the occasion of his first visit to America in 1841, spent some time with him. With Dawson he visited the celebrated section through the coal measures exposed along the coast of the Bay of Fundy as well as other parts of the coast line of that province, where Lyell was especially anxious to study the action of shore ice, as he was a strong adherent of the theory that the Post-Pliocene glaciation was due to shore ice and had not been able to get any evidence in support of this theory in his examination of the interior portion of the continent, although he had diligently sought it everywhere.

Lyell tells us how delighted he was to find in the cliff at the foot of Cape Blomidon a great groove which had undoubtedly been made by floating ice.

The other geologist mentioned by Dawson as having greatly influenced his career was Logan. Logan was born in Montreal and received his earlier education in that city and in the high school at Edinburgh. He then entered the University of Edinburgh, where he graduated, with distinction in mathematics in A. D. 1817. In A. D. 1831 he became connected with the coal-mining industry in Wales and made a geological map of the South Wales coal areas which he presented to Sir Henry de la Beche and which was by him issued as a publication of the Geological Survey of Great Britain. Later Logan returned to Canada to undertake some geological work in the Gaspé Peninsula and eventually became the first director of the Geological Survey of Canada, having its headquarters in Montreal.

By his own untiring labors and with the assistance of his colleagues through a long series of years he made a most valuable contribution to geology in his description and classification of the ancient pre-Cambrian rocks of the Canadian Shield, giving to us the Laurentian and Huronian systems, but he also founded the Geological Survey of Canada, which has been continuously at work ever since and to which we are indebted for most of our knowledge of the geology of that greatly extended area which now constitutes the Dominion of Canada. Being, furthermore, a man of large private means in that day of small things when the Geological Survey of Canada was in its infancy, he provided from his own private purse a not inconsiderable part of the financial support required to maintain the Survey in question until the government came to recognize the great benefit which it was rendering to the country and provided adequately for its continuance.

In A. D. 1855 Dawson left Nova Scotia and went to Montreal to assume the position of principal and professor of geology in McGill University. He worked in close cooperation with Logan for many years, who, recognizing the necessity of training up young geologists to undertake the geological mapping of the Dominion, endowed the Logan chair of geology in McGill University held by Dawson and also made provision in other ways for the teaching of geology at this seat of learning.

And so it came about that in the early years of the Geological Survey of Canada it was Dawson's students who carried out much of the actual work of the Survey, and Sir William Dawson's son, George Mercer Dawson, at a later date became its director and continued with great distinction the work so ably inaugurated by Sir William Logan himself. Thus the influence of the Scottish School of Geology made itself directly and widely felt across the sea.

Sir William Dawson was an honorary fellow, and both Sir William Logan and Dr. George Mercer Dawson were foreign corresponding fellows of the Geological Society of Edinburgh.

In conclusion, the present speaker may perhaps be allowed to say that, having received his early training in geology from Sir William Dawson and having succeeded him in the Logan professorship at McGill University, he too is proud to feel that any small contributions which he has himself been able to make to geological knowledge have in some humble and remote way been influenced and inspired by the teaching of Jamieson and his colleagues in those far-off days when we might almost say that British geology took its rise here in Edinburgh.

SUMMARY STATEMENT OF THE WORK OF THE NATIONAL RESEARCH COUNCIL, 1933-1934

By ISAIAH BOWMAN
CHAIRMAN

THE work of the National Research Council during the past year has called for an extension of associative effort into a number of new fields. The details will be found in the Annual Report for the year 1933–34, which will be published at the customary time. It has been thought advisable to publish a brief preliminary account of some of the recent major enterprises of the council for the immediate information of the public. They fall into five main classes:

(1) Aid to research through organization.
(2) The advancement of specific pieces of research.
(3) The advanced training of talented personnel.

(4) Selected projects that receive support for laboratory equipment, technical assistance and field work through special grants.

(5) The maintenance and improvement of relations of scientists of different countries.

By persistent and intensive study of the several fields of science the Research Council attempts to locate the most critical points of attack upon these several problems, to furnish the organizational basis for such an attack, and to throw its judgment and the relationships at its command into the effort to secure supporting funds. The council was organized over fifteen years ago to do these things because science had become so widely extended that good working relations between the parts and the maintenance of a certain necessary parallelism of advancement seemed to require general consideration by groups organized into divisions. Scientific progress has received such consideration in the past, but it is clearly better to do it systematically. No one who has done constructive work in science has failed to receive benefit from the exchange and correlation of ideas. More and more the borderlands between the classical branches of science have furnished the richest soil. Biology in relation to medicine, on the one hand, and to physics and chemistry, on the other, forms a convenient illustration.

The council also has the legal obligation of cooperating with the several departments of government. One of the agencies in such cooperation is the Division of Federal Relations; a new one was established on July 31, 1933, through the appointment for two years by President Roosevelt of the Science Advisory Board.

Particular attention has also been given during the past year to a study of borderlands in science. Provision has been made for the further discussion of the two borderlands of biophysics and biochemistry. A special meeting of the Administrative Committee will be called in the autumn of 1934 to discuss such borderlands in greater detail and to come to a judgment with respect to related projects which seem to occupy an important place in advanced research. In the meantime support has been given to the proposal for the establishment of an Institute for Biophysics whose purposes are "to promote research in the field of quantitative biology."

A sum of $10,000 has been given to the council for the expense of a survey of research in the field of mitogenetic radiation and for certain additional exploratory investigations. As a result of a conference held last February a program of research has been promulgated which will be carried on at the University of Wisconsin, the University of Rochester, Cornell University and Washington University, St. Louis.

Another borderland of science is illustrated by the general term "land-use." Concerned with this problem are specialists in climatology, soils, agriculture, geology and geography. A committee on land classification has been established in the Division of Geology and Geography in order that refinements may be made of terminology and techniques of classification adapted to the several regions of the United States. In addition the council has cooperated with the Science Advisory Board in calling a conference of Government officials to consider the scientific objectives appropriate to a national program of land-use. In the first annual report of the Science Advisory Board will be found a statement regarding this conference. The cordial cooperation of the government was secured in discussing the scientific aspects of land-use and a report on land problems that had been prepared. There was informing and useful discussion of the principles which should guide the development of such a program. Provision has been made both in the council and the Science Advisory Board for a further study of the general aspects of this important question. One of these is the ecology of grasslands. A committee of the council has formulated a plan of study of the grasslands in various typical parts of the United States, involving setting aside a number of selected areas for observation in connection with the projected studies.

In the administration of the three series of postdoctorate fellowships of which the National Research Council has charge (*a,* for physics, chemistry and mathematics; *b,* for the medical sciences; and *c,* for the biological sciences), the council has this year given special attention to the methods of administering these fellowships and the results which have come from the council's fellowships program in relation to the educational and social needs of the country. This study on the part of the three boards has been coordinated through an Advisory Committee on Fellowships. The boards themselves held a joint meeting last April for the discussion of the value of this form of assistance to research.

To the Research Council it appears that an additional year or two of training and experience in research given to men and women selected from among the best of those who have recently taken the doctor's degree affords an unparalleled means for the development of investigators who give promise of becoming leaders in science. Nor is this an assistance which can be offered once or during a limited period of years only. The need for this kind of assistance at this level in the development of scientific leaders is continuous if this country is to maintain its scientific momentum and advance the ideals of research attainment in scientific fields.

The Rockefeller Foundation, which has supported

these fellowships generously, has provided funds which have made possible the appointment of about 150 fellows under these three boards during the past year. The boards are studying upon means for sharpening their selection of applicants and for making the administration of these fellowship systems more fully meet the possibilities in them. The achievements of past fellows in their professional careers and the influence which the fellowships seem to have had upon the research life of the country, however, convince the council of the continuing value of this stimulus to the advancement of science and encourage the members of the boards to contribute enthusiastically their efforts to increasing the research resources of the country in this way.

For the past five years the Research Council has also been given funds (now totalling $370,000) by the Rockefeller Foundation for the direct support of scientific investigations through the making of research grants. Over 100 such grants were allocated last year, making a total of 580 grants given altogether during the five-year period. The results of the grants thus far made leave no doubt with the council of the desirability of keeping available a certain amount of money from which timely assistance in moderate amounts can be given to augment other facilities in the hands of investigators. The use of certain funds for research grants is believed to be fully as justifiable an application of money in the interests of science as the maintenance of research fellowships. There is appearing also a close relationship between the two in that, with increasing frequency, it is past fellows of the council whose work has merited a research grant upon request from this source. As with the fellowships, the council has been closely studying this year the methods and conditions of making a general research fund, applied to the individual needs of investigators, serve the progress of scientific knowledge as effectively as possible.

In the field of medicine there have been three significant studies that deserve special mention. First to be noted is the conference on tropical medicine that was called under the auspices of the National Research Council on February 5 and 6. It was attended by representatives from over 25 institutions. There was emphasized at this conference the scattered nature of the work in tropical medicine now under way in different institutions in the United States and elsewhere, and there was unanimous agreement that the desired advances in this particular field can now be best made through cooperative effort. A general need was recognized for some new type of organization whereby exchange of information and discussion of advanced means of attack might take place under favorable conditions. Agreement was reached that an Academy or Institute of Tropical Medicine might serve these purposes and elicit general support. Various alternative modes of organization are now under discussion and the outlook is promising with respect to support after an agreement has been reached with respect to an acceptable type of organization. There is no need to dwell on the importance of this developmnt in a branch of medicine in which great advances have been made but in which also so much remains to be done before the effort to conquer tropical diseases can be said to be organized on a scale adequate to the needs of humanity.

In previous reports notice was given of satisfactory progress in two major undertakings of the Division of Medical Science—studies in drug addiction and in sex research. Announcements concerning progress in these two fields must be conservative in nature, and it must suffice, therefore, to say that the results have matched expectations. Organized with a definite laboratory group for investigation upon the purely chemical aspects of the problem at the University of Virginia and with another laboratory group at the University of Michigan for investigations upon the physiology of narcotic drugs, the study of non-habit-forming drugs has advanced to the point where a great and we believe a permanent stimulus has been provided for a continued study of that branch of chemistry which deals with this subject and which for some reason has lagged behind the advances in other branches. Not only has a continuing stimulus been provided, but we can now say that definite results have been obtained. If we can not be equally specific about results in the field of sex research it is because this type of research is of a peculiarly difficult character. Enough has been accomplished to show that the possibilities of useful work in this field are extremely large and that the work now under way has demonstrated both the need and the opportunity for a basic attack upon this fundamental problem.

The results of the program of investigations upon narcotic drugs during the past five years have already distinctly advanced our knowledge of the analytical and synthetic chemistry of this class of substances, have created a center in this country for research on narcotic alkaloids, and have produced a number of new substances which upon being tested physiologically seem to have beneficial properties which, with further study, may make them of use in the curative treatment of drug addicts and for other legitimate purposes in medicine for which only the former habit-forming drugs have hitherto been available.

In the field of research in problems of sex the results of work during the past twelve years, which is being continued for the coming year supported by a grant of $65,000 from the Rockefeller Foundation,

have included the publication of over 700 articles by the collaborators in these researches. More important for the future of science, however, is the development during this period at a score of institutions about the country of laboratories competent in personnel and equipment to carry these and related investigations further. Previous work under the program of the committee in charge of this work has dealt largely with the physiology of sex. The program for the coming year will give increasing attention to the neurophysiology, psychobiology and psychopathology of the phenomena of sex.

In any summary of the year's operations notice must be given of the satisfactory progress of a major undertaking in psychiatric research. Through the cooperation of more than a score of experts there has been prepared a substantial report upon the status of research in this field, the objectives which are sought and the probable lines of attack which experience has indicated upon the large and growing problems of psychiatry in our ever-changing society. This report has just been published. It is believed to be one of the first comprehensive reviews of the contributions which can be made to psychiatry from such basic fields as neurology, pharmacology, endocrinology, serology, general and experimental psychology, clinical psychology, cultural anthropology and heredity.

One of the major undertakings of the council is the publication of *Biological Abstracts*. This rapidly growing branch of science has an almost paralyzing quantity of literature, and in recent years there has been increasing interest in the means whereby the laboratory results in this field can be most effectively disseminated among those whose work would benefit from a knowledge of advances in related fields. Biology and medicine are in the most intimate association, and biology has had to depend to an increasing degree also upon discoveries and techniques in the field of physics and chemistry. The subject stands, therefore, in a position midway between the physical sciences and the broad field of medicine. If it represented pure research with no thought of immediate applications to human welfare the struggle of the scholars for better organization of printed output might make less appeal. It happens, however, that many of the discoveries in physics and chemistry bear on the field of medicine only to the extent to which they are channeled by specific biological researches. Since good health is so fundamental to human welfare, the service which biological research renders it in an ultimate sense is a matter of general concern. Viewed in this light, *Biological Abstracts* should not be judged solely on the basis of convenience, but it should be recognized that in a very necessary way this journal relates pure biology and the inorganic sciences of chemistry and physics through medicine to human welfare, and it supports these relationships withal in a way which promotes discovery in each of them. The question of the continuance of *Biological Abstracts* is therefore not the responsibility alone of one specialty, or of a single field of science, but is a matter of general concern for all men engaged in the advance and application of these several fundamental sciences. It is hoped that before the end of a year a judicial estimate may be arrived at of the relative value of the abstracting journal in relation to research, the opinion being quite widely held that though the cost of producing *Biological Abstracts* is high, it is no higher than the value of the publication, even when measured by the yardstick of research, to say nothing of education.

There is a feeling on the part of some scientific men that the field of engineering represents a collateral line of endeavor rather than a main branch of science in the sense in which physics and chemistry are so considered. It is thought by such men to represent exclusively the application of scientific discovery rather than discovery itself. While applications of science to practical affairs engage the greater part of engineering effort, it is nevertheless true that substantial pieces of research are carried on by engineers, and the council has been fortunate in having had the cooperation of many engineers in enterprises of which a few may be noted at this point. We take for granted the abundant material things of life and their steady improvement to so large a degree that we do not appreciate how relentless is the effort of engineers to improve both the materials and the methods of construction that are found to be deficient for one reason or another. Conspicuous among such enterprises has been the progress made in both the technique of welding and the fundamental understanding of causes for difference in welding techniques at a time when the applications of welding to construction of many kinds have become varied and extensive. The insulation problem has been attacked with equal vigor and success. The same may be said of research on highway construction carried on with the cooperation and financial support of the Bureau of Public Roads. The studies in the corrosion of iron pipe, in which the Division of Chemistry and Chemical Technology stands in an advisory relation to the National Bureau of Standards, may also be mentioned among the promising lines of attack. It recalls the studies made by the bureau during the past five years on the deterioration of paper with advisory assistance from this division of the council, with funds supplied by the Carnegie Corporation.

The council has concerned itself during the past year in a special way with its relation to the Inter-

national Scientific Unions. These have now reached a state of development which calls for a specific group of operations of distinct value to science. Unhappily, the expenses of membership in the several unions had to be met by the National Research Council during 1932 and 1933 out of diminished income, and it became evident by the summer of 1933 that dues could no longer be paid by the council. An effort was thereupon made to have the government of the United States resume payments, not on the basis that served prior to 1932 but on the basis of special congressional action. A bill was introduced in Congress by Representative Sol Bloom, of New York, authorizing the payment of such dues normally in the amount of approximately $5,000 and now nearly 50 per cent. higher. Through the work of Representative Bloom and his associates in the House Committee on Foreign Affairs and through the cooperation of a number of senators the bill was favorably reported to both houses of Congress where it passed unanimously and ultimately received the signature of the President. It is hoped that in the ensuing Congress a suitable appropriation will be made. The effort to pass the bill was marked by a hearing before the House Committee on Foreign Affairs, when over twenty scientific men appeared before the committee and testified to the value of the unions in acquainting scientific men with the progress of science in other countries. The testimony was printed in the report of this hearing as a Congressional document.

The International Scientific Unions, under whose auspices the several scientific congresses are held, deserve the support of every scientific man. They perform a highly useful and important service in improving international relations. To take a single illustration, the International Geographical Congress of 1931 had about 900 members, of whom about 500 were in attendance, representing 40 countries. Such an association is one of many that serve to extend acquaintance and the exchange of results among professional men. The unions also provide the basis for an orderly and authorized organization of scientific congresses when they meet in a given country, a national committee being appointed in each case under whose control arrangements are made. A third point may be mentioned: commissions of these unions are appointed whose work is continuous between congresses. Through these commissions there is free and useful exchange of field and laboratory results that bear upon selected problems of science which, by international agreement, are considered to be of high, if not of first importance. Finally, it may be mentioned that for the past year six of these seven international organizations to which the council has adhered have had American presidents, and the participation of scientific men in the United States and the support of our government are, therefore, especially important at this time. For the International Congress of Geography held in Warsaw in August, 1934, a cartographic exhibit was prepared that included representative work both from government bureaus and from non-governmental scientific and educational institutions throughout the country. The cartographic exhibit at this congress was the greatest that has ever been prepared and the published description of it will be a permanent document of continuing future value.

During the past year the Division of Anthropology and Psychology has been able to do a piece of work which may be cited because of the striking nature of the results. Dr. A. E. Morgan, of the Tennessee Valley Authority, invited the chairman of the council to draw the attention of archeologists to the loss of important archeological material in the Tennessee Valley when the dams projected would become reality and valley sites would be inundated. Through the chairman of the Division of Anthropology and Psychology a plan was made, the support of the Carnegie Corporation was secured, C. W. A. and state relief personnel was employed and the artificial basin sites were thoroughly examined. At one time about a thousand men were engaged in the work. A number of domiciliary mounds have been found in the Norris Basin, and in the Wheeler Basin, where earlier work had already been done by the Alabama Museum of Natural History, several shell mounds have been excavated on islands in the Tennessee River. It is expected that both of these basins will be flooded within two years. The movable relics of their ancient inhabitants will, however, have been transported for preservation and study at suitable centers of archeological research.

Mention may be made of cooperation with the Science Advisory Board. This board was appointed on July 31, 1933, to cooperate with the National Research Council and, in the language of the executive order, its purpose was "to carry out to the fullest extent the intent" of the executive order of May 11, 1918, establishing the National Research Council. In accordance with the President's instructions, the National Research Council proceeded to do its part in the development of the work of the several committees appointed by the board to deal with problems in the government. Each division has participated to some extent in undertakings appropriate to its interests, and thus the council has been able to contribute its share in an emergency of national scope.

In addition to the matter mentioned above, each division of the council has engaged in other activi-

ties, all of which are important but which can not be enumerated here on account of lack of space. The details of these operations will be found in the Annual Report of the council, which will be published in the Annual Report of the National Academy of Sciences and in the first Annual Report of the Science Advisory Board, which will be published later this fall.

OBITUARY

KARL FREDERIC KELLERMAN

IN the death of Dr. Karl Frederic Kellerman at Garfield Memorial Hospital in Washington, D. C., on August 30, 1934, agricultural science lost a very productive investigator in the biological field and an unusually able administrator of a wide range of research, regulatory and service projects. Born in Göttingen, Germany, on December 9, 1879, while his parents, the late Professor W. A. Kellerman and Mrs. Kellerman, were temporarily there, his childhood and youth were largely spent at Manhattan, Kansas, and Columbus, Ohio, where his father held the chairs of botany in the Kansas Agricultural College and the Ohio State University. He was graduated from Cornell University in 1900 with the degree of bachelor of science and served there for one year as an assistant in botany before entering the then newly organized Bureau of Plant Industry of the U. S. Department of Agriculture in 1901 as assistant physiologist.

His next fifteen years were devoted largely to research in the fields of water supply purification and soil bacteriology, at first in association with Dr. George T. Moore and later in full charge of the bureau projects in those fields, the scientific results of which appeared in numerous publications of the Department of Agriculture and papers in technical journals. Practical methods now widely used for preventing the growth of algae and certain pathogenic bacteria in water supplies were developed, and improved methods of bacterial inoculation of leguminous crops were worked out and widely adopted by practical farmers.

In 1914 Dr. Kellerman became assistant chief of the Bureau of Plant Industry and in 1917 was made associate chief, in which capacity he served until recently transferred to the Bureau of Entomology and placed in charge of the work involved in the eradication and control of plant diseases, activities also assigned to that bureau which is now known as the Bureau of Entomology and Plant Quarantine.

While available space and present circumstance prevent the adequate setting down of the results of the twenty years of his active and productive life in the administrative field, as is contemplated for later recording, a continuing, intimate, personal association with him and his work during this period is the basis for the conviction that few public servants of our generation have rendered such able, energetic and productive service as he. Under his leadership, as chairman of its editorial committee, which responsibility he carried for ten years, the *Journal of Agricultural Research* was organized and established in 1913. For ten years, beginning in 1914, he served as a member of the Federal Horticultural Board during the formative period of national plant quarantine development and enforcement. In 1915, when the discovery was made that the introduced citrus canker disease had gained foothold at a number of scattered points in the orange and grapefruit producing regions of the Gulf States, under his vigorous and capable leadership there was developed and successfully carried through the cooperative research and regulatory program through which the causal organism was promptly determined and the pest brought under control, thus saving this highly important and valuable industry. The successful carrying through of this project, which at the outset was by many scientists and administrators regarded as hopeless, required the highest type of administrative courage and faith in the loyalty of cooperating associates both in laboratory and field. Recognition of the essential basic principles which were crystallized out through this campaign was of great value in the guidance of other emergency eradication projects which followed.

In 1917 Dr. Kellerman was designated by President Wilson as a member of the National Research Council, serving as secretary of the agricultural committee, and from 1918 he served as a member of the division of biology and agriculture and of the division of federal relations. In 1929 he organized the phony peach disease eradication project in the South and shortly before his death the Dutch elm disease eradication project in the Eastern States.

Among his associates Dr. Kellerman was a most highly regarded counselor and friend, the wholesome and stimulating effect of whose personality upon hundreds of scientific workers is widely recognized by the workers of the department and the state experiment stations. In the planning of research undertakings he possessed unusual clarity of vision, ability to locate the essential objectives and to work effectively with men of widely divergent training and temperament, as is frequently necessary in the public service. Inherently logical in his mental processes and honest in thought and expression, he was an un-