Information Problems of an Inorganic Chemist

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The difficulties of readily obtaining peripheral information and drawbacks of citation searches are discussed. A citation survey of inorganic chemistry journals is compared with previous studies. The publication of a chemical newspaper is proposed.

The difficulties of information retrieval for practicing university chemists have recently been surveyed;[1] however, a variety of specific problems do not appear to have been discussed.

The purposes of current literature searching are well described by the target model,[2] with the emphasis on the "bullseye," namely, information directly related to current research. This requirement is being increasingly satisfied by the various computer retrieval systems, though problems still remain.[2-4] Unfortunately, information only indirectly connected to one's field of endeavor is often regarded by the information scientist as "noise," whereas to a researcher it provides a fruitful source of new ideas and can often provide the answer to problems. At present this can only be obtained by the use of selected primary journals or a title abstracting service.

It has been pointed out that the majority of chemists still rely on perusal of primary journals for specialist as well as peripheral knowledge.[4] In the former role, this method is clearly inefficient, but the effectiveness of a selected primary journal scan for covering advances in a particular field of chemistry has not been investigated to date.[5] Recent surveys of citations by journal showed a few journals to be heavily quoted;[6,7] nevertheless, the possibility arises that the authors of the papers studied conducted an inefficient literature search rather than that the more obscure journals contained fewer important papers. If the former were true, then a correlation might exist between the number of uncommon journal citations and the number of citations per paper, based on the assumption that a more thorough literature survey should give rise to a higher number of citations on average. Considering the field of inorganic chemistry, there are four specialized English language journals, *Inorganic Chemistry, Journal of the Chemical Society (A), Journal of Inorganic and Nuclear Chemistry*, and *Inorganica Chimica Acta*, and citation data from one issue of each of these, together with one issue of *Journal of the American Chemical Society* (Inorganic Section) are listed in Table I. As can be seen, there is in fact no simple variation with number of citations per paper, thus supporting the validity of the results of Panton and Reuben.[7] In this survey, one third of the citations come from the less common journals; Table II shows the remarkable constancy of the percentage citations from within the common journals. These results would suggest not that there is a dominance of one journal as proposed by Barrett and Barrett,[6] but that within particular fields of inorganic chemistry these are preferred journals of publication. Nevertheless, this specialization is not sufficient to render a selective primary journal scan effective.

Retrospective searches of recent literature by means of citations also present problems. Until publication of the series of Specialist Reports by the Chemical Society,[8] it was often difficult to find a good initial paper in a specialized field prior to a citation search. The major problem however lies in the lack of cross citations, where a citation network diagram[9] leads back not as one "tree" but as two noncrossing systems. This takes a variety of forms, the most common occurring where two separate branches of science are both pursuing the same line of work. This is not uncommon on the increasingly studied border lines between the physical and biological sciences. Another example may be found in a particularly competitive field, where it is not uncommon for two separate "invisible colleges"[10] to form, deliberately only quoting previous work of their own group as a matter of policy. A smaller scale case occurs when a piece of work is published by a competitor first. The other researcher, requiring the publication value,[11] sometimes resorts to submitting the work without reference to the previous publication, hoping (often successfully) that the referees will be ignorant of other research in the field. A diminishing problem is noncitation of Russian papers, which has been alleviated by increased availability of translation services.

Table I. Variations of Citations with Number of Citations

Citations per Paper	Total Papers	Total Citations	Popular Journal Citations, %[a]
1–10	53	398	66.8
10–20	61	881	61.5
20–30	39	953	61.6
31+	9	352	67.1

[a]The 11 most cited journals from Ref. 7 plus *Inorg. Chim. Acta*.

Table II. Variation of Citations by Journal

Journal	Total Papers	Total Citations	Popular Journal Citations, %[a]	Citations of Same Journal, %
J. Amer. Chem. Soc. (Inorganic)	13	160	65.0	28.1
Inorg. Chem.	43	737	64.9	19.1
J. Chem. Soc. (A)	47	814	62.8	28.2
J. Inorg. Nucl. Chem.	31	400	56.8	14.8
Inorg. Chim. Acta	28	473	66.0[b]	6.3

[a]The 11 most cited journals from Ref. 7
[b]Same as [a] but including *Inorg. Chim. Acta*.

In what ways can the problems be alleviated? To keep the chemist in touch with related fields a chemical newspaper is required, perhaps of the form of the *Nature* News Sections, devoted to recent advances in chemistry as they are published. Difficulties of editing such a publication can be foreseen, nevertheless it would be a considerable improvement over present "browsing" methods. The problems of retrospective literature searches are more difficult to solve, being of human origin. Use of a parallel search based on a keyword method would eliminate past problems, though resulting in some time-consuming duplication. Continuance of such practices can only be prevented by more efficient refereeing.

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Quantitative Characteristics of Patents, Inventions, and Innovations

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Based on a survey of the literature published since 1962, quantitative information is presented which relates to sources and geographical origins of inventions, the time interval from conception to innovation, and the use of patents as evidenced by licensing. Of 33 examples of innovations since 1917, only six showed the same geographical origin for invention and innovation and had a time span from discovery to innovation of less than five years. Eleven examples showed different geographical origins for invention and innovation and a time interval of 10 or more years from date of invention to date of innovation.

One measure of America's technological strength is its number of inventions. The number of U. S. patents exceeds that of any other nation. Since 1950 when approximately 43,000 patents were granted, the number of U. S. patents issued annually increased to 50,000 in 1960 and 67,000 in 1970.

At the end of 1970, there were approximately 900,000 unexpired U. S. patents. About 60% of these live patents are owned by domestic corporations and 10% by foreign firms.[2] In 1964, 80% of all U. S. patents were of local origin. The remainder were divided as follows: 4% to firms from West Germany, 4% to British firms, 2% to French firms, and 10% to inventors from more than 25 other nations. In contrast, approximately 62% of all West German patents were of local origin. The remainder were issued to: firms from the U. S. (15%), Great Britain (5%), France (4%), and from more than 25 other nations (14%). In another example, only 19% of all patents granted in the Netherlands were of Dutch origin; while patents of U. S. and German origin each accounted for 22% of the total documents.[8]

Presently, about three out of four U. S. patents are assigned to corporations. The remaining one-fourth are owned by individuals, with a small proportion held by the federal government.[2] This ratio differs from 20 years ago when 55.2% of U. S. patents were assigned to corporations and 42.8% were issued to individuals.[7]

SOURCES OF INVENTION

Aluminum is a striking example of an industry created by invention. In a study of the American aluminum industry from 1946 through 1957, Merton Peck of Harvard found that primary producers of aluminum were an important source of inventions for new product applications and alloys but contributed relatively little toward advances in welding, fabricating, and finishing. Primary producers concentrated their inventive efforts in alloys which can be directly incorporated into the product line and which yield profits that are relatively immediate compared to profits from inventions in fabricating and manufacturing techniques. In comparison, equipment makers were the major