SCIENCE

FRIDAY, APRIL 18, 1919

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MSS. intended for publication and books, etc., intended for review should be sent to The Editor of Science, Garrison-on-Hudson, N. Y.

THE BOTANICAL OPPORTUNITY[1]

WHEN this program was arranged, it was intended to bring to the attention of botanists how they could serve the nation in the crisis of war. Committees had been multiplied to do various kinds of necessary work. The results were not all that we had hoped for, but botanists were beginning to find themselves, and organization was gradually becoming more effective, because the spirit of cooperation was developing. Enough results were obtained to prove that botany could be of great service at a time of national need. The practical results were not so conspicuous to the public in the immediate activities of the war as those of chemistry and physics for example, but they were fundamental and far-reaching, looking to future as well as to present needs. We must recognize that to bring into effective cooperation great numbers of isolated, scattered, and sometimes conflicting units, takes time and a great controlling motive. But we were making progress, not so rapid as the impatient desired, but probably as rapid as human nature permitted.

Now that the emergencies of war have passed, shall we stop this kind of progress? I wish to attempt to answer this question. In doing so, I shall not formulate any plan, any scheme of organization, but shall present in brief general statement what seems to me to be our opportunity. The other speakers upon the program will doubtless present more concrete suggestions, for which I hope my statement may be an appropriate background.

In connection with the period of reconstruction, there has come to the science of botany a great opportunity, and botanists must rise to the occasion. It is a critical time for our science, for we may lapse into our former state and become submerged by more aggressive

[1] Invitation paper before the joint meeting of botanists at the Baltimore meeting of the American Association for the Advancement of Science.

sciences that will rise to the occasion. This will certainly be our fate unless we make a determined effort. You realize that at the present moment the scientific study of plants is more fully recognized as a great public service than ever before in the history of botany. The recent pressure for food and for a wide range of plant materials and products has been met in the main, not by so-called practical men, but by trained botanists. Not only the practical government service, but also many industries are calling for botanists with fundamental training, realizing as never before that progress is based upon research.

It is the same great opportunity that came first to scientific medicine, through its appeal to the human interest; and later to chemistry in its relation to various industries. It is the appeal of *usefulness,* the appeal that always results in greater opportunity.

A response to this opportunity for public service does not mean *less* science, but *more* science; but it ties up our science so closely to the human interest that it will be in large demand. We are on the rising tide of the greatest demand for trained botanists we have ever known, and it is our task to see to it that the tide does not ebb and leave the profession stranded. If we respond, the opportunities for research will be greater than ever before, as they always are when a science is recognized as of large service. The present endowment for botanical research in universities and in certain industries are as nothing compared with what they will be presently, provided we equip men and women to take advantage of them.

It was my privilege during the war to be present at a meeting of so-called "captains of industry," who were being informed of the contributions that the various sciences could make to the public welfare. The general impression was voiced by one of the auditors in this statement:

> It is obvious that all of our progress in the past has been based on science, and that all our hope of progress in the future must be based on science. It is high time that we begin to pay our debts and give science greater opportunity.

My purpose is to indicate certain things we must stress in ourselves and in our students if we are to rise to the opportunity.

1. *The Synthetic View.*—As we all know, botany has developed many fields of research, and as these fields have multiplied, botanists have become more and more segregated into groups; in fact, in the history of botany we have just been passing through the phase of the *analysis* of our subject. When I began, botany in this country was only taxonomy, and all botanists were interested in the same thing. Then the splitting of the subject began. Different phases gradually became better and better defined, and in consequence more rigid. Presently taxonomists came to know little of any other phase of botany; then morphologists came to know little of taxonomy and to care less; then ecologists and physiologists began to segregate from the rest of us and to narrow their interests, and so for each segregate in turn.

The development of research increased this narrowing process, for it deals with special regions of a general field. For example, in research there came to be as many kinds of morphologists as there are great groups of plants, and so for other fields. This analysis was inevitable and desirable, for it developed technique, the essential equipment for research.

Now, however, the movement is in the other direction. We are passing from the *analysis* of our subject to its *synthesis,* and it is this synthesis that is being called for by the new botanical opportunity. The synthetic view recognizes, not the rigidity of separate fields, but the cooperation of all fields. Every phase of botany must be focused opon our important problems, for we recognize now that every important problem is synthetic. Our superficial separate problems that we have been cultivating have introduced us to the fact that nature is a great synthesis, and must be attacked synthetically. In the days ahead, the botanist who remains narrow will be stranded. We must recognize in every field of botany an important factor in the solution of problems. A man is expected to think

his own field the most important, but if he thinks other fields *un*important, he has blocked his own progress, and is bound to move in ever narrowing circles.

One of the demands upon us, therefore, is to cultivate the synthetic attitude of mind; to develop about our own specialty a penumbra of the botanical perspective. In other words, botanists must cease to be provincial; they must not be citizens merely of one small group, with no larger contacts, but citizens in the world of science. We must not remain persistently in the narrow valley in which our work lies, but we must get on to the mountain top often enough to realize the perspective.

2. *The Practical Outlook.*—The new opportunity demands this; in fact, it was this that created the new opportunity. This means that we are to see to it that botany is recognized as the greatest field for universal service. Medicine holds that position now in public estimation, simply because it ministers to the unfortunate, but they are in the minority. Botanical research underlies an essential ministry to all. Disarticulation of botany from its practical applications has been most unfortunate, and must not be continued. For example, to segregate botany and agriculture as two distinct fields is to damage both; a mistake that our recent experience has emphasized. The result has been that botany has not contributed to agricultural practise as it should; and agricultural practise has not called upon botany as it should. The same is true of the other industries that involve plants. We must recognize that *every* investigation is of possible practical service, and that *every* practise is of possible scientific suggestion. What we have failed to do is to establish the contacts between science and practise, to indicate the possibilities of every advance in knowledge in the way of public service.

This is very far from meaning that every investigation should have an obvious practical application. Research must be absolutely free, stimulated only by its own interest in advancing knowledge, but the importance of fundamental knowledge in solving practical problems should be emphasized at every opportunity.

Our recent experience in connection with emergency problems has shown that no field of botanical investigation is so remote from practical needs that it can not make its contribution if necessary. For example, taxonomy was called upon for information as to new geographical sources and new plant sources for raw products; vascular anatomy was asked to contribute its experience in solving some very important timber problems; ecologists were urged to organize their knowledge so as to be serviceable in relating the suitable crops to soil and climate; physiologists were constantly contributing information as to the possible control of processes essential to plant production. Pathologists did not need so much to demonstrate their usefulness, for their results are obviously practical, and for this very reason it is easier to secure opportunities for research in pathology than for any other of these fields of research. It is not a question of becoming *practical,* but merely of establishing connections that are obvious to the investigator.

We must emphasize, therefore, the connection between what have been called pure science and applied science, which have too long been pigeon-holed into separate compartments. Upon a previous occasion I have emphasized this relationship as follows:

> All science is one. Pure science is often immensely practical, applied science is often very pure science, and between the two there is no dividing line. They are like the end members of a long and intergrading series; very distinct in their isolated and extreme expression, but completely connected. If distinction must be expressed in terms where no sharp distinction exists, it may be expressed by the terms "fundamental" and "superficial." They are terms of comparison and admit of every intergrade. In general, a university devoted to research should be interested in the fundamental things, the larger truths that increase the general prospective of knowledge, and may underlie the possibilities of material progress in many directions. On the other hand, the immediate material needs of the community are to

be met by the superficial things of science, the external touch of the more fundamental things. The series may move in either direction, but its end members must always hold the same relative positions. The first stimulus may be our need, and a superficial science meets it, but in so doing it may put us on the trial that leads to the fundamental things of science. On the other hand, the fundamentals may be gripped first, and only later find some superficial expression. The series is often attacked first in some intermediate region, and probably most of the research in pure science may be so placed; that is, it is relatively fundamental, but it is also relatively superficial. The real progress of science is away from the superficial toward the fundamental; and the more fundamental are the results, the more extensive may be their superficial expression.

It is this situation that we must drill into our students, into ourselves, and into the community.

3. *Cooperation in Research.*—One of the most important by-products of the war has been the proof that if a nation is to develop its maximum strength and efficiency, all of its citizens must join hands and work together; in other words, competition must give place to cooperation. What is true of a nation is true of a science. Our isolated, more or less competitive investgations have resulted in a certain amount of progress; but it has been very slow compared with what cooperation would have secured. The important problems to-day are either too complex for the training of any one investigator, or they call for too many data for one investigator to secure, at least in a reasonable time. In the first case the problem is attacked sporadically from one aspect and then another, the attacks entirely unrelated to one another, and the result is a débris of unorganized results that is more apt to leave the subject in confusion than to clarify it. In the second case the data are either insufficient or are accumulated by an indefinite succession of investigators, probably under fluctuating conditions. As a result, both time and accuracy are sacrificed. Intelligent cooperation would clear up both of these situations and in a comparatively short time reach results that are fairly clear and accurate. Of course, effective cooperation is not possible unless it is voluntary.

This suggests what is probably the most serious obstacle to any general adoption of the cooperative method. We have worked so long in our isolated way in a kind of monastic seclusion, that we have come to regard our problems as personal property, and feel a sort of resentment if any other investigator ventures within our territory. This means that, perhaps unconsciously, we are more concerned with our own personal credit than with the solution of the problem. If our old method has developed this attitude of mind among investigators, it is high time to change it and to realize that research is to advance knowledge, and is not for self-glorification. What the science wants, and what the world wants, is *results,* as quickly and accurately as possible. If we can not be large enough to put truth above ourselves, the outlook for botany is discouraging.

The spirit of competition between individuals is depressing enough, but when it extends to competition between research establishments it is worse. This spirit of aloofness is the more emphasized between institutions that deal primarily with practical questions and those that deal primarily with fundamental research. For example, why should not the investigators of our universities be called upon freely by the Department of Agriculture for the help their training can give; and why should not the university investigators draw freely upon the immense store of practical experience that the Department of Agriculture has collected? Neither set of establishments can do all that is necessary. If each remains in relative isolation, absorbed by its own self-confidence, both science and practise will suffer. Such artificial barriers of self-sufficiency to full cooperation should be broken down that our science and its applications may be free to develop normally. To speak physiologically, we must remove the inhibitions, personal and institutional, and give the stimuli a chance.

In conclusion, if I may venture a prophecy, it would be that if in response to the great

opportunity that has come to us, we shall pledge ourselves to be synthetic rather than narrow in our point of view, to emphasize the possible practical connections of botanical problems, and to submerge our personal and institutional temperaments in a spirit of general cooperation to secure results, botany will come to be recognized as a great national asset, and research will enter upon a new era.

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PSYCHIATRY AND THE WAR

THE influence of the war upon psychiatry in Great Britain has been profound and shows itself in many different directions. A most important effect has been to draw psychiatry into closer relations with neurology. As an indirect result of the stringency of the lunacy laws there had come into existence in Great Britain a state unknown in other countries, in which a deep gulf existed between those who deal with the insane and those who treat the neuroses, the latter affections usually coming under the care of physicians otherwise occupied with the treatment of organic nervous disease. This gulf has been largely bridged as a result of the war. Both groups of practitioners have been called upon to deal with the enormous mass of psycho-neurosis which the war has produced, with the result that the outlook of each has been greatly widened.

One, and perhaps the most important outcome of this combined activity has been the general recognition of the essential part taken in the production and maintenance of the psycho-neuroses by purely mental factors. In the early stages of the war especial stress was laid on the physical effects of shell explosion, an attitude which found expression in the term shell-shock. As the war has progressed the physical conception of war-neurosis has been gradually replaced by one according to which the vast majority of cases depend on a process of causation in which the factors are essentially mental. The shell explosion or other catastrophe of war, which forms in so many cases the immediate antecedent of the illness, is only the spark which releases deep-seated psychical forces due to the strains of warfare. It has also become clear how large a part is taken in the causation of neurosis by physical factors which only come into action after the soldier has been removed from the scene of warfare.

Not only has war-experience shown the importance of purely mental factors in the production of neurosis, but it has also shown the special potency of certain kinds of mental process, the closely related emotional and instinctive aspects. This knowledge is already having, and will have still more, profound effects upon the science of psychology. This science has hitherto dealt mainly with the intellectual side of mental life and has paid far too little attention to the emotions. Students of certain aspects of mind, and especially those engaged in the study of social psychology, were coming to see how greatly psychologists had over-estimated the intellectual factor. The results of warfare have now compelled psychiatrists to consider from the medical point of view the conflicts between the instinctive tendencies of the individual and the forces of social tradition which workers in other fields have come to recognize as so potent for good and evil in the lives of mankind.

Closely related to this movement is another which has led those dealing with the psychoneuroses to recognize far more widely than hitherto the importance of mental experience which is not directly accessible to consciousness. Warfare has provided us with numberless examples of the processes of dissociation and suppression by means of which certain bodies of experience become shut off from the general mass making up the normal personality, but yet continue to exist in an active state, producing effects of the most striking kind, both mental and physical.

An interesting by-product of this increased attention to the instinctive, emotional and unconscious aspects of mind has been a great alteration in the attitude of psychiatrists to-