

THE NATIONAL RESEARCH COUNCIL

By VERNON KELLOGG

WHILE engaged with the work of Mr. Hoover's relief commission in German-occupied Belgium and France in 1915 and 1916 it was my peculiar privilege—and necessity—to live for several months at the German Great Headquarters in Charleville and to make many visits on matters of relief diplomacy to the headquarters in other months. Under these circumstances I came naturally to make the acquaintance of numerous important officers of the German General Staff, and to have much frank talk with them—with some of them at least. Now while this talking with the staff officers was not chiefly devoted to a discussion of science it touched so often on one particular matter of science that this matter will ever remain one of the outstanding indelible memories of these extraordinary conversations and experiences. And reference to it now will serve very well to introduce this present account of the National Research Council.

Whenever German victories were interrupted for a few days or weeks, or, as in the latter part of the period of my relations with the headquarters, were replaced by grudgingly admitted Allied successes, the officers of the General Staff had one unfailing solace. "All right," said they, "our scientific men will give us something new. They are all at work; their work is all organized so as to meet any emergency; just wait until next week or next month and we'll have something to make your eyes stick out." This is admittedly a rather free translation of what they said, but it conveys the meaning of their boasts. And they were not idle boasts. The organized scientific men of Germany did make the world's eyes stick out several times during the war. So at Great Headquarters there was always a confidence which

the spectacle of nation after nation allying itself to Germany's enemies would otherwise have made difficult to maintain. It was the confidence in Germany's organized science. And it was necessary before the war could be won to meet German science with English and French and Italian and American science. We and the Allies had to organize science, too, and, with a haste made desperate by necessity, it was done.

Stimulated both by the revealed need and by the realized possibilities of coordinated scientific attack on problems presented by the war, America and the Allies have taken steps to provide for a continuing encouragement and support of organized scientific research for the sake of an increased national strength and well-being. Scientific advance has a direct relation to national welfare and national progress. Although the World War has ended there is going on, and there is to go on continuously, a silent and less spectacular, but hardly less important or fateful warfare of each nation with disease and food lack and refractory natural conditions and of nation against nation in industrial and general economic competition. In all of this warfare science, both in its application and fundamental principles, plays, next to the racial qualities of the people, the preponderant role.

It is little wonder then that the illuminating revelation made by the war of this really basic importance of science in national strength has led to serious attempts by the more forward and understanding nations to put themselves in the way to take greater advantage than heretofore of their scientific resources, both of personnel and material. Great Britain, France, Italy, Belgium, Japan and America have all taken special steps to continue and to extend their scientific mobilization and organization for the new period of national reconstruction and international economic competition, and to be ready for the next great war if the present efforts to avert it fail.

In December, 1916, England established a Government Department of Scientific and Industrial Research, which was made responsible to the Lord President of the Council, who is the only Cabinet Minister who has relations with the whole British Empire. It was recognized that if British scientific research is to be organized efficiently, it must concern the whole empire.

But the great Dominions have not been content to rely solely on the activities of the mother country. Canada and Australia have already set up special governmental bureaus or institutes of scientific research, and South Africa, India and New Zealand have taken the necessary steps to establish similar organizations.

The other Allies have also taken, or are in course of taking, their measures in the same direction. Japan's activities are especially marked. A national laboratory for scientific and industrial research has been established with a first fund of two and a half million dollars for its maintenance. The work of this laboratory is being organized to deal especially with a series of selected subjects, such as electricity and electro-chemistry, scientific apparatus, drugs, dyes, perfumes, rubber, artificial or imitation silk, food-stuffs and beverages, oils, fixation of atmospheric nitrogen, utilization of fumes of metallurgical works, resistance power and speed of ships, fireproof and earthquake-proof buildings, and other subjects of national importance. Young men of promise in research are being appointed to fellowships and sent abroad.

In France, Italy and Belgium, the new organization of scientific work is in a more preliminary state of development, but in each of these countries, organization is actually under way.

What of America? Well, we also are moving. We have, for many years, had well-developed and well-supported governmental bureaus of scientific work. The list of them is long and imposing. We have also a number of well-organized and active special institutions of scientific research, supported by the great philanthropic foundations, such as the Carnegie Corporation and the Rockefeller Foundation, or by other private (as contrasted with Government) funds. We have developed first-class research laboratories and research men in the universities and great technical colleges of the country. There are, too, a considerable number of industrial research laboratories supported directly by industrial concerns. Some of these are large, but most of them are small and very strictly limited to a few special "works problems," of particular interest to the special industrial concerns supporting them. A list of about three hundred such private industrial laboratories has recently been published in a National Research Council

bulletin, and there are undoubtedly others not included in this list. But in Germany such research laboratories are not looked on as unusual or *de luxe* appendages of industrial concerns; they are something taken for granted as an integral necessary part of the industrial plant. Many thousands of highly trained German research experts find their regular employment in them. It is a familiar German scientific career.

But with all our various and excellent Government and university and private scientific laboratories, we found ourselves in the war needing something else. We needed a means for temporarily amalgamating and coordinating our research facilities both as to personnel and equipment. We needed means for a swift mobilization of the total scientific resources of the country, so that a combined and intensive attack could promptly be made on the pressing great war-time problems that demanded serious scientific investigation and ingenious scientific application for their solution.

There was therefore set up in the latter part of 1916, before we had actually entered the war, but when it was apparent to most thinking men that our entrance was only a matter of time, a cooperative organization of the scientific men of America, called the National Research Council. It was established under the auspices of the National Academy of Sciences. The academy itself was established by act of Congress, signed by President Lincoln on March 3, 1863. Its charter states that "the academy shall, whenever called upon by any department of the Government, investigate, examine, experiment and report upon any of the subjects of science or art." Under this provision, the academy dealt with many military problems during the Civil War, and since that time it has frequently been asked by the President, by Congress, and by heads of Government departments, to report on scientific and technical questions. In April, 1916, just after the *Sussex* incident, the academy offered its services to the President to assist the Government in any preparation it might be making for possible war. The President promptly acknowledged the offer and requested that steps be taken by the academy to organize the research agencies of the country, not solely with respect to the necessities of possible war, but also because of the importance of developing and utilizing their agencies more effectively under

peace conditions. The establishment of the National Research Council was the answer to this request.

It was not exactly the springing up of a million men to seize arms, and, untrained and unled, to form a great army to save the country, but it was the voluntary offering of thousands of trained and experienced scientific investigators to put themselves and their knowledge and capacity, under proper suggestion and leadership, at the service of their country. And they did real service. The men who know the secrets of the war know that; the responsible men of the Army and Navy will gladly testify to it. Joining their effort through the organized National Research Council with that of the scientific men already in regular Government service in Army, Navy and Washington bureaus, they attacked energetically and simultaneously all the pressing war-time technical problems.

Under the general direction of the Council many great centers of research throughout the country were kept occupied with Government work. In more than a score of leading universities the scientific laboratories gave feverish attention to military problems involving elaborate scientific investigation. The Council directed investigations relating to gun defense, high explosives, smoke screens, dyes, wireless telegraphy and telephony, fuel substitutes, detection of submarines, testing of materials and pathological and medical problems. Associated with the Council was also the group of psychologists whose work so largely modified the methods of organizing Army and Navy personnel.

Space forbids any detailed account of this work accomplished by the organization of American science under the stimulus of war. But the lesson from the work and from the manner in which it was accomplished is clear. It is that many forms of scientific effort can be greatly speeded up by proper stimulus; that many efforts can be made immensely more effective by proper organization; and, that while such organization can be encouraged and helped by the Government, it can be effected by cooperative effort among scientific men themselves. The present post-war reorganization of the National Research Council for coordinated attack on reconstruction and peace-time scientific problems affecting the national welfare has been largely determined by a recognition of the lessons learned in its war effort.

As it exists today, therefore, the National Research

Council is a cooperative organization of the scientific men of America, including also a representation of business men interested in engineering and industry and in the fundamental, or "pure," science on which the "applied" science depends. The Council enjoys the formal recognition and active cooperation of most of the major scientific and technical societies of the country, its membership being largely composed of appointed representatives of these societies. Although partly supported during the war period by the Government, it is now entirely supported from other than governmental sources and is entirely controlled by its own representatively selected membership and democratically chosen officers. It expects to maintain a close cooperation with Government scientific bureaus and their activities, but it is in no sense itself a Government bureau, differing in this respect from the more or less similar organizations, established for the same purpose by England, Japan and the other Allies, already described. Its essential purpose is the promotion of scientific research and of the application and dissemination of scientific knowledge for the benefit of the nation.

The Council is composed of a series of major divisions, one group of seven divisions of science and technology representing, respectively, physics, mathematics and astronomy; psychology and anthropology; geology and geography; the medical sciences, and engineering, and another group of six divisions of general relations, representing foreign relations, Government relations, States relations, educational relations, research extension and research information. As subordinate or affiliated lesser groups, each of these divisions comprises a larger or smaller series of committees, each with its special problem or subject of attention. There are certain other committees, administrative and technical, which affiliate directly with the executive board of the Council. Its general administrative officers are a chairman, three vice-chairmen, permanent secretary, treasurer, and a chairman of each of the various divisions. All of these, except the permanent secretary and treasurer, are elected annually by the executive board or by the members of the divisions.

The financial support of the administrative work of the Council is assured by a gift of five million dollars, recently made by the Carnegie Corporation. Part of this gift is to

be devoted to the erection of a suitable building in Washington for the joint use of the Council and the National Academy of Sciences. The rest is to serve as a permanent endowment for the Council. For the support of the special scientific projects set on foot or fostered by the Council, it relies on special gifts obtained from time to time from various sources. The most notable of these gifts so far made has been one of five hundred thousand dollars by the Rockefeller Foundation for the support, during five years, of a group of National Research Fellowships in Physics and Chemistry, administered by a Research Fellowship Board, affiliated with the Council. Other considerable gifts for specific purposes have been made by various philanthropic foundations, large industrial concerns, and private individuals interested in the advancement of science. The funds for the purchase of the land in Washington on which the headquarters building is to be erected were obtained from a score of such generous individuals.

So much for the general relations of the Council to the scientific men and societies of the country and for the skeleton of its organization and support. It will be seen by this outline that the Council is organized to be the direct instrument democratically controlled, of the scientific men of the country. And it distinctly considers itself as such. Any idea of an attempted domination of research activities in America is distinctly foreign to its thought. It looks upon itself as a means of promotion, of assistance, of helping to bring about a cooperation and coordination of American scientific endeavor and of *liaison* between this endeavor and that of other countries.

As for the policies and methods by which the Council hopes to accomplish results of service to science and the national well-being, limitations of space will prevent any but the briefest attempt to discuss them.

The Council is neither a large operating scientific laboratory, nor a repository of large funds to be given away to scattered scientific workers or institutions. It is rather an organization for bringing together scattered work and workers, for coordinating in some measure scientific attack in America on large problems in any and all lines of scientific activity, especially, perhaps, on those problems which depend for successful solution on the cooperation of several or many workers and laboratories, either within the

realms of a single science or representing different realms in which various parts of a single problem may lie. It particularly intends not to duplicate or in the slightest degree to interfere with work already under way; to such work it only hopes to offer encouragement and support where needed and possible to be given. It hopes to help maintain the *morale* of devoted isolated investigators, and to stimulate renewed effort among groups willing but halted by obstacles. It will try to educate the managers of great industries which depend on the applications of science for their success to a fuller appreciation of the necessity of support by them of fundamental science. It will try to encourage the interest in universities and colleges of research work and the training of research workers so that the inspiration and fitting of American youth for scientific work may never fall so low as to threaten to interrupt the constantly needed output of well-trained and devoted scientific talent in the land.

With any serious interruption in the output of American science and scientific workers the strength of the nation will be immediately threatened. The industries are today seriously draining the universities and the technical bureaus of the Government in their eager search for scientific men. This may mean an immediate advantage to the industries, but it means also an immediate injury to the indispensable scientific work of the Government and a grave menace to the future of all science in the country, including necessarily that required by the industries themselves. It is the obtaining of a supply of scientific men to satisfy the needs of the industries at the present at the expense of the provision of scientific men for the future. For it is upon the presence in the universities of a large body of devoted and inspiring scientific workers and teachers that the training and inspiration of new workers depends.

The methods of contributing practical assistance to American science in harmony with the general point of view and policy outlined above, which the Council has so far adopted are various. One is the establishment of special committees of carefully chosen experts for specific scientific subjects or problems urgently needing consideration, which plan modes of attack and undertake to find men and means (with the assistance of the general administrative offices of the Council) for carrying out the plan.

About eighty such committees are now in existence. Another is the bringing together of industrial concerns interested in the development of the scientific basis of their processes and inducing them to support the establishment of special laboratories or institutes devoted to this development under the advice of experts representing the Council. Another is the stimulation of larger industrial organizations which may be in a situation to maintain their own independent laboratories to see the advantage of contributing to the support of pure science in the universities and research institutes for the sake of increasing scientific knowledge and scientific personnel on which future progress in applied science absolutely depends. A great English industrial concern has just given half a million dollars for the support of research in the English universities. Other methods are the direct maintenance of university research fellowships; the publication of valuable scientific papers for which there is at present no other suitable prompt means of issuance; the preparation of bibliographies and abstracts of current scientific literature; the setting up of well-considered mechanisms for the collection and distribution of information on current research, university and industrial research laboratories and facilities, research personnel, etc.; and the dissemination through the press and magazines of popular but authentic scientific news and information for the sake of increasing the public interest in and support of productive scientific work. Still other forms of activities might be listed, but those given adequately illustrate the Council's methods.

Certain criticisms of the Council's programme readily suggest themselves to the critical-minded. One of these criticisms, especially, has been repeatedly voiced. It is that true research is the function only of the creative imagination; that it comes only from the scientific genius, and that he cannot be "organized." No amount of organization or special stimulation, or support of research can produce more or better science than the scientific geniuses will produce anyway.

The criticism assumes that research is all of one grade and that the very highest. It assumes that the only research is the truly creative work of the most gifted minds, the epoch-making men of the Galileo, Newton, Darwin, Einstein type. Such men need no stimulation; they do not

need organizing. We may grant that the greatest contributions to science have come and will always come from such men, and that they cannot be organized. They do not need "cooperation and coordination." But even that is not to say that they cannot be given, to great advantage, much material assistance in the way of experimental facilities and extra pairs of hands and eyes to save them time and energy. Among the most convinced and enthusiastic adherents to the National Research Council are men who, if we have any geniuses at all among American men of science, are admittedly such men. The most active man in the foundation and present development of the Council is one whose claim to genius would certainly be admitted in any consensus of American scientific men. This man believes that American science can be greatly advanced by organization.

He believes this because the real answer to the criticism is that a great deal of scientific investigation of great excellence and value and a great many scientific investigators of high capacity and fruitfulness are not of the genius type but are yet greatly worth while to the nation and the world, and that such work and men can be greatly helped by planned organization. Much research is so many-sided in its aspects that it cannot successfully be undertaken by one man working alone. Much research imperatively demands the cooperating work of several men and several laboratories; it may call for simultaneous and coordinated investigation by chemists and biologists; or physicists and geologists; or any three or all four of these. Problems of great national importance, such as many of those connected with food production and use, fuel production and use, public health, and plant protection, are simply beyond the powers of the single isolated workers to attack. Many good men and much good work in several different lines of science are needed for swift and large advance toward solving such problems. And such work does really need planned organization. It is particularly in connection with such problems that the National Research Council will probably find its chief opportunities to help in the encouragement and support of American science.

In a democracy like America's there are enjoyed the unquestioned advantages which spring from wide opportunity and the high premium put on individual initiative.

In all undertakings in which these two circumstances are crucial we outstrip all competition. But our success in this respect is purchased at a price, a price that we were likely to have paid very highly for in the World War; just as England and France did pay this price, so long as Germany held the advantage gained by having foreseen and prepared for other possible circumstances. Germany alone had seen the advantage of organized and coordinated scientific work and until the Allies and ourselves had taken a leaf from Germany's book and had similarly organized concerted scientific endeavor the victories were chiefly to Germany's science-backed armies and submarines.

What America needs is not to give up its individual initiative in science but to add to it means for coordination and organization. We need a wider recognition, an increased social evaluation of the place of scientific research in our national life, and hence a willingness not only to encourage and support individual scientific effort but also to insure a greatly augmented productivity of present research agencies and a much more effective coordination of them both with regard to planning and to executing the broad, inclusive scientific investigations which are required for the solution of the problems concerned with the most effective use of our national resources, with the highest production in our agriculture and industry, and with our national health. In a word we need more, and better-coordinated, science for the preservation and development of our national strength. The National Research Council is an organization that hopes to contribute in some degree, however modest, to the meeting of this need.

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"HOW'S IT LOOK OVER THERE?"

BY ALEXANDER WOOLLCOTT

ANIZY-LE-CHATEAU, an ancient village in the Aisne valley, is a desolate cluster of house-stumps, so engrossed with the burden the war left on its shoulders that, until only a few months ago, the bleached skeleton of some nameless poilu lay white amid the poppies, with all the world about too tired, too hardened or too busy to draw a sheet of earth across him.

The château that gave the hamlet its name, the manor house around which the life of Anizy had taken shape, is gone. Only a poor, jagged fragment of a single wall is left as a reminder of all its elegance. That château had been nested in by the Germans and it was blown to powder by the French guns perched just over the slope of the hill to the south. It is one of the legends of Anizy that the French artillery captain who directed its fire had been himself the owner of the château, born and bred within its walls like his father and his grandfather before him. Very likely the story is true.

As you trundle up the white road from Coucy these days, Anizy in the distant sunlight seems like a dead city, killed by the touch of some leprous giant reaching out of the ominous East. Yet as you draw nearer, you hear the occasional clink of hammer on stone, the wheeze of a leisurely saw, the rattle of pails, the hum of voices, the music of life. And in the village itself, you come upon things that tighten your throat, brave and comic and steadfast things that make you want to laugh and cry at the same time, and, passing, leave you with renewed respect for the spirit of man.

For example, there's the hotel. Anizy-le-Château has one. It isn't much of a hotel, to be sure — just such a long, bleak, wooden barrack as could be seen by the hundreds in any American camp this time two years ago. But as you