Letters

An Analysis of Citation Analysis

The citation index (News & Comment, 7 Dec., p. 1331; 4 Jan., p. 25) is a great artificial phenomenon, but not one worth citing. Like statistics, a little application causes haphazard outcomes. Methods papers have been removed from consideration because they receive too many citations (*1*). Other types of papers should also be removed from consideration by the citation index analysts, or perhaps be analyzed in a more meaningful way.

Review papers receive lots of citations, so with methods papers removed, reviews have replaced methods papers as front runners. And this seems reasonable. If a review has adequately summed up the literature, why not cite it instead of writing the review over again? For the analysts of the citation index, then, every paper cited by a review should also be given credit every time the review is cited. This should initiate a new way of analyzing citations, and the folks who make a living out of analyzing the citation index will have an exciting new enterprise to fill their time. One cannot stop there. Reviews are used to bury the literature and rewrite history. This is done by comprehensively recording all references in the first review, and then referring back to the first review by stating that "The earlier literature has been reviewed by whomsoever." Thus reviews can generate, either knowingly or accidentally, an eclecticism that tosses good science out of the running.

Kuhn states (*2*) that science progresses by forgetting the past or by making a myth out of it. The citation index helps in the myth-making, and therefore, by Kuhn's Law, is invaluable for the advancement of science and technology. Is that really better than keeping the record straight? Should not the citation index reach back through one generation, or more, of reviews to provide the proper credits now masked by creative and selective authors of reviews?

Alternatively, there is a more simple solution—eliminate reviews from consideration because they get cited too much and they contribute nothing to scientific discovery and research except, however sloppily, to consolidate it.

Three other types of papers should be removed from citation index analyses. They get cited too much because the scientific research community zeroes in on them and thereby creates lots of citations: (i) the "suspected fraudulent paper," (ii) the "controversial paper," and (iii) the "pizzaz paper." Often these papers slip from one class to the other during the zeroing in process.

If these three types of papers are eliminated from the analyses, as they should be, what is left? The scientific literature consists of large numbers of data collection papers and data analysis papers. Many solve local problems, like how to control insects that infest date palms in Iraq, or how to identify and counteract toxic ingredients in the Rhine River. Research papers are used for teaching, and many of these are cited in student reports. So papers useful to a user community which uses, but does not cite them in the open literature, also should be removed from consideration by the citation index analysts, because, though not cited, these are needed, like methods papers and reviews, for civilization to advance.

Another class that should be removed from consideration are those which cite their friends, but not their enemies or suspected competitors. Every scientist who has been subjected to that by the aggressive and the overtly ambitious knows whereof I speak. There are also unwitting omissions, which every scientist has made at one time or another, and the omissions by unspoken policy, such as those perpetrated by some scientists in government agencies who only cite the investigations of other scientists working in that agency. The citation index analysts can decide for themselves whether these latter two categories also should be eliminated. This will require that the citation index analysts understand the literature. Their learning to read and comprehend science would benefit the administrative community enormously.

Still another class that should be eliminated are those papers which have multiple authorships. The best thing about limiting citation index analysis to sole authorship papers is that there would be so little work for the analysts to do. Perhaps not only multiple authorships, but also the single authorships, should be eliminated from consideration because everyone knows the data collection was done by an excellent technician who should have been cited, and, anyway, we all know that the sole author got the idea from his ex-colleague, who thought that he/she was a collaborator.

So what does this leave for the analysts to analyze? Well, they could find other criteria to analyze. For example, they could find the research in science which has had a major impact, even though the paper was never published. Research published as an abstract, as a remark after a symposium lecture, or even as a title in a program of a meeting, not to mention ideas and materials given by those disincluded from a publication, has had such uncitable impact.

Thus the citation index analysts could help reverse the most famous dictum of the 20th century, "publish or perish," first coined at the mid-century mark by Kimball C. Atwood III (but not published by him, and therefore, according to the current rules of the game, not citable).

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REFERENCES AND NOTES

1. D. Pendlebury, *The Scientist* **4**, 18 (8 January 1990).
2. T. S. Kuhn, *The Structure of Scientific Revolutions* (Univ. of Chicago Press, Chicago, IL, ed. 2, 1970).
3. Examples of cases cited above can be obtained from the writer of this letter.

Clean Air Act Amendments

Philip H. Abelson's editorial "Incorporation of new science into risk assessment" (14 Dec., p 1497) highlights a congressional mandate for the National Academy of Sciences to review and improve risk assessment methodology for hazardous air pollutants. This mandate is contained in the recently enacted Clean Air Act Amendments of 1990. We at the Environmental Protection Agency (EPA) agree with many of the points in the editorial and welcome any opportunity to consider and, where appropriate, incorporate recent scientific information in risk assessment. The introduction to the editorial, however, contains an assessment of the overall Clean Air Act with which we strongly disagree. Abelson seems to belittle the potential health benefits of the act and predicts that the major results of the bill will be increased costs, uncertainty in corporate planning, job losses, weakened competitiveness for U.S. industry, and increased bureaucracy and litigation.

These unfounded assertions do a disservice to those in the Congress, the Administration, and environmental and industry groups who have worked together over the past 2 years to craft this legislation. We believe the scientific consensus supports our position that this bill will bring significant health and environmental benefits by reducing exposures to chemicals such as ozone, carbon monoxide, acid aerosols, and a number of specific toxic air pollutants. Although the costs of the bill are significant, so are the known and potential benefits. The President's Council of Economic Advisors esti-