of $3, and also because it makes the membership more permanent, members hesitating to withdraw for a short time when such a fee must be paid to resume their membership. The council, however, passed a resolution providing that those becoming members of the national affiliated societies might be elected to membership in the American Association without payment of the entrance fee, if they join the association within one year of becoming a member of the affiliated society. This offer should give assistance to the affiliated societies as well as the association, and should serve to unite in the association almost without exception the younger scientific men of the country.

The nation should be proud of its scientific men when it regards the three presidents of the association, the retiring president, the president of the meeting and the president elect. Dr. W. W. Campbell, director of the Lick Observatory, who has twice crossed the continent to attend the meetings and has devoted his invaluable time to the organization of the Pacific Division, gave the address as retiring president, which in content and in form of presentation set a model which any similar officer anywhere in the world will find it hard to meet. This address will be printed in SCIENCE as soon as arrangements can be made for the illustrations. Dr. Charles R. Van Hise, president of the University of Wisconsin, in the front rank of geologists in a country which leads in geology, and equally a leader in university education and in movements for the public welfare, made an admirable presiding officer, both in the general sessions and at the meetings of the council. Dr. Theodore W. Richards, director of the Wolcott Gibbs Memorial Laboratory, Harvard University, distinguished wherever chemical research is undertaken, the only native-born American to whom a Nobel prize in science has been awarded, was elected to preside at the meeting to be held next year at Pittsburgh and to give the address the following year in Boston.

PRODUCTIVE SCIENTIFIC SCHOLARSHIP[1]

I WARMLY sympathize with the ambition expressed in your annual report to have this musem more than a mere zoologic or scientific museum. It should be a museum of arts and letters as well as a museum of natural history. The ethnology and archeology of the Indians of New York make up a subject peculiarly apparent for treatment in a museum of this character. There should be here a representation of all our colonial and revolutionary life. There should be in this museum, for the instruction and inspiration of our people, a full representation of American history since the time when New York cast off its provincial character and became an integral portion of the American republic. Finally there should be here all the representation possible of the great arts and great literatures of the nations of the past, and the nations of the present; so that, enriched by the knowledge of what has been done elsewhere, in time and in space, our own people shall be better equipped to work in the fields of original productive scholarship.

All this lies in the future. At present we have only to do with biology.

A museum of this character has more than one function to fulfil. It must pre-

[1] Address delivered at the opening of the New York State Museum in the State Education Building, Albany, N. Y., on the evening of December 29, 1916.

sent to the people as a whole in vivid and yet truthful form, knowledge of the natural objects of our countryside—that is, knowledge of nature—in such a fashion as to be readily understood.

Moreover, it must aid in the study of nature—that is in the study of soils, insects, plants, birds and mammals—from the utilitarian standpoint.

Again, it must aid the growing army of nature students, the men and women who love nature, or love science, for the sake of nature or science, without any set and immediate utilitarian purpose. This museum should keep aloft the standard of those who delight in all knowledge and all wisdom that can not be reduced to, or measured by, any money scale.

Finally, this museum should perform the even more difficult task of giving research facilities to the extraordinary and exceptional student, the man who has in him a touch of the purple; the man who can supply that leadership without which it is so rare for even the laborious and well-directed work of multitudes of ordinary men to realize the ideal of large productive achievement.

Little can be done save by cooperation and coordination. We are fortunate in this state to have at the head of our educational system, in President Finley, a man whose ability to work by himself goes hand in hand with ability to work with others, and with ability to train up others to work under him; and who does all this in such fashion as to produce the maximum of benefit to the people as a whole. No man has done more than he has done to secure for New York City a broadening of the standard of cultivation, so as immensely to increase the number of persons who can profit thereby, and at the same time to provide for the needs of those exceptional men and women who, if given the chance, will do work of such exceptional character that, to the permanent impoverishment of mankind, it will remain undone unless these exceptional persons are permitted to do it.

It is essential that this museum should command the services of many different men for work in many different fields, and that its work should be so closely related to work of the same kind elsewhere that it shall all represent a coordinated whole. This is true of all departments of its work, but especially so of those departments which have a direct utilitarian bearing. It is the farmer who benefits most from the utilitarian type of zoological work. The rising generation will see a great change in the position of the farmer in our social economy; our governmental activities are already in process of being turned to this end. Most of the initial difficulties of connecting the farmer in fruitful fashion with the government have been at least partially overcome. The book man and the closet man now understand that their science is worthless unless subjected to the test of actual conditions of life and labor. And on the other hand the farmer has begun to understand that the most practical rule-of-thumb man can profit by a wise use of the learning of the soil expert, the plant expert or the expert in the knowledge of fungi and insects. It is essential that the work of this sort in each state should be hitched on to the work in other states, and in the federal capital, if the best result is to be obtained.

In addition to this science which is of direct utilitarian bearing, to this knowledge of nature which can be scientifically applied to economic and agricultural betterment, there is science pursued for its own sake. There is a twofold warrant for the encouragement of the study of pure science by the state.

In the first place, the knowledge justifies itself. The scientific student is justified

because he studies science, if he studies for a serious purpose, exactly as is true of the man of arts, or the man of letters. Mere addition to the sum of the interesting knowledge of nature is in itself a good thing; exactly as the writing of a beautiful poem, or the chiseling of a beautiful statue is in itself a good thing. A nation that does not understand this is not wholly civilized; and a democracy that does not understand this can not claim to stand abreast of such a democracy as Athens in the past and France in the present.

In the next place, the greatest utilitarian discoveries have often resulted from scientific investigations which had no distinct utilitarian purpose. Our whole art of navigation arose from the studies of certain Greek mathematicians in Alexandria and Syracuse, who had no idea that their discoveries would ever have a direct material value. It is impossible to tell at what point independent investigation into the workings of nature may prove to have an immediate and direct connection with the betterment of man's physical condition.

Most of the men and women, indeed the immense majority of the men and women, who work for pure science, can not aspire to the position of leadership; exactly as most business men can not expect to press into the ranks of the captains of industry. Yet each can do work which is not only creditable and useful, but which may at any time become literally indispensable, in helping to discover some great law of nature, or to draw some great conclusion from the present condition, or from the former physical history, of the world. This museum, like all similar institutions, should do everything possible to develop large classes of workers of this kind.

We must never forget, however, that the greatest need, and the need most difficult to meet, is to develop great leaders, and to give full play to their activities. Of course it must also be our aim to develop men who, if they do not stand on the heights of greatness, shall at least occupy responsible positions of leadership.

In the entirely proper effort to develop numbers of individual workers, there must be no forgetfulness of the need of individual leadership, if American achievement in the scientific field is to be really noteworthy. In the scientific (as in the historical) associations and academies this fact is sometimes forgotten. Undoubtedly much that is indispensable has been done, and much more can be done, in the field of historical research by the collaboration of numbers of men. But really great works will never be produced by such collaboration. The really great works must be produced by an individual great man, who is able to use to the utmost advantage the indispensable work of a multitude of other observers and investigators. He will be the first to recognize the debt he is under to these other observers and investigators; if he does not do so, he will show himself a poor creature. On the other hand, if they are worth their salt they will be proud to have the great architect use all the results of their praiseworthy and laborious and necessary labor in constructing the building which is to crown it.

Darwin's epoch-making work would never have been done had not the foundation been laid deep and wide by many acute and faithful observers. But it needed the man of masterly genius to produce the great work.

I need hardly say that insistence upon the need of men of towering genius to do the supreme, the epoch-making work, does not in the least mean that there is not utmost need of first-class work of the ordinary type by the rest of us, who are just ordinary men. The best library is a mighty

poor library unless the immense majority of the books are by men who are not of epoch-making genius; and in any community in which much first-class scientific work is being done the bulk of it will be to the credit of men who do not pretend to belong to the highest category. In the scientific, as in every other field of endeavor here in the United States, there is ample room for the man who can not be called a genius but who can do capital work. Nevertheless, it remains true that the third-rate man can not produce first-rate work and that from the standpoint of the world, while it is well to help or train the third-rate man to do his third-rate work well, what is of most importance is to give the first-rate man the training and the apparatus to do the first-rate work, which, unless he does it, will not be done at all.

Let me give my statement more precision by speaking of just one small corner of the scientific field, that with which I am most familiar—the study of ornithology and mammalogy. In these fields there is need for work by experts who are only closet workers. But there is far more need of work by field naturalists. Most of all there is need of work by trained laboratory men who also possess a wide field experience. As regards mammals, there is still a good deal of work to be done in mere collecting, but even as regards mammals, and infinitely more as regards birds, the days of the supremacy of the mere collector have passed. This is true even of the least known parts of the earth, and is infinitely more true here of New York. The man who merely collects multitudes of bird skins or mammal skins, and then goes over them with laborious minuteness in the study, for the purpose of a classification which really represents primarily a fetishistic adoration of a highly conventional and technical trinomial terminology, must always occupy a humble, and may readily occupy a merely useless, position in the scientific world. The ordinary pamphlet describing new subspecies and even new species, differentiated from one another by trifling characteristics, represents work which it is true possesses a slight usefulness; but it is a usefulness not entitling the author to a grade much above that of the man who totes bricks in a wheelbarrow. Ninety-nine times out of a hundred these little pamphlets are of interest exclusively to rival, and equally unimportant, pamphleteers with slightly different views on terminology, and on trivial questions of subspecific differences. Generalizations based on sheer imagination or on imperfectly observed facts or on entirely insufficient data are at best useless, and are apt to be mischievous. Any type of honest work by the intellectual brick-collectors and wheelbarrow men is better than such dishonest attempts to pass off castles in the air as productive real estate. But mere vast collections of minute facts, which in themselves are of trivial importance, without any attempt to explain and correlate these facts, and without cautious wisdom to generalize from them, are of strictly limited usefulness.

Study of the interrelations of the lines of descent among birds and beasts is of absorbing interest. Study of the comparative effect of environment and heredity on physical structure is no less interesting. There must be ample research in the laboratory in order even to present these problems, not to speak of solving them, and there can be no laboratory study without the accumulation of masses of dry facts and specimens. I do not for a moment mean that there should be any failure to recognize the need of such accumulation of facts. But I do mean that there should be an equally clear recognition, that the ac-

cumulation of facts is only the beginning; that it is only laying the foundation on which the man of high ability must rear the superstructure. I also mean that from now on it is essential to recognize that the best scientific men must largely work in the great out-of-doors laboratory of nature. It is only such out-doors work which will give us the chance to interpret aright the laboratory observations.

In the New York State Museum Bulletin, published last July, there are pictures of two birds, once common in America, now totally extinct. One is the passenger pigeon and the other the Labrador duck. The passenger pigeon formerly existed in this state in millions, and the Labrador duck was common off the coast. The passenger pigeon has been exterminated through sheer brutal, reckless, and largely wanton, slaughter, by our so-called civilized people. The Labrador duck became extinct from causes of which we are absolutely ignorant. There are plenty of stuffed specimens of both in museums. But in the case of neither do these stuffed specimens throw any real light on the birds' life history. As regards the Labrador duck, we shall in all probability never know the particulars of its life history, nor the causes of its sudden extinction. As regards the passenger pigeon, in its physical structure (which in its essentials is strikingly like that of our common mourning dove) there is nothing which would give the least hint of its extraordinary habits, of the innumerable myriads in which it moved fitfully hither and thither over the land, and of the enormous extent of its shifting nesting sites. There is now no other bird in the world with such habits; and the stuffed specimens that remain of it do not, all put together, begin to equal in value the written records dealing with it in such old-style natural histories as those of Wilson and Audubon. There are many points in its life's history which are still obscure, and these points are obscure chiefly because so few of the many ornithologists, who abounded in this country at the time of its extinction, had any idea that their closet work in museums was of no consequence whatever compared to a thorough and careful life study of the passenger pigeon. The extinction of the passenger pigeon is a blot on our civilization (and let me remark parenthetically that every society of this kind should be a focus of effort to prevent any of the birds we still have from following in the wake of the passenger pigeon); but, inasmuch as it is extinct, it is well for us to remember that we owe an incalculable debt to the observers who have left for us a record of its life history, whereas we owe only a very small and easily calculated debt to those who merely collected specimens of it for their collections.

Let the scientific man realize that he must be a good first-hand observer of wild things in their native haunts, if he is to stand in the first rank of his profession. Let him also remember that it is his business to write well! Of course, he can not be expected to write as well as John Burroughs; but he ought to have writings like those of John Burroughs before him, to represent the ideal toward which he strives. Let him strive to do original work, the work of original productive scientific scholarship.

The New York Zoological Park, under the guidance of Dr. Hornaday, the American Museum of Natural History in New York, under the guidance of Mr. Osborn and Mr. Chapman, have furnished models in this matter. The three gentlemen named have done original productive scientific work of the highest value, at the same time that they have in every way popularized—not cheapened!—science, and made the present and the past life history of this

planet accessible in vivid and striking form to our people generally. Their assistants have done hazardous and exceedingly interesting and important work in the wildest of the waste spaces of the world. It has been my privilege to journey through the East Central African wilderness and the Brazilian wilderness in company with outdoor faunal naturalists—Mearns, Heller, Cherrie, Miller, Loring—and myself to witness the hazard and the high value of their work; and last winter I visited in Demerara Mr. Beebe's really extraordinary field laboratory for intimate biological research in the tropics, and I count it one of the privileges and pleasures of my life to have worked with these men.

Theodore Roosevelt

Dedication of the Ceramic Engineering Building of the University of Illinois

On December 6 and 7, the University of Illinois, dedicated its new ceramic engineering building. The dedication exercises were opened at 1.30 P.M. on Wednesday, December 6, by a meeting of the advisory board of the department, followed by a reception in the building, at which all of the laboratories were thrown open to the visiting guests and the university public.

On the evening of Wednesday an introductory session was held in the university auditorium, presided over by Dr. Edmund J. James, president of the university. At this session, Dr. S. W. Stratton, director of the National Bureau of Standards, gave an address on "The Ceramic Resources of America." This was followed by an address on "Science as an Agency in the Development of the Portland-Cement Industries," by Mr. J. P. Beck, general manager of the Portland Cement Association of Chicago. Dr. Stratton discussed the organization and formation of the different types of clay deposits together with their most prominent geological and geographical positions in the United States. This was followed by a discussion of the reactions occurring during the burning of clay products. A detailed classification of the various clay products fashioned from ceramic materials was also presented. The whole address gave a very clear idea of the great variety and extent of the clay resources of the nation and the multifold products which are manufactured from them.

The second dedicatory session was of a technical nature and assembled on Thursday morning in the university auditorium. It was opened with an address on "The Manufacturer's Dependence upon Ceramic Research" by Mr. W. D. Gates, president of the American Terra Cotta and Ceramic Company, of Chicago. This was followed by further discussions by Mr. Ross C. Purdy, research engineer of the Norton Company, and by Mr. L. E. Barringer, engineer of insulations for the General Electric Company. Mr. C. H. Kerr, who was to discuss the same topic from the standpoint of the problems of the glass industries, was unable to be present, but sent his discussion for presentation.

The second address of this session was given by Mr. W. W. Marr, chief state highway engineer of Illinois, upon the topic "The Use of Ceramic Materials in Highway Construction." This paper was discussed in a very interesting manner by Mr. Blair, secretary of the National Paving Brick Manufacturers' Association, of Cleveland, Ohio, and by Mr. G. G. Wooley, engineer for the Road Bureau of the Portland Cement Association, Chicago.

A paper on the topic "Ceramic Products as Structural Materials" was presented by Mr. H. J. Burt, structural engineer, of Chicago, and discussed by Mr. A. V. Bleininger, ceramic chemist and head of the clay products laboratory of the United States Bureau of Standards.

The last topic for discussion at this session was "The Use of Ceramic Products in the Artistic Embellishment of Buildings." The discussion was opened with a paper by Mr. Claude Bragdon, author and architect of