look in vain to our universities and other institutes of scientific research.

Over a period of several years, these centres of research have responded admirably to the call for aid from refugees from divers countries. Many such aliens have now been inevitably interned. Our French colleagues constitute a different category. Everything must be done to help them, though we fear that the terms imposed upon France will preclude most French men of science from leaving their country and continuing their work in that atmosphere of freedom which still prevails in Great Britain, and for which all British and all free French will continue to work and fight.

SCIENCE AND THE WAR EFFORT

SOON after the present Government took office, the Minister of Supply, Mr. Herbert Morrison, made a powerful appeal for intensification of effort in the production of munitions and other commodities, in the course of which he used a phrase, "Go to it", that has already become a slogan. He asked for speeding up of manufacturing processes, the over-riding of trade customs and the hard-won privileges of the trade unions, and in general the subordination of everyone and everything to the supreme task of winning the War. The military disaster in France has accentuated our need. From now on, Great Britain is the immediate target, and the need for munitions to replace losses in France, as well as to provide for the needs of the future, should require no emphasis.

The immediate demands of our war effort upon scientific workers and other technical experts are, of course, for the provision of the skilled work of control, in the testing of materials and products, and in the supervision of processes to ensure that the production of munitions of war, whether of explosives, guns, tanks, aeroplanes, war-chemicals or other products is smoothly, efficiently and safely maintained. This demands the continuous scrutiny of existing products and processes with the view of improving them and of replacing them by others superior to those used by the enemy.

All this, however, is only the first and possibly the least significant part of the contribution of science, great as are the demands it makes on the scientific worker for untiring accuracy, patience and skill. The nation's production of armaments must in some measure be related to the natural resources available. Unless the fullest possible use is made of these, we may be wasting our reserves of man power, of transport, or of foreign exchange.

It is difficult indeed to visualize the many ramifications here involved. The most effective utilization of coal, for example, affects not merely the manner of burning raw coal, its carbonization or conversion to coke or gas, or the generation of electric power. The by-product position has to be considered with reference to raw materials which it provides for explosives or other branches of chemical industry. Questions of atmospheric pollution and the like are also linked up with this question of efficient utilization of fuel, and it needs little imagination to visualize the reactions upon public health, problems of transport and the location of industry.

The importance of the scientific contribution is equally important in regard to questions of crop production. The decision as to which crops attention should be concentrated upon involves not merely an accurate knowledge of soil and climatic conditions, questions of shipping space, the interlocking of export policy and exchange reserves. It is linked up also with the whole policy of agriculture and food supply.

The importance of this latter question has been repeatedly stressed of late by Sir John Orr, Sir Daniel Hall, Mr. C. S. Orwin and others, who in the daily Press and elsewhere have stressed the necessity for a scientific policy of food production and directed attention anew to the valuable services rendered during the War of 1914–18 by the Food (War) Committee of the Royal Society. Their arguments have since been strongly endorsed in the Fourth Report of the Select Committee on National Expenditure, which expresses serious doubts as to whether sufficient use is being made of scientific research in regard to the wider issues in planning of food policy, such as the allocation of sugar or the planning on the basis of the fullest scientific study of a ration adequate in calories, etc., at a less cost in shipping and external currency than with the present normal form of diet. At present there is evidence that allocations of supplies are being made on the basis of a rough

and ready compromise between various interests, and not on the basis of a plan scientifically devised in the interest of the country as a whole.

The problems of scientific discovery and progressive industry must be of paramount importance in our war effort. Ultimately such problems, of course, resolve themselves into the effective utilization of natural resources—the adaptation of industrial processes and methods to provide the products required by a war-time economy, whether to meet the demands of the Fighting Services, essential civil needs or the requirements of the export market, from the raw materials available under war-time conditions. Equally urgent is the question of developing or expanding processes for products which previously have been imported in whole or in part from countries which are now cut off. Such development or expansion may involve in the first instance intensive scientific research; for example, in the field of medicinals it may be necessary to elaborate processes for products which are urgently required to meet immediate war needs. Other scientific work may be required for the production of scientific apparatus on a much larger scale, or for the supply of products such as dyestuffs to seize the opportunities in export trade which have been opened to us by the blockade.

In the main, such problems are already being tackled by industry. There must, however, be continuous improvement both of our products and processes in the light of new knowledge, whether for offensive or defensive purposes, the service of essential civil needs or the export market, to establish an overwhelming superiority over those used by the enemy. This is a matter which involves the most effective utilization of our whole structure for fundamental as well as industrial research, and the bringing into the service of our needs that creative intelligence which is one of our greatest assets, as it is one of the great values in the heritage which we are defending. Here, above all, scientific workers must make their main contribution, not merely in the skill and resource with which they grapple with the immediate problems confronting them, but also in visualizing new problems and in organizing the most effective mobilization of all the resources of scientific knowledge or personnel to serve our myriad needs in this desperate struggle.

Nor is this merely a matter for the application of scientific knowledge and methods on the production side of industry alone. Science has almost equally important contributions to make in perfecting our methods of civil defence, in the mitigation of strain imposed by such conditions as the black-out or evacuation measures, and in safeguarding the health of the industrial workers and indeed of the whole civil population.

If we are to secure the maximum output from our mechanical equipment, very careful attention must be given to such questions as hours of work, canteens, rest periods, and the organization of holidays, so as to avoid interruption of output or throwing a strain on transport. The report already issued by the Industrial Health Research Board on industrial health in war has emphasized the dangers to efficiency as well as to health which may result from excessive hours or continuous work without intervals for rest, and from failure to give adequate attention to such matters as lighting, ventilation or accident prevention, as indicated in the experience gained in this field in the War of 1914–18. A letter from the Association of Scientific Workers on p. 1024 of this issue refers to this question, and recent utterances of the Minister of Labour and the appointment of a Factory and Welfare Advisory Board shows that the difficulties are appreciated.

Other problems, too, call urgently for scientific management. Such methods offer the best way of securing the more rational distribution of orders, increasing the mobility of labour and operating an efficient system of priority. Equally they play an important part in training the new workers required by industry for war purposes and in discovering, for example, just what kinds of skill can be acquired by intensive methods of only a few weeks duration. Technical education demands attention, for the training of highly skilled and responsible men in industry is a long-period problem, which must not be overlooked although the main and immediate problem of training is concerned with the hundreds of thousands of machine operators who are already needed.

If the tremendous drive in our industrial war effort to which we have been summoned by the Minister of Supply is to reach its full effect, it must be based on scientific knowledge and guided by scientific methods at all stages, in the planning of policy, in the development and in the control of processes and products. The contribution of scientific workers will demand the utmost vigour of creative thought and fundamental research, no less than the intense prosecution of the team-work characteristic of industrial research.