which never appeared in print. Many of these views have since been generally adopted at the later independent suggestion of others less diffident about publication. An example in point is his opinion concerning the structure of diazo bodies, first conceived by him over twenty years ago, and now conceded to be the most probable hypothesis.

Hill's original work and his lectures were equally conspicuous for thorough knowledge, convincing logic and perfect sincerity. Until the end his highly cultivated and widely varied tastes continued to be sources of refreshment and pleasure to him, while to those of his colleagues who came closest he revealed also keen and appreciative sympathy, self-forgetting generosity, a stanch and devoted friendship, undaunted courage, and above all, single-heartedness in the search for truth.

T. W. R.

THE STATUS OF PUBLIC MUSEUMS IN THE UNITED STATES.

I. THE AUSPICES OF OUR MUSEUMS.

No general discussion of the status of our museums has been attempted, although G. Brown Goode (see 'Annual Report of Smithsonian Institution,' 1897, Vol. II., U. S. National Museum) has presented many phases of the subject in a masterly manner in his papers upon 'The Genesis of the United States National Museum,' 'The Origin of the National Scientific and Educational Institutions of the United States,' 'The Beginnings of American Science,' etc. He also instituted some comparisons between our museums and those of Europe, and in his report upon the condition and progress of the U. S. National Museum, 1892–93, he shows that while for 24 years the South Kensington Museum had spent an annual average of about $47,000 in the purchase of specimens, our National Museum had never spent more than $8,500 annually for this purpose.

It is gratifying to observe that while our National Museum has been enabled to spend annually somewhat more for specimens than during the period referred to by Goode, yet in 1901 the American Museum of Natural History expended more than twice as much as the National Museum for this purpose.

The whole question of museum status has become an important one, as we are in all probability upon the eve of a museum movement which may prove comparable with the great increase in efficiency and number of our public and school libraries, which during the five years from 1895 to 1900 have increased from 4,026 to 5,383, and the number of volumes from 33,051,872 to 44,591,851, or almost 35 per cent.

No corresponding increase has taken place in the number of our public museums or in the magnitude of their collections; and, indeed, the subject has attracted so little public interest that no published lists of our museums are at present available, although a very valuable list of the natural history museums of the United States and Canada and an account of their collections are being prepared under the direction of Professor Frederick J. H. Merrill, of the New York State Museum, and will soon be published.

Professor Merrill has been so kind as to allow me to inspect the proofsheets of this interesting work, and I am also indebted to the Smithsonian Institution for a partial list of the museums of the United States. It appears that within the United States there are at least 252 institutions which contain collections of objects of natural history. Of the total number, 176 or 70 per cent. are school, college or university museums; 31 are the museums of learned

societies; 29 are under national or state control, such as the museums of the various geological surveys, agricultural and mining bureaus, etc. Sixteen of our museums are not under the control of colleges, learned societies or national or state governments, but either are maintained by private endowment derived from public-spirited citizens, are supported by municipalities, or are under the control of boards of trustees, who administer funds derived both from cities and from private subscription.

It is noteworthy that, although the number of such institutions is as yet small, among them we find some of the greatest and most useful of our museums, such as the American Museum of Natural History, the Field Columbian Museum, the Carnegie Museum at Pittsburgh, etc.

It is both sad and interesting to observe that no society composed primarily of learned men has succeeded in maintaining a thoroughly successful museum, yet forty-five years ago the leading museums of our country were controlled by such societies. It is possible that the government of these societies may have been too democratic to insure that permanency of policy and maintenance of a strong executive which appear to be necessary to insure the success of American institutions of learning.

However, these societies have not advanced in material resources at a rate comparable with that of the country itself, and in consequence are relatively poorer to-day than they were many years ago. Their general lack of success is the more remarkable from the fact that most of them have existed in our wealthiest and most progressive cities, and that while other institutions of learning have received bountiful support from both private and public sources,* the museums of learned societies have been relatively neglected. In other words, they have generally failed to interest men of wealth who are desirous of devoting a portion of their resources to the advancement of public education.

Experts upon scientific subjects are not usually adepts in matters of finance, and the successful management of a great museum appears to demand that its financial resources and expenditures be under the control of a board of trustees composed of representative men of affairs, while the scientific policies of the institution might well be directed by men of science.

Such, in general, is the scheme of management of some of our best museums, and it would appear that our learned societies must surrender the control of financial matters into the hands of experts in finance before they can hope to achieve their due measure of success in museum management. It is much to be regretted that many of the collections which have furnished the basis for classic memoirs of science, and some of the most valuable scientific libraries in our country, are stored in buildings which are not fire-proof and are inadequate in many ways for the proper care and maintenance of the treasures which they contain.

Turning to the subject of museums under the control of colleges and universities: 176 such institutions are known to maintain collections in the natural sciences, while 44 more small colleges are believed to contain collections. It is safe to say that fully two thirds of these college museums are, as Goode aptly states, 'mere storehouses for the materials of which museums are made.' Our universities, both under private endowments and under state control, are developing good museums, but it

* In 1850 the funds of Yale University amounted to about $300,000. In 1902 they were over $6,800,000. During the same period the funds of Harvard have increased from a little over $600,000 to more than $14,000,000.

is worthy of note that the most successful of these owe more of their prosperity to the generous interest and financial support of public-spirited individuals than to the college itself.

A good example of this condition is seen in the zoological museum of our oldest university, which, distinguished above all others for its publications of research and for having been the cradle of most of our leading naturalists, has been mainly dependent for many years upon the generous bounty of a single individual. Other examples might be cited, but the above will suffice to show that even our greatest and richest universities have not been able to maintain museums worthy of their aims, unless aided by private subscriptions for the purpose. The financial resources of our universities have been taxed to the utmost in the erection of buildings and employment of leading scholars upon their faculties, and few of them have been able to devote a due measure of support to museums.

Moreover, our universities have often failed to recognize the benefit which the museum may confer upon the institution as a whole as a center for productive scholarship and publication of research.

Unfortunately, at present, museum curators are too often narrow specialists who display little interest in subjects other than those which demand their immediate attention, but the fact remains that the curator enjoys a unique opportunity in that he gains much of his knowledge direct from nature and that in this his opportunities for research and exploration are unrivaled. The organization of graduate schools in our universities is beginning to demand the appointment of professors who shall be productive scholars and leaders of research, and who shall instil into the graduate students that thirst for knowledge and desire for its advancement which inspires the university students of Germany. The curators of university museums should be men of this stamp.

Too often our college museums are vast storehouses of practically unstudied materials under the charge of men who are already overworked in the prosecution of their duties as teachers of elementary facts, or worse still, under the control of specialists who rarely or never may lecture to the student body, and whose store of valuable knowledge is wasted in seclusion. The university museum should be the center for the intellectual life of the graduate student in the natural sciences. The curators should be his teachers, and the resources of the museum should be constantly expanded to meet his needs, and to encourage research which may lead to the discovery of new laws of science.

It is remarkable that, although large sums have been given within recent years for the construction of buildings and for the purchase of collections in our museums, relatively little has been devoted to the endowment of publications of research.

Our university museums must remain ineffective as centers for the advancement of science until this defect has been overcome.

It appears that museums under purely political or governmental auspices have in our country rarely attained to that success which one might reasonably have expected them to have achieved.

Without in the least reflecting upon the character or abilities of the corps of eminent men of science whose names are inseparably connected with that of our National Museum, and who in the face of limited means and meager opportunities have devoted their lives to its service, it may not be too much to say that this institution should be granted a greater measure of independence, its curators should have

more freedom to devote their energies to the advancement of science, and the museum must receive more effectual rather than greater financial support before it can hope to attain to that exalted position among the world's museums which should be occupied by the National Museum of the United States.

On the whole, it appears that our most successful museums are those in which the financial control is vested in boards of trustees composed of representative, public-spirited men of affairs, who serve without salary and who determine the expenditure of funds derived from both public and private sources. Such boards of trustees should be and usually are dependent upon the advice of scientific men for suggestions concerning the scope, management and educational policy of the museum.

The responsibility incident to the administration of public funds maintains the stability and efficiency of the board, and enables it to secure the services of men of culture, energy and influence, whose connection with the museum becomes an important factor in maintaining public interest and respect for the institution.

II. SCOPE, DISTRIBUTION AND RESOURCES.

From a study of Merrill's 'List of the Natural History Museums of the United States,' *The American Art Annual,* 1900, and other sources of information, it appears that there are within the United States at least 233 museums of natural history, 13 of science and the fine arts, 6 of science and industrial arts, 34 of fine arts, 11 of industrial arts, 20 of history, and 26 which combine art, history, archeology and ethnology in varying proportions. There are thus at least 343 collections in the fields of art, science and history open to the public of the United States.

It is evident that our country is already rich in incipient museums, for while many of the collections recorded above are mere 'materials out of which museums may be made,' there is reason to expect that a large proportion of them will ultimately develop into creditable museums.

The fact that there appear to be but 17 museums devoted to the industrial arts in the United States is remarkable when we consider the enormous progress which our country has made in this direction. This may possibly be taken as an indication of the general lack of interest in museums which prevailed until within recent years in our country, and this explanation appears more probable when we consider that among our most valuable industrial collections are those in the Patent Office building, which were accumulated not primarily for the purpose of establishing a museum, and that such exhibitions are either insignificant or altogether wanting in our great industrial cities. With the exception of Philadelphia, our industrial cities have not yet awakened to an appreciation of the valuable educational influence which may accrue through the exhibition of carefully selected and clearly labeled models of machinery and apparatus used in the arts and trades, and displays of products in various stages of manufacture.

Certainly the remarkable advance which Germany has achieved in manufacture and in the industrial arts has received substantial aid from her great industrial museums, where these processes may be studied in detail. Our technical schools and colleges should devote more attention to the establishment of well-planned museums, wherein the processes of the arts and the history of inventions may be exhibited.

Although our museums are most deficient in industrial exhibits, they are but little better in their historical dis-

plays. Only 43 museums known to the writer contain historical exhibits, and 84 per cent. of these are in the oldest states. Massachusetts leads with 12 such museums. Pennsylvania has 10, Virginia 4, Washington, D. C., and New York 3 each, while California and Illinois have 2 each. Maine, Maryland, New Jersey, New Mexico, Ohio, Rhode Island and Utah have each one such museum. Nearly all of these museums are under the control of historical societies, most of which receive little or no aid from public grants and, in common with other learned societies in our country, are financially poor and becoming relatively poorer as the country develops. A museum of history maintained at least partially by public funds should be established in each of our leading cities.

Although remarkable progress has been made in the establishment of museums of art in our country within the past ten years, these institutions still exist in surprisingly small numbers even in some of our richest states. Massachusetts has 14, New York and Pennsylvania 12 each, Washington, D. C., 7, California 3, Colorado, Connecticut, Illinois, Maryland, Rhode Island and Virginia have 2 each, while Georgia, Michigan, Missouri, New Mexico, Ohio, Oregon, Utah and Wisconsin each have 1. In addition to these, however, there are 19 general museums which are devoted to both science and art. Eighty per cent. of our art museums are in the states on the Atlantic seaboard. The majority of these institutions are art galleries rather than museums of art. Nowhere is the labeling more imperfect or the arrangement of the exhibits more illogical, from the educational standpoint, than in most of our art museums. Almost no effort is made to give a comprehensive view of the development of art, and the pictures are arranged to produce what is known as an 'artistic effect' rather than to show the sequence of the various schools or the causes of their rise and decline. We also learn but little of the life histories of the artists, their aims or achievements, and the display is designed to appeal more to the eye than to the mind. It is not the purpose of this article to criticise, but to indicate what might be done in the future. No department of museum activity can exert a more immediately refining influence upon the people or lead more surely and rapidly to a higher development of public appreciation of the beautiful, than that of art. The contrast between the architecture in our American cities and that of those in Europe is sufficient warrant for the conclusion that although great improvements have been made within the past few years, public appreciation is still crude and uneducated in matters of art.

Our oldest, most numerous and, in general, richest museums are those devoted to natural history. These are more uniformly distributed over the country than are museums of other sorts, only 46 per cent. of them being found in the region comprised in the original thirteen states. New York leads with at least 31 such museums, then follow Pennsylvania with 19, Massachusetts 17, Illinois 15, Ohio 14, and California with 10. Not only are the natural history museums of New York and Pennsylvania more numerous than those of Massachusetts, but the annual income of a single natural history museum in New York is much greater than the combined incomes of all such museums in Massachusetts, and the richest museum in Massachusetts has not one third the annual income of the Field Columbian Museum of Chicago.

Although now small and poorly supported financially, a generation ago the natural history museums of Massachusetts

were the most creditable in our country, and while they are still distinguished as having been the fields of labor of some of our greatest naturalists and as having produced research work of high and lasting value to science, yet are they doomed to sink into insignificance in comparison with those of New York, Illinois, Pennsylvania and California unless that public spirit which has ever distinguished Massachusetts be immediately aroused in their behalf.

Number of Museums in each State.

Name of State.	Natural History.	Art, History, Industries, Etc.	Total.
New York	31	13	44
Pennsylvania	19	18	37
Massachusetts	17	20	37
Illinois	15	3	18
California	10	5	15
Ohio	14	1	15
District of Columbia	6	8	14
Virginia	4	5	9
Colorado	6	2	8
Kansas	8	0	8
Maryland	5	3	8
Wisconsin	7	1	8
Connecticut	5	2	7
Iowa	7	0	7
Missouri	6	1	7
Rhode Island	4	3	7
Indiana, Minnesota, Tennessee.	5	0	5
Georgia, Maine, Michigan	4	1	5
Kentucky, South Carolina, Vermont, Washington	4	0	4
New Jersey	3	1	4
Alabama, Mississippi, Nebraska, New Hampshire, South Dakota, Texas	3	0	3
Oregon	2	1	3
Florida, Hawaii, Louisiana, North Carolina, North Dakota, Utah	2	0	2
New Mexico	1	1	2
Arizona, Arkansas, Delaware, Idaho, Indian Territory, Montana, Oklahoma, West Virginia, Wyoming	1	0	1

Within recent years Boston has acquired what is probably the most extensive and well-planned system of public parks in our country, but it must be stated, to her discredit, that she gives nothing to the support of her museums, all of which are struggling against undeserved poverty. In this respect she is more conservative than New York, Philadelphia or Chicago; and even small cities of Massachusetts display a more enlightened policy than Boston.*

The accompanying table gives the geographical distribution of our museums.

Resources and Expenditure of our Museums.

No general consideration of museum economy in the United States has hitherto been attempted. Believing that some interesting results might be derived from such a study, an examination was made of the latest treasurers' reports of sixteen of our leading museums, such as the National Museum, American Museum of Natural History, Metropolitan Museum of Art, Field Columbian Museum, Pennsylvania Museum and School of Industrial Art, Free Museum of Science and Art of the University of Pennsylvania, The Museum and Library of the Art Institute of Chicago, Carnegie Museum of Natural History, Museum of Comparative Zoology at Harvard College, Museum of the Boston Society of Natural History, Cincinnati Museum Association, Peabody Museum of Archeology in Cambridge, Detroit Art Museum, and three other institutions which are under political auspices and whose employees are controlled by civil service rules. The total annual income of these museums amounted to $1,418,144, of which $723,583 was derived from public grants, while $694,561 was obtained from private sources consisting of gifts, subscriptions, interest on endowment and admission fees. This amount does not include balances on hand at the beginning of the year or the proceeds of sales of speci-

* In 1901–02 the city of Springfield, Massachusetts, appropriated $29,945 for the maintenance of its museums and library.

mens or catalogues, but represents the voluntary contribution of individuals to the direct support of the museum.

These museums expended $725,116 for salaries and wages, from which we see that the public support which they received was not quite sufficient to meet this item alone, the entire expense for maintenance, purchase of specimens, cost of expeditions, libraries and publications being, so to speak, borne by voluntary subscription of private individuals.

It is possible to discover the amounts paid for specimens in the case of thirteen of these museums; the total sum being $80,828, or less than twice the sum annually expended by the Kensington Museum for this purpose. Eight of the museums maintained expeditions for collection or research, and these cost in the aggregate $48,544. Nine institutions expended a total of $58,118 in the publication of researches, and twelve expended a total sum of $13,895 for books, pamphlets and binding. In other words, in these sixteen museums we find that 51 per cent. of their income came from public grants, and 49 per cent. from private sources, while 51 per cent. of their total income was expended in salaries and wages. Where the amounts are known, an average of 6.1 per cent. of their income was expended for specimens, 4.9 per cent. for expeditions, 5.7 per cent. for publication of researches and 1 per cent. for books, pamphlets and binding; leaving 31.3 per cent. for maintenance, repairs, cases, installation of collections, etc.

The museums under political auspices, whose employees serve under civil service rules, show poor economy in their management in comparison with that of museums whose finances are managed by boards of trustees not subjected to political influences, and who have full control over the administration of public or private funds, with power to appoint and discharge all museum employees under rules of their own making.

Name of Museum.	Year Ending	Total Per cent. Paid for Salaries and Wages.	Per cent. Paid for Salaries of Scientific Staff and Preparators.	Per cent. Paid for Salaries of Clerical Staff, Laborers and Guards.	Per cent. Paid for Specimens.	Per cent. Paid for Expeditions.	Per cent. Paid for Books, Pamphlets and Binding	Per cent. Paid for Publication of Researches.
National Museum.....	June 30, 1901.	66	24	42	4.6		0.7	4 7
American Museum of Natural History.....	Dec. 31, 1901.	45			10.2	9.6	0.6	5.4
Field Columbian Museum	Sept. 30, 1901.	53	31	Janitors, guards, labor, 22.	6.9	7.4	0.4	2.5
Carnegie Museum of Natural History	March 31, 1902.	52			13.6	8.2	2.2	5.1

For example, the four institutions under civil service rules expended from 45 per cent. to 75 per cent. of their incomes in the payment of salaries and wages, the average being 63.7 per cent.; whereas the twelve museums not under civil service regulations expend from 25 per cent. to 66 per cent. in salaries and wages, the average being 45 per cent. or 18.7 per cent. lower than that of the institutions under the civil service.

A fair example of the general lack of economy of civil service administration in our museums is illustrated by a comparison of the expenditure of our National Museum with that of three non-political institutions,

such as the American Museum of Natural History, the Field Columbian Museum and the Carnegie Museum of Natural History in Pittsburgh.

This comparison appears fair, owing to the fact that the management of our National Museum is more economical than that of many other prominent museums under political auspices.* The results are presented in the table on previous page showing the percentage of total income devoted to various purposes.

In general, it appears that museums under political control expend more for salaries and wages and less for specimens than do those whose management is entrusted to boards of trustees who have power to appoint and discharge employees independent of civil service rules. Museums under civil service rules, however, expend relatively more for books and pamphlets, and more for the publication of research, than do public museums not under political control.

The museums of universities or of learned societies, however, lead in the proportionate amount devoted to the development of their libraries and to publication of original research, and these institutions have in our country contributed to the advancement of science and education in a ratio wholly disproportionate to their relatively meager income.

An analysis of the expenditures for salaries and wages in our museums under civil service shows that in general they pay much more for the services of clerks, guards and laborers than for the salaries of men of science, artists and skilled preparators, while the reverse is the case in museums under other auspices. The museums of colleges are most economical in their appropriation for salaries, but in many such museums the lack of curatorial work upon the collections is very apparent, and renders their educational value insignificant in comparison with that of collections which have received more attention in labeling and arrangement. Also the universities often rely, to a considerable extent, upon the services of unpaid curators, who devote only a portion of their time to museum work and whose spasmodic efforts are, on the whole, unsatisfactory.

As Sir William Flower* aptly states: "What a museum really depends upon for its success and usefulness is not its building, not its cases, not even its specimens, but its curator. He and his staff are the life and soul of the institution, upon whom its whole value depends."

Specimens are materials only; their usefulness depends upon what is done with them. Our museums can do no better than to obtain the services of men of the best scientific training and efficiency. We require better rather than more men. Museums from their nature afford exceptional opportunities for study, research and exploration, and may be made peculiarly attractive as fields of labor for men of science who desire to increase knowledge. The leading men of science in our country should be found in the museums, but a narrow policy in the granting of opportunity for research, exploration and publication, and the general poverty of our museums, have confined them largely to our universities, where their efforts are devoted to elementary teaching rather

* The National Museum being the repository for all collections made under the direction of government, is not obliged to maintain expeditions under its own auspices. The sum of $2,016, or 0.7 per cent. of its total income, was devoted to 'travel.'

* 'Essays on Museums and Other Subjects Connected with Natural History,' London, 1898, p. 12.

than to productive scholarship,* and this condition will hardly improve until our universities can afford to appoint professors who shall lecture exclusively to the students of the graduate school.

As a whole, our museums expend too small a proportion of their resources upon the development of their more serious aims, such as the maintenance of learned libraries, the publication of research and encouragement of exploration. The great majority of our museums contribute little or nothing to the direct advancement of knowledge, either in publication of original work, or in the maintenance of lecture courses given by acknowledged masters. Moreover, the installation, arrangement and labeling of their collections, and economy in expenditure leave much to be desired. It is true that all of these deficiencies are in a measure traceable to the poor support which our museums receive from public funds, a fact which is apparent when we consider that the British Museum in 1897–98 received a public grant of about $812,000 or more than the entire public support given more recently to sixteen of our best museums whose finances we have been considering.

In European countries the state of civilization and development of culture of each nation is certainly commensurable with the development of its museums. Measured by this standard, the United States compares unfavorably with other civilized countries.

This investigation appears to show that the average well-managed museum in the United States devotes one half of its annual income to salaries and wages, one third to maintenance, installation and repairs, and only about one sixth of its income to expeditions, library, publications of research and purchase of specimens.

* An excellent exposition of the inefficiency of our universities as centers for the production of research is given by Hugo Münsterberg, 'American Traits from the Point of View of a German,' Chapter III., 'Scholarship,' 1901, Houghton Mifflin and Co.

ALFRED GOLDSBOROUGH MAYER.
MUSEUM OF THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

*MONTANA AS A FIELD FOR AN ACADEMY OF SCIENCES, ARTS AND LETTERS.**

IT seems appropriate at this meeting, the first in the history of the work of the Montana Academy of Sciences, Arts and Letters, to discuss the opportunities for work in the state, rather than to take the discussion of some problem or phase of work, tempting as the latter may be. In this day of many societies and organizations, when each line of work has its own organization, with a membership composed of those directly interested in the work fostered by the organization, it would appear that new organizations and societies should not be brought into existence without good reasons for so doing. Let us present some of the reasons for the organization of this academy.

In organization lies strength. According to the laws of physics, if a thousand separate forces act upon an object from different directions the object will move in the direction of the component of all the forces and with the force exerted by it. This component may be smaller than any single force, when the forces act against each other. Or it may be the sum of all of them when they act together. Each human being may be considered to represent a force. The sum total of progress represents the combined action of all the forces of the different units, human beings. When the work is concerted and not antagonistic, progress is rapid. When every

* Address delivered at the first meeting of the Montana Academy of Sciences, Arts and Letters, at Bozeman, Montana, December 29, 1902.