ington, but went on and prepared it in its final form for publication in *The Popular Science Monthly*.

There was little published comment, and it was not until 1899, sixteen years later, that Dr. Geo. H. F. Nuttall, now of Cambridge University, England, in his classical paper "On the Rôle of Insects, Arachnids and Myriapods as Carriers in the Spread of Bacterial and Parasitic Diseases of Man and Animals—A Critical and Historical Study," published as one of the Johns Hopkins Hospital Reports, Vol. VIII., Nos. 1 and 2, that the full force of King's argument began to be appreciated. Nuttall here incorporated practically all of King's arguments and added many data gathered from other writers as well as his own, and, as he has since publicly stated and as he has personally remarked to me, it is remarkable that the 1883 paper was not soon followed by critical investigation. As has been shown so many times since, however, and strikingly in the case of Sambon's insistent claims for the carriage of pellagra by *Simulium*, a theory in no way comparing to King's for the soundness of its basis, conclusions based on epidemiological findings or upon coincidences are always dangerous. Where the range of a suspected host coincides with the range of a disease, it is possible or even probable that the suspected host may have some relation to the disease, but of course transmission experiments are necessary for absolutely definite conclusions.

And so it happened that, apparently without knowledge of King's paper, but based upon his own work in the transmission of filariasis by *Culex* and upon the then recognized transmission of the causative organism of Texas fever of cattle (sometimes called bovine malaria) by a tick as demonstrated by Smith and Kilbourne, Manson suggested to Ross the necessity for accurate laboratory work on malaria with mosquitoes as possible hosts. How triumphantly Ross carried out this magnificent piece of research is known to all the world, but it is a pity that it had not been done years earlier. Of course the laboratory technique in 1883 was not what it was in 1897, and of course, although Laveran had already discovered the *Plasmodium malariæ*, practically nothing was known of its life-cycle in 1883, but is it not possible, indeed is it not probable, that, had our fellow member, Doctor King, possessed the laboratory facilities and the technique at the time when he was so full of his great idea, he would have solved the problem, would have confirmed his anticipations, would ultimately have received the Nobel prize, and would have gone down to history as one of the greatest benefactors of the human race?

L. O. HOWARD
U. S. DEPARTMENT OF AGRICULTURE

THE COMMITTEE OF ONE HUNDRED ON SCIENTIFIC RESEARCH OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE committee held its second meeting in Houston Hall, the University of Pennsylvania, Philadelphia, on the afternoon of December 28, 1914. Mr. Pickering was in the chair, and the other members present were:

Messrs. E. W. Brown, Franz Boas, J. McK. Cattell, A. D. Cole, Edwin G. Conklin, Chas. R. Cross, Chas. B. Davenport, H. L. Fairchild, Karl E. Guthe, Ross G. Harrison, L. O. Howard, George E. Hulett, Chas. S. Howe, W. J. Humphreys, W. W. Keen, Frank R. Lillie, D. T. MacDougal, C. F. Marvin, C. L. Mees, George T. Moore, T. H. Morgan, Herbert V. Neal, Edward L. Nichols, E. B. Rosa, Wm. T. Sedgwick, Frank Schleslinger, Edgar F. Smith, Henry B. Ward and Arthur G. Webster.

After a statement by the secretary and introductory remarks by the chairman, the committee listened to reports from the subcommittees on research funds, on research in educational institutions, on the selection and training of men for research, on the promotion of appreciation of research and on plans for the subcommittee on research in industrial laboratories. Each of the reports was fully discussed, most of the members of the committee in attendance participating.

On the recommendation of the executive

committee or on motion, action was taken as follows:

1. Mr. Charles R. Cross was made chairman of the subcommittee on research funds, to fill the vacancy caused by the death of Charles Sedgwick Minot. Mr. W. B. Cannon has been appointed to fill the vacancy on the committee of one hundred.

2. The subcommittee on research in industrial laboratories was constituted to consist of Messrs. Raymond C. Bacon, C. L. Mees, M. C. Whitaker and W. R. Whitney.

3. A subcommittee on research under the national government was authorized with Mr. S. W. Stratton as chairman.

4. A subcommittee on research on the Pacific Coast was authorized with Mr. J. C. Merriam as chairman.

5. The executive committee was authorized to establish other subcommittees. Among those suggested and discussed were committees on research institutions, on research in museums, research under municipalities, research in the south, research by agencies promoting the public health and the publication of research.

6. The committee adjourned to meet with the American Association for the Advancement of Science at Columbus, Ohio, on the afternoon of Monday, December 27, 1915.

There are appended the opening remarks of the chairman of the executive committee and reports from the four subcommittees.

J. McK. Cattell,
Secretary

Scientific Research: Introductory Remarks by the Chairman

Several persons have asked the question "What can be accomplished by the Committee of One Hundred on Scientific Research?" To answer this question, we must first ask, what is the present condition of the United States as regards scientific work of the highest grade, and what means are at present available? Six years ago from a study of the men recognized as eminent by the great scientific societies of the world, it appeared that the number selected from the United States was six, the same as from Saxony. The ratio of the populations is about twenty to one. Of the Americans thus selected no one devoted much, if any, of his time to teaching, and three were born outside of the United States.

The government of the United States expends an enormous sum each year in scientific research. In the departments of science best known to me, a portion only of this amount is spent wisely. Certain of the states and cities also appropriate large sums, a part of which may be regarded as devoted to research.

At the last meeting of this committee the results attained by the research laboratories of the great industrial corporations was brought out in a striking manner. It was shown that they were not restricted to commercial results, and that friendly relations existed between them. A single successful research might here easily repay the entire expenditure.

The universities of the country devote vast sums to the diffusion of knowledge, but their contributions to its extension are comparatively limited. They expend large sums entrusted to them with the condition that it shall be used for original research, and valuable results are also obtained by their officers in their own time. The proportion of the entire funds which is devoted to research is, however, exceedingly small. There are few universities which could appropriate money for research, apart from teaching, for instance, to supply an officer with an instrument, an assistant, or money for publication. The general public do not realize this; they think that since the universities teach science, they add to it, as well as diffuse it. Research receives but little aid from the numerous unrestricted gifts to universities. If a tenth of the money used for teaching were employed in research, Americans would soon take their proper places among the great men of science of the world.

Certain institutions like those established by Rockefeller and Carnegie have devoted large sums of money to research along particular lines, but having no especial relations with other investigators.

None of the methods so far described help the man of genius in his home or in his laboratory, none of them "seek the particular man, and aid him." The research funds are the only means for supplying these needs. Unfortunately, their total income is small, but some of them have a very remarkable history. For instance, the Elizabeth Thompson Fund has an annual income of about a thousand dollars, but largely through the eminent skill of our late fellow member, Charles S. Minot, during quarter of a century it has aided 169 researches, with only five failures. A large part of these could not have been completed without this aid. The grants have been distributed throughout

the world and have aided nearly every department of human knowledge. Similar results in a narrower field have been reached by the Rumford Fund. By such funds as these, administered by local committees, it is probable that greater advances in pure science can be obtained for a given outlay than in any other way. An attempt has been made to furnish a concrete example.

Astronomy has been more favored than any other science in receiving large gifts for its support, and it is through these that America occupies its present honorable place in astrophysics. As a consequence, observatories are carefully organized and great results can be obtained from a moderate expenditure. Recently I wrote to twelve leading astronomers, asking each how he would expend a moderate sum.[1] The unexpected reply was that, in almost every case, the greatest need was for an assistant. In many cases, a small sum would thus double the output of an observatory.

It is obvious that each of the problems here considered suggests a field of work for this committee, at first through subcommittees accumulating facts and then if possible improving the conditions. We shall this afternoon see that a good beginning has already been made.

REPORT OF THE SUBCOMMITTEE ON RESEARCH FUNDS

The fact that the members of the subcommittee on research funds reside in places remote from one another has made it impracticable since its appointment in April, 1914, to hold formal meetings, but several meetings of an informal character for consultation and debate have taken place among those who could be assembled. At only one of these, however, have they had the benefit of the counsel and advice of Dr. Minot, the chairman, since his illness followed by death occurred before any work could begin in the autumn.

It seemed to the subcommittee that a most obvious manner in which at the beginning, it could aid the work for which the Committee of One Hundred was instituted would be to enter, if possible, into communication with those having the charge of the various funds in this country which are available for purposes of scientific research, so that there might be a wider knowledge than at present exists as to the range of application of the several funds and of the researches in progress with aid from any one or more of them. With this knowledge, in case of the receipt of meritorious applications for aid by the trustees of any particular fund which they were unable to grant or which might seem to come especially within the scope of some other research fund, the trustees thus applied to could refer such applications to those in charge of such other fund should they think it advisable. With this end in view, the following letter was sent to the chairmen of the trustees or committees in charge of a number of representative research funds.

Dear Sir: At a meeting of the "Committee of One Hundred on Scientific Research" of the American Association for the Advancement of Science held at Washington, April 20, 1914, several subcommittees on Research Funds, was constituted as follows: Charles S. Minot, chairman, Simon Flexner, E. C. Pickering, R. S. Woodward, Charles R. Cross, secretary. The recent illness and death of Dr. Minot have deprived the subcommittee of his inestimable services.

It is felt that this subcommittee may perhaps aid in the furtherance of research if it can bring about relations of correspondence among those in charge of the various research funds existing in this country, whereby scientific workers who need aid in the prosecution of their researches may be directed to the sources from which such help is most likely to be obtained. This has been done informally in a number of instances in the past, and the experience thus gained has suggested the belief that some definite plan of cooperation would be useful.

For this it would be desirable that the subcommittee on research funds should have a record of the several existing funds, the amount of each, the approximate annual income from each, the objects to which they are devoted, the conditions under which they are available, and the grants already made for researches still in progress. Frequently such information is already to be found in published form. With this at hand, the committee could refer suitable applicants to the officers in charge of such particular funds as in its judgment might appropriately consider the matter.

The committee, of course, would neither expect nor desire that any portion of the authority or responsibility of the trustees of any research fund should be delegated to it. Its function would only be to act as a sort of clearing house, as it were, which could to some extent classify and distribute applications for aid to the most available sources. Such a procedure would in no way obligate the managers of any funds to grant aid to any person unless they should believe that they themselves would have been ready to do so upon their own initiative.

It seems to be the case that many younger scientific men who are engaged in the prosecution of meritorious researches are not aware of the existence of certain of the research funds, and still less of the purposes to which they may be applied. Such a committee as that appointed by the American Association for the Advancement of Science, which would soon become generally known, might, it would seem, be of value to all such.

Will you kindly inform the undersigned whether

[1] See SCIENCE, Vol. XLI., p. 82.

such suggestions as have been made in this letter meet with your approval, and whether you would be willing to join in such collaboration as has been outlined. And furthermore, if you are favorably disposed toward such action as that outlined in this letter, this committee would be glad to know whether you have at present any applications for grants for research which you care to send to it for consideration.

An early reply will be appreciated in order that as complete a report of progress as is possible may be made to the American Association at its forthcoming meeting in Philadelphia.

I am

Yours respectfully,

CHARLES R. CROSS,
Secretary of the Subcommittee on Research Funds

The replies received express approbation of the plan set forth in the letter and indicate a willingness to undertake such an intercommunication of information as the letter suggests.

CHARLES R. CROSS,
Secretary

SUBCOMMITTEE ON THE SELECTION AND TRAINING OF STUDENTS FOR RESEARCH

In presenting a report from the subcommittee on the selection and training of students for research Professor E. W. Brown regretted that owing to his absence until November very little had been done. He gave, however, a brief account of some of the ideas which the subcommittee had in mind. One of the chief questions raised has been whether the chief effort should not be made towards improving the facilities for the abler men in their undergraduate work. In two or three of the American universities special courses have been established for such men and it is proposed to find out how much development has taken place in this direction and what success has been achieved so far. The subcommittee also proposes to find out the methods used in other countries to advance the interests of the abler students. Various methods have been planned to achieve this object: amongst them separate instruction, extra work, less teaching in the classroom and more work expected outside, the recognition of scholarship in various ways and more specialization in one or two particular subjects have been suggested. In the discussion which followed some valuable suggestions were made. It was pointed out that in some subjects far too much assistance was given to the students, and consequently their faculties are not properly developed. It was proposed that some effort should be made in the direction of inducing graduate students to go to some particular university because of the excellence of the department in that university rather than on account of the money rewards which it might offer. The committee hopes to undertake investigation of these questions and to offer a report with suggestions in due time.

SUBCOMMITTEE ON RESEARCH IN EDUCATIONAL INSTITUTIONS

The chairman of the committee, Mr. Edward L. Nichols, made a report of progress. The committee had had two meetings, and through its secretary, Mr. J. McK. Cattell, had addressed letters individually written and signed to the executive heads of all institutions of higher education in the United States, some 600 in number. The letter made enquiry concerning the attitude of the institutions in the following respects: (1) In making appointments and promotions, what weight is given to scientific research and productive scholarship? (2) Is research a part of the work expected from instructors and professors, and, if so, how much of their time can be devoted to it? Replies had been received from most of the institutions and some of them were read to the committee. In general they emphasized the weight given to scientific research and productive scholarship in making appointments and promotions and stated that research work was regarded as part of the function of the institution and its instructors, but there was great variation in different institutions. The committee plans to prepare and publish an analysis of these letters. It hopes later to make enquiries in regard to the actual opportunities for research work in different institutions.

PROVISIONAL REPORT OF THE SUBCOMMITTEE ON THE PROMOTION OF APPRECIATION OF RESEARCH

Your committee believes that the main ideas which it desires to present are already familiar to those conversant with the situation. But the committee nevertheless believes that these ideas are so important as to need further reiteration and emphasis.

In the first place a marked distinction may be made between research concerning the fundamental laws, principles and phenomena of any given subject, on the one hand, and research aiming to apply these laws more efficiently to practical purposes on the other hand. Happily, research in applied science is being developed, each year in larger measure, on this side of the Atlantic. None the less, there is danger of our overlooking the first type of

investigation, which is really more important than the other, because principles can not be applied before they are understood.

Research in pure science, with which the committee is mainly concerned, may in turn be divided into two categories: first, the discovery of original ideas and new phenomena; and, secondly, the systematic elaboration of ideas already suggested. Investigation of the latter type demands, to be sure, a high quality of intellect and thoroughly competent training, or it may become worse than useless; but, given these things, its success is mainly dependent on efficient organization and adequate financial support. On the other hand, research of the former type (namely, that leading to the discovery of new ideas) demands not only intellect and training, but also initiative or genius; it can come only from an *individual,* and from an individual possessing intuition and insight far beyond those of the average man. Because of the extraordinary importance of new ideas, especial emphasis must, therefore, be laid upon finding and supporting brilliant individuals.

It is not within the province of your committee to discuss the question as to whether these would best be fostered by universities or by research institutions. Each may be of invaluable service in its own way, and it is highly probable that some men would work better in one atmosphere and others in the other. We believe, therefore, that it would be a mistake for either universities or unacademic establishments to obtain a monopoly of research.

The main point with which we are concerned is the question of finding the underrated, unusual man and seeing that he is appreciated and given opportunity in the place best fitted to develop his powers. It is probable that at present the university is the best hunting-ground for this purpose, because the investigators in our important research institutions are already well fostered. In our great American institutions of learning, much valuable research is even now being accomplished both by teachers and by students. Among these men there are certainly many who are especially worthy of additional opportunities—for, in most cases, additional opportunities are needed by the men who are to perform original work of a high order. The demands made upon the American teacher are often not too great for those whose main business it is to teach, but, both in hours of class work and of administrative routine, they are very often altogether excessive for him who ought to give his main energy to research.

We feel, therefore, that in order to encourage the original minds in America, there should be more research professorships and research assistantships of high grade, which would raise their holders above the worry and inefficiency caused by financial need. Your committee recognizes that in most, if not all, American institutions of learning the salaries of professors are too low to support adequately those who have families, and believes that the salaries should be large enough to enable the original man of high rank leading the normal life to give his whole time to research and not to be forced into pot-boiling distractions. We all know of specific cases of men of unusual ability who have reluctantly abandoned research in pure science because of legitimate financial necessity.

Moreover, the research professor should not only be given time and adequate salary, but should likewise be provided with such skilled, private assistants as he may need to bring his work to its full fruition, and should be allowed to choose from among the graduate students applying for guidance those whose ability promises to offer real service to science.

The finding of the really promising man (who must possess not only originality, but also sound judgment and intellectual honesty) is not easy, because it often involves the gift of prophecy on the part of the searcher. Nevertheless, it seems to us that all those in each of our larger institutions of learning who are really interested in research of the highest kind, either individually or grouped together as a voluntary committee, should keep their eyes open for persons possessing in high degree the happy combination of qualities desired, and should urge upon presidents and governing boards the importance of supporting these persons so as to make it possible for them to yield their best fruit in discovery. To some extent, of course, this is already done, but concerted action and greater emphasis are desirable.

We suggest also that those understanding the importance of investigation should emphasize this importance on every reasonable occasion, and endeavor to increase the appreciation of the people of America, even the cultivated section of which is often ignorant of the nature and value of scientific research. This can probably be accomplished most successfully by pointing out how much has resulted for the good of humanity from specific researches in the past, bearing in mind the profound statement of Francis Bacon: "There is much ground for hoping that there are still laid up in the womb of nature many secrets of excellent use, hav-

ing no affinity or parallelism with any thing that is now known, but lying entirely out of the beat of the imagination, which have not yet been found out. They too, no doubt, will some time or other, in the course and revolution of many ages, come to light of themselves, just as the others did; only by the method of which we are now treating they can be speedily and suddenly and simultaneously presented and anticipated.''

These suggestions constitute the recommendation of this preliminary report.

THEODORE W. RICHARDS, *Chairman*
HARVEY CUSHING,
RICHARD MACLAURIN,
T. H. MORGAN,
E. H. MOORE

SCIENTIFIC NOTES AND NEWS

THE award of the Bruce Gold Medal of the Astronomical Society of the Pacific, for 1915, has been made to Dr. W. W. Campbell, director of the Lick Observatory, "for distinguished services to astronomy." Candidates for this medal are nominated annually by the directors of the Berlin, Greenwich, Paris, Harvard, Lick and Yerkes Observatories, and from these the medalist is elected by the directors of the society.

DR. JOHN C. BRANNER has submitted his resignation as president of Stanford University to take effect on July 31.

PROFESSOR G. O. SARS, professor of zoology in the University of Christiania, has been elected an honorary member in the Challenger Society.

AT the annual exercises of the American Museum of Safety, held in New York on February 10, the following medals were awarded: The *Scientific American* medal for the most efficient safety device invented within a certain number of years and exhibited at the museum, to the Shurloc Elevator Safety Company, Inc., New York; the Travelers' Insurance Company's medal for protecting the lives and limbs of workmen, to the Commonwealth Edison Company of Chicago; the Louis Livingston Seaman medal for progress and achievement in the promotion of hygiene and the mitigation of occupational disease, to Surgeon-General William C. Gorgas, U. S. A.; the E. H. Harriman memorial medal to the American steam railroad which during the year has been the most successful in protecting the lives and health of its employees and of the public, to the New York Central Railroad; the Anthony N. Brady memorial medal to that American electric railway company which for the year of the award shall have done most to conserve the safety and health of the public and of its employees, to the Boston Elevated Railway Company.

THE National Committee on Mental Hygiene met in New York City on February 17 when officers were elected as follows: *President,* Dr. Lewellys F. Barker; *vice-presidents,* Dr. Charles W. Eliot and Dr. William H. Welch; *treasurer,* Otto T. Bannard; *medical director,* Dr. Thomas W. Salmon; *secretary,* Clifford W. Beers; *executive committee:* Dr. August Hoch, chairman; Dr. George Blumer, Miss Julia C. Lathrop, Dr. William Mabon, Dr. William L. Russell and Dr. Lewellys F. Barker. Gifts of $44,500 by Mrs. Elizabeth Milbank Anderson and $40,000 by Mrs. William K. Vanderbilt for the general work were announced, and the Rockefeller Foundation has agreed to contribute for a series of years the money necessary to retain the services of Dr. Thomas W. Salmon, who has been medical director of the national committee for three years.

DR. CHARLES D. WALCOTT, secretary of the Smithsonian Institution, has received a letter to the effect that the Stazione Zoologica at Naples is in a somewhat serious condition financially, owing to the withdrawal of German support. The Smithsonian Institution maintains a table at the station, which is all it can do under existing conditions. The writer of the letter suggests that if our universities would take up some of the vacated tables, it would not only assist the station, but would eventually result in closer cooperation between our scientific men and those of Europe.

AT the meeting of the Royal Geographical Society on January 11 the president made the following statement: "Before we come to the