aeroplane and a quantity of stores have already been sent out to the Falkland Islands. The expedition is setting out with the object of exploring territory between Luitpold Land and Charcot Land, and will fix its base on the west coast of South Graham Land, as far south as the ice permits.

DISCUSSION

REFORM IN THE SYSTEM OF SCIENTIFIC PUBLICATION

THE appearance of the letter from Dr. Atherton Seidell (SCIENCE, July 20, 1934, p. 70) on "Reforms in Chemical Publication," outlining the plan of Mr. Watson Davis for an improved method of recording and distributing the results of scientific research, prompts me to publish a résumé of a plan which I have discussed with several scientists during the past three years. Some of the points in the plan result from recent experiences with lithoprinting as a means of reproduction for text-book and other material. The following statement written a year ago sets forth some of the many reasons for a change in our system of publication and preservation, and briefly indicates another type of system which it appears would obviate most if not all of our present difficulties. It is to be noted that the plan suggested by Mr. Davis is similar in purpose to that outlined below and that the methods are only slightly different. It appears somewhat significant that independent approach to the problem has led at least two persons to virtually identical conclusions concerning the method of choice in the eventual solution of the problem.

The problem of providing means for the dissemination of scientific information has become more acute with the increase in the number of scientific investigators. It is becoming increasingly difficult for the journals which propose to publish the results of original research to function adequately. In America alone the number of persons who devote themselves so largely to scientific work as to require mention in Cattell's "American Men of Science" has increased fivefold from 1906 to 1933. To those acquainted with scientific work it is apparent that this increase in number of workers has resulted in at least a corresponding increase in the volume of scientific work needing publication.

The present "journal method" of publication had its origin in a local institutional, or even departmental, organ of publication. There was a character to a journal arising in a particular department given to it by its head, who was at once editor and chief contributor. The use of widely distributed periodicals for publishing scholarly work in full has appealed to the natural scientist apparently more than it has to philosophers and social scientists, who have long used the monograph system for their original contributions. It may be that scientists have been willing to condense their material and omit the majority of its detail in a way that other scholars have been unwilling or unable to do. It is a fact, however, that there arrives a point in the process of condensation and elimination beyond which one can not go without sacrificing the clarity and completeness of evidence.

It seems that this point has been reached in the requirements which editors of scientific journals are now forced to impose upon their contributors in order that the whole volume of results of current research may be reported in some manner.

The problem of scientific publication is becoming exceedingly acute from another angle, namely, that of the cost of providing working libraries in centers of scientific research. With the increase in volume of published material, the great majority of research libraries have been unable to keep up more than the pretense of maintaining complete files of all relevant periodicals. A survey of subscription lists in the United States shows that there are many periodicals in special fields for which there are only two or three subscriptions in the entire country. Even in the case of some of the most important periodicals in certain specializd fields, such as hematology, there are only ten subscriptions in the entire country. This condition is deplorable because it implies that a great many investigators must be without ready access to literature of primary importance to their own problems. It is, in all likelihood, a contributing factor to a lack of familiarity with important literature which is often evident in scientific papers. The notion that any reasonable number of libraries can at present hope to maintain a complete file of all relevant publications is a myth, which it seems should be dissipated as soon as possible.

The solution of the problem is of great importance, even if it is not simple. An increase in the number of periodicals or in the volume of those already in existence would accommodate the increased volume of publication, but it would do nothing to lighten the load on the libraries or on the investigator himself who finds it increasingly difficult to read the entire volume of original material in his own field.

There are three major objectives in any permanent solution of the publication problem. The first, and most important, is provision for full and adequate presentation of all aspects of the problem, including a reasonable historical introduction, a reproducible description of all methods of observation and a full presentation of experimental results and deductions.

The second objective consists in a device for adequate indexing and abstracting of all publications in order to lighten the burden upon the investigator who is finding the literature problem an overwhelming one. For many persons the difficulty in acquiring a working knowledge of what has already been done in the field is so great as to occupy his whole time to the exclusion of opportunity for original effort. There is no really sound reason why the duplication of effort in searching out all relevant material in the literature should be imposed upon every investigator in the field. I trust the time will never arrive when indexing and cataloging will be so perfect that an investigator will have to do no foraging on his own account; but there could be an enormous improvement in our existing workaday routine methods without danger of losing the opportunity for individual ingenuity in literary searches.

The third objective is to provide a mechanism whereby a library may, with a reasonable budget, maintain itself as an adequate working tool for investigators using it. Two changes seem to be indicated in order to bring about needed improvement in this line. The cost of publishing scientific material must be reduced. The expensive methods of printing and illustration must, it seems, give way to less expensive, yet entirely adequate, methods of reproduction. Scientific literature has a very limited distribution and the expense of type setting and engraving is not warranted, either from the point of view of the necessity for perfection and permanence, or from the economic angle. With the perfection of such methods as photolithography which lend themselves to the problem of inexpensive reproduction in limited editions, there seems no longer any necessity for the continuance of the time-honored methods.

Furthermore, the journal method itself is open to serious criticism as the most desirable means for publishing scientific results. A volume of a journal may contain anywhere from a single to two hundred separate and distinct publications. There are many so-called border line journals which contain infrequently very important contributions to investigators in a particular field. A working library can not afford to be without those contributions, neither can it afford to pay for the printing and distribution of all the irrelevant matter in order to provide itself with the small part which is really necessary. There are some journals whose entire content is useful in particular libraries. There seems to be no question but that a larger number of libraries could be completely stocked with substantially all relevant publications in particular fields if those publications were available as separata instead of being available only in connection with large quantities of irrelevant material.

In order to bring about these desired ends, it is suggested that an organization such as the National Academy of Sciences undertake the problem of supervising the publication of all scientific material in this country. Similar bodies might function in other countries. The academy would serve as a clearing house and depository for original documents. Once every two weeks a list of all titles, including a condensed abstract of each manuscript, would be sent to every contributing library, carefully and completely indexed as to the content of each paper. Each library would then indicate which papers it desired for its files in the form of separata. A lithoprinting would be made, the cost of each publication being determined by the number of requests received for it. The cost of reproduction would be low, and sale of copies after the first issue could probably be counted upon to provide most of the funds necessary for the abstracting and indexing service. It is estimated that several million dollars a year are spent for the purchase of strictly scientific periodicals in the United States. It is not hard to imagine a system whereby this project could be successfully handled with an expenditure considerably less than is necessary at present.

Difficulties arise in the fact that there would be handicaps during the establishment of any system so radically different from the existing one. A duplication of effort in attempting to keep two systems working would be uneconomical and prohibitive from that angle unless some endowed organization or governmental agency could undertake to carry such a project through the first few difficult years.

It is suggested that the American scientific societies consider these problems in their annual meetings, or appoint committees to work jointly in considering a general scheme.

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BIOLOGICAL VARIATION vs. ERRORS IN MEASUREMENT

MEASUREMENTS are made with instruments which differ greatly in precision. On the one hand, there are relatively accurate determinations, like weight and length. On the other, there are elusive estimates of color and quality, together with the difficult kinds of laboratory measurements typified by the settling method for estimating the sizes of particles in the soil. The investigator is under the unfortunate necessity of including the variation in his measurements with the variation of the entity measured. Frequently the former is trivial in comparison with the latter. However, in new experimental practises and new laboratory techniques the relative magnitudes of the