Resolved, That a corresponding twelve-year cycle of meetings for the intervening two-year periods be arranged for large cities in succession in the New England, the Central and the Atlantic States, in which it is desirable that the national scientific societies join.

Resolved, That a provisional schedule of meetings in other cities for the odd years be arranged in advance for the convenience of the scientific societies that may find it desirable to meet with the association.

Resolved, That arrangements be made for a summer meeting in 1923.

Resolved, That scientific councils, boards and committees can to advantage hold their meetings in Washington during the fourth week of April, in New York at the end of Thanksgiving week, in Chicago on or about February 1, and in Wood's Hole in August.

Resolved, That Convocation-Week be the week in which New Year's day falls when this is Thursday, Friday or Saturday; that when New Year's day falls on Sunday, it be the preceding week, that when it falls on Monday, Tuesday or Wednesday, it begin two days after Christmas and continue into New Year's week.

J. MCKEEN CATTELL
Chairman

FUNCTIONS OF THE DIVISION OF GEOLOGY AND GEOGRAPHY OF THE NATIONAL RESEARCH COUNCIL[1]

THE purpose of this paper is to ask the geologists of the country what ought to be done with the National Research Council. I do not mean to imply that there is any trouble, or any disappointment, or that the right thing is not being done now. But the council is young, very young, and also very plastic, as it should be. It has the possibilities, and the dangers, of an infant.

It may be well to state first certain dangers that do *not* exist. The organization is *not* likely to die, in the sense of ceasing to exist. If it does there will be left a million dollar building bearing the words *National Research Council* carved in marble along with the words *National Academy of Sciences.* In the second place there is no immediate danger of its not having an organization and officers. The income from a few million dollars of permanent endowment is enough to settle the question of continued existence in some form. So, for better or for worse, the National Research Council is here, probably to stay. But what the council will be like in ten years or fifty years from now is what no man knows.

When all foreseeable possibilities have been assembled, they gravitate into two main groups. The council may become, on the one hand, a dispenser of "grants" or, on the other, an agency for promoting research in other ways, mainly by stimulating, organizing or federating the research activity which arises without grants. In either case money is paid out and research comes in, more directly in the former case, indirectly in the latter. One of the questions for the future will be whether research comes higher by direct purchase or by the more roundabout method.

The above statements apply to the council as a whole, but our own interest is in a single division, Geology and Geography, which is one of seven covering Science and Technology. It does not follow that the seven will, or ought to, develop alike. Exactly opposite divisional tendencies are among the possibilities and may even prove desirable.

Before setting forth more fully the option which lies before geologists, it will be well to describe more exactly several of the possible functions of a national council of scientific men. On the approach of war in 1916-17 it suddenly became necessary to find out what was known and who knew it; also what had to be done and who could do it. It was mainly for such purposes that the National Research Council was organized under the Council of National Defense. The details of this war organization were not suited to times of peace, but the central idea held over, namely, that it paid to get scientific men together in groups to take stock of what had been done and what is being done and to advise together concerning the things that remain to be done, especially those which ought to be done soon.

[1] Published in advance to be discussed at a round table of the Geological Society of America at Ann Arbor, December 28. Discussion to be led by David White.

No other purpose can be so basic as this one of taking stock and surveying the field. It is the most essential business of men acting together. As a corporate function it can stand on its own merits with or without other functions. This step is worth while whether another is taken or not. This is the answer to the question—What can we do if we do nothing else? What is worth while if we can do only one thing? It is not yet certain to what extent this function will be realized by the council. If it is not satisfactorily performed, then some future president of the United States may have to send out another call as Lincoln did in 1864 and as Wilson did in 1916, asking scientific men to get together and tell us where we are at in science. The function thus described may hereafter be referred to as that of General Survey. Its inevitable complement is the giving out of information. This double function is the basic duty of the Research Information Service. The figurative term "Clearing House" is often used and is not inappropriate.

A second function is that of coordinating researches and of inspiring and organizing new ones. It is inevitable that any body of men performing the first function described above will be consulted by others who have problems on hand. About the first question a man asks when face to face with a new problem is: What has been done on this question by others? Who else is working on it now? If I am willing to do my share of a task too big for one man, how can I get the other phases taken care of? So the organizing and coordinating of work follows so naturally on the clearing house function that it would be difficult to keep out of it.

A third line of activity is found in financing projects. Not all valuable projects require financing. Much valuable energy needs only organizing and coordinating. The council may be a vital agency with or without the financial function. In the original plan the financial function was nowhere distinctly specified; certainly not regarded as essential.

It will be well to explain here in just what sense the council or any one of its divisions may be said to be paying out money for research. (1) The chairmen of the divisions of Science and Technology and other necessary officers are salaried. (2) Within certain limits, traveling expenses are paid. This applies to officers on duty and to members of divisions and committees in attending certain meetings of their respective bodies; also in some cases to other men invited to participate in conferences on problems and projects. (3) A staff of technical helpers is maintained for the clearing house work of the Research Information Service. (4) When all the expenses of running the organization (not here enumerated) have been paid, there remains a moderate sum to be allotted in small amounts to committees for the actual expenses of research. For the most part such sums are given merely to clear the way for starting projects which are expected to be otherwise supported. The expression "priming the pump" has been used, and describes the intention fairly well.

The great bulk of the money thus far expended under the auspices of the council has been obtained by solicitation by and for the individual division or committee having charge of a project. Generally the donor gives it for a specific purpose. Thus the responsibility for finding the money has been largely on the men whose project was to be supported. It is necessary to make this point clear, lest the impression should prevail that some men are *beneficiaries* of the Research Council in a sense that other men are not. There is no scramble to "get in on the deal," for when the pushers of a certain project have gotten in, they are still in large measure responsible for its support. I say "in large measure"; it is of course true that they enjoy the advantage of having their project stamped with the approval of twenty or more representatives of their own science, picked from the nation, and with the further approval of a body representing all sciences, whose business it is to distinguish the *most worth while* from the merely *desirable*. In addition to this advantage, there is sometimes some actual aid in solicitation by the general officers of the council and a special committee on Funds and Projects.

These are the only ways in which money is

dispensed for research. It should be plain from this that the democratic or representative character of the council, designed, as it was, to express the combined judgment of scientific workers, is not in any way impaired by the function of making "grants" or selecting a list of "beneficiaries."

If the council is ever to become a dispenser of funds, the change would no doubt come about through such a growth of confidence in its work that much larger donations would be made with less and less question as to their use. It is not impossible that this will occur, but the indications that point that way do not affect our division and need not be mentioned here.

As the great question before the geologists of our country is the use which they can make of their own division, and as the possibility of raising money is often a part of that question, it will be wise to examine briefly the sources of the support thus far obtained for other purposes. The several scientific divisions differ enormously in the financial support which they have been able to command. Should this difference be regarded as a measure of efficiency or merely as an indication of difference in method? Ought Geology and Geography with equal leadership and diligence to have captured their "share" of the more than half a million dollars donated for Physics and Chemistry, or of the like amount given to Medicine? These questions may not be answered positively, but it will help some if we inquire what relation the donors have borne to the objects of their donations. In other words—What has been the nature of the "appeal" in each case? When we have finished this analysis we may ask whether Geology should be going to its friends with similar appeals.

The largest donations have come from corporations holding large trust funds whose income *must* be distributed. Each one of these corporations specializes more or less in certain fields of science and generally elects to make its donations in fields related to its central interest. Thus the Rockefeller Foundation is known to be interested in Medicine and its contributory sciences. In addition to the five million dollars given by the Carnegie Corporation for endowment and building, well over a million dollars have been pledged for research by various trusts of similar character.

Another large class of donations, aggregating to date a few hundred thousand dollars, have had for their object some improvement of technique of manufacture or other ultimate advantage in production. The donors to such projects generally represent commercial interests in the corresponding fields of industry. The researches subsidized are of fundamental character but their relation to industry or trade is sufficiently patent to afford a strong appeal to producers. Examples of this class are found in the donations for the Critical Tables of Physical and Chemical Constants and in the support of the Crop Protection Fellowships. A slightly different appeal, looking toward preservation rather than production, is found in the support of the Marine Piling Investigation.

A smaller amount must be credited to pure philanthropy or public spirit. In these cases the donor can hope for no return in the way of personal profit, as when a great retail merchant gives the money for a biological fellowship. While less than one hundred thousand dollars given directly to scientific work comes under this classification, it is fair to mention the one hundred and eighty-five thousand dollars contributed by twenty friends to purchase the site for the building.

Lastly, a few thousand dollars have been contributed by states toward cooperative researches, such as reforestation and highway problems. The appeal here is for state aid in what is properly a state function.

With this classification of donors and appeals before us, geologists should be able to run down the list and form some idea whether their science is in position to make effective appeals for money. The list of great trusts is not long and the general field that each one favors is known. Geology is by no means excluded from their interests (recall, *e.g.*, the Carnegie Corporation and the Shaler Memorial Fund) but in no case is it likely that the National Research Council would be asked to

handle their donations. If the measure of usefulness of a division is found in the funds it handles, this would be discouraging. If, on the other hand, the division is primarily interested in seeing the science advance, the situation may be quite ideal. Illustrations might be given of projects first fostered by the Division of Geology and Geography and then "turned over" to other agencies.

Is there anything in the field of Geology analogous to the interests which manufacturers have in the improvement of production through study of fundamental principles? Could mining men be asked to get together and finance a study of structural geology or geochemistry? To put down the answers which these questions suggest would take more space than is permitted. The most obvious answers would not encourage such hopes for the immediate future.

Can we appeal to men on the basis of pure public spirit or scientific interest? Certainly Geography does this, if exploration may be called geographic investigation. It is quite true that money thus donated might not generally pass through the hands of the National Research Council, but that is a mere detail so long as the Council inspires the undertaking.

Almost the same may be said of state and federal funds. Little if any of this will appear on the accounts of our division, but it would be surprising and ought to be disappointing if we do not influence the work of official surveys even to the extent of inducing them in some cases to take up definite projects.

The general impression from such a casual analysis might be that our division can not well expect to be asked to administer large donations for geologic research. More largely than any other science, Geology is regarded as a governmental function and no one likes to subscribe to a governmental deficit. An observer from the outside might say that Geology is already pretty well supported. Of course geologists know it is not. But ours is not the only family whose poverty is known better inside than outside.

As for Geology in private employ, largely in mining and drilling, there remains a peculiar assumption of private interest and the value of secrecy. The pooling of interests to support researches in basic problems has not gone so far among mining men as among steel manufacturers, as the Research Council and the Engineering Foundation have good reason to know.

On the other hand the United States Geological Survey and some state surveys, despite all we say when our humor is bad, do provide deliberately for some research in pure science, and the by-product of pure science from both public and private work is large. The nature and amount of such by-products is determined largely by individual interests, as it should be. But it would be all folly to deny that there is much fine enthusiasm resulting in scattered and sometimes fruitless effort; mere lost motion. There are strategic points and timely moves in science as in war. The kind of guidance that comes from cooperation and the fullest possible knowledge of what others are doing ought to be profitable. Can the Research Council supply these elements?

The situation here referred to is exemplified in the work of our committee on Sedimentation. A few years ago it was tacitly assumed that the manner of origin of sedimentary rocks was completely stated in our elementary texts. Then individual workers began to raise questions. Interest appeared at many points and contributions began. When the Research Council was reorganized on a peace basis one of the first demands made on this division was that it organize the study of Sedimentation. The result has been a tripling of the work and, better still, a conscious planning to send workers into the darkest parts of the field. Other sciences have been drawn on for assistance. Men have been newly inspired by finding that their own little studies were highly useful in a big problem. The work may go on a few years more. There is little doubt that, fifty years hence, men will point back to the decade embracing these researches as a time in which the study of sedimentary rocks was raised to a new scientific level.

Now a point to be emphasized is that the Research Council is paying out no money for this research except for occasional conferences. The work is being done by skilfully appropri-

ating the opportunities offered by surveys and universities. It can scarcely be said that men have left other studies for this work. In most cases they have merely been asked to direct their efforts toward a certain point, or to have in mind their bearings on another principle.

Having set forth something of various ways in which the Research Council works, it should scarcely be necessary to guard scientific men against certain misconceptions. There have been such and they have done some harm.

The first of these possible misconceptions is that the council was designed to superintend research workers and see that they did the right thing; perhaps to assign problems to this and that man and to tell others what fields to keep out of. Such a situation is purely imaginary. No doubt some newspaper writers, not knowing the ways of science, did give utterance to such dreams, but they should not have deceived scientific men.

Another assumption, less absurd but just as wrong, is that the council is an "institution" carrying on researches on its own account. It has no laboratories, not even a library, except a few reference books. It hires no investigators. It is merely a *mode of cooperation.* There is something almost fallacious about speaking of the Council as "it"; there is no *it;* nothing but *we.* The council does nothing except what men in groups have always been trying to accomplish. The only valid claim is that men's combined efforts are being spent to better advantage. Geologists *always have* conferred, analyzed their problems, cooperated and looked around for help. The only question before us is whether such activities can be facilitated by a bit of machinery for conference, correspondence, record keeping and administration.

To guard against misunderstanding it should be stated explicitly that it is highly desirable that the Division of Geology and Geography should have funds for its own projects. But the point which needs emphasis just now is that the thing which is to *justify the existence* of the Research Council is something quite different. When the geologists of our country have definitely adopted the National Research Council as a *mode of operation* they should by all means undertake to enlarge its usefulness by financial aid.

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NATIONAL RESEARCH COUNCIL'S MEDICAL FELLOWSHIPS

EARLY this year the Rockefeller Foundation and the General Education Board jointly pledged to the National Research Council for the administration, through its Division of Medical Sciences, of medical fellowships the total sum of $500,000, payable annually through a period of five years in sums not to exceed $100,000 a year.

A special board for administering these fellowships was selected with the approval of the National Research Council and the two foundations. The board is composed of the following members with the chairman of the Division of Medical Sciences of the National Research Council (at present Dr. F. P. Gay, professor of bacteriology, University of California) as chairman, *ex officio;* David L. Edsall, professor of medicine and dean of the Medical School, Harvard University; Joseph Erlanger, professor of physiology, School of Medicine, Washington University, St. Louis; G. Carl Huber, professor of anatomy and director of the anatomic laboratories, University of Michigan; E. O. Jordan, professor of bacteriology, University of Chicago; W. G. MacCallum, professor of pathology and bacteriology, Johns Hopkins University; Dean D. Lewis, professor of surgery, Rush Medical School, Chicago; Lafayette B. Mendel, professor of physiological chemistry, Yale University; W. W. Palmer, professor of medicine, Columbia University.

This board met for the first time on April 18, 1922, and in this and subsequent meetings outlined certain regulations that should govern their decisions in connection with the appointment of fellows and the method and place of their work. Since that time two additional meetings of the board have been held for the purpose of appointing fellows from the list of