither an "MX fan" nor a "submarine fan." I believe our best security lies in maintaining a diversity of survivable land-basing and survivable sea-basing for our missile forces.

WILLIAM J. PERRY

*3645 N. Monroe Street,
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I regret having understated Perry's enthusiasm for the land-based MX missile system, and I am glad he has taken the opportunity to demonstrate that his zeal was not that of a "good soldier" but of a true believer.



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Readers interested in learning about the submarine debate are referred to the *New York Times* article of 5 October 1980 by Richard Burt: "Brown admits aides distorted MX issue: Pentagon sought to push missiles by exaggerating Soviet gains against U.S. submarines."—ELIOT MARSHALL

Science Funding in West Germany

In his recent letter about the federal government's role in basic research (16 Jan., p. 226), Senator Harrison Schmitt takes issue with Milton Friedman's concern about academic freedom being inhibited by excessive federal support of basic science. Senator Schmitt states that during the last decades, due to a drastic reduction in the proportion of private research funds relative to federal funds, the direction of such research has been channeled and prostituted in many instances.

A balance between government and private funding of research is important, but establishing exactly what that balance should be is very difficult and indeed depends on the science system being considered. In the Federal Republic of Germany, support for basic science depends almost exclusively on government funds. Out of a total of approximately \$2.7 billion spent by German universities on research in 1978, only \$50 million came from private sources, mostly from industry. A similar situation prevails in nonuniversity research institutions doing basic research. In spite of this seeming imbalance, there is no serious inhibition of academic freedom in my country. This may be partly due to the policy of the government to support basic research predominantly by financing the budgets of a few large, independent, scientific funding organizations, such as the Deutsche Forschungsgemeinschaft (the equivalent of the National Science Foundation, but without organizational ties to the government) and the Max-Planck Society. There is little government interference in the process of distributing these funds to research institutes and individual researchers.

The German scientific community is highly sensitized to any threats to this independence from the government. Also, the Max-Planck Society stresses the importance of the existence of some—very limited—private funds they can use without having to give an accounting to the government. Similar views are maintained by researchers from academic institutions.

These views probably reflect an emphasis on the principle of pluralistic sources for basic research more than a recognition of the monetary contribution private funds make in this area of science and technology. Nevertheless, private institutions continue to have an important complementary role in encouraging and supporting scientific research in fields which, for one reason or another, do not meet the requirements for funding or are not sufficiently supported by large funding institutions.

WERNER MENDEN

*Embassy of the Federal Republic of
Germany, Washington, D.C. 20007*

U.S.-Soviet Relations

No action on the part of American scientists affecting cooperation with their Soviet colleagues could be justified which increases the chances of nuclear confrontation with the Soviet Union. This far—but this far only—we are in agreement with William Carey (Editorial, 24 Oct. 1980, p. 383). In advocating resumption of U.S.-U.S.S.R. scientific exchanges and meaningful cooperation between U.S. and Soviet scientists, Carey appears to misunderstand the purposes and effectiveness of efforts like the moratorium on professional cooperation with Soviet scientists advocated by Scientists for Sakharov, Orlov, and Shcharansky (SOS). His editorial misrepresents the position of "leaders in science" in the United States on such actions.

At a press conference in Washington, D.C., on 16 October in which the five of us participated, we made it clear, as does the SOS pledge signed by 7900 scientists from 44 countries (including 33 Nobel laureates, 187 members of the National Academy of Sciences, and 82 fellows of the Royal Society), that such activities do not prevent and are not intended to prevent contacts between U.S. and Soviet scientists on such matters as arms limitation or other aspects of world peace. We are aware that such contacts played an important role in the test ban treaty and, while we doubt that scientists can play an effective role in ameliorating the current U.S.-Soviet impasse, we would support any actions by scientists in the search for peace and disarmament.

It is our firm belief that the moratorium advocated by SOS and, more generally, the sharp reduction in Soviet-U.S. exchanges, which have been valuable to us as well as to the Soviets, not only do not bring us any closer to the confronta-

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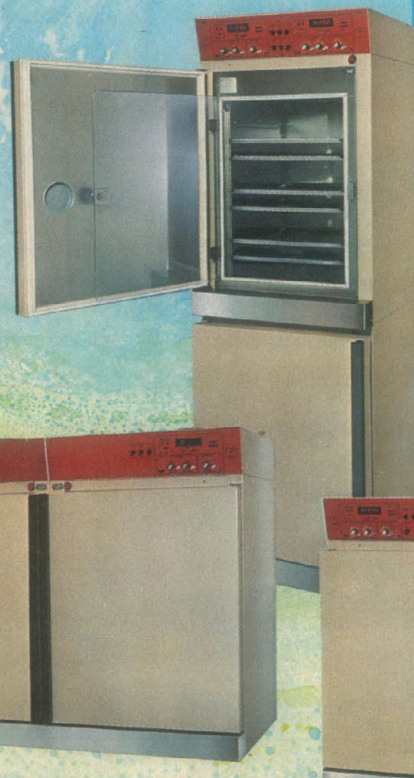


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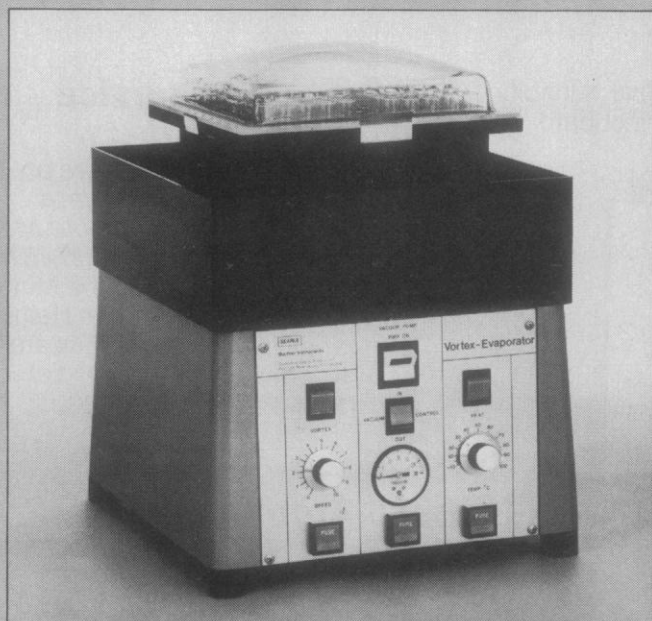
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tion which Carey dreads but are, indeed, effective means to create a climate in which progress toward peace will again be possible. What Carey proposes is just what the Russians rely on after the jailing of an Orlov or a Shcharansky, or the exiling of Sakharov, namely, a brief period of Western protest followed by détente as usual. We are convinced of the necessity of a consistent, long-term commitment to the position espoused by our French colleagues on 16 October in Paris that "scientific cooperation is only morally acceptable if fundamental liberties—freedom of expression, of movement, of association and the freedom to work—are effectively guaranteed." Nothing less will serve when the most basic human rights of our colleagues in the Soviet Union are being violated. Moreover, precisely because of the fact that Soviet scientific elites are "extraordinarily valued professionally," as Carey says, and because contacts with the West are eagerly sought and encouraged, curtailment of such contacts may induce Russian scientists to bring pressure to bear on Soviet authorities, causing them to relax their rigid control of scientists and to moderate their brutal treatment of dissidents and refuseniks. In the words of Sakharov, "It will be totally unforgivable if the West fails to use this leverage" (1). Unlike Carey, we think there is some evidence to support our view. Of course, this policy has not helped "the besieged defenders of Afghanistan"; none of us ever expected it would. But Sakharov is in exile rather than in jail, others are in jail rather than dead, and a considerable number of Soviet scientists have emigrated. The strongest evidence favoring this position is the virtually unanimous support of our activities by Sakharov and other dissidents and refuseniks within and outside of the U.S.S.R.

We must also register our dismay at Carey's call for a "reopening of scientific traffic" with the Soviet Union purely on the grounds of "expediency." We are not naïve idealists; rather it is clear to us that to ignore Soviet violations of the human rights agreements they formally entered into at Helsinki can only support the Soviet belief that they can with impunity violate any agreement not convenient to keep. To reinforce this belief is a sure road to the confrontation Carey wished to avoid. And we reject the view that "The quarantining of Soviet science, however principled, defeats the chances for engaging . . . in a dialogue of reason." To the contrary, Sakharov asserts, out of deep concern and profound in-

sight, that "... the fear in the West that ... defense of human rights may harm arms negotiations is unfounded" and that "the human rights issue is ... a paramount practical ingredient of international trust and security" (1).

Where human rights are concerned, principle, sound policy, and the best chance of achieving meaningful détente are congruent.

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References

1. A. Sakharov, *Alarm and Hope* (Random House, New York, 1978).

As three scientists who participated in an extended botanical exchange program in Siberia during 1979, we wish to commend *Science* on the conciliatory and understanding view of intellectual and cultural exchanges between the United States and the Soviet Union as stated in Carey's editorial.

During our visit, we talked to scores of scientists at all conceivable levels and found genuine concern for mutual understanding as well as fear of the attitudes of many American factions toward the Soviet Union. A true desire for peace was overwhelming among the Russians we met, most of whom had lost family during World War II. They were not, as we are sometimes led to believe, simply parroting propaganda on the advice of superiors.

We hope that Carey's thoughtful editorial will help reverse the antagonistic trends of the last few years and will lead to increased person-to-person contact between scientists of the United States and the Soviet Union.

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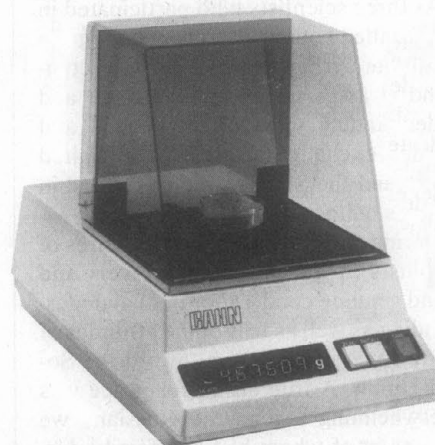
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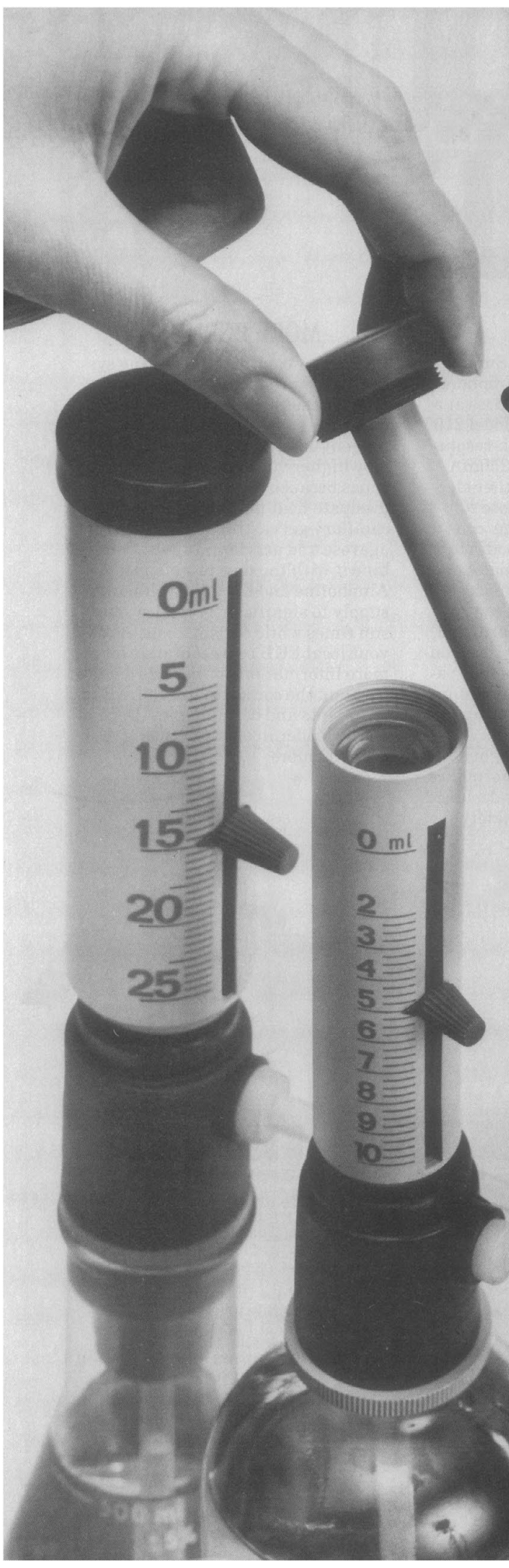


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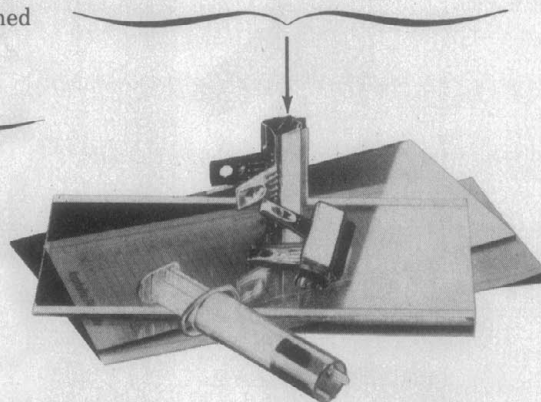


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An Alternative Funding Mechanism

At a recent science policy seminar in Washington, Philip Handler described the changes in the actual meaning of "peer review" in research funding. He pointed out that in the 1950's, informal phoning around by the program manager in a funding agency to a select group of active scientists served to strengthen the judgment of the manager. Thus was born peer review. The complicated time- and creativity-consuming process that has since evolved and that we also call peer review serves a different purpose. Handler's view was that the peer review process now functions as a legitimating balance wheel between the inherent elitism of science and the egalitarianism demanded by the structure of American democracy.

The wastefulness of the present system, which takes on the average 2.5 full-time equivalent person-years just to get and manage \$1 million, is admitted on all sides. Yet the question is often asked rhetorically: Is there an alternative system that can achieve the same goal of equitable funding of the best science? The answer is that there is, and it has many advantages over the present system. The system I describe below is only one example of a genre of systems that could be called productivity-based formula systems for research funding. Underlying the new system is the changing social contract between science and its patron society. The change of Administration and of the national mood is an opportune framework within which to rewrite this contract. Alternative systems based on what Philip Abelson once referred to as "performance rather than promise" will provide a much firmer basis for public accountability.

University research is unique in one important respect in reasons for commanding public support: It makes possible the education and training of research personnel principally at the graduate level. In addition, universities conduct varying percentages (depending on the field) of the total national basic research effort. Finally, universities are part of the research base drawn on by mission agencies to achieve national goals. The formula suggested here arrives at a figure of merit for support of basic research on the basis of these three benefits or services, which are the principal outputs of university research. It takes the general form:

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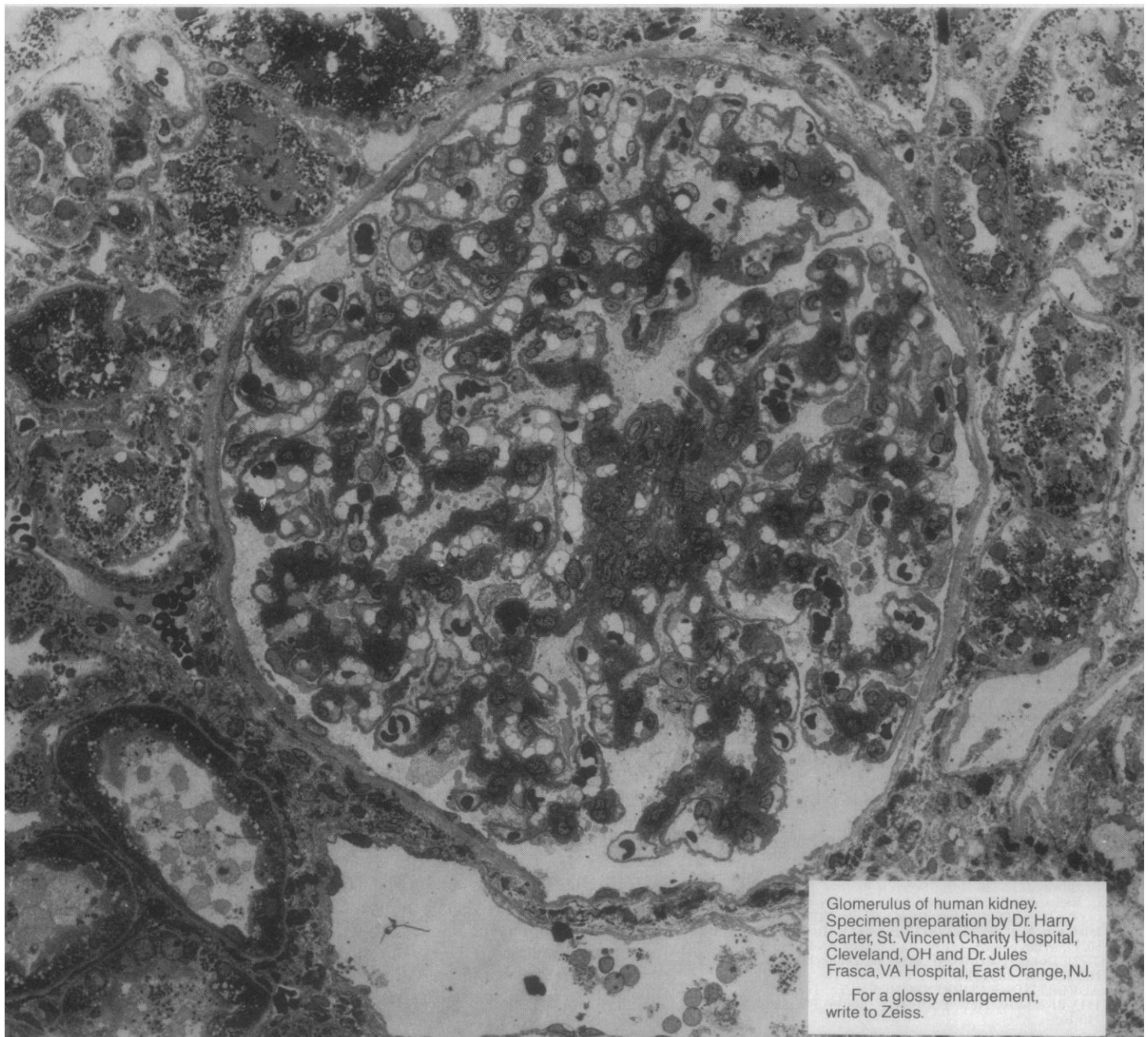
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4) Technical Comments: Up to two pages of text, including references and notes.

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1) Articles: About half the Articles published in *Science* are solicited by the editor. Both solicited and unsolicited Articles undergo outside and in-house review. Articles are expected to (i) provide a review of new developments in one field that will be of interest to readers in other fields, (ii) describe a current research problem or a technique of interdisciplinary significance, or (iii) present a study of some aspect of the history, logic, philosophy, or administration of science or a discussion of science and public affairs. Readers should be able to learn from a technical Article what has been firmly established and what are significant unresolved questions; speculation should be kept to a minimum. Preference is given to Articles that are well written, well organized, and within the length limit. Balance of subject matter in *Science* is an important consideration when a choice is made between acceptable Articles.

2) Reports: Reports are selected on the basis of reviewers' comments and an in-house review. Reports are expected to contain solid research results or reliable theoretical calculations. Preference is given to those that describe departures or discoveries that will be of broad interdisciplinary interest or of unusual interest to the specialist. In making the final selection, the editors take into consideration (i) the reviewers' comments: reports most likely to be accepted are those that receive persuasive outside reviews favoring publication; (ii) clarity of presentation within the prescribed length

limit; and (iii) subject matter in relation to that of other papers on hand. An attempt is made to balance the subjects of Reports so that one discipline is not overrepresented to the exclusion of others.

3) Letters: Letters are selected for their pertinence to material published in *Science* or because they discuss significant problems of interest to most scientists. Letters of a highly technical nature are usually transferred to the Technical Comments section. Letters pertaining to material published in *Science* may correct errors, provide support or agreement, offer different points of view, clarify, or add information. Outside reviewers may be consulted on questions of accuracy. Insinuations and conjecture about another author's motives, abilities, or intelligence are considered inappropriate for publication. The selection of letters is intended to reflect the range of opinions received.

4) Technical Comments: Technical Comments may be selected for publication if they express significant criticisms of papers published in *Science* or offer useful additional information. Technical Comments are usually sent for an opinion to the authors of the original papers before being reviewed. Discussions of minor issues or priority claims are not deemed appropriate, nor are questions that can be resolved by correspondence between the critic and the original authors.

5) Book Reviews: The selection of books to be reviewed and of reviewers is made by the editors.

Submission of Manuscripts

Submit an original and two duplicates of each manuscript together with a letter of transmittal giving:

- 1) the name(s) and telephone number(s) of the author(s);
- 2) the title of the paper and a statement of its main point;
- 3) the names, addresses, telephone numbers, and fields of interest of four to six persons in North America but outside your institution who are qualified to referee your paper;
- 4) the names of colleagues who have reviewed your paper; and
- 5) the fields of interest of readers who may want to read your paper.

Manuscript Preparation

Typing. Use double spacing throughout the text, tables, figure legends, and references and notes.

Units of measure. Use metric units. If measurements were made in English units, give metric equivalents.

Symbols and abbreviations. Define all symbols, abbreviations, and acronyms.

References and notes. Number references and notes in the order in which they are cited in the text. Place references cited only in tables or figure legends after the text references. Gather all acknowledgments into a single, brief statement at the end. Use *Bibliographic Guide for Editors & Authors* (American Chemical Society, Washington, D.C.) for abbreviations of journal titles. For journals not listed there provide the full title. Use the following forms:

For a journal paper: H. Smith, *Am. J. Physiol.* **98**, 279 (1931).

For a book: F. Dachille and R. Roy, *Modern Very High Pressure Techniques* (Butterworth, London, 1961), pp. 163–180.

For a paper in a compilation: F. Dachille and R. Roy, in *Reactivity of Solids*, J. H. de Boer, Ed. (Elsevier, Amsterdam, 1960), p. 502.

For unpublished material: A. Giraud, paper presented at the American Nuclear Society Conference, Washington, D.C., November 1976.

Illustrations. For each illustration submit three copies of a quality suitable for reproduction. Label each on the back with the name of the author and the figure number. Plan figures for the smallest printed size consistent with clarity. Color may be used if necessary but authors are billed accordingly. Cite all illustrations in the text and provide a brief legend for each.

Tables. Type each table on a separate sheet, give it a number and title, and cite it by number in the text. Give each column a heading. Indicate units of measure in parentheses in the heading for each column, and do not change the unit of measure within a column.

Equations and formulas. Use quadruple spacing around equations and formulas that are to be set off from the text. Define all symbols.

Special Requirements and Procedures

1) Articles: Provide a title of one or two lines of not more than 26 characters and spaces each; a brief author note giving your position and address; and a summary of 50 to 100 words. The summary should convey to the general reader the main point of the paper and outline the results or conclusions. The introduction should portray the broad significance of the work, and the whole text should be intelligible to scientists in different disciplines. Explain all technical terms likely to be known in only one field. Insert short subheadings at appropriate places in the text to mark your main ideas. Provide a reference list in accord with *Science* style. Reference lists should not be exhaustive; citation of a single review article can often replace many references. A maximum of 40 references is suggested.

2) Reports: Provide a title of one or two lines of not more than 54 characters and spaces each, and an abstract of 50 to 75 words. The abstract and the first portion of the report should portray for the general reader the results described and their significance. The body of the report should be intelligible to scientists in other fields of expertise. Complete documentation need not be presented but should be available in cited references.

3) Letters: Letters should be short (up to 250 words) and to the point; they should be carefully phrased, free of technical jargon, and nonrepetitive. When a Letter refers to an Article published in *Science* the original author is usually given an opportunity to reply. Letters are frequently shortened and edited. Letters are acknowledged by postcard; authors are notified if their letters are accepted for publication. Letters must be typed with double spacing.

4) Technical Comments: Technical Comments on Reports or Articles are published at the end of the Reports section. When a Technical Comment is accepted for publication the authors of the

original paper are usually given an opportunity to reply.

5) Book Reviews: Instructions accompany review copies when they are sent to reviewers.

Printing and Publication

Editing. Before being sent to the printers, papers are edited to improve accuracy and effectiveness of communication. When changes are needed because the author's meaning is not clear, the editor may consult the author by telephone; when the editing is extensive, the manuscript may be returned to the author for approval or further adjustment before the type is set.

Proofs. One set of galley proofs is provided for each paper. Alterations should be kept to a minimum and marked only on the proofs. Extensive alterations may delay publication.

Scheduling. Papers are not scheduled for publication until *Science* has received corrected galley proofs from the authors. The median delay between acceptance of papers and mailing of galley proofs to authors is 4 to 8 weeks (allowing for editing and typesetting); the median delay between receipt of authors' galley proofs by *Science* and publication is 4 to 6 weeks (allowing for proofreading, layout, and paging). There may be additional delays in publication for papers with tables or figures that present problems in layout and for papers accompanying cover pictures.

Reprints. An order blank for reprints accompanies proofs.

Cover Photographs

Particularly good photographs that pertain to a paper being submitted will be considered for use on the cover. Submit prints (not slides, negatives, or transparencies) together with the manuscript, and indicate in the letter of transmittal that a possible cover picture is enclosed.