

The Role of International Scientific Organizations in

IMPROVING SCIENTIFIC DOCUMENTATION

By *Elmer Hutchisson*

AS a representative of a scientific society which has membership on the US National Committee of the Fédération Internationale de Documentation (FID), I will be concerned primarily here with the problem of international scientific documentation as seen by a physicist-administrator intensely interested in the work of both FID and the American Documentation Institute, and at the same time having close ties with the documentation committees of the International Union of Pure and Applied Physics and the International Council of Scientific Unions. Because of the very limited time available, I will restrict myself to two aspects of the problem, hoping to obtain your reactions to some thoughts on this subject which have been going through my mind during the past several months.

At the outset, I should state my firm conviction that the written record of the accomplishments of scientific research constitutes one of civilized man's most important intellectual resources. This record consists of a constantly growing stockpile of organized knowledge which scientists everywhere draw upon constantly. Active scientists take particular pride in being able to add to this stockpile even though at times their individual contributions may necessarily be quite small. In recognition of the great intrinsic value of this body of knowledge, scientists throughout the world feel a deep sense of responsibility in seeing that the information contained therein be preserved in an orderly manner with ready accessibility and that additions to the stockpile meet the same high standards that have prevailed in the past and have made it such an important part of our intellectual heritage.

The two aspects of this problem which I want to consider are, first, the maintenance of standards for additions to our stockpile of scientific knowledge, independently of which country these additions come from, and second, the improving of the accessibility of this in-

formation, taking into account the special accumulative nature of scientific knowledge.

I must stress that, while science itself is international, the written records of research are very much national in character. These records occur primarily in scientific journals, the majority of which are owned nationally. Some examples of the ways in which scientific journals are sponsored and operated are:

1. Under *national scientific society* sponsorship and editorship (for example, The American Physical Society owns and edits *The Physical Review*, The American Chemical Society owns and edits its *Journal*, etc.). Such journals are usually operated on a nonprofit basis.
2. Under *national commercial* sponsorship, with the editor chosen by the publishing company with or without the advice of scientific societies. Examples are the *Physics and Chemistry of Solids*, published by Pergamon Press, and the *Annals of Physics*, published by Academic Press. Such journals often have an international editorial board. In principle, the commercially sponsored journals are operated for profit, but in practice such publications ordinarily earn a very small amount and sometimes are operated at a loss.
3. Under *international* sponsorship. Examples are the *Review* published by the International Council of Scientific Unions, and *Impact*, published by the United Nations Educational, Scientific, and Cultural Organization.

Fortunately, from the point of view of improving journals, by far the largest number of scientific journals are in the first category and, therefore, although national in character, they are under the direct control of scientists who recognize their international significance. This fact makes it possible, I believe, for international scientific organizations to play an important role in maintaining standards for primary publications and I would like to suggest a three-step program which possibly could bring this about.



Elmer Hutchisson, director of the American Institute of Physics, presented this paper at a symposium on Documentation on the International Scene held November 6, 1961, during the annual convention of the American Documentation Institute in Boston.

The first step which I would propose is that there be set up an international committee to identify those qualities of a scientific journal which are the determining factors in making it fully acceptable to the scientific public. Standards for each of these qualities can then be determined which must be met by a journal to be acceptable. I won't try to delineate each of these qualities but many of them are fairly obvious. For example, we would all agree that a good scientific journal should publish significant papers which have not been published previously. One way of insuring this is that all articles be critically refereed by competent scientists. This could be established as at least one minimum standard for an acceptable journal.

Another requirement is that a satisfactory author abstract should be included. It is essential that the titles used be meaningful and that they include most of the important words under which the corresponding article would be indexed. To accomplish these goals it is undoubtedly necessary for the editor and the referees to assume responsibility not only for the content of each paper but also for the quality of the author abstract and the adequacy of the title. These again could be minimum requirements.

Still another quality of a scientific journal which governs its acceptability is the time lag between the submission of a manuscript and its publication in the journal. Fortunately, this is a quantitative matter and standards may be set in quantitative terms. Personally, I would recommend a minimum figure of between four and six months for publication after receipt of a manuscript. Much lower minima could be set for the publication of brief articles or "letters".

Another factor of a quantitative nature is the cost of the journal to the worker in the field. In some countries at least, science flourishes most if journals are provided at a cost sufficiently low to permit workers to have their own individual copies of the important periodicals in their fields. The cost can be kept low if one recognizes that no research is complete until it is published and that part of the publication cost should be borne by the research budget.

A rather obvious factor in determining whether or not a journal is acceptable is the provision, semiannually or annually, of good author and subject indexes. This particular quality is more difficult to measure than others but nevertheless it seems to me that standards could be set upon which most scientists would agree.

AS a first step, therefore, in improving scientific documentation at the international level, I would recommend that either the scientific unions or ICSU call meetings of interested scientists to establish minimum standards for those qualities of scientific publications which scientists consider journals must have in order to be acceptable.

The second step which I would suggest in developing an effective program would be to establish within one or more of the international scientific organizations procedures whereby a regular reporting is made for each important journal of those qualities which were previously delineated as being significant and for which standards have been established. I have in mind regularly appearing summary tables which would list, for example, the average number of months' lag between the receipt of an article and its publication for each of the major journals. Additionally, these tables would indicate whether or not articles are refereed, whether abstracts and adequate indexes are included, etc. A preliminary report of this kind has already been planned by Dr. G. A. Boutry, Secretary of the ICSU Abstracting Board for the *ICSU Review*. The principal objective in these tabulations would be to make the characteristics of each of the major journals a matter of public information. Publicity is the major weapon used in a democracy to correct deficiencies and, I think, would be quite applicable in the field of international scientific reporting.

The third step in my suggested program would, I hope, occur automatically. Whenever a journal regularly falls below the standards set by a recognized international scientific organization, distinguished scientists within the appropriate country would confer with other scientists in that country to determine how an improvement could be made. I am sure that in the long run scientists would not want to see their country's journals put in a disadvantageous position with respect to those of the rest of the world.

A program of the kind which I am suggesting could, I think, be carried out by one or more of the international scientific organizations. I do not believe it could be effective if it were carried out by an organization concerned primarily with documentation. If this were attempted, scientists would feel resentful and it would be extremely difficult to get improvements made. I would suggest, therefore, that such a program is primarily a task for either the individual international scientific unions or for ICSU.

Let me now pass on the problem of making the information in our scientific stockpile readily accessible. Before doing so, however, it seems to me that we should recognize that all knowledge does not have the same characteristics and that this fact may be quite significant in considering the problem of improving accessibility. Let me explain more fully what I have in mind. The most important characteristic of scientific knowledge is its cumulative quality. It accumulates through a step process in which, first, observations are

made and recorded, and then generalizations are developed which in a very real sense make most of these earlier observations obsolete. The generalizations then lead to new observations and these, in turn, are again made obsolete by further generalizations. Thus, by this step-wise process, great masses of information are compacted into a comparatively small but highly intertwined reservoir of scientific knowledge. Dr. Zay Jeffries used to remark that it is only through such generalizations that scientists can possibly cope with the ever mounting stockpile of scientific information.

This compact quality of scientific knowledge has both advantages and disadvantages. First, it enables sophomores in college today to learn in a year to solve problems which Newton was hardly able to solve after a lifetime of study. It enables each scientist to build upon his predecessor's work much as though it were the scaffold for an arch which can be discarded as soon as the new work can stand by itself. This characteristic does not obtain in most other areas of knowledge. Thus, we don't expect Picasso's art to make Rembrandt's obsolete or a new form of government to make our knowledge of Plato's republic obsolete. In these areas, knowledge of all ages must be kept and be made accessible since there is no built-in obsolescence as there is in scientific knowledge.

I have mentioned that the compact nature of scientific knowledge has certain disadvantages. Just because of its compact nature, its language must be very precise, and many years of study are necessary before one can speak it fluently. Because of the precise description based upon careful observation which science gives of nature, scientists have often been accused of being dogmatic in discussing their work with those in the humanities. The distinction between a proven conclusion and an opinion is much sharper than in most fields. Because of this, a communication block has been built up which unfortunately often leads to the bifurcated culture which C. P. Snow has spoken of so eloquently.

What, then, has this to do with the documentalist? It is this: The working scientist approaches literature in his field in quite a different manner from that of, let us say, a worker in business management. Scientific information has a structure built into it with which a scientist, by his training, must be thoroughly familiar. This structure is being constantly refined by the scientist himself and it is part of his job to know in detail what effect new knowledge and new generalizations will have on this internal structure. In nonscientific fields, the internal structure is not, at least at the present time, set by nature itself; it is man made or perhaps I should say documentalist made. Thus, while classification schemes in many fields can be, and even must be, set up more or less independently of the advanced workers in these fields, such an approach can be fatal in scientific fields. This, to my mind, accounts for the very small use which physicists, for example, make of the existing UDC numbers. Furthermore, as I have mentioned, scientific knowledge has a built-in obsolescence which other fields do not have, and this must be

taken into account in devising a useful retrieval system.

What I have been saying leads inevitably to the conclusion that the establishment of an effective retrieval system in scientific fields requires very close cooperation between creative scientists in the field and documentalists. Cooperation of the kind needed does not come easily or automatically. Under National Science Foundation sponsorship, Pauline Atherton, of the American Institute of Physics, is trying to do this in physics. She is making good progress but still has a long way to go.

Perhaps the most important job for the documentalist in these fields is to assist in building bridges between the tightly organized knowledge with which the scientist is familiar and the needs of those who are applying science who do not have the detailed knowledge of the internal structure which the scientist must have. By helping those who are applying science, we can assist in making the results of basic scientific research more readily available and thus take a part in raising ever higher our standards of health and human comfort. It is imperative that the new scientific knowledge which nowadays is being generated at an ever-increasing pace be made accessible to nonscientists in the minimum time possible and with the least amount of effort.

This is a task on which the documentalist and the scientist can work together to a very good purpose. The documentalist can bring to this problem his detailed knowledge of the theory of classification, of indexing, and of machine retrieval. The scientist can contribute his knowledge of the changing internal structure of science and in particular the effect of obsolescence in reducing greatly the coverage needed in a given field at a given time. On the international level, I would recommend a joint approach to the problem of retrieval in applied science by FID and ICSU. Working together, they could do much to enhance the value of our stockpile of information as a truly important intellectual resource.

Let me conclude by summarizing very briefly the two aspects of the problem of international scientific documentation I have been discussing. First, in order to insure that additions to our stockpile of scientific knowledge meet the high standards set in the past, I have proposed a three-step action program which probably can best be undertaken by an organization of scientists such as ICSU. Secondly, I have stressed the cumulative nature of scientific knowledge which leads continuously to the compacting of the knowledge and to the rapid obsolescence of earlier information. Because of this characteristic and because of the very great need of making new basic scientific knowledge available quickly and as widely as possible, I have suggested a joint approach to the problem by international organizations of documentation specialists such as FID and by the corresponding international organizations of scientists such as ICSU. The implementation of these two proposals could accomplish much in the field of scientific documentation on the international level.