

Foreword

With the explosion of biomedical knowledge in the 1870's and 1880's, which started essentially in Germany under such scientists as Koch and Virchow, came a concomitant need for a system of informing scientists anywhere of what had already been determined. Even more, the clinician who had to transfer theoretical knowledge into practical methods for treating sick individuals had to be kept abreast of the latest findings. It comes as no surprise, therefore, to realize that much of the earliest modern work on publicizing new biomedical research findings emanated from Germany, and that many of Germany's most honored research workers realized its importance and took an active part in its dissemination.

Moreover, these late-19th-century systems of recording new biomedical information had significance for the mid-20th century's attempts to reach the same goal; thus a study of how the systems worked can illuminate what Gene Garfield had inherited when he began his experiments—experiments designed to make possible the continued dissemination of biomedical knowledge in the changed circumstances of mid-20th-century science and technology.

The 19th-Century German System

Just as today, the biomedical worker in the latter half of the 19th century felt overwhelmed by the amount and richness of reports on new findings.¹ While some scientists needed knowledge of the small increases in knowledge of particular parts of the field, most required a more synthetic view: something which could give them perspective on the relation of each small piece to the total. To meet these diverse needs three different forms of publications arose:

1. Indexing and abstracting journals which reported each individual article published on a specific topic, without relation to any other

articles on the same subject. Such keys to the literature were usually titled *Centralblatt* (or *Zentralblatt*) and merely reported objectively what each article said. The modern *Current List of Medical Literature* (now *Index Medicus*) and *Biological Abstracts* are descendants of these.

2. Journals which brought together all the reports on a specific topic for a whole year, so that their readers could get a conspectus of change within a reasonably small period of time. Again, these journals (usually called *Jahresbericht*) tended not to evaluate but only to describe the reports—though they might point out contradictory findings. Many famous German scientists edited these *Jahresberichte*, and because of their pre-eminence they were able to call on other well-known scientists for these yearly reviews. We still find such works useful, as evidenced by the successful publication of many *Annual Reviews* series even today.
3. Finally, there were review publications which evaluated and put in perspective knowledge of a particular subject field gained over a number of years. In these journals (generally named *Berichte*) the same topics might not be discussed each year; a topic would be discussed only when enough new data and conclusions from these data made a new interpretation of knowledge possible. Here too the prestige attached to authoring such a report persuaded many eminent scientists to leave their laboratory benches for a time to produce the reports.

This system for controlling the flow of biomedical information remained in place until World War I, and parts of it continued to limp along under non-German auspices until the advent of the knowledge explosion of post-World War II. It broke down because of the same reasons that had caused it to be founded some 75 years earlier, namely, the enormous growth of new data being generated. But not only had the volume of the literature increased; the societal milieu did not allow any more for the continued expansion of the people and funds needed to produce the control publications, and biomedical scientists did not wish any more to spend the necessary amount of time away from their other scientific pursuits in order to keep the system working. (Gene Garfield himself has discussed this problem in one of the essays to be found in this volume.² In discussing Ira Herskowitz's receipt of the National Academy of Science's Award for Excellence in Scientific Reviewing, he asks, "Why write reviews? Why does this obviously

busy person take on the demanding task of writing scientific reviews?" To this Herskowitz provides the answer—to make inaccessible material available to those working in the field.)

As a result of changes in our scientific world which occurred for a number of years after the end of World War II, therefore, a kind of "flailing around" took place in the information field without much consensus on the way out of the dilemma. This is where Gene Garfield came in; the system under which we now keep track of our newest knowledge certainly owes much to the work of Gene Garfield and his Institute for Scientific Information.

Equipment and Insight

It has been said so often that it is now a cliché that many proofs and advances in science are forced to wait for the development of tools which allow for the observation of facts only guessed at by the most brilliant thinkers in a field. Thus Harvey's theory on the circulation of the blood had to await the development of microscopes capable of showing the capillaries, and the discovery of the moons of Uranus was not possible until space probes able to report their findings to earth had been engineered. Similarly, many attempts to harness the information in biomedical publications had to await the development of computers capable of handling vast amounts of data speedily and easily.

The story of how machinery capable of storing and retrieving in myriad ways the extremely large records of biomedical advances—from its early beginnings in punched card and sorting machines, through print-outs only, to display screens and instant reactivity—has been told many times. Gene Garfield was central to much of this, and he has given us the details in his essay³ in this collection. What might not be immediately obvious from this is how his imagination went beyond the production merely of the indexes to the scientific literature—a Gargantuan task, to be true, which taxed even such brains as those of Frank Bradway Rogers and Seymour Taine at the National Library of Medicine, and Ralph Shaw at the U.S. Department of Agriculture. What Gene did was for the first time to allow a seeker after information go forward in time, rather than only backward. By knowing one single article and using the citation indexes produced by Gene, the searcher could learn quickly and easily the identity of others since the time of the original article who had cited it and who therefore might be presumed to be working on the same subject.

This was just the beginning of innovations from Gene's fertile imagination. By "mapping" who cited whom in a particular field, clusters of individuals who influenced each other could be determined, providing historians of science with data with which to study the history of ideas. The importance of so-called "gatekeepers" who bridged the knowledge in different groups of investigators could be seen. "Classic" articles could be identified through counts of citations to them and some conclusions drawn as to why they were seminal. Libraries could determine which journals to subscribe to in order to yield the greatest return on their investment.

Techniques are important, but sadly the world has seen them used for unworthy uses as well as noble ones. Gene was aware of this and wrote feelingly about the dangers of using citation counts for academic promotions and kudos, as he did in his essay on "Uses and Misuses of Citation Frequency"⁴ and in his speech as the first Estelle Brodman Lecturer at the Washington University School of Medicine in St. Louis, Missouri, in May 1981.

Personalia

Over the years Gene Garfield and I used to see each other at meetings and odd places around the world where our differing paths seemed to cross in the 1960's and 1970's, and for many years we always tried to manage a private breakfast at the annual meetings of the Medical Library Association. There I would learn of his latest insights into problems and his plans for solving them; and even when we disagreed about such topics as charging for the indexes produced at the National Library of Medicine, we could remain good friends. Now, alas, our paths diverge more than they converge, but I cannot conceive that our respect for each other will ever change. I can hardly wait to learn where his next mental vision will take him and with it our joint field—the transmission of scientific information.

*Estelle Brodman, Ph.D.
Librarian & Professor of Medical
History Emerita
Washington University School of
Medicine
St. Louis, Missouri*

REFERENCES

1. Brodman, E. Our medical literature. *Bull. Med. Lib. A.* 47:253-7, July 1959.
2. Garfield, E. The 1985 NAS Award for Excellence in Scientific Reviewing goes to Ira Herskowitz for his reviews of phage biology. *Ghostwriting and other essays*. Philadelphia: ISI Press, 1986. p. 151-9.
3. Garfield, E. Origins of *Current Contents*, ISI, and computer-aided information retrieval. How it all began at the Welch Medical Library Indexing Project. *Ibid.*, p. 320-6.
4. Garfield, E. Uses and misuses of citation frequency. *Ibid.*, p. 403-9.