

# NATURE

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## LOOKING FORWARD

THE announcement of the official cessation of hostilities with Germany overshadows all other considerations. As we have been frequently reminded, we are by no means at the end of our perilous journey; but we can at least rejoice soberly in the accomplishment of one stage of it, and that a stage which has been fraught with the direst danger. When we look back over the past six years, no one can but be amazed at the achievements of peace-loving peoples against an enemy who over a period of years devoted himself to preparations for war.

Much of our success has been due to the efforts of scientific and other professional workers, who were swift to respond to the call for their services. Throwing aside their normal occupations—in industry, the universities and elsewhere—even before the outbreak of war they put themselves individually at the disposal of the country. Through the Central Register, a most valuable body of information on the scientific and engineering man-power resources of Britain was voluntarily compiled, which has made possible the staffing of the large number of war-time factories necessitated by the scale and diversity of needs of modern war. Moreover, the general public has not been unaware of, or ungrateful for, the contributions made by science to the task of defeating the enemy; indeed, there have been times when it has been necessary to check public enthusiasm and to remind people at large that science alone could not achieve a decision. In the Press and in addresses in the Houses of Parliament and elsewhere, there have been many sincere tributes to the effectiveness of the application of scientific knowledge and methods in the most unexpected fields. The reason for this outburst of enthusiasm for science is clear enough, but it is a reflexion upon the general scope of education in Britain—and also upon scientific workers for their lack of missionary zeal—that such achievement should apparently come as a surprise to a majority of the people.

It may not be out of place even here to indicate very briefly some of the noteworthy advances in knowledge which have been brought to public notice during the War. Radiolocation and other developments in radio communication immediately come to mind, in spite of the fact that it has not been possible to publish much definite information on the subject. Happily much of the work in this field of electronics has obvious applications for the days of peace. The development of aeronautics, both as regards power-driven machines and gliders, has been equally striking. Aeroplanes of a size which would have been regarded before the War as possible but highly unlikely within several decades are now almost commonplace, and great fleets of a thousand or more operating as a unit are being used. But beyond great increase in size and speed of the individual machine and of the operational unit, there is a host of ancillary services, each of which can make a contribution to post-war progress. Air navigation, by night and by day, has become as precise as sea



navigation, and both will benefit from the increasing sureness of radio communication. The significance of the enhanced power and reliability of internal combustion engines requires no emphasis; and the development of a new prime mover, the jet propulsion engine, though particularly associated in the minds of most people with the 'flying bomb', will have its place in the aerial transportation of the future. Meteorology has been amassing data the importance of which can only be surmised; it is sufficient to note that trans-Atlantic flights in both directions have become matters of routine.

In the medical field there have been equally noteworthy achievements. Turning again to problems connected with the aeroplane, it is noteworthy that much progress has been made in connexion with high-altitude flights. As regards more strictly medical matters, mention must be made of the extended use of the sulpha drugs, and also of the applications of penicillin; between them, there is little doubt that the sulpha drugs and penicillin have been the means of reducing substantially the number of fatalities from war wounds. Great progress has been made, as is usual in such times, in the surgery of war wounds, and also in the treatment of burns. Blood transfusion has been carried out on a scale never previously contemplated, and has led to much important new work on the constitution of the blood, the factors it carries and their significance in inheritance. Considerable importance is also attached to the discovery of new insecticides, of which D.D.T. is probably best known.

Food technology has also received a great stimulus. The drying of milk and eggs was carried out on a commercial scale before the War, but the cutting off of supplies of fresh eggs from the Continent, and the great curtailment of shipping space, have increased the traffic in the powdered products by an extraordinary amount, until they have become part of our regular rations. Valuable knowledge has also been acquired in the preparation of concentrated foods.

Perhaps more important still is the opportunity which enforced rationing has given of seeing that the nation, as a whole, has had available a diet which medical statistics have shown to be very satisfactory from the point of view of physical health. In this connexion it is interesting to note that, probably for the first time, certain imports have been deliberately regulated as to kind and quantity in accordance with scientific data derived from nutritional studies.

More purely social studies also come into the picture. The paucity of knowledge on population movements and their effects became evident on the outbreak of war, with the ill-conceived but well-executed evacuation of the children of London and other big cities. As a piece of organization the operations were successful, but too little attention was given to the human element, with the result that a steady drift back to the cities quickly set in. The transfer of industries to safer areas was more successful, perhaps of necessity, but brought in its train many difficulties which ought at least have been eased by deeper knowledge of social trends. The data thus painfully acquired will be of

considerable value to future studies of population movements and mass psychology. War-time study of munition workers and others has also provided useful material in the field of health in industry, and has amply justified the investigations of the Industrial Health Research Board, which originated from similar investigations undertaken during the War of 1914-18.

Enough has probably been said to remind readers that many scientific developments of first-rate importance have taken place during the War. But it must not be imagined that we have any desire to extol war, or even to credit it with additions to knowledge. The developments referred to above were inherent in the progress of science; the War has provided almost unlimited financial support, increased opportunities and the stimulus of public interest born of the nation's peril.

Turning now to the immediate future, and even confining ourselves to strictly utilitarian considerations, there is still a multitude of tasks ahead for scientific workers, from the highest levels to the lowest. In these columns it is not so necessary to stress their part in promoting the well-being of the community, and in industry and commerce, though this is of high importance. We have in mind rather the problem of the control of Germany in the post-war world; and we stress the point because even men of science themselves may not realize the extent to which a just but effective control will depend on scientific knowledge and method. That the multitude of problems should be approached in a scientific manner by assembling the data and determining action on the impartial consideration of the whole need not be emphasized. Even in the political field, there are problems of mass psychology on which scientific men should be able to provide valuable guidance. In the control of industry, the influence of the man of science and the engineer is more obvious. Indeed, it is not too much to say that without scientific knowledge it is impossible to devise adequate controls, and policy-making in this field must be largely in the hands of scientific men. Some of the possibilities were indicated in an article in *Nature* of April 24, 1943, p. 455, referring to the control of 'key' chemicals, and reference was made to the difficulty, for example, of effectively separating the fertilizer from the explosives industries.

Then again, adequate control of the manufacture of fine chemicals in Germany will be necessary. Some may go so far as to say that it must be suppressed; but it would be better to ensure that the undoubted abilities of German chemists in this field should be used, not for flooding other nationals' markets to the exclusion of local products and creating world-wide monopolies of strategic and commercial importance, but for the good of mankind. The problem is a difficult one, and should not be dismissed without careful consideration.

Even in the munitions industries it is only the final stages of the products that are specifically connected with war. In their engineering, metallurgical and chemical aspects, they are inextricably mingled with agricultural and other industries. Thorough appreciation of the scientific basis of these



industries is necessary in order to formulate measures of control, and more than a superficial acquaintance with physics and chemistry will be required to supervise the controls imposed. Chemical industry should not be entirely suppressed, for that would not only lead to additional unemployment, directly and indirectly, but also to the increased dependence of Germany on imports; and that at a time when the utmost strain is being imposed on the United Nations to supply their own needs in the agricultural and industrial fields. Again the problem is an intricate one, which will require careful discussion in the light of all the known facts.

The fact that the Government has been asking for civilian recruits with various grades of scientific and engineering knowledge for service in Germany after the War in Europe ends indicates that there is appreciation in Government circles of the part that scientific men can play. There can be no question that their services, provided they are not unduly constrained by the administrative and military machines, will be of vital importance in the control of Germany.

Enough has probably been said to show that scientific workers have played a full part in the prosecution of the War, and that they must be intimately concerned in the years to come in dealing with numerous problems arising directly out of it. In addition to such *ad hoc* activities, it is generally conceded that science must take an ever-increasing share in the promotion of peace-time industry, and that ample provision must be made for that form of research which is perhaps best described as the pursuit of knowledge for its own sake.

The broad outlines of the strategy and tactics of research in Great Britain during the years to come were outlined in a series of six articles on "Scientific and Industrial Research" published in *Nature* last autumn, and the main points are worth repeating. Strategy is the premier consideration, for it must determine the general programme, and it will obviously involve decisions on policy at the highest levels. The whole educational system of the country is involved, in that it will decide the quality of the personnel who will carry out research, while the nation must be able to appreciate the significance of the work scientific men do and the way in which they approach their tasks. No rigid dividing line should, or indeed can, be set between so-called pure and applied research; and increased facilities should be made available for the interchange of personnel between the universities, industry and Government service. The recent foundation of senior fellowships in science in the universities, where those appointed will combine research with a certain amount of teaching, is probably a most valuable step in the right direction. This leads inevitably to the consideration of the position of the universities in the post-war world. Expansion there must be, but radical innovations would not appear to be needed; the universities must continue to be, fundamentally, communities of teachers and students, where knowledge is sought for its own sake, as well as for its value as a preparation for a particular task or mode

of livelihood. In particular, they will be expected to provide opportunities for the development of the qualities required for leadership.

It is, of course, premature to attempt to foresee the optimum number of research workers in advance of the actual programme of research. But some consideration of subjects is not out of place. Thus it is already realized that both biology and geology will require many more trained workers than are at present available, and the universities will have to make corresponding preparations. Social biology is a relatively new and actively growing subject which will demand consideration. Re-allocation of research effort between the various sciences may become an urgent necessity; this will clearly involve machinery for the co-ordination of research in the universities and elsewhere. The British tradition favours evolution, and it is to be expected that existing institutions and methods, where they have proved successful, will be developed and extended. New institutions will obviously be necessary; but flexibility is of prime importance. The increase of State assistance to the universities must not be allowed to encroach on their independence. As regards research in Government institutions, there is at present insufficient correlation of effort between the various bodies, and there should be provision for associating it with advances in the fields of social science and economic science. Research carried out by industrial firms is more difficult to organize, but the suggestion from industry itself of a central co-ordinating office is worth careful consideration.

In any discussion of the future of scientific and industrial research, prominent consideration must be given to the improvement of conditions of service. By this is meant not salary alone, but also questions of status, publication of the results of research, superannuation, interchange of staff between university, Government and industrial institutions, and so on. Here the professional institutions can play a leading part; for they have among their members the varied knowledge and experience which will be invaluable in formulating codes of professional conduct and related matters (see also *Nature*, December 2, 1944, p. 693).

This cursory survey of the present achievement and future significance of science has ended, as it began, with the human element. This has been thought necessary, because it is on the personality, integrity and devotion of the man of science that so much will depend. Never has science stood so high in public esteem; never have the efforts of scientific men been so widely appreciated and acclaimed. Science has been accorded—and willingly accepted—a foremost place in the highest councils of the nations; it must continue in that place, and by its influence justify the faith the peoples have grown to have in it. The key to the present and the future is unremitting vigilance and purposeful activity. There must be no slackening of effort, no relaxation of standards. Rather must the present thanksgiving be a spur to additional exertion, in the sure knowledge that we are building on a tried and stable foundation a new and progressive world order.