medicine with basic science, and to reap the benefits of the mutual stimulation of basic and applied science.

The dangers I have referred to are real and concern all those interested in universities. The damage probably will not go as far as feared by one of my colleagues, who remarked that, if the present trend keeps up, our scientific faculties will eventually consist of the overaged, the incompetent, and a few fanatics who prefer the academic atmosphere, no matter what the cost. Yet it is true that basic science has always had to depend a great deal on fanatics or "queer ducks," and I am sure it will continue to do so. To those who belong to this peculiar group and who are willing to continue in university work, there are compensations for the flesh pots of his life payable in the joy of teaching, in the advantage of close contact with scholars in other disciplines, and in real freedom and independence in intellectual pursuits. These benefits of academic life mitigate the lack of great material rewards. They are sufficiently satisfying, provided the disparity in the material reward of the basic and applied scientist is not too great. It is up to the various interested parties to see that the present unjust difference is lessened in order that one of the important reasons for the present grave situation may be corrected. The difference should, however, not be entirely eliminated, because too great an emphasis on material rewards would result in recruiting to the universities men who are lacking the missionary spirit and the burning interest in understanding nature that are so necessary for basic research.

Royal Society Scientific Information Conference

Ralph R. Shaw, *Librarian*[1]
U. S. Department of Agriculture

WHILE THE WAR WAS STILL IN ITS DARK PHASE, in 1941, Dr. Alexander King, then of the Ministry of Supply and now of the Central Scientific Secretariat, and Mr. Neville Wright, then of the New Zealand Office in London, approached the secretaries of the Royal Society to propose an Empire Scientific Conference. After three years of study it was decided that an Empire Scientific Conference should be convened as soon as possible after the war. The Conference was finally set for 1946 and was planned in two parts: a Royal Society Empire Scientific Conference, followed by a British Commonwealth Official Scientific Conference.

During the course of these conferences it became evident that scientific information services are a matter of first importance to the development of science, and it was therefore recommended by the Empire Scientific Conference that the Royal Society convene a conference of libraries, societies, and institutions responsible for publishing, abstracting, and information services in order to examine the possibility of improvement in existing methods of collection, indexing, and distribution of scientific literature. The British Commonwealth Official Scientific Conference endorsed this proposal and adopted the following resolution:

The Conference endorses the general recommendation of the Royal Society's Conference but desires to record its opinion that such a discussion should be regarded as preliminary to a wider Conference, invitations to which should be extended to the U.S.A. as well as to the operating agencies of the United Nations which are concerned with the subject.

The Royal Society, in accepting responsibility for arrangement of the Scientific Information Conference, provided that it ". . . will be limited by considering the subject only from the point of view of use and service to the scientific community. . . ." This Conference was held in London from June 21 to July 2, 1948.

Planning the Conference

Preparatory work divided subjects before the Conference into four sections: (1) publication and distribution of papers reporting original work, (2) abstracting services, (3) indexing and other library services, and (4) reviews and annual reports.

Planning of the meeting, extending over more than 6 months, resulted in the preparation of 46 papers dealing with various aspects of the work of the Conference and in the statement of more than 100 problems relating to scientific communication, for consideration by the Conference.

While substantially all of the subjects considered have been discussed over the years by scholars and by librarians, the distinguishing features of this Conference were: (1) that, as noted above, subjects were to be considered only from the point of view of use and service to science; (2) that the scientific

[1] Representative of the U. S. Government at the Conference on behalf of the Department of State and its London Scientific Mission.

method was evidenced in preparations for the Conference, notably in the gathering of facts upon which sound decisions might be based; and (3) that the Conference, as stated by Sir Henry Tizard, considered particularly the problems of scientists in isolated places, who do not have immediate access to extensive library facilities.

Major Topics Covered

Many of the topics for discussion which were formulated by the preparatory meetings appeared to the working committees to require additional experimentation before sound decisions could be reached; a few others were judged matters of technique which did not appear to have vital significance for scientific communication and were dropped without recommendation; still others seemed to defy solution on an Empire-wide base because of varying conditions under which they must be applied. The major issues discussed by each of the four sections of the Conference are noted below.

I. *Publication and Distribution of Papers Reporting Original Research*

The major issue in the field of preparation and presentation of scientific literature was the proposal put forth by J. D. Bernal, over the last few years, that all scientific communications be issued as separates rather than as periodical articles. This plan, which is described in Conference Paper No. 2, provides also for central distribution of manuscripts to editorial boards of the scientific societies and for central publication and distribution of these separates. This proposal met with violent opposition and was the subject of considerable newspaper publicity before the Conference started. It was withdrawn from consideration by its author.

A second proposal concerned improvement in preparation of scientific literature. The group attempted to determine what measures might be taken to improve the quality of manuscripts. Here considerable emphasis was placed on the need for judging publications solely on their scientific merits and on continuing effort to save time at all stages from the completion of actual research to final publication.

Précis journals were proposed both as a means for covering large areas of literature which are not now covered by abstract journals and as a means for saving time for scientists, who might, by reading a précis journal, keep up with general developments in their own and related fields without handling a large number of separate publications. During extensive discussion of this subject it was pointed out that, although précis journals might be desirable in some fields, in fields such as chemistry a journal providing a one- or two-page précis of each article would run to thousands of pages every month and would largely duplicate abstracting journals. The final recommendation, therefore, was that the Royal Society should consult editors and controlling bodies of groups of journals to find out whether précis journals might be of value in certain fields and whether facilities for their production can be made available.

Auxiliary publication was a fourth major topic. This term refers to a technique developed by the American Documentation Institute for making available papers which are too long or too complicated for economical publication, or which are of interest to a number of scientists which is too small to justify publication. This scheme provides for publishing an abstract or an abbreviated paper in a suitable journal, indicating that a microfilm or photostat copy of the whole article may be obtained. The chief problem which arose in this respect was taxonomic, since international rules for nomenclature do not now provide for recognition of auxiliary publication as true publication in the determination of priority of descriptions of plants or animals.

A fifth recommendation of importance dealt with payment by authors for part or all of the cost of publishing their articles. At first there was a tendency to state that it is undesirable that authors be asked to pay for the cost of their publications in any circumstances. It was finally decided that no recommendation for action would be made, but that the sense of the Conference—that payment by authors is generally undesirable—be included in the report as a conclusion.

Provision of reprints received a great deal of attention, both because of its relationship to Prof. Bernal's proposal, noted above, and because of the extent to which scientists are thought to use separates in their personal collections.

Paper No. 46 indicates that the use of reprints by scientists constitutes a much smaller proportion of their use of literature than had previously been estimated. Nevertheless, according to this preliminary study, about 5 or 6% of the literature used by scientists may be in the form of reprints. The recommendation on the provision of reprints recognizes that there is additional value in the personal contacts which result from individual exchanges of reprints and suggests continuance of the present procedure. It further recommends study to determine whether central facilities for securing reprints can be developed in order to make them more readily available.

Since preliminary investigation (see Paper No. 46) showed that approximately 80% of all scientific literature is obtained from libraries, as against some 20% from all other sources combined, the Conference

recommended that enlargement and increased support of central scientific libraries is absolutely essential.

II. *Abstracting Services*

Based on the finding that few scientists really do have facility in foreign languages, it was recommended that more detailed abstracts be given of articles published in foreign languages and for those in publications not readily available, that comprehensive subject indexes be provided in each volume of abstracts, and that consolidated subject indexes be issued at least every 10 years. The relationship of indexing to abstracting was also recognized, and it was recommended that prompt announcement of authors and titles of papers (with annotations if possible) would be very desirable in all fields and that a continuing consultative committee of abstract organizations be established for exchange of views and for the promotion of cooperation generally.

Author summaries evoked a considerable amount of discussion, and it was finally concluded that, while the present general unsuitability of author summaries for use as abstracts is recognized, nevertheless, if these could be used, the speed of publication would be increased and the cost of abstract journals reduced. It was therefore recommended that the Royal Society invite editors of scientific journals to cooperate with abstracting organizations by seeing that each paper is accompanied by a factual summary suitable for use as an abstract and that abstracting organizations be called upon to formulate agreed principles to guide editors of scientific journals.

III. *Indexing and Library Services*

This section was assigned more problems of detail than were found in the other sections, and, in view of the fact that it dealt with administrative problems to a greater degree than others, it was difficult to arrive at general recommendations on processes and procedures. For example, in recommending one process as against another, the relations of labor and material costs vary very widely between countries. Clerical staff may, in fact, cost 40 times as much in one of the countries represented as it does in another. Thus, many of the recommendations in this section were fairly general, and here, as in other sections, one of the most valuable parts of the Conference was the number of fields in which the need for additional objective investigation was pointed up. This group discussed Universal Decimal Classification, alphabetic indexing, issuance of catalog cards with publications, the relative merits of the various photographic processes and means of mechanical selection, proposed changes in organic chemical notations and systems of organic chemical notations, training and status of special librarians and information officers, specific additional reference works needed, translation services, and the provision of copies of scientific literature to scientists at a distance from research libraries.

The recommendations were, for the reasons noted above, quite general and indicated need for further investigation under the conditions under which the techniques were to be applied. Only in the field of copying services were there implications which were basic to the primary purposes of the Conference. The confusion in legal interpretation of the right of scientists to copy and quote and the resultant confusion in the right of scientists to have material copied for them were determined to be a major block to scientific communication. The Conference adopted the following recommendation with respect to copyright:

> Copyright.—This Conference recommends that the Royal Society adopt the following position in relation to copying, and that it exert its influence to obtain universal acceptance of this principle:
>
> As science rests upon its published record, ready access to public scientific and technical information is a fundamental need of scientists everywhere. All bars to access to scientific and technical publications should be removed.
>
> The Conference believes that making single copies of extracts from books or periodicals is a fundamental need of research workers, and that the production of such single extract copies by any means, by or on behalf of scientists, is necessary for scientific practice.
>
> In some countries it appears that copyright restrictions are preventing the quick and free flow of scientific information to research workers and some action is necessary to overcome this. It is recommended that the Royal Society should initiate such action.

IV. *Reviews, Annual Reports*

The chief recommendations of the group working on reviews and annual reports, as passed by the final plenary session, were: (1) that critical and constructive reviews written by leading specialists in particular fields are of the greatest value. These reviews should be made informative to nonspecialists by general introduction and conclusion. Senior investigators should regard the production of these as of comparable importance to the pursuit of new knowledge; (2) that the attention of the relevant societies and institutions, as well as government organizations, should be drawn to the importance of providing reviews in the progress of the applied sciences.

The Conference closed with the general recommendation that it ask the Royal Society to investigate the possibility of the continuation of research into the uses of scientific literature and other topics referred for further consideration by the Conference and that a continuing committee be established for this purpose.

It was further recommended that the Royal Society seek funds to carry out this recommendation. Finally, the Conference authorized the redrafting of these resolutions.

Summary and Evaluation

Since the recommendations have not yet been put into final form and the Council of the Royal Society has not yet acted on them, it is a little early to say what the final results of the Conference will be. However, it would appear that these will have to be measured over the years rather than by achievement during the next few months.

Summarizing the purpose and operation of the Conference, it might be stated that the central theme of the Conference appeared to be removal of blocks, whatever their nature, which interfere with free communication among scientists, wherever they may be located and whatever their fields of specialization.

If it is agreed that the advancement of science rests primarily upon the genius of each scientist in his laboratory, whether that laboratory be in a great center of research or in an isolated corner of the world, and that each scientist, no matter where he may be, must profit from the work of his colleagues, all over the world and of all times, then it must follow that anything which contributes to the freedom and ease of communication among scientists is, per se, a contribution to science.

It is in that light that the Scientific Information Conference justified the time and energy of a group of the caliber which it assembled and the sponsorship under which it was brought together. The extent to which it may contribute to the advancement of science by improving communication among scientists is the yardstick by which the success of the Conference should, in the final analysis, be measured.

Viewed in this frame of reference, the Conference appeared to attack the problems of limitations upon freedom of communication among scientists along three major fronts:

First, there is the broad area of possible improvement in communication through publishing. In the light of the purposes of this Conference, publishing may be viewed as a mechanism through which any scientists may speak to all scientists, all over the world and for all time. Conversely, it is the mechanism through which each individual scientist may receive the recorded findings and thoughts of his colleagues, of all times and places, in a form in which he can give them the attention which they may warrant.

The second broad front on which this Conference appears to have worked is the intellectual Tower of Babel resulting from the great mass of scientific literature assembled over the ages in our libraries, documentation centers, and in our indexing, abstracting, and review journals. Major emphasis appears to have been placed upon secondary publications, such as listing, abstracting, and review series, and on library and other techniques for organization of literature, in a search for measures which may tend toward the clarification of the deafening confusion of tongues.

The third and final goal of the Conference appears to have stemmed from the concept of the advancement of science noted above and therefore revolves about the needs of the individual scientist—any scientists, anywhere. This issue is probably the most crucial one involved in the Conference, and it is one which has no other organized sponsorship. Publishing will evolve and improve, as it has over the ages, through the interested efforts of private publishers and of various scientific bodies. Libraries and documentation services will no doubt continue to grow and improve. However, the needs of the scientist who is working at some distance from a good library and who cannot, obviously, acquire everything published—or even learn about all that has been published—cannot be served even partially unless new philosophies and new services are developed.

It is not feasible to duplicate the world's great research libraries at all points at which research must be carried on. If we do not believe that science evolves upon its written record, then we are wasting time and money in building up great libraries anywhere. If, as has adequately been demonstrated, good library facilities are indispensable to the advancement of science, then we must expect inferior science from those who cannot work at the great research centers until mechanisms are developed to insure that every scientist, no matter where he may be, may have access to the recorded record of science to the full extent to which it can contribute to his investigations. Any advances made or suggested in this area by the quality of pooled scientific judgment represented by this Conference should be watched as possible major contributions to the advancement of science.

Regardless of future benefits which will undoubtedly accrue to science from this Conference, its objective approach and its high level of consideration of the tools of scientific communication in terms of contribution to science may well be a landmark in scientific communication. The approach to problems of scientific communication on the basis of objective data, if it leads to a continuing tendency to make decisions in this field on the basis of the scientific method instead of the basis of habit or personal predilection, will be a second major contribution.

The final recommendations and proceedings of the Conference will be available for distribution in a few months. When issued, they will merit serious study by all who are interested in the advancement of science.