THE PUBLICATION OF SCIENTIFIC RESEARCH

By Dr. ATHERTON SEIDELL
U. S. PUBLIC HEALTH SERVICE

THE periodicals devoted to the publication of scientific research are of the most varied character. They may contain relatively few original papers or be devoted exclusively to such reports. They may appear at very irregular intervals or sufficiently frequently to make several volumes per year. They are published in many countries and under widely varying conditions.

The majority are issued at the expense of academies, governmental agencies, scientific societies or other organizations having for their object the promotion of one or several branches of science. Some are house organs of industrial establishments. A certain number are published by private initiative on a more or less self-supporting basis. In general, however, purely scientific periodicals require some form of subvention. Those sponsored by scientific societies are usually supported by dues received from members.

They are in all cases collections of reports upon many different problems in one or several fields of science. For this reason any one journal contains papers upon a far greater variety of subjects than are of direct interest to an individual or small group of research workers. To obtain the papers concerned with a given problem, a far larger number of reports of no immediate application to that problem will be simultaneously received. These increase the cost of those desired both for their acquisition and subsequent conservation.

Due to the varied character of scientific periodicals the published reports upon given problems are scattered in a larger number of journals than can usually be afforded by individual workers. Such persons must therefore depend upon the collections of the larger institutions for their literature requirements. For this reason scientific research can usually be advantageously pursued only in proximity to adequate library collections.

The present system of publishing original scientific research thus restricts its acquisition to the community of workers. This is in striking contrast to that other important class of scientific literature composed of digests, treatises, reviews, text-books, etc., which is largely distributed to individual students and specialists. The market for the one is accordingly restricted and that for the other of far greater diversity.

In addition to this difference in market there is also a difference in the literary character of the two classes of publication. The one consists almost exclusively of concise and very accurate descriptions of natural phenomena or of experimental investigations, contributed by numerous individuals. The other, represented by monographs, compendia, text-books, etc., consists of the orderly presentation and critical discussion of the facts disclosed in the original communications published in the journals. They are usually written by one or a small group of authors and depend for their success upon the manner of treatment of the subject and the clarity and excellence of the presentation. They are essentially the type of literary production for which the author is entitled to the protection afforded by copyright. This can not be claimed with equal justice for the original communications published in the scientific periodicals. These are essentially contributions to the advancement of science, offered in return for reciprocal benefits derived from the similar contributions of others. Any restriction upon their most widespread use, which might be imposed by copyright, is not only contrary to the wishes and best interests of research workers but also indirectly to the public welfare.

There is furthermore an essential difference in the risk involved in the publication of these two classes of scientific literature. In the case of periodicals their sale is largely provided for in advance by subscriptions and, after each issue is distributed, very little if any further returns can be realized from reserve stocks. Copyright protection is accordingly of negligible value. In the case of compilations, treatises, text-books, etc., the risk must be wholly assumed in advance by the author and publisher. The entire profits are derived from the sale after publication, hence copyright protection is indispensable to assuring a just reward of the efforts which the undertaking has involved.

In recent years a procedure for the greater diffusion of reports of original scientific investigation than can be secured by journal publication alone, has been developed. This consists in the photographic reproduction upon microfilm of the separate articles in the periodicals and the distribution of these to workers who do not have access to the journals in which the reports are published.

The process is the most economical so far devised for making a single copy of a given text. By means of it the scattered articles upon a given research problem can be segregated from the numerous others with which they are published in journals. The research worker is enabled at small cost and without effort to collect the papers pertaining to the problem

upon which he is engaged. It has rendered proximity to adequate literature collections no longer an indispensable requisite to the prosecution of experimental research.

Microfilm copies offer a number of advantages over the printed texts as contained in the bound journals. Among these is their insignificant bulk, which permits the assembling of a far larger number of papers at one time than can be brought together in the bound volumes of journals each containing only one or a very few papers on a given subject.

Furthermore, the collected microfilm copies of papers can be kept and need not be returned promptly to the library for the use of others, as is the case with the bound periodicals. The microfilm copies when attached to cards or sheets of papers lend themselves to filing for future reference exactly as manually prepared notes, reprints or any other collected material upon a given subject. They are especially adapted to the assembling in the most convenient form of the large numbers of scattered publications required by authors of compendia, treatises, textbooks and all other digests of scientific literature.

Microfilms, however, have the disadvanatge that they differ in form from the ordinary printed page with which from long habit one has become accustomed, and in addition require special means for reading them. The devices which are available for this are monocular magnifiers and projection apparatus. The former, although quite inexpensive, require a certain effort for use, and the latter have not yet been produced at a price within the means of most individuals. Since, however, microfilm copies usually represent only a small fraction of the literature collections made by individuals, the effort to read them will not be a serious task, and will be very largely repaid by the advantage of having at hand the photographic copy of the original publication.

In connection with microfilm copying from scientific periodicals, only one criticism has so far been advanced. This is in reference to the possible effect the increasing use of microfilms may have upon subscriptions to journals. It is apparent, however, that such an apprehension is ill-founded when the total amount of published original research is considered in relation to the inconsiderable fraction of it that may be desired and can be copied in the form of microfilms. If, for example, the field of medical research is considered, the total number of titles of books and journal articles listed during the last 60 years by the Index Catalogue of the Army Medical Library is about 2,500,000. If it is assumed that one half of these have become obsolete, a request for a single copy of each of the remaining 1,250,000 would require more than 100 times the microfilming equipment and number of persons employed in the several services now operating. Even if microfilm services should attain 100 times their present capacity only a single complete copy of any one journal would, on the average, be distributed as microfilms in one year. This corresponds to fewer copies than are given away by authors in the form of reprints supplied by the publishers. It is evident, therefore, that microfilm copying can not justly be charged with adversely influencing subscriptions to scientific journals.

The real cause of the failure of certain scientific periodicals to attract and retain a sufficient number of subscribers to pay the cost of their publication is the diversity of their contents. There is probably a close relationship between the financial stability of a journal and its degree of specialization. Those journals serving a particular field of research become indispensable to the workers in that field and will be supported by individuals, whereas those containing papers upon many branches of science can be afforded only by large institutions in which research in many fields is being pursued.

Periodicals of this latter type have in many cases been founded without due regard to the purposes to be served. They sometimes simply satisfy the aspirations of those responsible for their existence or may be used largely as exchanges for securing other periodicals. They frequently become the cemeteries in which useful descriptions of original research are buried. They greatly increase the difficulties of bibliographic searches and contribute to the chaos in publication which now prevails. It is evident that a complete reorganization of the present system of publishing the results of scientific investigation is needed.

Toward this end an advisory council on publication should be organized in each country for the purpose of studying the existing periodicals and defining more precisely the character of the contributions to be published in each. A system of routing the original communications in accordance with the field covered by each journal should also be established. The more highly specialized periodicals produced in this manner would enable the subscribers to receive more papers in which they are interested and fewer on subjets with which they are not concerned. The individual research worker would find it to his advantage to subscribe to them, and the cost of their publication would thus be distributed to an increasing extent among those for whose special benefit they are produced.

The supervision of publication by a central agency in each country would probably result in the elimination of some journals and avoidance of the many changes in character, policy, title, size, price, etc., in others which now so greatly complicates the collection and maintenance of complete sets of periodicals

by libraries and the task of making bibliographic searches in them.

Although abstract journals aid in reducing the disadvantages of the haphazard publication of scientific research by classifying and indexing the papers contained in the journals, they constitute a partial republication of the original contributions and to this extent are uneconomical. A part of the cost of publishing abstracts could probably be saved if the contents of the journals themselves were sufficiently uniform to permit workers to obtain directly a larger proportion of the original papers in which they are interested.

It is also probable that if abstract journals themselves were restricted to narrower fields, those using them would be better served at a lower cost. If, for example, *Chemical Abstracts,* which now attempts to cover the entire field of chemistry, were issued in several parts, chemists would be relieved of the obligation of purchasing and conserving the abstract literature of those branches of chemistry in which they are not directly engaged. It is apparent that the urgent need in the publication of scientific research is a greater degree of specialization in both the periodicals and the abstract journals.

In addition to the problem of better organization of scientific publication there is also the question of securing the funds for printing the rapidly increasing number of papers which are being written. Practically all journals are forced to either refuse many papers or publish them in such condensed form that their usefulness is greatly impaired. A plan for relieving this situation, based upon the use of microfilms, has recently been proposed by Watson Davis, director of Science Service. This plan has been designated "Auxiliary Publication" and provides that papers which editors are unable to accept in their complete form be condensed for printed publication and, in connection with such résumés, notice given that the complete paper with all the charts, tables and explanatory details has been deposited with a central agency which distributes microfilm copies of it at a modest stated price. Thus for purposes of bibliographic classification the paper is widely circulated in curtailed printed form and for the benefit of those directly interested in the details of the work it is distributed as photographic microfilm copies. The organization of Auxiliary Publication is a task which advisory councils on scientific publication in each country should undertake in connection with the supervision of publication in general.

A common reproach to scientific investigation is that adequate use is not made of so much of it that is published. The cause of this is simply the inaccessibility of such a large proportion of it to those capable of using it to advance science. Aside from the introduction of microfilm copying no improvement in the means of distribution of original description of scientific research has been made in recent years. The perfection and extension of microfilm copying as well as the reorganization of the printed publication of scientific research is deserving of the earnest support of all who are interested in the advancement of science and the public welfare.

SCIENTIFIC EVENTS

RESERVATION BY THE U. S. FOREST SERVICE OF A VIRGIN HEMLOCK-BEECH FOREST

THE U. S. Forest Service has announced the formal setting aside of 4,131 acres of essentially virgin hemlock-beech forest, on the Allegheny National Forest in northwestern Pennsylvania, to be devoted permanently to scientific use and for the education and enjoyment of the public. This area is seven miles south of Ludlow, and is unique in that it contains the largest acreage of original forest of its type in the east. It is also the largest single remaining body of virgin timber between the Adirondacks of New York State and the Great Smokies of North Carolina. The purchase and reservation of this tract, which was advocated by leading scientific men and promoted by the Pennsylvania Forestry Association, had the support of the late Chief Forester F. A. Silcox, and was approved by the National Forest Reservation Commission in 1934. Its reservation is an important forward step in the U. S. Forest Service program of permanently preserving natural areas characteristic of native forest and range vegetation in all regions of the United States.

In administering this area the Forest Service recognizes two obligations. First, to preserve the native plant and animal life in its natural state in so far as this can be done on an area of this size, and, second, to allow the public to enjoy its unique qualities without jeopardizing their perpetuation. For this reason the area is divided into two parts; the northern portion, consisting of 2,018 acres and designated as the Tionesta Scenic Area, will be made accessible to the public by road and foot trails. Here the inspiration and true recreation to be found in a fairly large area of primeval forest may be enjoyed amid towering hemlock 300 to 500 years old and veteran beech 350 years of age. The southern portion, consisting of