

Was the *Science Citation Index*
Concept Inevitable?

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Not long ago a correspondent asked whether I had "ever mused about just how inevitable was the invention of the *Science Citation Index*® concept".¹ In my reply to Dr. Goldman, I sent him a copy of the preface to the *Genetics Citation Index* written by Professor Joshua Lederberg in 1963.² The text is reproduced below.

It may be irrelevant to point out that in the history of the *Science Citation Index* (SCI®), there were many scientists, librarians, and laymen who actively and passively opposed any inevitability. They failed to see anything useful about it. It was unconventional. The concept of the citation as an information 'handle' was unfamiliar. Indeed, we at ISI® were often discouraged in our early efforts by the stubborn incomprehension of so many researchers. They were eager for information on the one hand. On the other, they were determinedly wary of any new or different routine in acquiring it.

All this may be irrelevant. The acceptance of a new idea may certainly be delayed by detractors, but it depends ultimately upon the commitment of those who recognize its potential. Clearly, Lederberg was among the first, along with some others. The question of inevitability can never be answered. But I can address the question of hurrying up the inevitable. Consider that *Shepard's Citations* had been used by American lawyers for 80 years by 1955,³ yet no one else had developed the concept, even for legal literature, until after the *SCI* came out in 1964.

Perhaps one should use a discussion of inevitability to glorify not the *SCI*, but the incredible invention of the *citation* itself. Its appearance in the Bible and other ancient works always fascinated me. It is interesting how many people take for granted its invention, and its subsequent application. The adoption of formal citations is a significant indicator of the maturity of certain fields.

I won't labor the point of why scientists cite each other's work. The fact is that they do. In some cases, without doubt, citations may be used for all those sullied purposes that supposedly demean its usefulness for information retrieval--flattery, padding, borrowed distinction, etc. These uses of the citation were the hallmarks of critiques of the *SCI* in its early days. Now that we publish a *Social Sciences Citation Index*™ they are being rediscovered. Quite frankly, those attacks might have been disastrous were it not for the financial success of *Current Contents*®. However, given enough time, the many and other practical reasons for scientists' citations won out over the trivial exceptions.

Citations are a particular notation of knowledge-as those who attacked their use usually proved by duly citing the relevant literature when their attacks came in written form. My irritation with those attacks was always salved by my amusement at finding those citations at the end of the diatribes.

Thus, if after the heavy investment of time and money citation indexing and the *SCI* were successful and thereby inevitable, it is because the citation itself is incorruptible. It can be sloppily reproduced, to be sure. But it is not significantly affected by old or new disciplinary boundaries, translation problems, the regularity or irregularity of "subject heading" requirements, indexing policy, etc. It remains the one unchangeable and permanently reliable description of a paper. A list of papers one cites is often more pertinent and descriptive than the title one may choose. At the same time, the citation facilitates the transmission of new significances discovered in subsequent research.

Any proper discussion of inevitability in science would take into account Merton's work on multiple independent discovery.⁴ In the case of the *SCI*, there was certainly

nothing like the competition that spurred development of the first successful automobile or airplane. But just as there were theoreticians who proved that human beings could and should not ride or fly, there were others who predicted that both were inevitable. Perhaps the *SCI* was too. In any event, I'm glad we didn't have to wait another eighty years to find out whether the *SCI* would fly as well.

1 Goldman, J.A. Personal communication, 11 September 1974.

2 Lederberg, J. "Preface" in: *Genetics Citation Index; Experimental Citation Indexes to Genetics with Special Emphasis on Human Genetics*. (Philadelphia: Institute for Scientific Information, 1963), 864 pp., p. iii. Reprinted in *Current Contents* No. 50, 11 December 1974, p. 6.

3 Garfield, E. Citation indexes for science. *Science* 122:108-11, 1955

4 Merton, R.K. Singletons and multiples in scientific discovery. *P. Amer. Philosoph. Soc.* 105: 470-86, 1961; reprinted in: Merton, R.K. *The Sociology of Science* (Chicago: University of Chicago Press, 1973) pp. 343-70.

Genetics Citation Index

(Philadelphia: Institute for Scientific Information, 1963)

PREFACE

by

Joshua Lederberg

Dr. Garfield's article on citation indexing which appeared in *Science* in 1955 first brought this technique to my attention and was my first introduction to the organization now known as the Institute for Scientific Information. Citation indexing seemed a clever idea at the time and I wondered whether it would ever come to fruition.

A few years later the suggestion recurred and I was puzzled how to find out whether there had been any follow-up on Garfield's first suggestion. I had no idea how to look up the literature in the documentation field and from past experience with subject indexing in science had little confidence in the utility of a literature search.

This was the very incident that convinced me of the need for the citation index--it was parallel to many others in my own research activity. How often I have run across some older reports on methods or on some curiosities of bacterial variations and been frustrated in attempts to find later work on the same subject and, especially, critical enlargement on the earlier work.

For many reasons genetics is an especially apt field for the introduction of citation indexing. It is inherently interdisciplinary, cutting across biochemistry, statistics, agriculture, and medicine so that geneticists need insight into a wide range of scientific literature. While there have been many revolutionary developments, many facets of genetics still rely heavily on older work. The principles of *Drosophila* research of 40 years ago are first finding their application in human cytogenetics today. Geneticists have tended to be perceptive about the historical development of their concept and to fulfill their responsibility in furnishing the appropriate citations in their bibliography. Their concern with parent-offspring relationships perhaps makes geneticists more perceptive to the understanding of the structure of scientific activity that is inherent in citational references. It

was, therefore, most gratifying that the review panel of the NIH and NSF concurred in supporting this trial in the field of genetics.

Citation indexing is, of course, only one aspect of literature searching. There will be many disappointments in its use--but a negative result within the scope of the index is perhaps more meaningful than with any other technique. Other methods generally place great reliance on subjective classification with which the final user can rarely be entirely familiar. Citation indexing can uncover unexpected correlation of scientific work that no other method could hope to find, and a successful match can often be located with great speed and assurance. The chief limitation is perhaps merely the scope of the indexing effort in the sample--in a given year there may have been no literature on a given reference. A cumulative index to all of science would, of course, be a large undertaking but of course no larger than the problem to which it is addressed. In fact the machine basis of this approach should make it far less costly and more expeditious than any other technique now apparent. Until a complete index is available we may not know the full value of the technique, but the present sample is a noble effort which should give many investigators substantial help in their present retrieval problem and show the way to an ultimate, even more satisfactory, result.

My own contribution to the project has been too limited to inhibit me from commending Dr. Garfield and his associates for organizing and implementing a project which has required an unimaginable attention to detail, technical skill, enthusiasm, and above all, an irrepressible concern for meeting the real need of scientists. To flourish, science has many needs but none is more vital than responsible communication with history, society, and posterity embodied in what we casually call the scientific literature.