The Research Worker and the Library

The increase of books and print is an outstanding phenomenon of this strange and fearful world in which we live. University librarians do not, of course, need to have this development and problem, with which they constantly live and work, brought home to them. Nevertheless, it is germane to the purposes of this paper to reflect upon current and future trends of this growth, since it affects and will continue to affect all users of libraries. It is only yesterday, in geologic and anthropologic time, that man discovered the magic of print from movable metal type. Yet in this relatively brief period, from the time of Gutenberg to the present, civilization has moved rapidly forward (if it can be said to be forward) on a veritable and rising wave of printer’s ink rolling over an ever-expanding sea of paper. So enormous have become the piles and tons of hieroglyphics-covered paper, upon which our civilization rests, that one archivist has said, “... we are inextricably entangled in our ribbons and reams of paper and sometimes we hear complaints that it is slowly choking us to death, that our civilization built on this fragile substance will ultimately die of it.”

Certainly the rising wave of printer’s ink and our paper-filled library catacombs have carried us inexorably toward the steam engine, electricity, the telegraph, the gas engine, radio, television, radar, and now the nuclear fission of matter, all in constantly increasing tempo. It has carried us, too, toward libraries, as we all know, that can count their books more accurately in miles than volumes. Analysis of the physical growth of the Library of Congress, symbolic of the rapid increase of written records, will dramatize the surging flood. In 1944 that great library added 481,733 books and pamphlets, bringing its total holdings to 7,304,181 volumes. At customary space calculations this amounts to 178 linear miles of books. What is most significant in this growth is that 12 miles were added during 1944 alone, that on an average the library adds almost one book per minute the year round and, at its 1944 rate of growth, 1310 books every 24 hours. Twenty-five or 30 books will troop to their places on the shelves of the Library of Congress while this paper is in the process of reading. Approximately 8000 more books will be added during the period of this A.L.A. conference.

Books definitely beget books, with each newcomer resting in some degree on its predecessor’s back, ultimately to the beginning of recorded thought and experience. This writer is convinced that the increase of books is definitely in proportion to the convenience and economy with which men can set down in writing whatever seems to them important, and, as we all know, many things so recorded seem, and undoubtedly many actually are, very trivial indeed. We already have evidence and

1 Paper presented at the meeting of the Association of College and Reference Libraries, Buffalo, June 18, 1946.
Some studies of many libraries doubling their size roughly every sixteen years. While this cannot go on continuously, it seems certain that the numerical increase of books on a unit basis will continue to rise rapidly. Perhaps, some day, someone will work out ratios for this growth and establish a "law" of increase of books which will be duly set down in still another book.

When we contemplate increase, even at current rates, down through the years we get an awe-inspiring prospect. The Library of Congress, now adding books at the rate of 120 miles per decade, will add 360 miles during the normal professional lifetime of a young librarian now entering its service or almost twice as many books as it now has altogether. It will add 180 miles or once again as many books as it now has during the remaining professional life expectancy of this writer.

Place of Libraries

These reflections contribute to a consideration of the relationship of faculty members and research workers to libraries in this new atomic age because that relationship must necessarily be conditioned and largely determined by the vast and increasing mass of materials which our academic and research libraries must encompass, organize, and digest to the point where it is readily and conveniently available for the use of the research worker. How this problem will be met and what directions our libraries will take under their mounting burden and obligations is indeed one of the important educational and cultural problems of the atomic age. One thing is certain. The problem transcends the facilities of any one library. It will require eventually the cooperation, or at least will involve the operation, of all libraries, large and small, on a world basis.

It seems to this observer that two solutions are most likely to result. The one would be the founding of a number of large superlibraries in the nature of huge reservoirs or storehouses located strategically throughout the nation and throughout the world and charged with the cooperative and integrated responsibility of collecting all the important written records of the past and future. The libraries of outlying academic institutions and research centers could then content themselves with a basic collection of the most important and current literature with all the less frequently used material supplied from the central reservoirs by some rapid transit method such as telegraph or television photography, rocket tube, or some other of the fantastic gadgets which the inventive genius of mankind, resting directly upon the books in our libraries, is making not only possible but commonplace.

Specialization

The other possible solution will be the spreading of the burden by specialization among libraries, as already promoted by the Library of Congress, the Association of Research Libraries, and our bibliographic centers. For the immediate future this seems the most likely development. It is quite possible that a combination of the two solutions may be arrived at. As we all know, there have been developments, not too satisfactory up to the present moment, which give promise of at least a workable solution of the physical problems of housing our mushrooming libraries. It is therefore not our miles of books, in terms of the present codex book, that needs to concern us so much as the ways in which this material can be satisfactorily organized for use. A correlated problem of the cultural world is the ability of man to master and understand the records of his past, both in the physical and the social sciences. Van-
nevar Bush, the director of the Office of Scientific Research and Development and one of the most brilliant thinkers in matters scientific in the world today and upon whom this paper leans heavily, says this:

There is a growing mountain of research. But there is increased evidence that we are being bogged down today as specialization extends. The investigator is staggered by the findings and conclusions of thousands of other workers—conclusions which he cannot find time to grasp much less to remember, as they appear. Yet specialization becomes increasingly necessary for progress, and the effort to bridge between the disciplines is correspondingly superficial. . . If the aggregate time spent in writing scholarly works and in reading them could be evaluated, the ratio between these amounts of time might well be startling. Those who conscientiously attempt to keep abreast of current thought even in restricted fields by close and continuous reading might well shy away from an examination calculated to show how much of the previous months' efforts could be produced on call. The difficulty seems to be not so much that we publish unduly in view of the extent and variety of present day interests, but rather that publication has been extended far beyond our present ability to make real use of the record.3

Coming directly to problems within the province and concern of all bibliographers and all university librarians, Mr. Bush says this:

Professionally our methods of transmitting and reviewing the results of research are generations old and by now are totally inadequate for their purpose. . . . The summation of human experience is being expanded at a prodigious rate and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-rigged ships. . . . The real heart of the matter of selection, however, goes deeper than a lag in the adoption of mechanisms by libraries or a lack of development of devices for their use. Our ineptitude in getting at the record is largely caused by the artificiality of systems of indexing. When data of any sort are placed in storage they are filed alphabetically or numerically and the information is found (when it is) by tracing it down from subclass to subclass. It can be in only one place unless duplicates are used; one has to have rules as to which path will locate it and the rules are cumbersome. Having found one item moreover one has to emerge from the system and re-enter on a new path. The human mind does not work that way. It operates by association. With one item in its grasp it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain. It has other characteristics of course; trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory. Yet the speed of action, the intricacies of trails, the detail of mental pictures is awe-inspiring beyond all else in nature. Man cannot hope fully to duplicate this mental process artificially but he certainly ought to be able to learn from it. In minor ways he may even improve, for his records have relative permanency. The first idea, however, to be drawn from the analogy concerns selection. Selection by association rather than indexing may yet be mechanized.4

This latter suggestion, full of promise, is the first concept that this writer has come across which offers any hope of really simplifying and making more easily usable our increasingly ponderous bibliographic machinery.

One result of the recent (or should we say present) war and of the wary beachhead civilization is establishing in the atomic world has been the intensifying of the general awareness of the importance of our research libraries in the scientific field, at least, and the establishment of official governmental concern for the welfare and development of scientific libraries. This concern is given expression in Science, the Endless Frontier, the report of the Office of Scientific Research and Development to President

4 Ibid., p. 17-32.
Truman. This report, released just about the time that the first atomic bomb was loosed on the world (and I say “world” advisedly), devotes an appendix to “Library Aids” which, under the three heads on interlibrary cooperation, abstracting and translating service, and bibliographic and reference service, emphasizes the problem of making scientific knowledge available to the scholar.\(^5\)

No Service Satisfactory

The report says, as librarians well know, that none of these services is now entirely satisfactory, that even the largest libraries can no longer cover all materials. It proposes the establishment of a national research foundation and recommends that it use a part of its funds for a solution of the problem. It implies that really revolutionary technical aids may become available which will help us solve our bibliographical complexities, but that until this happens comprehensive plans for interlibrary cooperation are necessary. This includes, the report says, the necessity of having somewhere in this country one copy of every needed publication, which presumably means every copy of any consequence published. It is further suggested that sorting machinery and use of microfilm may “go far to improve” the searching of the literature and making bibliographies. It is recognized that this might require reclassification of science literature for at least the past several decades. “In the future,” says the report, “this problem could be met by arranging for the classification of every article prior to publication, according to some prearranged system.”

Here is an idea that has been voiced, time and again by librarians, only to fall by the wayside either because of the real and very practical difficulties involved or because of the lack of sustained and centralized attention and financing. Perhaps, at long last, under official government sponsorship and support, such reclassification will come. A general reclassification of the literature of the past several decades to mesh with such reclassification involves even greater problems and will be much less likely to be achieved.

National Science Foundation Act

Legislation is, as of June 1946, pending in Congress (S.F. 1850), known as the National Science Foundation Act of 1946, designed to put the recommendations of the Office of Scientific Research and Development into effect. The present bill, the result of voluminous hearings before the Committee on Military Affairs, brings in opinions and ideas from the elite of our scientific and academic workers from all over the nation. As at present written, it establishes a national science foundation to be managed by an administrator, by and with the advice of a national science board. It provides for eight divisions, including one of publications and information, and authorizes three more divisions as need may arise.

This writer has been pleased to note that the bill, as now written, provides for one section to be devoted to the social sciences, and this in spite of the fact that a group of important scientists had testified that study of the social sciences could not be conveniently integrated into the work of the foundation and might better be handled separately. While there was no effort in this testimony to belittle the importance of the social sciences, we may take courage from the fact that young James Hummel, a science talent winner of 1945 and perhaps clearer of vision than his learned elders, testified before the committee that the so-

---

cial and cultural sciences have lagged behind the physical sciences because they cannot be studied as can the physical sciences, because "they are much deeper," and require research on an extremely vast scale and should therefore receive more attention than the natural sciences.\(^6\) Dare we hope that our young high school graduates, in multitude, are equally discerning?

**Use Existing Agencies**

It is not the intent of this pending legislation to set up new research agencies and machinery but insofar as possible to use the existing federal agencies and through contractual arrangements, existing university, college, and industrial research facilities. Included in the hearings on this vitally important legislation is a considerable body of data on the library, indexing, abstracting, and research problems stressed in *Science, the Endless Frontier*.

Albert F. Blakeslee, of *Biological Abstracts*, told the committee that the greatest impediment to the advancement of science at present is the lack of effective means by which the findings of scientists, especially those of other nations, can be mobilized and put to work.\(^7\) He said that the research literature of the biological sciences has now become so great that no scholar can follow it, even in his own field, without the most potent scholarly aids. Before the war there were at least 6,000 research periodicals in the biological fields alone, issued in more than 25 languages and publishing some 60,000 to 70,000 articles annually. Nowhere are all these journals available in their completeness, and no library is able to contain them all. Mr. Blakeslee says: "Aside from perhaps forty or fifty of the larger universities the biological libraries in colleges, universities, and research establishments are pitifully inadequate. Research published in the more difficult languages, such as Russian and even Italian and Portuguese, is rarely seen and still more rarely applied. There are countless small institutions with very capable men who have at their disposal scarcely as many as a dozen of the research periodicals." Abstracting, microfilming, and borrowing is the best answer to this situation, says Mr. Blakeslee, thus giving each science a really effective clearing house of information. "There is probably no field of scientific activity in which the dollar applied can accomplish so much," he believes.

**Federal Funds Necessary**

But all this will cost money, more money, says Mr. Blakeslee, than can be secured from subscriptions or other present known sources of income. Replacement of the present obsolete methods of publication and fact-finding by modern methods can be done, he maintains, only with the resources of the federal government. The cost of translating, abstracting, and publishing Russian research literature in the biological, agricultural, and medical fields alone he estimates at $165,000 annually. He therefore recommends that the proposed legislation confer upon the science foundation powers adequate to deal with these problems in whatever way national welfare and the changing times in which we live may require.

Harry Sobotka, of the Mt. Sinai Hospital, also emphasized before the committee the need of governmental cooperation and concerted planning on a national and international scale for the abstracting and indexing of literature, which he characterizes as a public service.\(^8\) To Germany's hegemony of scientific publication, Dr. Sobotka as-


\(^7\) Ibid., p. 1188-92.

\(^8\) Ibid., p. 1192-93.
cribes much of the "myth" of her scientific pre-eminence as well as a considerable scientific handicap of the allied powers, in prosecuting both World Wars I and II. In addition, he says (and this all university librarians will applaud), it allowed the Germans to "exact a disproportionate financial tribute to their publishing business from the libraries of other nations."

It is neither possible nor desirable, says Dr. Sobotka, that Germany should resume her scientific publishing. Filling the vacuum left by her withdrawal therefore devolves on American and British science. Because of the size of the problem, this must be done on an accelerated basis.

He further states:

... Obsolete Continental methods must be supplanted with modern filing and indexing procedures developed through American ingenuity, as well as new methods of dissemination of information by microprint, microfilm, etc. Finally, any fear of quantitative and qualitative lack of domestic manpower for this job is wholly unjustified; on the contrary, participation of hundreds of American graduate students adds new education and economical prospects for the postwar generation of scientists ... an active service of abstracting and reference literature in the exact sciences as well as in the historic sciences is one of the most important tasks of any National Science Foundation and must form an integral and properly organized part of its effort.

Basic Freedom of Science

Watson Davis, director of Science Service, told the committee that government support of a program for prompt and complete announcement of the results of research is necessary not only to put knowledge gained to work but to assure people of the world, as well as of the United States, of the basic freedom which science needs if it is to be effective and fruitful. Thus can ill will, created by keeping information secret, be neutralized. Mr. Davis urges that essential knowledge be brought into a kind of "world brain." He says, and all librarians know how right he is, that abstract journals have struggled with this problem with laudable success in some fields and almost complete neglect in others. We have, therefore, a tremendous backlog of scientific knowledge, unpublished, unabstracted, unindexed, and untranslated, far beyond the ability of our present science organizations to handle.

Mr. Davis believes that if we are foolish enough to try to print all research in the traditional manner our presses (to say nothing of our libraries) will be hopelessly clogged. He recommends as a substitute, auxiliary publication through the deposit of the manuscript in a central place, to be numbered and abstracted by the central agency without cost. This central agency can then send out film copies of any deposited manuscript, as required, through its abstracting service. This idea is already in operation in the Bibliography of Scientific and Industrial Reports prepared, rather curiously, it seems to this writer, by the Office of the Publication Board, Department of Commerce, organized on June 8, 1945, as an interdepartmental board to assist the director of war mobilization and reconversion by bringing scientific and technical information to his attention.

Provision of Act

As a result of the concern over ways and means of making the results of research known, as indicated in Science, the Endless Frontier and by the foregoing and similar statements, Senate File 1850 makes the following provision:

The Administrator shall record, collect, index, and promptly publish or cause to be pub-

lished significant data on all inventions and discoveries and other findings produced in the course of federally financed research and development activities, or arrange with other Government agencies for such publishing, recording, collection, and indexing. In consultation and collaboration with the Library of Congress and other Government agencies, the Administrator shall take such steps as he may deem necessary to make such information and other available significant scientific and technical information accessible to the public including the preparation and distribution of reports, periodic catalogs, inventories, abstracts, translations, bibliographies, and microfilm and other reproductions thereof; and for such purposes the Administrator may utilize the facilities of Government agencies and other organizations to the extent that he deems necessary or desirable, and may contract for the expenditure of funds for such purposes.

Since this proposed legislation, in some form or other, is certain to be passed, it seems that we are coming to the end of the era of rugged individualism and voluntary cooperation in the systematic organization of learned literature, an era characterized by Poole's *Index to Periodical Literature*, the Wilson indexes, the *Union List of Serials*, a variety of abstracting services, cooperative cataloging, the importations program of the Association of Research Libraries, self-supporting union catalogs, and similar aids and tools which librarians, learned societies, and commercial publishers have more or less haphazardly sweat out by themselves, often through the efforts of a few members of hard-working committees. Further evidence that we can look for increasing governmental concern in these matters is the fact that the Library of Congress is prepared to include, in its proposed budget, funds for an exploration of the whole field of indexing and abstracting. Plans are also afoot for UNESCO to lend practical assistance to the centralization and coordination of bibliographical activities on a world basis. The national science foundation and other government agencies will not, of course, immediately take over existing bibliographical agencies and tools but, with federal and, presumably, eventually international purse strings open, more and more governmental responsibility will be assumed in these fields, as it must be if the ever-increasing burden is to be satisfactorily handled.

The result will undoubtedly be a more complete and efficient bibliographical recording and service than the world has ever had—a service growing, under present techniques, ever more ponderous and undoubtedly tending more and more to bureaucratic control and attitudes. To the writer's horse-and-buggy eyes, the prospect for such tremendous progress which we all should, and undoubtedly do, applaud seems somehow a little dismal and uninviting, requiring, as it will, more, more, and ever more very small cogs in a huge machine—cogs that can never know the joys and satisfactions of the pioneers of Poole, Sabin, Evans, the Wilson indexes, *Chemical Abstracts*, bibliographic centers, and similar enterprises. The haphazard 'pre-atomic bibliographical tools which we shall eventually look back upon from the push-button vantage point of a streamlined, mechanized atomic world were far from perfect, but they gave and are giving their originators all the full satisfactions of the creator and the pioneer, of the individualist standing on his own feet and sweating out the path toward achievement without governmental support. Of such is the cost of progress. It is a sad commentary on our civilization that all this prospective progress will finally come about as a measure of military defense.


Attitude of Faculty

What of the relation of the faculty member and research worker to his libraries under the streamlined integrated efficiency of the atomic age? In an effort to assay the library attitudes and opinions of our present generation of scholars who march with us into this new atomic age, the writer has addressed some comments and a series of questions to eighteen friends and colleagues, divided equally on three different campuses and equally between social scientists and physical scientists. Admittedly this is a small sampling of opinion and thought, but it is a sampling, and an interesting one, which permits some reasonably authentic generalizations about scholarly reactions to the probable library developments of the immediate future.

On the basis of replies received it can be said that the faculty member of today and for the next decade at least will want, in his own institutional library, the largest and most comprehensive collection of codex books in his field within the means of his institution. He will continue to accept, but by no means enthusiastically, interlibrary loans for literature not owned by his library. He will reluctantly accept, if he must, microfilm or microprint but he will much prefer the codex book. He will continue to be irked by the delay incidental to interlibrary loans. He will increasingly want, as the methods and innovations of the future may permit, the requested material the same day asked for or the day thereafter and not next week. Here he stands a good chance of being happier and better satisfied in the atomic age than in the years immediately past.

The present faculty member would definitely not be content with a basic collection of some fifty or sixty thousand volumes of the most important literature, supplemented by high-speed loans through photographic service or otherwise, no matter how rapid, from some large central library or reservoir. He will continue to want access to the stacks and to feel the need of having the more important literature of his field at his disposal. More than anything else faculty members questioned emphasized the importance of freedom to roam the stacks, pulling down books at will, not necessarily along the lines of the research in progress. This freedom the "world brain" suggested by Watson Davis or the microcards of Fremont Rider cannot possibly give. One scientist stressed the stimulating effect of such random reading, stating as an example that E. O. Lawrence had gotten the idea for the cyclotron while scanning a German research article in which he had not been particularly interested. Another said, "I do not see how I could get along without being able to go into the stacks and hunt. I always hated Crerar for that reason."

The faculty member of the present and immediate future will welcome the assistance of a highly trained and competent subject specialist librarian, but only as an aid in locating the literature. He will feel the need of himself knowing the indexing, bibliographical, and abstracting aids in his field and will also feel that he must understand their peculiarities and complexities rather than leaving this to the subject librarian. This much he believes will be necessary if he is to keep his feet on the ground and if his work is to retain its validity. He will feel that a subject librarian can do no more than some preliminary laborsaving work for him. One historian queried stated, "I have yet to meet the reference or research man that has quite the same angle on my research problems as I have myself." Another social scientist said, "By the time I could get over complete instructions the librarian might as well write the book."
Unnecessary Publication

There is considerable agreement, in the group questioned, that there is unnecessary publication in the various subject fields. To this writer it came as a considerable surprise that the physical scientists are more unanimous on this than the social scientists. One chemist stated simply, “Some people can work one day in the laboratory and publish half a dozen articles on the results.” Another physical scientist said optimistically, “In the future there will be more careful selection of research topics, less unimportant research undertaken, the worker will know more of what has been done, and there will be more careful editing, thus reducing the length of articles and duplication.” To this the librarians and all other scholars will add a prayerful Amen!

Although admitting that there is unnecessary publication, faculty members, as reflected by this small cross section of opinion, at least, are no more agreed than librarians as to the discarding of anything that has achieved the dignity of print. One scientist said, “It would be difficult or impossible and perhaps even presumptuous for any person or persons to draw a line between that which should be retained and that which might be discarded.” This will strike a sympathetic note with all librarians who have struggled with this knotty problem, even though, with the mounting flood of materials to be processed and indexed, we cannot permanently continue to evade it. Another scientist places the dilemma squarely back in our laps by logically saying, “Just as the library must constantly be planning additions in the light of the needs and finances of the institution it serves, so also it might well be planning deletions of materials no longer needed.”

Our interest and enthusiasm in developing streamlined, centralized library techniques, procedures, and research aids should perhaps be given pause by this observation of a historian: “Scholarship and research must not forget the benefits of decentralization and should not elaborate the mechanics of research to the point that we burn up all our energy in procedures and machines and have but little left for the task itself.”

As to what the professor born into the atomic age will expect of his libraries, those of us conditioned by having lived most of our lives in the pre-atomic age can do no more than surmise. Perhaps this statement by Richard Lewontin, a high school senior and a finalist in the science talent search of 1945, points the way. Says young Lewontin, not realizing perhaps the full implications of his statement, “... if you want to do a piece of research, the first thing you do is go out and look up all the books that have been written on it and find out everything that everybody else has found out, and only then can you do a successful piece of research.”13 No promise here for relief for harried librarians, catalogers, bibliographers, and abstracters. No promise either for a pleasant life of leisure for Mr. Lewontin and other prospective research workers of the future. No matter to what infinitesimal degree the work week of the future musician, coal miner, or railroad worker may be shrunk, the scholar of the future, if he is to retain his competence, must necessarily be chained to his books and his laboratories. Even now one historian has said, “Keep up with my field? Not on twenty-four hours a day!”

Good and Bad Books

As this writer surveys the uses to which books have been put, as he has come to understand that use through two decades as a practicing university librarian, he comes to

the conclusion that we librarians have tended to have a naive faith in the value and power of our books. If only people would come to our libraries and read our books and if only we could get them all organized for easy use, we have frequently said and more often implied, everything would be all right. In saying this and believing this, we have failed to realize that books reflect human experience and are therefore both good and evil and that, because man is the strange and unpredictable creature that he is, a book that is good for one person may be bad for another. More and more we are impressed that in all our miles of books, carefully marshaled row on row, there are comparatively few books of wisdom and those that there are go largely unheeded and unread. Our catacombs and corridors of books contain much knowledge, a tremendous store of facts, ideas, and technical know-how, a sorry story of greed, strife, and inhumanity as well as an inspiring chronicle of noble and enlightened thinking and action, a brilliant record of the mastery or at least the plumbing of the mysteries of nature. The books of true wisdom, however, the books containing the philosophies of men concerned with spiritual values and the real significance of the human mind and soul, the books of Lao-tse, Buddha, Isaiah, Christ, and others, books which could yet save the world if they should be seriously read and applied, stand lonesome and neglected among the millions. They still carry the same messages of hope, peace, and tranquility, should man choose to pause and heed, as when the spawning of our books of knowledge and the rapid and now frantic march to mastery over natural forces first began.

Legendary man has always been seeking some object which would give him supernatural power over material things and over his fellow beings and has frequently found it. Aladdin and his wonderful lamp, Jason with his fleece, Siegfried with his ring have had such objects, and in every case the power attained was greater than the wisdom to use it. So far this has been in the realm of legend and fantasy but now man, here and now, today, in 1946, living and breathing, has attained such power and stands frightened and bewildered, fearing he has achieved Inferno, desperately hoping that it may yet turn out to be Nirvana.

Wisdom for Good

It is largely through books that man has achieved his modern magic and the new terrible medicine of the atomic bomb. Can he also, through books, find the wisdom to use this new power for good and not for evil? Let us hope and pray that the vast library resources and bibliographical aids of our nation and of all nations may yet, through the work and study of men of learning and goodwill, ourselves included, bring to men everywhere understanding, tolerance, humility, and, above all else, wisdom to use their God-like powers for the good of their fellow men.