Letters

NSF and Citation Analysis

Nicholas Wade's article "Citation analysis: A new tool for science administrators" (News and Comment, 2 May, p. 429) by and large presents a fair assessment of a new and *potentially* useful tool for science administrators and perhaps for scientists themselves. However, Wade makes one statement concerning the National Science Foundation (NSF) that needs correction—namely, that the NSF "is using the technique to assess its funding of chemistry departments and as a safety net to catch chemists who write bad grant proposals but are heavily cited."

The NSF chemistry section does not use citations in its review process or in assessing its funding. Aside from any consideration of citations, the chemistry section does not fund chemistry departments. We support individuals, not departments, on the basis of proposals written by them and submitted by their institutions on their behalf. The extent of support received by a given department is not a criterion for deciding upon the possible support of any individual in that department.

We do not provide a safety net to catch chemists who write "bad" proposals. The implication of the statement seems to be that the staff of the chemistry section gives a bonus to heavily cited chemists to prevent a "bad" proposal of theirs from being declined. This is not the case. If a heavily cited chemist writes a "bad" proposal, as judged by his peers, then he or she will meet the same consequences as anyone else who does a poor job. We do not use citation analysis as a backup to our present peer review system.

The chemistry section is studying the possible utility of citations in several respects, such as postgrant evaluation, and observation of interactions between subdisciplines and changes in these interactions. We plan to continue these studies.

Quite apart from the concern of whether citations measure anything substantive, however, there is a basic question concerning the accuracy of raw citation data sorted only on the basis of the names of investigators and not carefully analyzed to remove homographs (same name, different person). This problem is severe even when the individual sorting is detailed to a last name and two initials, and we urge the producers and users of citation data to give serious thought to its solution.

O. W. ADAMS
Chemistry Section, National Science Foundation, Washington, D.C. 20550

Academy Forum Publication

I read Albert Jonsen's letter (11 Apr., p. 98) concerning the National Academy of Sciences' forum on human experimentation with great interest. Since both the forum, and Jonsen's letter to a lesser degree, are likely to stimulate discussion and debate, I would like to inform readers that the published presentations and discussions from this forum are now available in paperbound edition. *Experiments and Research with Humans: Values in Conflict* may be obtained for $5 per copy from the Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, D.C. 20418. Prepayment must accompany all orders.

LAURIE STROBLAS
Printing and Publishing Office, National Academy of Sciences, Washington, D.C. 20418

Is "Doomsday" on Target?

Fifteen years have now passed since von Foerster, Mora, and Amiot published their thesis "Doomsday: Friday, 13 November, A.D. 2026" (*1*). Their work contained the following formula for world population, N, as a function of time, t

$$N = \frac{1.79 \times 10^{11}}{(2026.87 - t)^{.99}} \quad (1)$$

where time is measured in years A.D., the derivation having been based on a combination of empirical and theoretical reasoning. As they showed, the formula provided a remarkably close representation of human population for the period 1750 to 1960, for which figures of some accuracy are available, and also was in agreement with estimates of population 1000 and 2000 years ago.

On this 15th anniversary of their article, and as our bicentennial year approaches, it seems appropriate to ask whether the world's population still remains on target according to Eq. 1.

Putting t = 1975 in Eq. 1, we find that N = 3.65 billion persons. On the other hand, the Population Reference Bureau's 1975 estimate for N in mid-1975 is 3.97 billion (*2*). Thus, we are not merely on target according to Eq. 1, we are in fact comfortably ahead of schedule. That is, while the formula of von Foerster *et al.* predicted an infinite world population as of A.D. 2026, our present growth rate gives us hope of reaching the desired goal even earlier than they expected.

Some of my colleagues have suggested that, in view of this, we should revise our estimate of the glorious moment, moving it forward say 5 years, thus giving a larger number of those presently alive some hope that they might be present to celebrate the event.

That Eq. 1 underestimates world population for 1975 is, however, probably an anomaly due to our relative freedom over the past 15 years from major wars, pestilence, or famine. Indeed, the Population Reference Bureau (*2*) sees a "medium variant" population of 6.25 billion persons in the year 2000, which would indicate a turnaround because Eq. 1 predicts 6.87 billion persons for that year. Whether the turnaround will be as great as anticipated by the Population Reference Bureau can, however, be debated. It seems unlikely that the world will so quickly give up its opportunity to reach the desired goal by 2026, before the oil runs out. (The writer may also perhaps be forgiven a personal motive for not wishing to change the year 2026. He will be exactly 100 years old on 1 November of that year, and cannot resist the thought of the usual press interview: he is storing up useful and wise sayings for the event.)

An incisive reader might see difficulties—either human or theoretical—with Eq. 1, but these difficulties have already been carefully dealt with by von Foerster *et al.*, not only in their original article, but also in response to a series of later comments on it (*3*). We content ourselves with the remark that other predictions of the 1975 world population, made at essentially the same time as von Foerster *et al.*'s, ranged from 3 billion to 3.5 billion and thus were considerably less accurate. We are similarly confident that, in 15 years (A.D. 1990), the world population will be much closer to the value predicted by

Eq. 1, namely, $N \approx 5$ billion, than to other estimates being made now by those who do not see the millennium arriving quite so early as we do.

JAMES SERRIN
Department of Mathematics, University of Minnesota, Minneapolis 55455

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1. H. von Foerster, P. M. Mora, L. W. Amiot, *Science* **132**, 1291 (1960).
2. P. F. Myers, L. F. Bouvier, J. R. Echols, *1975 World Population Data Sheet* (Population Reference Bureau, Washington, D.C., 1975).
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Crowding on Yosemite Buses

Lack of riders has plagued many public transportation systems around the country. However, the free Yosemite Valley shuttle-bus system in Yosemite National Park, California, had the opposite problem during the summer of 1974. Bus routes connect stores, trailheads, the visitor center, campgrounds, and motels in the valley. During the afternoon and evening hours of July and August, ridership averaged 80 percent of bus seating capacity. Often there was standing room only. On Friday and Saturday nights, bus drivers often had to leave many people stranded at bus stops because buses were full. Overloaded buses overheated and had to be taken out of service. At the busiest stops, visitors were frequently observed jockeying for position and pushing one another in preparation for boarding.

These and other findings were obtained in a study of crowding in natural settings funded by the National Science Foundation. Our research team recommended, and the Yosemite National Park Service has adopted, a number of changes which should help alleviate some of the problems described.

Given the general reluctance of people to use mass transportation, it is worth speculating on the factors which contribute to the popularity of the Yosemite Valley shuttle-bus system. These may include the following. There is no fare; the system is completely subsidized by the National Park Service. Some of the shuttle buses are double-decked, and all are open-air, thus providing unobstructed views of the scenic valley. Many younger visitors may have no alternative means of transportation (except walking). For adolescents and young adults, the buses provide a place for meeting peers and for "partying." Visitors who are unfamiliar with the park may not wish to risk becoming lost while driving. Visitors, being on vacation, may not be in a hurry to arrive at their destinations. The area served by the bus system is small (only a few square miles), and routes include stops at most points of interest. A few miles of one route are on roads not open to private vehicles.

ALLAN W. WICKER
Faculty in Psychology, Claremont Graduate School, Claremont, California 91711

Scientists and Politicians

As a political scientist working at a scientific center (the National Center for Atmospheric Research), I am in general sympathy with some of the views expressed in Roger Revelle's farewell address as AAAS president (21 Mar., p. 1100). However, one point that he makes may in fact undermine the type of cooperation between scientists and politicians that he seeks to bring about.

Revelle writes that "The politician is publicly egotistical, gregarious, garrulous, and has a strong gambling instinct. The scientist, at least in his own image, is publicly modest, introverted, relatively inarticulate, and seeks certainty rather than risk."

Here Revelle compares two unlike things: the public (or realist's) view of the politician and the self-image (or idealist's view) of the scientist. In fact, the politician and the scientist are more like each other than Revelle leads the reader to believe. In the realist's view, politicians are seekers of votes, but not necessarily of sound policy or rational decisions, and scientists are seekers of grants, but not necessarily of truths. Scientists, just like politicians, are guilty of myth-making, "Appealing to the emotional and the irrational in other men as well as to their calculating self-interest." Revelle notes that "For the politician in a democratic society, infinity is the election after the next one." A realist might say that, for the scientist in a democratic society, infinity is the research grant after the next one.

What Revelle says about the real politician could be said about the real scientist and what he says about the ideal scientist could be said about the ideal politician. Awareness of this point is an important place to begin for those who seek to establish more cooperation between these two professions. The similarities are much more pronounced than are the differences.

MICHAEL H. GLANTZ
Advanced Study Program, National Center for Atmospheric Research, Boulder, Colorado 80302