SCIENCE

VOL. 77 FRIDAY, JUNE 9, 1933 No. 2006

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

THE NATIONAL ACADEMY OF SCIENCES[1]

By Dr. W. W. CAMPBELL

UNIVERSITY OF CALIFORNIA

ONE year ago, our committee on program and arrangements for the annual meeting of 1932 asked me, as the then new president, to deliver an address, of a specified length, at the annual dinner, and I did so. To the best of my knowledge, that was an innovation—a supplement to the prevailing type of dinner program. This year the committee repeated the invitation, perhaps largely because last year I respected the wisely specified time limit, with three minutes to spare. But I have a purpose in these preliminary remarks. As two points fix the direction of a straight line, so two presidential addresses in successive years may go far in establishing a custom. Fortunately, the membership of the academy is highly individualistic, and is always ready and quick to express its views. I need say no more.

It was gratifying, last week, to observe that the deep depression in the curve representing the recent course of financial and economic events in our country is apparently not matched by a similar depression in the curve depicting the output of new knowledge, achieved through research, in the domain of the physical and biologic sciences. The number of papers offered for the program of this week's meeting was uniquely large, and to accommodate them it was found necessary to hold duplicate sessions, one in this auditorium and the other in the lecture room, on all our four half days, as you will have observed. The high quality of the papers anticipated from the authors' names has been amply confirmed in their reading. These facts in relation to the academy's program are, I believe, in accord with the advance in knowledge made in our nation, as a whole, through research, as indicated by papers and volumes, rich in contents, published in the last year or two. I take special delight in adding that we have been extremely fortunate in the qualities of the papers presented in response to personal invitations issued to several guests by the academy's committee on program: Professor Vegard, professor of physics in the University of

[1] Address of the president at the annual dinner of the National Academy of Sciences, Washington, D. C., April 25, 1933.

Oslo, Professor Swann, director of the Bartol Foundation for Research in Physics, Philadelphia, Dr. Allison, head professor of physics in the Alabama Polytechnic Institute, Dr. R. H. Fowler, professor of mathematical physics in Cambridge University, and Dr. F. E. Matthes, of the U. S. Geological Survey; and I tender them this more comprehensive expression of the academy's gratitude than was possible in the several sessions. We are likewise deeply indebted to our former president, Professor Thomas Hunt Morgan, of the California Institute of Technology, for his admirable lecture of last evening.

I have been speaking of research activities and research results of the present and of the recent past; but what of the future, even of the immediate future? They threaten to be very different. A condition of intense anxiety on this subject exists in nearly all our universities, in the research institutions, in the learned societies in general, in the research organizations supported by the government of the nation, and with countless thousands of public-spirited and wide-awake citizens who have a fair comprehension of what scientific discovery, through experimentation and research, has done for humanity. In many universities, especially state universities, where research, sympathetically nurtured and supported through the years, has brought forth new knowledge of tremendous importance to the welfare of the nation, the degree of existing anxiety as to what may happen can be said to have approached, here and there, the stage of fear. The legislatures of the majority of our states are now in session, and they have the duty of appropriating funds for the support of their respective educational institutions through the next two years. The attitude of many, perhaps nearly all, of the legislatures toward research at public expense may fairly be described as unsympathetic and, in some cases, I am informed, as severely hostile. I need not say to this audience that a university, shorn of its research activities and deprived of the scholarly atmosphere that research develops, will eventually differ but little in character from what we may call a higher high school. The name "university" will remain, but the qualities special to a real university will dwindle and disappear. The Book of Great Wisdom, tried and proved through the centuries, says that "Where there is no vision, the people perish." Equal confidence may be placed in the thesis, "Where there is no research, the universities perish." The governments, the universities and the peoples in Europe and in many other parts of the world understand this principle perfectly. The universities in those countries, with few exceptions, are national, or state, or municipal universities, financially supported in major degree by their governments.

No American citizen in possession of his senses questions for a moment the absolute need for reduced appropriations. Wisdom in the immediate present, and our welfare, both our public and our private welfare, in the future, demand the prompt balancing of budgets—national, state, county, municipal budgets, and personal budgets as well; and all good citizens are ready to lend their approval to proposals for reductions made circumspectly and in accord with the inherent needs and the inherent merits of the services that would be thereby affected.

There is a large amount of valuable research now conducted, under the government, in the city of Washington, or with Washington as its administrative center. It is, for the most part, work that the states and the universities—both the state universities and the private universities—in their happiest days, and the research institutions existing and actively operating in this country, could not undertake, for reasons partly financial and for other extremely important and vital reasons that are not financial. For example, how could the state of Nevada or Colorado or Tennessee or Vermont undertake to contribute, individually, to the plans now being carried out by the U. S. Coast and Geodetic Survey? The investigational work conducted by our government is more or less in parallel with, but not unnecessarily duplicating, research activities supported on a large scale by the government of Great Britain, including Canada and the other dominions, the government of France, the government of Germany, the government of Italy and the governments of many of the other and smaller nations. The financial support of our national government for the researches in Washington and elsewhere in the United States has been obtained, for the most part, upon the basis of need and merit, and not at all by political log-rolling, not to any extent whatsoever by the threats of an "organized minority," tacit or vocal, to the effect that the congressman or the senator who does not vote the financial support asked for will be defeated at the next election. The researches referred to are conducted, it is absolutely unnecessary for me to say, by able, conscientious men who spent many years and much money in their later 'teens and their early twenties preparing in colleges and universities and graduate schools, many of them in England, France or Germany, to do this work—in fact, devoting several decades of each of their precious lives to fitting themselves for carrying on their present investigations. Many of the research organizations, under the government, to which they are attached, have had long and glorious histories; their high standards are being maintained; and their accomplishments continue to be valuable in commendable and worthy degree. At this point I must

say that I am in possession of no knowledge that would justify me in thinking, for one moment, that any executive officer of the government is proposing or intending to cut appropriations for the support of existing research activities in unjust or catastrophic degree. It is difficult for me to anticipate or fear that arbitrary cuts will be made, in the course of the conscientious governmental administration of our country, even though the power so to proceed unquestionably exists.

The Act of Incorporation of the National Academy of Sciences, adopted by the Congress and approved by President Lincoln in the year 1863, makes the academy an official agency of the government, as expressed in the following language, quoted from the act: ". . . the Academy shall, whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject in science . . . , but the Academy shall receive no compensation whatever for any services to the Government of the United States." When an American citizen, necessarily a successful scientist, accepts election to membership in the academy, he tacitly agrees to heed every such summons, and to serve his government to the best of his ability, in the manner described, and without expectation or hope of receiving compensation. The academy has responded many times, and promptly, to the government's call, and it welcomes such duty.

If this address should happen to be published—this may or may not be the case—there would be opportunity to *read* the passage just quoted from the Act of Incorporation, and to comprehend better its significance. The reader could not fail to observe the limitations imposed upon the academy's freedom of action. The connection between the government of the nation, on the one hand, and the National Academy of Sciences, on the other, is not in the nature of a broad avenue with lines of trees and a strip of lawn in its center and a roadway on either side. It is rather a street, and it is not for me to say how wide is that street. The specification reads that "the Academy shall, whenever *called upon* by any department of the Government," and this corresponds to the definition of a one-way street.

In this connection a few very special things should be said, and even emphasized. Here I am speaking as a member of the academy, and not in commitment of the academy to any views or policies—I have not that authority or power—but in the light of my membership and experiences and observations in relation to the academy extending back through thirty-one years.

(1) The academy is composed of 265 members, whose chief interests throughout their lives have resided in the natural sciences and the biologic sciences. They have all had wonderful opportunities—in many cases opportunities of their own making—to advance human knowledge in their several fields, through research and discovery, and they have been successful in their quest for the truth; otherwise, they would not be members of the academy. They are men (and two women) of strong character who have found happiness and satisfaction in their work. They have extended knowledge and, in many cases, have applied new knowledge to the daily affairs of the world, all with incalculable advantage to the human race. On such questions as government appropriations they have no "axes to grind." Their judgment would be devoid of self-seeking and, after due consideration of the facts, wholly in accord with the public welfare.

(2) The academy's interest in scientific research, of high merit, whether conducted in universities, research institutions or under government auspices, is very deep; but the academy would not and could not give its support to pseudo-research—that is, research in name that is not research in fact.

(3) The academy could not by any possibility lend its moral support to poor or faulty or uninspiring systems of research administration, or to systems or plans financially extravagant.

(4) I can not doubt that the academy would hold to the view that existing organizations, or their substitute organizations in other departments, charged with responsibility for the conducting of research, should be prepared to accept such reasonable subtractions from their financial resources as are based upon the thorough consideration of all elements involved.

I am not called upon to set forth here, of all places in the United States, and especially before this audience, the importance of research, the incomparable values of its accomplishments, the need for its continuance in strength diminished in no greater degree than is unavoidable. In my opinion, the products of research and invention in the domain of the physical and biologic sciences have been more potent in advancing the state of civilization on the earth from its low level of the fifteenth century to its high level in the twentieth century than have all other forces combined. I do not expect universal acceptance of this thesis, but I am prepared to defend it. There is no question that many other forces, both idealistic and practical, have been exceedingly influential and powerful in behalf of the nations and their peoples, but in the main those forces would not have existed, or certainly could not have operated, if the physical and biologic sciences had not provided the mental

and moral attitudes, the opportunities, the open sesame that permitted them to go out into the great world and exert their effective and beneficent influences.

Neither is there need for saying to this audience that the desirable cultivation of the fields of knowledge represented in the research activities of universities and governments has been but little more than begun. Our great commercial organizations recognize this fact in the existence of their research departments. They know that the discovery of fundamental knowledge and the application of the finest methods of scientific research are the essential and powerful aids to industrial progress. These commercial organizations control and apportion the appropriations in support of their several departments of activity and endeavor with rare acumen and judgment, and we shall not learn that any of those organizations, successful in large degree, will reduce their financial support of research for the year beginning on July 1, 1933, in percentages exceeding those relating to their administrative divisions. Their boards of trustees are too wise for that. I do not know of any good reason why research activities conducted in universities and under governments should not be supported in accordance with the same policy. We know that such research activities have earned and paid priceless dividends through the years, the decades and the centuries of the past, and I do not have the slightest lack of confidence in the correctness of the thesis that further research activities, continued through the years, the decades and the centuries ahead, will be equally fruitful in results that the human race should have and will use to its tremendous advantage.

A HISTORY OF THE NATIONAL RESEARCH COUNCIL 1919--1933

IV. DIVISION OF CHEMISTRY AND CHEMICAL TECHNOLOGY[1]

By Professor CHARLES A. KRAUS
CHAIRMAN

THE Division of Chemistry and Chemical Technology is a representative organization of American chemists. Its membership in the main consists of representatives from the different societies of American chemists and members-at-large nominated by the division itself. In addition, it acts through numerous committees, the membership of which is unrestricted. The division is, therefore, under the control of American chemists acting through representatives chosen by their own organizations.

Its chairmanship has been held by the following persons since the organization of the division in 1918:

1918 —John Johnston
1919–1920—W. D. Bancroft
1920–1922—F. C. Cottrell
1922–1923—E. W. Washburn
1923–1924—J. Enrique Zanetti
1924–1925—James F. Norris
1925–1927—William J. Hale
1927–1928—Frank C. Whitmore
1928–1929—George A. Hulett
1929–1930—James E. Mills
1930–1931—Harry A. Curtis
1931–1932—Henry K. Benson
1932–1933—Charles A. Kraus

The division acts as agent in cooperation with other similar national agencies on all problems of international concern. It recommends the appointment of delegates to the International Union of Chemistry, votes on matters requiring decision *ad interim*, receives and distributes reports of committees of the union, and assists in organizing American committees supplementary to committees of the union. In a field such as chemistry there are many questions that can be settled only by international agreement. The division, owing to its wide affiliations, is in a position to give expression to the opinions of American chemists.

Following the war, there was great need for reliable values of physical and chemical constants. Indeed, a thoroughly satisfactory tabulation of such constants had not theretofore been made. At the request of the International Research Council, the Division of Chemistry and Chemical Technology, acting conjointly with the Division of Physical Sciences, undertook the stupendous task of publishing "International Critical Tables of Physical and Chemical Constants." The publication of these tables entailed the critical examination of the vast amount of data collected in the literature up to that time. The division organized an editorial staff, including ten foreign representatives; and arranged for the detailed analysis of all available data by collaborating experts in the various fields. The first volume of the Tables appeared in 1926 and the seventh volume in 1930. These seven volumes totaled 3,404 pages.

[1] This is the fourth of a series of ten articles prepared to describe briefly the nature of the activities with which the National Research Council has been engaged during the past fourteen years.