DISCUSSION

NEED FOR AN INTERNATIONAL REPOSITORY FOR ORIGINAL RESEARCH DATA

PROBABLY the best conception of an ideally complete project of research is that it requires (1) the accumulation of a sufficient number of experimental observations to eliminate the influence of experimental error or chance variations; (2) the deduction of a hypothesis concerning the principle or law which embodies the conclusions derivable from the experimental observations, and (3) the testing of the accuracy of this hypothesis by experimental applications of it in practice until it becomes generally accepted as an addition to knowledge or guide to action. The third step in this process usually must be taken by others than the original investigator. The latter workers need to be familiar with the original data in order to plan intelligently their own experiments or to interpret confirmatory, or criticize conflicting, evidence which they may secure.

On the other hand, many investigators are content to limit their own efforts to the first of the steps of the process and to present their data for the consideration of others, leaving to some other or possibly later student the task of assembling all available data for the purpose of study of underlying causes or principles and of developing hypotheses and applications.

Either of these concepts of contribution to knowledge requires that the original research data shall be made available for the use of others. Formerly, this was fairly easily and satisfactorily accomplished by the publication of a "scientific contribution" which included in detail all the author's contributions to the problem in question.

In recent years, however, the volume of scientific research has increased so enormously that the problem of complete publication of its details has become extremely difficult. Scientific journals have multiplied in number with great rapidity and yet are unable to keep up with the demand for space. The "literature" of any single scientific problem is now so extensive as to be a tremendous burden to libraries and an almost insurmountable obstacle to comprehensive knowledge of even a narrow branch of science by any single individual.

There are two separate difficulties in the way of complete publication of original research data under present conditions. One of these is the enormous expense involved both in cost of printing and in subscription to and storage and cataloguing of scientific journals by reference libraries or individual scientists. The other is the fact that the great majority of the readers of any journal or article, under present conditions, have neither the time nor the inclination to examine the details of the individual observations or data which an author has accumulated and are much better served by a statement from him of the number of observations recorded; their maximum, minimum and average, with a mathematical statement, if possible, of the standard deviation, probable error and odds of significance of the observed data and his conclusions and comments upon the applications thereof.

But for the sake of the occasional student who wishes to examine critically the original data of an investigation or to compare these with other similar data accumulated by himself or others, these data ought to be available. At present, efforts are made to insure this through publication of data in full in scientific journals, etc., but with the serious difficulties of expense of publication and of library space and expense, and the inconvenience to uninterested readers which have been mentioned. These difficulties are becoming so great that many scientific journals are being compelled to refuse to publish lengthy papers giving full details of experimental studies. "Abstracts" only are becoming undesirably frequent publications. Many research institutions and individuals are finding it necessary to keep in their own files or vaults the original data and to publish only summarized conclusions therefrom. The risk of safe preservation of this material for any considerable length of time in such ways as are available in local institutions and the inaccessibility of the data for later use by others make this a very undesirable form of preservation of research data. Furthermore, photostat copies or some other form of mechanical duplication of original records are a more accurate and oftentimes more usable record of such data than are the printed pages of a bound volume of a journal. Their convenience is illustrated by the demand for "separates" of printed articles.

These considerations point clearly to the need for some general system of national or international repositories for such original scientific data, where they can be safely preserved and at the same time be made accessible either for study in place or for the mechanical production of copies to be sent elsewhere for critical study by the relatively few future users of such material.

It would seem that provision for such a service might be a proper function of the League of Nations, if its activities are to be directed toward the advancement of international good-will and understanding. Or it might be very properly provided by some of the international research organizations which are already in existence or in process of formation, if they can be endowed adequately to provide the necessary facilities

and expense of operation of this repository function.

A proposal is before the Congress of the United States which has for its purpose the establishment of a national "Hall of Records," where data and records accumulated by the several branches of the federal government can be safely preserved and made available for reference. If provided, this service could probably be extended by legal enactment to include many research activities which are now supported cooperatively by federal and state appropriations, and might possibly be made available to other research data. If this were done, the problem would be met to a considerable extent so far as American scientific research is concerned, but not for that of other nations.

This need has been considered by the division of biology and agriculture of the National Research Council and by it referred to the executive board of the council with the request that attention be given to possible means for meeting the need. It is to be hoped that careful consideration of the problem and some positive action looking toward its solution may be forthcoming in the not far distant future.

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PRESERVATION OF NATURAL AREAS

THE article on this subject by Mr. L. G. Rommel in SCIENCE for July 28, 1929, makes it seem timely to call attention to the following resolution passed last winter by the Ecological Society of America at its New York meeting:

WHEREAS, Owing to their situation in high if not actually mountainous regions the National Parks fail to include any areas exemplifying some of the most remarkable, beautiful and scientifically interesting types of forest characteristic of western North America; and

WHEREAS, No fine examples of the immense Sitka spruces, lowland white firs, cedars and others of the sixteen or more species of trees that in the forests of the northwest attain a height of 200 feet or more are being permanently protected, and no satisfactory sample tract even of the Douglas fir, the most important timber tree of that region of the continent, seems likely to escape the lumbermen; Therefore be it

Resolved, That the Ecological Society of America ought to invite the attention of the United States Forest Service to the importance, from a scientific point of view, of setting aside, for permanent preservation in their natural condition, the finest possible sample tracts of the various types of forest in the National Forests before the rapidly progressing utilization of the timber shall have rendered it impossible to save any but inferior examples. And be it further

Resolved, That copies of this resolution be sent to the Secretary of Agriculture and to the Chief of the United States Forest Service.

The Forest Service has recently announced the establishment of a number of reservations for the preservation of natural conditions, but unfortunately none of these fulfil the need that these resolutions point out. They are not forested, or contain only forest growth of inferior character, and as the cutting of such timber as they bear, grazing, not only of cattle but sheep, mining, irrigation and water-power developments, hunting and fishing, and camping by vacationists are not to be excluded, their value for scientific purposes as examples of areas in their natural condition may be questioned.

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INSECT NUTRITION

ON December 31, 1928, the *Transactions* of the Entomological Society of London appeared, containing a valuable paper by Mr. B. P. Uvarov, of the Imperial Bureau of Entomology, entitled, "Insect Nutrition and Metabolism." This paper was prepared at the request of the British Committee on Civil Research, through its subcommittee on dietetics. The author calls attention to the fact that most papers dealing with the nutrition of insects emphasize the morphology of the parts concerned but usually give scant attention to the actual physiological processes. For this reason, special attention is given in this paper to chemistry and physiology and not to morphology. The data are, however, presented from the standpoint of an entomologist. There is an excellent bibliography of over six hundred titles.

It is not the purpose of this note to attempt a summary of a summary, but it seems pertinent to call the attention of American entomologists to this important compilation. The author and the organizations responsible for this work are to be complimented on the work, which will be most useful to their colleagues on this side.

In the introduction, prepared by the secretary of the Committee on Civil Research, it is stated that copies of the original abstracts prepared by Mr. Uvarov have been deposited in two libraries in Great Britain, for the use of those interested. Through the generosity of the Committee on Civil Research, a set of these abstracts has now been received and deposited in the library of Cornell University, where they are available for consultation. Copies of these abstracts will shortly be available for distribution through the usual library exchange, and those interested should make application through a university or public library.

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NEW FOSSILS FROM MAINE

EARLY in June of this year the writer made brief visits to the slate quarries at Brownville and Monson,