



# Periodicals

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IT IS GENERALLY accepted in library-documentation circles that non-monographic material such as periodicals presents the largest difficulty in the establishment of a firm bibliographical control of the world's annual output of printed matter. This is in no way intended to minimize the problem of bibliographic control of monographs. However, as Herbert Coblans has pointed out, serials in general and periodicals in particular appear to be the bibliographic entities with which it is hardest to cope.<sup>1</sup> He goes on to outline those non-book types of materials *published* which have distinct characteristics such as periodicals, conference papers, proceedings and translations; and *unpublished and semi-published* materials such as report literature, internal documents, and pre-prints. Moreover, there is the added confusion of translations appearing in periodical form, conference papers published as periodical reports, and multiple combinations of any of these. The straight monograph, relatively speaking, has fewer complexities.

For the purpose of this paper a periodical is considered as:

A publication issued at regular or irregular intervals, each issue normally being numbered consecutively, distinguished from other serials in that the process of publication is continuous with no pre-determined termination.

Within this definition are included periodicals which are commercial ventures, usually containing material on a variety of topics, those of a like kind published by societies and institutions, and also the regular proceedings, transactions, annual reports, etc., of those bodies. The latter group is usually distinguished in cataloging by being entered under the heading of the particular society or institution, other periodicals normally receiving entry under title.<sup>2</sup>

An examination of Constance M. Winchell's *Guide to Reference*  
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*Books* and the supplements provides access to retrospective and current union lists, directories, indexes and various types of bibliographies instrumental in exercising bibliographic control of periodicals.<sup>3</sup> The seventh edition contains approximately 5,500 entries of which 140 annotated citations are carried in the "Periodicals and Newspaper" section as directories, union lists, and indexes; the 1950-1952 Supplement carries a total of approximately 1,000 entries of which 31 are in this section; 1953-1955 lists 1,200 entries of which 47 are in the "Periodicals and Newspapers" section; and the 1959-1962 Supplement gives 1,300 titles of which 48 deal with periodicals and newspapers. In addition, there also are annotated listings under most of the subject categories in the main volume which, used in conjunction with the supplements, provide an extensive coverage of those bibliographies, directories, indexing and abstracting tools available in the area of periodical bibliography. An assessment of the increase in the general areas of new bibliographical tools for periodicals has not been startling according to these figures. However, M. J. Fowler's *Guides to Scientific Periodicals* is an exception to this generalization, being unique in a number of ways. It places under one cover for the first time about 1,060 universal, national, and regional publications important in the exercising of bibliographical control over current and discontinued scientific periodicals.

The continuing growth of abstracting journals is quickly evidenced by comparing the main volume of Winchell with the supplements, where each succeeding one carries more new titles. The increase in this field of bibliographic control is even more striking when one examines the list which the Science and Technology Division of the Library of Congress compiled, *A Guide to the World's Abstracting and Indexing Services in Science and Technology* (1963) combining *A Guide to U.S. Indexing and Abstracting Services in Science and Technology* (Washington, D.C., National Federation of Science Abstracting and Indexing Services, 1960) and *Index Bibliographicus*, 4th ed., Vol. I, *Science and Technology* (The Hague, Fédération Internationale de Documentation, 1959).<sup>4</sup> This combined list contains 1,855 titles from 40 countries. The larger countries are represented as follows: United States, 365 titles; Great Britain, 195 titles; West Germany, 182 titles; France, 147 titles; and the Soviet Union, 117 titles.

Members of the National Federation of Science Abstracting and Indexing Services produce the following: <sup>5</sup>

*Abstract Services*

Applied Mechanics Reviews  
 ASTM Bibliography and Abstracts  
 Biological Abstracts  
 Chemical Abstracts  
 Engineering Index  
 Fire Research Abstracts and Reviews  
 Geoscience Abstracts  
 International Aerospace Abstracts  
 Mathematical Reviews  
 Meteorological and Geostrophical Abstracts  
 Nuclear Science Abstracts  
 Prevention of Deterioration Abstracts  
 Psychological Abstracts  
 Review of Metal Literature  
 Technical Abstract Bulletin (ASTIA)  
 Technical Translations  
 Tobacco Abstracts  
 U.S. Government Research Reports (OTS)

*Title Listing Services*

Bibliography of Agriculture  
 Biochemical Title Index  
 Chemical Titles  
 Index Medicus  
 Meteorological and Astrophysical Titles

The above professional bibliographical "probes" carry a major portion of the responsibility for providing the stabilizing factors in a fluid and complex situation. During the past few years computer methods have provided accelerated handling of citations, new indexing techniques such as *BASIC* (Biological Abstracts Subjects in Context) and other innovations produced through computer methodology.

Important steps forward in the search for better ways of bibliographical control of journals and their contents have been made by the National Library of Medicine through their Medical Literature Analysis and Retrieval System (MEDLARS).<sup>6, 7</sup> The devising of an effective publication system through MEDLARS for the processing of *Index Medicus*, *Cumulated Index Medicus*, and the *Bibliography of Medical Reviews* has carved a deep niche into the foundations of

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librarianship for the factor of "machine use" as part of the planning of any sophisticated program. They are symbols of the emergence of a new library technology—a revitalizing concept of periodical bibliographical control.

MEDLARS required two and one-half years to develop and was preceded by years of research to find a system which would store, manipulate and retrieve records; automatic abstracts of papers are not produced. The goal is to have an annual input of 250,000 citations by 1970.<sup>7</sup>

Certain bibliographical works are immediately associated with periodicals, among them being the *Union List of Serials in Libraries of the United States and Canada*, the first edition of which appeared in 1927 and the third edition in 1966. The 1927 edition, exclusive of the two supplements, contained entries for 75,000 serial titles located in 225 libraries; the third edition contains 156,449 titles which began prior to January 1, 1950 and are held by 956 libraries, and is to be updated by *New Serial Titles*.

*NST* was brought into being when in June 1952 the Joint Committee on the Union List of Serials followed through on the Report of the Library of Congress which pointed out the urgent national need for a basic Union list of new serials and an updating procedure; it recommended the expansion of *Serial Titles Newly Received* begun in 1950. This was done by including holdings reported by cooperating libraries beginning January 1, 1953. *Serial Titles Newly Received* was renamed *New Serial Titles*.

*New Serial Titles* has brought about significant bibliographical control for those periodicals which began publication after January 1, 1950. The 1954 cumulation contained 20,650 titles, and the 1961-65 cumulation will carry over 100,000 titles, and show over 600,000 locations. In summary then, *New Serial Titles* from 1953-65 has provided bibliographical control for 165,000 serials which began January 1, 1950 or later. At present, however, the scope of *New Serial Titles* is broader than the *Union List of Serials*, and a survey is in progress regarding necessary realignments.<sup>8</sup> This survey is in addition to the consideration the Joint Committee on the Union List of Serials is giving to the implementation of a comprehensive serials data program.

Another important bibliographic control of periodicals is the revamped *British Union-Catalogue of Periodicals* (BUCOP) which will provide through its annual volume a continuation of *The World List of Scientific Periodicals*.

Although they represent a large decentralized factor, regional union lists published throughout the country provide identification of, and access to, thousands of periodicals which might otherwise be lost to the small communities served by the nation's network of libraries. The soaring increase in the number of such bibliographical tools which have appeared during the past few years is in almost direct proportion to the availability of new data processing equipment in an area. The *Union Lists of Serials, a Bibliography* records 1,218 lists and the compiler admits in the introduction that this edition has not achieved completeness any more than did the 1943 edition which provides some perspective as to the expansion taking place in this area of periodical control.<sup>9</sup>

Winifred Gregory's *List of the Serial Publications of Foreign Governments 1815-1931*, although sadly out of date, still provides difficult-to-find information in this area.

In this country the phrase "periodical indexes" is almost synonymous with the H. W. Wilson Company. The prototype, *Readers' Guide to Periodical Literature*, has been followed by the *Education Index*, *Art Index*, *Index to Legal Periodicals*, *Library Literature* and the *Nineteenth Century Readers' Guide to Periodical Literature, 1890-1899*. In 1957, as a result of a study conducted by the ALA Committee on Wilson Indexes, the *Industrial Arts Index* was divided into the *Applied Science & Technology Index* and the *Business Periodicals Index*, effective July 1958. Other changes have included the replacement of the *International Index* with the *Social Sciences & Humanities Index* in April 1965 and the revamping of the *Agricultural Index*, published since 1916, and changing its name to the *Biological & Agricultural Index* as of October 1964.

Examples of other indexes include *Poole's Index to Periodical Literature, 1802-81*, and supplement, 1882-1907; *Annual Literary Index, 1892-1904*; *Review of Reviews, 1890-1902*; and the *Annual Library Index, 1905-1910*. These provide limited and uneven access to earlier periodical literature. Other approaches to periodical literature include *Subject Index to Periodicals, 1915-1961*, superseded in 1962 by the *British Humanities Index* and *British Technology Index*.

The N. W. Ayer & Son's *Directory of Newspapers and Periodicals, (1880- )*, is valuable for basic bibliographic searching. *Ulrich's Periodicals Directory*, first appearing in 1932, has expanded into two volumes, *Ulrich's International Periodicals Directory* (Volume 1 covering over 12,000 scientific, technical and medical periodicals; Volume 2

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covering 16,000 titles in the arts, humanities, business, and social sciences and listing titles for 117 countries outside the U.S.) Numerous other directories assist in monitoring new serial titles such as *Willing's Press Guide*, which has been published in London since 1874; *The Standard Periodical Directory*, a new American directory; and the new Italian "Ulrich's" *Repertorio Analitico della Stampa Italiana* (Messagerie Italiane, Milan, 1964- ) containing over 8,000 Italian periodicals with the citations in Italian, English, French, German and Spanish. Similar new directories are constantly appearing from all over the world, providing a type of fragmental international control of new periodical titles. Directories such as Ronald S. Crane and F. B. Kaye's *Census of British Newspapers and Periodicals, 1620-1800* (Chapel Hill, University of North Carolina Press, 1927) and the *Catalogue of English Newspapers and Periodicals in the Bodleian Library, 1622-1800* (Oxford, Oxford Bibliographical Society, 1936) provide a much needed historical dimension. Other titles could be mentioned which provide various degrees of containment of the periodical bibliographical problem, among them being:

British Museum. Dept. of Printed Books.

*Catalogue of Printed Books; Periodical Publications. 1899-1900.*

Royal Society of London.

*Catalogue of the Periodical Publications in the Library. 1912.*

Toase, Mary (ed.)

*Guide to Current British Periodicals. 1962.*

*Annuaire de la Presse Française et Étrangère et du Monde Politique, 1880- .*

Académie des Sciences, Paris.

*Inventaire des Périodiques Scientifiques des Bibliothèques de Paris. 1924-25. Supplement, 1929.*

*Bibliographie der deutschen Zeitschriftenliteratur, mit Einschluss von Sammelwerken. 1896-1964. Now Internationale Bibliographie der Zeitschriftenliteratur aus allen Gebieten des Wissens.*

*Deutsche Bibliographie: Zeitschriften, 1945-*

The growing availability of reprints and microform editions for periodical titles long out of print has resulted in catalogs such as University Microfilm's *American Periodicals, 18th Century-1800-1850* (Ann Arbor, 1956) which provide new bibliographic access to journals of interest to research libraries. At the present time the Serials Policy and Research Committee of the Serials Section, ALA RTSD, still has pending a proposal to develop a single bibliography which

will cite type, location, coverage and cost of all periodical reprints being published in the U.S., as well as to consider ways of obtaining listings for the larger firms abroad. There are presently several publications which attempt to cover this growing bibliographic problem: *Bibliographia Anastatica* (Amsterdam) is a quarterly which began in 1964 and covers serial and monograph reprints; another one is Renate Ostwald's *Nachdruckverzeichnis von Einzelwerken, Serien und Zeitschriften aus allen Wissensgebieten*,<sup>10</sup> which began in 1965 and is to have supplements. The Ministère de l'Éducation Nationale, Maison des Sciences de l'Homme, Paris, has in progress a publication which will cover periodical reprints in the field of social sciences. The latest bibliographical control in this area is the Microcard Corporation's publication, *Guide to Reprints 1967*. This "guide" covers 69 publishers including AMS Press, Inc., Barnes & Noble, R. R. Bowker, Hafner, Johnson Reprint, and Kraus Reprints. This new listing has 12,000 entries arranged alphabetically, giving author, title, publisher, and price.

A major portion of the research activity today, both in academic circles and industry, draws much of its sustenance and continuity from periodicals. Periodical publishing in all fields has increased and each subject area has problems unique to itself as well as those common to all.<sup>11</sup> The rate of acceleration in this publication medium, particularly in the fields of science and technology, has had a dramatic effect on the thinking of research librarians, documentalists and information officers during the past two decades relative to bibliographical control. Moreover, the question has been raised, apropos of publication lags and indexing-abstracting gaps, as to whether or not the periodical is any longer a practical form of communication in these "high-speed" science areas. Is it obsolete for certain areas which multiply on themselves by reworking old ideas?

How many periodicals are there? The elementary nature of this question is not matched by the complexity of the answer.

Dr. Frank B. Rogers, Chairman of the Joint Committee on the Union List of Serials, Inc., pointed out when applying for a grant from the Council on Library Resources, Inc.: "1) . . . serials represent the largest part of the bulk of materials handled by research libraries and probably three-fourths of the budget of these libraries is devoted to them. 2) The absolute number of serials is enormous. Probably a half-million serial titles have appeared." Verner Clapp in announcing the grant estimated that serials possible comprised 75 percent of all publication.<sup>12</sup>

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Estimates of the world-total of serials, largely comprised of periodicals in science and technology, have ranged from 50,000<sup>13</sup> to a projection of 100,000 by 1979,<sup>14</sup> with any final figure largely dependent upon the refinements as to just what is to be termed a "science and technology" title. In 1963 R. C. Martin and W. Jett published *Guide to Scientific and Technical Periodicals*, saying in the introduction, "There are close to 60,000 technical journals published throughout the world with an estimated 10 per cent annual increase."<sup>15</sup> The previous year Charles M. Gottschalk and Winifred F. Desmond presented a paper at the Silver Anniversary Conference of the American Documentation Institute giving the figure as 35,300 titles—plus or minus 10 percent. Their survey included titles in the natural, physical and engineering sciences but excluded the social sciences. It did, however, include the "behaviorial science" of psychology.

The Gottschalk-Desmond survey, conducted by the Science and Technology Division of the Library of Congress and financed by a National Science Foundation grant, thus provides a recent and reliable census of the world's output of scientific and technical serials.<sup>16</sup> Within the limits established for this survey, and based on published bibliographical source materials for each country, it was found that the total publication in this area was significantly less than previous estimates had indicated. As a result of this new count, a clearer understanding has evolved as to the degree and kind of coverage our indexing and abstracting services are presently providing. It has also helped to set a direction as to which services are ultimately to be the foundation for a realistic evaluation of the amount of bibliographical control that can be made for periodical literature.

Over 50 percent of all scientific and technical serials, this study revealed, are split among six major countries. The United States is first with 6,200 followed by: East and West Germany with 3,000; Japan with 2,800; France with 2,700; and the U.S.S.R. with 2,200. These figures are for current scientific and technical serials published as of 1961, the total for the 41 entries coming to 35,300. In all broad subject fields the number of technology periodicals was the largest. In the United States 56 percent of the scientific periodical publications is in the area of technology; 23 percent in agriculture; 13 percent in medicine and 8 percent in the natural and physical sciences. Comparable information for the other countries is also given.<sup>16</sup>

Charles P. Bourne, in an earlier study of periodicals being published throughout the world in the science and technology areas, developed statistics showing an analysis of linguistic and national output and an

outline by subject to learn the amount and kind of coverage handled by indexing and abstracting services.<sup>17</sup> Only a limited amount of the total periodical literature is being covered. Moreover, persons who could use the information these tools provide are frequently unaware of their existence. A lack of general agreement as to what is essential in the way of abstracts and indexes for science and technology or how comprehensive such coverage should be has dissipated energies and resulted in the fragmentation of these secondary publications. A clear definition of the problem of covering these journals is needed as well as a centrally located point where decisive and positive action can be initiated *and* coordinated.

Journal mutations and periodical hybrids have appeared in ever increasing numbers in the past twenty years, and with particular intensity during the past decade. This has resulted in specialized journals with high-speed coverage, to the point where the "box-within-a-box" idea has been brought into play through the publication of "express" and "contents in advance" periodicals, which strive to bridge the gap between publication date and indexing and abstracting time-lags and also to serve as a direct aid for scanning.

One of the problems in this area of periodical literature is not so much what titles are being covered but rather what significant ones are being overlooked. Another problem concerns the degree of duplicate coverage and whether such duplication can be warranted in areas where some periodicals are under little or no bibliographical control. There is much protoplasmic publication, as compared with the nucleonic type of periodicals which carry the really important articles in any particular field. This problem appears to be minimized in the Soviet Union as a result of their centralized control. The U.S.S.R. Institute of Scientific and Technical Information in Moscow receives all Soviet and about 12,000 foreign scientific-technical periodicals.<sup>18</sup> These are abstracted and cited in the publication, *Referativnyi Zhurnal*, which is comprised of 13 independent series, published both as a combined volume and in separate editions for each subject area. This centralized system provides high periodical coverage with limited overlap. The Russian service system covered about 694,000 articles in 1960. In 1961 all of the largest U.S. scientific abstracting and indexing services—those making up the National Federation of Science Abstracting and Indexing Service (NFSAIS)—covered approximately 16,000 of the world's 30,000 scientific and technical journals, producing a total of 750,000 abstracts.

The publication of new journals adds to the already complex bibli-

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ographical control problem by fostering overlap through discipline divergence, and thereby reducing the degree of accessibility of information published in a given field. Digest and abstract journals have been developed such as *Chemical Abstracts*, *Biological Abstracts*, *Computer Abstracts*, *Psychological Abstracts*, *Sociological Abstracts*, and numerous others, to help remedy this worsening situation by allowing the specialist to sort out, without having to scan, those articles really pertinent to his work. Journal space in a particular field is often at a premium with the result that, in an effort to reduce communications time, publication is fulfilled by the specialist often in a new periodical oriented to the particular phase of the overall field.

Keeping up-to-date in any field where periodicals are involved, requires an active "reading" program. Investigations have shown that the median number of periodicals scanned by a person is ten, with few in the field of science scanning less than five or more than twenty for any given issuing period. The selection of the ten periodicals to be read follows a basic pattern of eight specialized journals, one or two scientific news-type periodicals and an abstracts journal.<sup>19</sup> About five hours a week is given to professional reading; three of these are devoted to periodicals.

How much are periodicals used by social and behavioral scientists? In a pilot study of the bibliographic needs of social and behavioral scientists, J. S. Appel and T. Gurr attempted to obtain "(1) systematic information on the use and adequacy of existing bibliographic resources and (2) an evaluation by social and behavioral scientists of the usefulness of various features of several proposed bibliographic retrieval systems."<sup>20</sup> The survey involved sending a questionnaire to a group of anthropologists, economists and psychologists. Within the three groups, it was found that 15 percent spent 15-32 hours a month obtaining bibliographic information from citations in articles, books and the bibliographic sections of periodicals and that abstract journals were used by less than one-third of the respondents.

To the question as to whether or not they had failed to learn in time about relevant work in their fields, about 60 percent said they had, the other 40 percent rarely had a problem of this nature. The point was made, however, that some frustration resulted because of the "hit or miss" manner in which they found out about related work. Luck and accident accounted for a share of useful bibliographical information located in periodicals and other resources. Foreign publications and obscure periodicals, which were not picked up by review

periodicals, accounted for some of the failure to find materials they could have used, and finding out about articles published outside the United States was a point of particular trouble for the anthropologists.<sup>20</sup>

The lag factor in *Psychological Abstracts* and *Sociological Abstracts* was reported as a hindrance in research, although psychologists rated the former service much higher than economists did *Economic Abstracts* (The Hague) or the *Journal of Economic Abstracts* (Cambridge). *Psychological Abstracts* received the highest rating of all of the 30 major social science journals carrying entirely, or largely, bibliographic materials.

The difference between researchers in the social sciences and those in the science and technology fields is pointed up in the following statement by D. J. Foskett, Librarian, University of London Institute of Education: "Emphasis on current publication in periodicals, though considerable, is nothing like so preponderant as in science and technology. I suspect too (though I have no real evidence for this) that the play of serendipity is greater. Thus, while we certainly need the speedy indexing and abstracting of current publications, we also need a wider knowledge of the continuing availability of older work—perhaps in the form of bibliographies and even union catalogues, as well as of national lending libraries."<sup>21</sup>

As compared with persons in the science-technology fields, relatively few social scientists appear to be as actively concerned about the existing bibliographic systems, and in fact, appear in need of some prompting as to the possibilities existing in the new bibliographic techniques being developed if there is to be evolved a centrally coordinated system in their areas of concern. This is particularly important inasmuch as Bradford's Law of Scattering has made it clear that there are as many articles on a person's subject in journals not immediately in his field as there are in those directly related to his discipline. The importance of always including an abstracts journal in any professional reading program can readily be seen.

The major stabilizing elements in controlling the increasing number of periodicals which appear each year have been the secondary publications: abstracts, indexes, directories, and union lists. A project financed by the National Science Foundation provided a world inventory of abstracting services in science, technology and the social sciences in December, 1963.<sup>22</sup> The survey, made by the International Federation for Documentation, received 1,500 valid replies; 2,900 re-

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quests for information were sent to 50 different countries. In 1965 a guide to services in the natural sciences was published. It is estimated that about 3,500 abstracting and indexing services of various types exist in the world. Approximately 550 of these are in the United States.<sup>23</sup>

Approximately 300 abstracting and indexing services support the scientific community in this country and total approximately two million citations per year.<sup>24</sup> Profession-oriented services attempt to cover significant periodicals in basic fields of science. Another bibliographical approach to abstracting and indexing of periodicals is project-oriented without regard to a single field, but rather toward comprehensive coverage in the area as a whole. These secondary publications are sponsored by commercial enterprises, trade associations, technical societies, etc., and differ in one major respect from professional ones in that their longevity is largely determined by the continued interest in the project area.

The need to increase the span of bibliographical control for periodicals and other forms of publications can be seen quite clearly when one realizes that in 1957 the major abstracting and indexing services in this country covered 437,000 titles and in 1963 handled 900,000 titles, over twice as many. This last coverage figure exceeds the 1962 figure of 752,000 which the Russians' monolithic center for such services handled. Bibliographic control has grown so that in 1963 there were 20 major (professional) abstracting and indexing services in the United States putting out 900,000 abstracts; about 900,000 were coming out of *VINITI* (the Russian system). The coverage has doubled for us and the quality has remained reasonably stable.

However, the subscription rates of some of these services because of printing costs, distribution charges and payment for the work itself have grown to the point that new funding sources are needed. For example, in 1950 *Chemical Abstracts* costs \$20; in 1966 the price was \$700.

A financial problem concerning these services is in need of an early solution if the kind of coverage wanted is to be realized. As of 1961 the income of the 18 profession-oriented services was about 7 million dollars—6 million from subscribers and 1 million from the three government-operated services. By 1971 it is expected the costs of these services will rise from 7 million to 25 million dollars; the present services have an existing potential that can produce only a maximum of 9 million dollars. This pending problem is amplified when one remembers that it has often been estimated that the world output of

scientific and technical literature has been doubling about every ten years and the growth will probably continue.

Project-oriented services, of which there are approximately 270, are as varied in size as the markets for which they are designed. However, the growth potential is better than that of profession-oriented services. In 1961 "project" services had an income of 15 million dollars but they are being confronted by the same cost problems as profession-oriented services.<sup>24</sup>

Whether or not the decentralized service can continue is a question. Some feel it should "because our culture, our economy, and our resources are decentralized and diverse."<sup>25</sup> However, there is a tendency toward a centralized or interlocking operation of major science and technical information services to achieve a more comprehensive bibliographical control of periodical service publications.

In an effort to clear up this increasingly muddled bibliographic control, the Office of Science Information Service was established by the National Science Foundation in 1958 with instructions to "provide for, or arrange for the provision of, indexing, abstracting, translating and other services leading to a more effective dissemination of scientific information . . . and . . . be primarily of a co-ordinating rather than an operating nature." Four years later the National Science Foundation established an additional coordination and referral point, the National Referral Center for Science and Technology in the Library of Congress. This center maintains information of services which will assist bibliographical control of periodical information, as well as that appearing in other forms, in medicine, technology, social sciences, and the natural sciences.

It is at this point that the idea of a national plan enters the picture calling for coordination of the activities of the professional-oriented services as well as an expansion of the activities of NFSAIS to assist in revised approaches toward a unified plan for present abstracting and indexing services.

The number of periodicals indexed and abstracted can be reduced sharply by becoming more selective in the acceptance of materials to be published. An editorial in *Science* pointed out that "The present communication problems could be greatly ameliorated if the scientific community would adopt a tougher standard of what is acceptable. If editorial policies were tightened the amount of material appearing could be cut to a quarter of the present volume with no essential loss. . . ." <sup>25</sup>

The top ten journals read by scientists in each of five disciplines,

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chemistry, biology, physics, psychology and mathematics were learned through an ASLIB survey.<sup>26</sup> Concentration of these titles by secondary publications handling these areas, along with an analysis of the content of other journals in the field, would be helpful. L. M. Raisig pointed out the need to take into account, when abstracting, a "long-term evaluation of many journals. The method itself constitutes a mathematical measure of the success of any scientific journal as a vehicle for the communication of ideas. In the larger view, it may in time serve as the key to such presently abstruse problems as the value of the general scientific serial to the specialist (particularly in the field of medicine), the measurement of the effect of published abstracts upon the journals from which the original articles were abstracted, the importance of country of origin as a factor in serial selection, and the exploration and establishment of new relationships in subject fields and serial publications."<sup>27</sup>

New understanding and more candid examinations of our library procedures for storing and retrieving information are needed.<sup>28</sup> It has become reasonably evident that sophisticated hardware can be developed without a fraction of the difficulty librarians and documentalists have in establishing just exactly what they want the machines to do. The problem of developing mechanized periodical processing and retrieval procedures is made more of a challenge because of the diversified and independent abstracting and indexing services which emanate from private, commercial and government sources.

Among the newer approaches to bibliographical control of periodicals and other publications is the citation index, which is handsomely represented by the *Science Citation Index* published by the Institute for Scientific Information (Philadelphia, 1961- ). The following is Eugene Garfield's definition of a citation index: "A citation index is an ordered list of cited articles each of which is accompanied by a list of citing articles. The citing article is identified by a source citation, the cited article by a reference citation. The index is arranged by reference citations. Any source citation may subsequently become a reference citation."<sup>29</sup> Multidisciplinary journals have been emphasized in those selected for the *Science Citation Index*. In 1961, 613 journals were processed and in 1964 about 700. Educationalists and other social scientists are also investigating the potentialities of using citation indexes in their fields. Librarians have had a cautious approach to citation indexes whereas scientists, in general, favor them. Dr. J. M. Hammersley, while reviewing the Index to the *Annals of Mathematical*

*Statistics*, is quoted by Martyn: "Librarianship in the future will become a task less for the bibliophile and more for the electronic engineer. With the publication of these indexes . . . the writing is already on the library wall."<sup>30</sup> A contrasting point of view from the library world comes from E. M. Keen, who, while not intending to criticize any support of citation indexing work, asks "whether the citation index would look so attractive if similar effort was being expended on conventional indexes."<sup>31</sup>

Yehoshua Bar-Hillel presented a thoughtful rejection of the idea that the mechanization of information retrieval procedures should be based on the argument of the exponential growth of scientific periodicals and other publications. If this argument is carried through, a scientist would have to double the number of pages he reads every ten years or so, assuming the number of periodicals doubles in his field during this period. Moreover, unless his reading speed increases accordingly, which is unlikely, twice as much time would be spent on this operation. He points out that the rate of increase in the number of scientific and technological publications is commensurate with the manpower increase in their fields. The area of a specialty in 1961 is estimated to be only half of what it was in 1949, and the width of concentration will again be reduced one-half by 1973. Since the English language is now used for about 60 percent of all scientific publications, the amount of material American scientists can read has increased significantly.<sup>32</sup>

Bar-Hillel also feels that "full automation of many aspects of the information retrieval field, such as translation, abstraction, or indexing, is not feasible. Partial automation, on the other hand, is theoretically feasible and might also be so economically. But the needed investigations should be carried out in suitable institutions of higher learning and in accordance with standard scholarly methods."<sup>33</sup>

As can be seen, the debate is still in full swing as to just how much machines can or should be expected to do in the way of processing information and providing service in a grand, magically mechanized operation. Using the *Readers' Guide to Periodical Literature* as a point of departure, Ralph Shaw draws on the information the General Electric Company disclosed in an unpublished report regarding the automation of the University of Illinois Library, Chicago Branch, calculating that it would require 80 reels of modern magnetic tape to convert the *Readers' Guide*, and to look up one or more questions would require a computer running time of six hours and forty min-

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utes. He goes on to say that "by their very nature, machines will be useful only when there is a relatively high frequency of repetitive operations. The more expensive the machinery used, the higher the frequency of repetitive operations that is required to amortize the cost of the machine and the investment in programming the operation."<sup>34</sup> It should be noted that the Russian system (*VINITI*) is not mechanized beyond the typewriter, photoduplication and elementary punched card equipment.

Research and development expenditures rose from \$5.2 billion in 1953-54 to \$15 billion in 1961-62.<sup>35</sup> However, even in view of such vast sums the library community which houses much of the raw materials in the form of periodicals has been barely touched by what could be called "the data processing revolution." Duplication of effort, time and resources still prevails in the acquisition of little used periodical materials in special area study programs, and elements of chaos still exist in our presently fragmented bibliographic control of these publications.<sup>35</sup>

Research into improved ways of handling periodicals is reflected in the National Science Foundation's 1966 volume of *Current Research and Development in Scientific Documentation*<sup>36</sup> which carries 12 citations to research activities, including projects such as: Research on the Mechanization of a Permanent Inventory of Current Foreign Periodicals; Determination of Acceptable Minimum of Information in Abbreviated Scientific Journal Title Citations; CODEN for Periodical Titles; Tests on Abstracts Journals; and Evaluation of British Science Periodicals. In addition to such programs as these are the Information Transfer Experiment (INTREX) now in progress at the Massachusetts Institute of Technology.<sup>37</sup> In addition to probing the possibilities of providing detailed bibliographical control of periodicals through automatic indexing and abstracting systems, the possibilities of retrieving journal articles will be examined in terms of the audio, visual and printed media.

This experimental four-year program will run into millions of dollars. It will attempt to apply the most advanced data processing and information retrieval equipment in an "on-line" computer operation. Project INTREX is to explore a vast range of ideas concerning the shapes information handling might take in a large university research library which could become operational in the 1970's.<sup>38</sup> The approaches will also consider costs and effectiveness, as well as an examination of the potentials of a national and international network of information units.

Computerization of library records has been slow both because of cost and because the resources of most libraries are not large enough to permit the effective utilization of a computer-oriented system. The awareness of this need for better bibliographical control becomes more acute with the demand for more efficient literature-searching by the growing number of research persons requiring prompt access to information carried by periodical literature. It is estimated that 1,400,000 engineers and scientists are affected, and this figure is presently increasing so as to be doubled within ten years. Another element adding to the need for a National Library of Science System, according to Stafford Warren, is the increasing number of specialized information centers in the U.S., which has been broadly estimated as being from 450-3,000. The National Library of Medicine is the only library to have actively attacked a large segment of the periodical bibliographic problem so as to process and retrieve information in biomedical journals.<sup>39</sup> Individual computer systems are being worked on in libraries throughout the country as an examination of "library literature" will show. However, at present these experiments are loosely coordinated and only desultory cooperation is experienced through clinics and "private" communications.

Arguments for continued decentralization of bibliographical control of periodicals through service publications are also strong. Large vested interests in these secondary publications, such as those issued by the American Chemical Society, must be confronted. Questions of the judiciousness of government control of the editorial functions paramount in the production of periodical indexes and abstracts require consideration. The following statement by Joseph H. Kuney, Director of Business Operations for the American Chemical Society Applied Publications, present something of the spirit of the matter:

The ACS (American Chemical Society) of course has a very large vested interest in indexing and abstracting services. . . . At this moment I fail to see that it will be possible under the conditions in which it must operate for a single government group to give editorial direction to a variety of scientific disciplines. Further, the government has given increasing evidence that if you are going to take government money, you are going to dance to the government tune.<sup>40</sup>

A recent study on the feasibility of developing a continuing national inventory of the world's science-technology periodicals was carried out under a contract with the National Science Foundation by and under the direction of the Committee on Scientific and Technical In-

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formation (COSATI). The unit cost of a serials program which would bring 50,000 current science-technology periodicals under bibliographic control would be \$30 per title initially and \$6 annually to maintain. It was estimated that there were 5,000 science-technology libraries averaging 300 current subscriptions—a total of 1,500,000 subscriptions per year. To establish this serials data program would cost each library \$300 initially and an annual charge of twenty cents per subscription to maintain.<sup>41</sup>

Two other cost figures involving bibliographic control, while not directly comparable, give some idea of the cost levels being discussed. It has been estimated that it will require 50-70 million dollars for the automation of the Library of Congress and at least 3-4 million for the machine conversion of the *National Union Catalog*.<sup>41</sup> Permanent financial support for the serial data files would have to be provided since the study concluded that sufficient income could not be realized to make the operation self-supporting.

Another study recently announced is being undertaken by the Systems Development Corporation at the request of the National Science Foundation "to analyze the present and potential role of abstracting [and] indexing services . . . in the context of a national system of scientific and technical communication." The Systems Development Corporation is to receive guidance and consultation from COSATI. The study is to cover "present status and effectiveness of current services in terms of technical and economic factors, coverage of primary sources (users, and so forth), a projection of the state of the art, and the identification of problem areas."<sup>42</sup>

Bibliographical control of periodical literature is always being modified because of the nature of the material, which requires close husbandry if we are to avoid overlaps yet not leave border areas uncovered. When gaps occur, secondary publications are of necessity brought into being—often improperly formed and with no sustaining source. The splintering of abstracting and indexing services does not appear feasible any longer if, as is planned, these scanning and sorting tasks are to be machine-oriented. Programming of this kind can function best through coordinated operations made practicable through a central agency. Verner Clapp in giving the keynote address at Gordon Research Conference on Scientific Information Problems in Research, July 2, 1962, concluded his talk as follows:

As I see the future of information work, it will by necessity be composed of many levels of organization. But if there is one

thing we have learned from Charles C. Jewett and his successors, it is that in the exploitation of a mass-produced product, as is the book, mass-produced controls are requisite to efficiency. This argues for central bibliographic services, for it is cheaper to perform a bibliographic job excellently once than to do it poorly innumerable times. There will increasingly be, then, central bibliographic services, assembling the records and producing secondary publications in forms which will undoubtedly include the machine-usable forms of publication which can be employed for local purposes. Content analysis will be performed mechanically and will be available at any level desired; if access to documents is required, that will be available; but if access to facts and information in the form of statements of fact is preferred, that, too, will be feasible. To reach this result, however, we shall require continuous and extensive research in the semantics of information processing, in man-machine interaction, and in the development of machines.<sup>43</sup>

The handwriting is indeed on the library wall.

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