ferent fields the opportunity to work together on the solution of a complex problem. We are in an age when the problems that can be solved by isolated individuals or groups are fewer and fewer. The era of cooperative attack is here. The applied field can provide both the specific problems around which specialists can rally to help each other and the means of support for an attack upon these problems.

It may be impertinent to ask whether a biologist really ever exists happily and successfully alone. It is probably not worth while to attempt to answer the question, but it may be worthy of passing comment. Like an active molecule, it is natural for a biologist to cleave to something. This does not destroy the usefulness or the value of a molecule; rather, it enhances its value. To be sure, there are molecules that exist uncombined with others, but it is the combined forms that are most helpful. Just so do biologists prosper when associated with or in symbiotic relation to medicine, plant and animal breeding, plant and animal pathology, agronomy, dairying, poultry husbandry, processing, canning, freezing, and scores of other fields.

Now we are approaching an era of public support for research such as that projected in the new Hope-Flannagan Act—support of gigantic proportions. Here is an opportunity and a challenge to both fundamental biology and agriculture. Agriculture needs the help of fundamental biology; without it, it will starve. Fundamental biology needs the support, the encouragement, the satisfying outlets, and the cooperative opportunities that agriculture can provide; without it, it may grow thin. Let us hope that a liberal attitude on the part of administrators in applied fields may prevail toward fundamental biology and that those in the fundamental field may find it attractive, worth while, and profitable to accept the encouragement, satisfaction, support, and opportunity for cooperative effort that the applied field can provide.

Possible Advantages of Cooperation Between Societies in Publication

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THERE SEEMS TO BE A RAPIDLY GROWing sentiment on the part of biologists toward some form of closer cooperation between the various societies—a sentiment based upon enlightened self-interest as well as upon a desire to contribute as fully as possible to the public welfare.

In the past, the tendency in biology has been toward disintegration. Those in the various fields of specialization have tended to work for the development of their own specialties to the neglect of the needs of biology as a whole. In so doing, they have failed to develop and support a more central and more general biological organization. One reason for this divisive tendency is the fact that biology is so diverse a field. The terminology and problems of one specialty are without meaning to many individuals in other specialties. There is not in biology, as there is in the fields of physics and chemistry, a large enough body of common knowledge and of common techniques to weld all biologists easily into a single, closely knit group. For this reason, biologists find it difficult to stick together; for this same reason, therefore, the need of cooperative effort and of organization is all the greater.

Although we biologists may speak many scientific languages, each being interested in matters unintelligible to many others, there is one thing that we all do in common. We all publish the results of our researches, and we all have to struggle with the problem of getting these results published promptly and economically.

That much can be done to increase the efficiency of our publications may be illustrated by reference to the situation I happen to know best—that of the *American Journal of Botany*. Financial reports of this journal from 1933 to date reveal some interesting facts. The average yearly income of the journal for the years 1936–44 was only slightly more than that for the years 1933–35, and the disbursements were only slightly less. We may say that these items have remained fairly constant. Nevertheless, with essentially the same income and expenses, the *American Journal of Botany* has, since 1936, achieved the following remarkable advances:

(1) It has increased its cash reserves 1,000 per cent.

(2) It has published, on the average, almost twice as much material per year since 1936 as in the years immediately preceding the reorganization (an average of 4,900,000 characters per annum vs. an average of 2,570,000).

(3) It has greatly decreased the time for publication of a paper, which averages at present between four and five months from date of receipt to date of publication, as

opposed to an average before 1936 of one and sometimes two years.

In short, with almost the same income and outgo, it has doubled its output, has reduced the time of publication to about one-fifth, and has increased its reserves by a factor of 10. This shows what can be accomplished when those who guide the destinies of a journal undertake to discover ways to increase its efficiency. Many other journals would, no doubt, benefit greatly by a similar study.

Dr. Griggs has kindly placed at my disposal a chart analyzing some 22 biological publications, plus a few general scientific or popular magazines, from the standpoint of efficiency of publication. A striking difference among the various journals in the list suggests that some journals may be printed more efficiently than others.

Let us consider, for example, the simple matter of the proportion of the page devoted to textual material. In *The Reader's Digest*, about 69 per cent of the page is occupied by printing; in *Time*, about 72 per cent. In one botanical publication, 67.1 per cent of the page is so occupied; in another, only 45.2 per cent. Then there is what Dr. Griggs calls the "index of economy"—the numbers of characters per unit area of page surface. The index for *Time* is 102; that for *The Reader's Digest*, 78.9. For one botanical journal it is 78.6; for another, it is only 43.8. One botanical journal thus has an "efficiency index" almost twice as high as that of another botanical journal. Obviously, much more remains to be accomplished in the direction of increased efficiency. These may be only minor items, since cost of paper is not of major importance in the total cost of publication. They suggest, however, the possibility that differences of greater importance exist among the various journals with respect to economy of publication.

It seems to me that development by various societies of a cooperative program of publication would be one of the best ways in which to bring about increased efficiency and to promote economy. I would suggest that such a joint program might involve two steps:

(1) A joint study might be undertaken of formats, typography, printing contracts, and other matters with a view to arriving at a plan that would result in maximum economy of publication with minimum fatigue to the reader.

(2) The societies might arrange to have their journals printed by the same firm, possibly under a joint contract. By standardization of printing specifications, the cost of printing could, no doubt, be greatly reduced. Consolidation of the business offices of these societies might result in further economies. Editorial policies would not be affected by such arrangements. Each society would continue, as at present, to control through its editorial board the rejection and selection of material.

I have seen correspondence between Dr. Griggs and a printer who, at the time of this correspondence, was publishing some 48 technical journals. It was the judgment of this printer that the joint publication of a group of journals with uniform format, typography, paper, and cover would save the participating journals up to 30 per cent in publishing costs. If the societies publishing these journals were also to give their accessory printing business to the same printer, the cost would be further reduced.

That this is not idle speculation is shown by the experience of the American Institute of Physics, which publishes 8 journals through a joint business office and a single printer. Some of these journals were losing large sums of money prior to the establishment of the Institute, but all are now in flourishing condition.

The possibility that biological journals could be published more economically by the cooperative effort of a number of societies should be thoroughly studied. It is only one of many advantages that might be derived from joint action, but it might prove to be one of the most tangible benefits to accrue from united effort.

What sort of cooperative organization might be set up to accomplish this and other benefits? Two proposals have been made for action on the part of botanists: (1) to establish an institute of botany; (2) to join in the organization of an American Institute of Biology. It is certain that botanical societies and botanists individually cannot support two such organizations. They will have to choose between them. If an institute of botanists were established, it would weaken an Institute of Biology if this were also set up. It might also result in the establishment of an "American Institute of Biology" that would include zoologists but not botanists—a situation that might prove to be very disadvantageous for the botanists.

It is my suggestion that the botanists do everything possible to aid in the studies which must precede the establishment of an American Institute of Biology; that they strive to bring out the sort of organization which will function most effectively in the furtherance of the work and welfare of both botany and zoology. If an Institute of Biology cannot be established on an effective basis, then will be the time to consider the formation of an American Institute of Botany.

Representatives from 27 national societies in the biological sciences, meeting together recently as an Organizing Board, have undertaken to solicit adherence to the American Institute of Biological Sciences from their respective societies as advocated, and the Institute is to be set up within the framework of the Division of Biology and Agriculture of the National Research Council, which is financing the preliminary Organization. H. B. Steinbach, Washington University, St. Louis, with headquarters at the NRC, is acting as executive Secretary during the period of organization.