

TWENTY-FIFTH
ANNUAL REPORT
OF
THE CURATOR
OF THE
MUSEUM OF COMPARATIVE ZOÖLOGY
AT HARVARD COLLEGE,
TO THE
PRESIDENT AND FELLOWS OF HARVARD COLLEGE,
FOR
1884-85.



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FACULTY OF THE MUSEUM.

CHARLES W. ELIOT, *President.*

ALEXANDER AGASSIZ, *Curator.*

THEODORE LYMAN.

JOSIAH D. WHITNEY, *Secretary.*

GEORGE L. GOODALE.

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REPORT.

TO THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE:—

TWENTY-FIVE years ago, on the 13th of November, 1860, the first section of the Museum building was inaugurated. It may not be out of place to recapitulate the changes it has passed through, and to note the gradual transition of the Museum from a State institution to that of an independent department of Harvard College.

It was most natural that Professor Agassiz, with his European ideas of government support for scientific establishments, should primarily have looked to his adopted State for aid in carrying out his cherished plans. While no one was better fitted than he to interest a Legislature, and to obtain liberal appropriations even in the most critical times, yet he also recognized fully the value of the American method of private endowments, and from the outset the Museum owed its material existence to a happy combination of State aid with personal interest. In time, however, with the growth of the Museum, it became more and more difficult to hold together a special Board of Trustees. The intimate connection of the Museum with Harvard College suggested an easy remedy, and the duties hitherto performed by the Trustees were relegated to the already existing governing boards of the University. By this consolidation with Harvard College, the Museum, while it lost the immediate support of the State, gained the good will and interest of the College students, the class upon whom it must eventually depend for its maintenance. To the graduates of Harvard interested in the study of nature the Museum must appeal for intellectual and material support. With the ever-increasing influence of the natural sciences, the field of the Museum becomes a large one, and men must be found who will devote themselves to its interests and keep it abreast of the requirements of a great University.

The State aid forms but a part either of the invested funds or of the expenditures incurred in behalf of the Museum. During the first decade of its existence its resources were naturally spent in forming the collections which in some fields of study are to make it a great scientific centre. This result was necessarily accomplished at a certain sacrifice of its educational aims, and the number of trained students sent out from the Museum as teachers during its earlier years, though undoubtedly great, was perhaps not as large as might have been expected from the pre-eminent qualifications of the founder himself as a teacher. Fortunately, the period of great outlays for collections, and for buildings and their equipment, is nearly past, and we may hope in the future to see the means of the Museum expended rather on its laboratories, its investigations, and its publications, than on material objects. There are no doubt many directions in which it would be advisable, for the sake of completeness, still further to increase our collections, but that may be left for the future benefactors of the establishment.

By a strange coincidence the foundation of the Museum dates from the publication of the "Origin of Species." Of course so powerful a movement in the scientific thought of the time could not fail to modify the problems which the institution was intended to illustrate and to solve. Yet the usefulness of the plans laid down for the Museum remains unimpaired by the new methods of treating questions of affinity, of origin, of geographical and geological distribution. Should the synoptic, the systematic, the faunal, and the palæontological collections cease to bear the interpretation given to them by the founder, their interest and importance, even for the advocates of the new biology, would not be one whit lessened. If the anatomical, embryological, synthetic, and other series presented by the pupil of Cuvier from his point of view, are differently considered to-day by the followers of Darwin, they may for this very reason have gained a general interest they did not formerly possess.

The plans of the founder have been realized, perhaps, far beyond his most sanguine expectations, and it has been reserved for his immediate successor to see the establishment of a prosperous school of Natural History, amply provided with laboratories, connected with a University, and recognizing in the administration of its trusts the claims of the College and of the advanced

students, as well as those of the original investigator, and giving them ample opportunity to publish their theses or researches. The Museum has not, however, limited its usefulness to being a simple educational University Museum; it has become, to a certain extent, a public institution, intended for a larger circle.* Finally, it has not neglected the interests of specialists, and has accumulated extensive collections, conveniently stored, and easily accessible to all who are able to make a proper use of this material. These collections are in charge of a limited number of assistants, whose time is not wholly occupied by their administrative duties.

The publications of the Museum, in the shape of its eleven volumes of Bulletins and thirteen of Memoirs, give, with the addition of the Monographs thus far issued by workers at the Museum, a fair idea of the field covered by its various departments. It was but natural that during my administration special stress should have been laid on the Zoölogical Department, but it has been my aim not to allow the other departments to lag too far behind. Each branch should in its turn be properly developed, and the plan of our buildings is fortunately such, that, as fast as any department outgrows its quarters, a new section of the building may be added for its reception. There is no reason why, with the increase of the Geological, Anatomical, Geographical, or other Department of the Museum, suitable accommodations and room for expansion should not be provided.

The concentration of all the departments of Natural History within a single square will in the future be the natural result of the present plans. It will facilitate greatly the work of the different departments, prevent needless duplications, and increase the efficiency and economy by a central management.

The Library has grown from a few hundred volumes to an important collection of biological works, and it is constantly increased by its exchanges, purchases, and donations; it now numbers over 17,500 volumes, exclusive of pamphlets and of the Whitney Library.

In 1860 the space covered by the first section of the building erected was eighty by sixty feet, and it contained in all sixteen

* The number of visitors is constantly increasing, and on Sundays the building is crowded.

rooms, used as lecture-room, laboratories, store-rooms, and exhibition-rooms. A visitor to the Museum in those early days would now find it difficult to recognize the rooms or their contents in the present arrangement. The ground covered by the building as it stands to-day is five times as great. There are no less than eighteen exhibition-rooms,* with their corresponding galleries, of which eleven are open to the public. Thirty-two rooms are used for storage and quarters for special students and assistants. There are also a lecture-room, a Curator's room and office, eleven laboratories of biology and geology for College and advanced students, four rooms devoted to the Library, and in the basement, in addition to boiler space, rooms intended as an Aquarium and Vivarium and for receiving freight ; — making in all seventy-one rooms, the dimensions usually being thirty feet by forty, and twelve galleries.

Of course, this result has not been attained without a very considerable expenditure, and from the nature of the case a certain waste could not be prevented. In addition to the ordinary income of the Museum about half a million of dollars has been expended since 1875 for land, the buildings, the collections, and the publications.

We have probably reached the limit of a university organization for such an institution. While it undoubtedly is capable of indefinite expansion in the way of endowments for special professorships and assistants, it is doubtful if it is wise to expect or aim at any expansion beyond that which naturally comes from the demands of endowed chairs in a university. Original investigation has always been best promoted in connection with educational institutions, and, in conformity with their demands, museums should grow so fast and no faster, unless they are to become mere unwieldy and meaningless accumulations.

The difficulty, if not impossibility, of uniting with other institutions, so as to avoid repetitions which are often both useless and expensive, is a most discouraging feature in museum administration. No matter how the field may be preoccupied, each director will pride himself upon his success in having accomplished what probably has already been done by others. No doubt, in a country covering so great an area, and with the dense

* For an enumeration of the contents and uses to which our space is devoted see Report for 1882-83.

population occupying some of the older States, a considerable amount of duplication is permissible. Yet our higher institutions of learning, or rather the numberless sickly children carefully nursed under the name of Universities in every State of the Union, present a spectacle of scientific impracticability and a waste of resources foreign to the hard-headed and thrifty American methods in other directions. Germany, with its old population, boasts but a fraction of the number of our universities, where collections and laboratories in every department of science only lead a languishing existence, and from want either of co-operation or of centralization do not produce results in the least commensurate with the expenditures. The good effects of genuine competition are felt as keenly in scientific matters as in business circles, but the mere paralleling, for the sake of local prejudices, of an older institution, if I may be allowed to borrow this expression from another field, is as disastrous as it is wasteful. No institution can abandon a well considered and original policy, because a neighbor chooses to do the same thing somewhat later. Fortunately, it matters little in scientific matters where the progress is made, as long as the thing is accomplished. Methods and aims have of late years changed so rapidly, that the managers of older establishments may be pardoned at feeling somewhat discouraged if their plans have become antiquated before they are fully carried out.

A school of Natural History such as was contemplated by the founder of this Museum not only needs collections, libraries, an ample fund for its publications, a large staff of teachers, and the necessary buildings for storage and for its laboratories; but it also needs in the field and on the sea facilities for ever renewing its contact with nature itself, without which the work of its teachers would soon pass into that of the closet naturalist, and their instruction lose its stimulus. It is in this direction that we may yet hope to unite as far as practicable the forces in the field and on the sea-shore. In connection with the Laboratory of the United States Fish Commission, the Universities of the country might found a seaside laboratory which would render unnecessary, except for special work, the various establishments already under way along our coast. Those States which from a geological or biological point of view present an interesting field of study could be visited in succession, in accordance with

a well-considered plan. But the unfortunate conditions existing in many of our educational institutions renders the execution of such a plan a most delicate task.

To fill out the skeleton plan of our Museum as originally sketched, there yet remains the completion of the rooms devoted to the Marine Faunæ and the Palæontological collections. The expenditures necessary for this object are considerable. It will require at least \$8,000 to place the Atlantic and Pacific Rooms in a condition to be opened to the public, and the four Palæontological Rooms can scarcely be completed for a less sum than \$25,000. Having for more than ten years borne the brunt of the expenditures necessary to erect the buildings, to accumulate the collections, and to place on exhibition what is now open to the public, I feel as if I ought to devote my time and such means as I may command in a different direction, and one perhaps more suited to my tastes. The development of the proper courses of instruction in Natural History at Cambridge, the fostering of original work among the Professors and Assistants of the Museum as well as among the students, and the providing of the means for the publication of such researches as may be of value, is a field quite large enough in addition to the carrying on of my own scientific researches, which have suffered more or less from the interruptions due to the claims of the management of so large an establishment. While this is to be my principal object, I shall not forget that, in addition to these departments of the Museum in which my interest was centred, there are others yet to be completed.

The claims of the Geological Department for a larger share of the income of the Museum, and for additional room, cannot be much longer ignored, and there are many collections still to be acquired before we shall attain the proper proportions between the various departments of the Museum.

The following annual courses of instruction have been given at the Museum: —

A course in Biology, by Professors Goodale and Faxon.

An advanced course in Zoölogy, by Professor Faxon.

General Lectures by Professor Mark, who also had charge of the Embryological Laboratory; Professor Faxon took charge of the general Biological Laboratory, assisted by Mr. Nolen.

Professors J. D. Whitney, Shaler, and Davis gave the usual courses in Geology, Palæontology, and Physical Geography.

For the details of the courses I would refer to the accompanying special Reports.

About nine hundred volumes have been added to the Library of the Museum during the past year. This is exclusive of the books ordered by the College Library for the Natural History Department.

The Europeo-Siberian Room has been opened to the public during the year. This, with the exception of the Marine Faunæ, completes the arrangement of exhibition-rooms devoted to zoological collections.

Collections of Fishes and of Echinoderms have been sent to the Museums of Stockholm, Bergen, Brussels, Paris, Copenhagen, London, Florence, Milan, Göttingen, Hamburg, and Vienna, to the Smithsonian, to New Haven, and to Professor Ward of Rochester. Exchanges have also been continued with our Australian correspondents.

For the High School of Gloucester a good typical collection of Mollusks and of Echinoderms was made by Messrs. Hamlin and Fewkes.

Materials from the Museum collections have been sent for study to the United States Geological Survey, to Dr. Dobson of the Zoölogical Society, to Professor Solas, Dr. Joubin, and to Professor Bütschli. A number of persons have received invoices from the Entomological Department. In view of the number of specialists applying for types contained in the Museum, it will soon become impracticable for us to send out such material, unless our working force can be increased, as this work is constantly making greater claims upon the Assistants, leaving them no time to attend to the regular work of their departments.

Dr. Meinert has returned the collection of Cymathoæ sent him and the late Professor Schiödte for their Monograph of the group. Professor Lesquereux has returned to the Museum the large collection of fossil plants collected in 1883 by Professor Lakes of Golden, which he had kindly consented to examine and to identify. He has retained the more interesting species, to be figured in a memoir he is preparing for the United States Geological Survey on the fossil plants of the Dakota group. The spiders sent to Count Keyserling have also been returned to the Museum. Mr. P. H. Carpenter has returned the Stalked

Crinoids obtained by the "Blake." Excellent progress is making with the reports on the "Blake" collections still unfinished, and it is hoped that during the coming year the reports may all be published. The plates for Mr. Dall's Report are nearly completed, and Professor Goode and Dr. Beane hope within a very short time to send the manuscript of the descriptions of the collection of Fishes made in the Gulf of Mexico by the "Blake." With the completion of these publications it will be possible to devote more space than heretofore to the results of the special work of the Assistants, and to the investigations of the Professors, Assistants, and students in the Museum Laboratories both at Cambridge and at Newport.

The work at Newport has been limited during this season to that on the Embryology of Echinoderms by Dr. Fewkes, — who has been quite successful in tracing the development of Echinarachnius and of Ophiurans, — and to my own work on the Embryology of Pelagic Fishes.

At the Museum Dr. Whitman has continued his previous work. Dr. Faxon has, in addition to his College instruction, devoted his time to the revision of the Astacidæ. Dr. Mark has nearly brought to completion the memoirs he is preparing on the development of Lepidosteus, while taking charge of the Embryological Laboratory. This Laboratory will hereafter be well equipped for work, the Corporation having made an appropriation to supply it with the greater part of the necessary apparatus.

Dr. Farlow, although on leave of absence, spent a portion of his time at Cambridge at work on a Monograph of the North American Pucciniæ and Uromyces. For the completion of this memoir he collected a considerable amount of material during his trip to the West Coast. Dr. Farlow regrets that the Botanical Department should not have a Museum where the larger and more striking forms of vegetation could be displayed. The greater part of the collection made by Dr. Farlow had to be reduced to the common herbarium size. In addition to some short notes Dr. Farlow published in the Proceedings of the American Academy "Notes on some Species of Gymnosporangium," and a paper on the Synchytria in the Botanical Gazette.

Doctor Horn of Philadelphia has kindly spent a number

of days at the Museum examining with Dr. Hagen the Le Conte collection, with special reference to the type specimens it contains.

Dr. Slade has completed the unpacking of the collections of Western Fossil Vertebrates brought together during the past years. There is a large amount of excellent material, but the bulk which has to be examined and rejected before the material suitable for the Museum can be set aside makes this method of collection by professional collectors a very expensive one. It will be far cheaper, and more for the interest of the Museum, to purchase even at a comparatively high price a collection which has passed through this stage, and represents only such specimens as are considered of value by an experienced palæontologist;—such a collection, for instance, as that brought together by a well-known palæontologist, containing the principal types of the greater number of our Western formations, representing many years of study at home and explorations in the field. An accession of this kind would form an invaluable addition to our North American fossils, and, if this collection cannot be purchased by the friends of the Museum, we must be gradually gathering a similar collection. To duplicate this collection would require at least ten years of active field work and an expenditure of over \$75,000. But I may hope that some friend of the Museum will enable us to secure this important scientific material, which ought not to be allowed to pass out of the country, but be kept together as representing the active work of an indefatigable investigator.

In the mean while, thanks to the permission granted us by Professor Marsh, casts have been taken of the more interesting and characteristic of the types described by him. These have now been received at the Museum, and will in due time be placed on exhibition in their proper place with the Palæontological series. Want of means has prevented the Museum from securing the important collection of fossils brought together by the late Dr. Thomas Wright of Cheltenham. The collection was, in accordance with the terms of his will, offered to the Museum, and we were very reluctantly compelled to decline the offer.

Mr. J. A. Allen, who for many years has taken charge of our collections of Birds and Mammals, has left the Museum, having

accepted a similar position in the American Museum of Natural History. The Museum is most fortunate in having secured the co-operation of Mr. William Brewster, who has kindly consented to charge himself with the department formerly under Mr. Allen's care. Since his appointment, Mr. Brewster has made an examination of the mammal skins, and, in accordance with the plan already carried out in other departments, of rejecting everything not of the first quality, he has materially reduced its bulk. The collection is now of great value, and can readily be cared for. Before leaving, Mr. Allen finished labeling the specimens in the Indian, African, and European Rooms, and he further revised the rapacious birds, the pigeons, and the grouse.

We have also lost the services of Mr. Paulus Roetter, who for the past eighteen years has been the indefatigable artist of the Museum, and to whose skilful pencil the Museum publications owe the greater part of their illustrations during that time.

Mr. Lyman, who during the past two years could give but a most general supervision to his department, has now resumed his place at Cambridge.

The Museum is indebted to Messrs. Cabot and Slade for their interest in behalf of their respective departments. Dr. Slade has made a complete catalogue of the Osteological collections.

Professor Hamlin has unpacked and made a preliminary arrangement of our acquisitions of Fossil Invertebrates; they are now safely stored in the four rooms of the first floor devoted to that purpose. He has also transferred to the upper story the Fossil Vertebrates, which occupy two large rooms of that floor. While an immense amount of work still remains to be done on the collection of Fossils, they are all accessible, and it will be a comparatively easy task to select from our stores the necessary series for the Palæontological Exhibition Rooms, and to place the collection in order for special students.

Mr. Garman has brought the collections of Fishes and Reptiles into perfect order, and is gradually sending out our duplicates for distribution to other institutions. Professors Hamlin and Faxon have also condensed the alcoholic collections of Mollusks

and Crustacea, and Mr. Fewkes has done the same with the Radiates. This now leaves in the basement only the alcoholic collections of Birds and Mammals, which have not yet been thoroughly examined; the other alcoholic collections having all received the revision they so greatly needed.

I may mention among the more important accessions, exchanges with the Museums of Bergen, Milan, Göttingen, and the British Museum. From the "Challenger" office we have received a series of duplicates of their Stalked Crinoids, in exchange for a similar series of the "Blake" expedition, intended for the British Museum. From the Paris Museum we have received a collection of Patagonian birds, — a valuable addition to our American faunal series. We have continued a general system of exchanges with the Smithsonian, as well as, to a limited extent, our purchases from Professor Ward, the principal additions belonging to the African Faunal Room. We have also received in exchange casts from the Museums of Oxford and of Munich. A collection of Palæozoic Fossils was made by our collector, under the direction of Mr. C. D. Walcott, in the Eureka District, with the permission of Major Powell, the Director of the Geological Survey.

During my visit to the Sandwich Islands I devoted considerable time to the study of the recent and extinct reefs of the group, and am now preparing a short paper on the subject for the Museum Bulletin. I made an extensive and interesting collection of the various limestones characteristic of the modern and ancient reefs.

From the Peabody Museum of Salem we have received in exchange the most important addition to our Entomological Department ever received. It contains a large number of types described by prominent American and European entomologists. I must confess that I accepted this collection with great reluctance, as it will involve a considerable outlay in the way of boxes and cabinets, as well as a good part of the time of the Assistants of the department to preserve it from deteriorating. The same is true for other collections we have received, and which do not all fill some important gap. A few such additions, entailing increased expense and care, will materially cripple the usefulness of the institution. It becomes a serious question how far we can allow our resources to be absorbed in the future by

the care of collections which those who have brought them together are unable to give them, and thus be almost compelled to divert our means from the more legitimate outlays of the Museum, without at the same time receiving the necessary assistance for such increased work.

I am happy to state that the invaluable collection of Indian Birds presented to the Museum by Mr. A. O. Hume of Simla is now at the British Museum. In a letter addressed to Prof. W. H. Flower, Director of the British Museum, Mr. Hume says, "Of the duplicates available, I would wish that the first set should be sent to Professor Agassiz." The Director of the British Museum also informs me that the selection of our series will, in accordance with the wishes of Mr. Hume, be made by Mr. Sharpe.

A list of the Museum publications issued during the past academic year is given in Appendix A of this Report. They consist of two numbers of the Bulletin, and of two numbers of the Memoirs. The third number of the Embryological Monographs having absorbed nearly all the miscellaneous plates prepared for that work, this publication will for the present be discontinued. Professor Whitney has published for the Museum the first part of the Lithological Studies by Professor Wadsworth, announced in the last Report.

The Report of Mr. Murray on the specimens of bottom deposits obtained by the "Blake" is now passing through the press, and will form one of the numbers of the Bulletin. Professor Faxon has also completed his "Revision of the Astacidæ," and I have myself, in connection with Mr. Whitman, completed the first part of an investigation on the "Embryology of Osseous Fishes." These two monographs have been printed, and will be issued as numbers of the Museum Memoirs.

In addition to the investigations issued in the publications of the Museum, Professors Hagen, Shaler, Faxon, and Davis, and Messrs. Garman and Fewkes, have published in the Proceedings of the American Academy and other journals a number of papers. A list of these is appended to the special Reports. I have with Dr. Whitman printed in the Proceedings of the American Academy a preliminary account of our investigations on the development of Pelagic Fishes. I have also made excellent progress towards completing the final Report of the "Blake Cruises."

Thirteen chapters are printed, leaving unfinished only the chapters devoted to the zoölogical results, which await the final reports of two or three special investigators. Professor Huxley has kindly sent me for this Report drawings of the *Spirula* dredged by the "Blake," which had been sent to him for use while preparing his Report on the specimens of the same genus collected by the "Challenger."

The first part of the final Report of Mr. P. H. Carpenter on the Crinoidea of the Challenger has been published.* This includes also the Stalked Crinoids of the Blake which had been sent to Sir Wyville Thomson, who intended to incorporate them in his Report on the Challenger species. After his death, the Challenger as well as the Blake collections were transferred to Mr. Carpenter, who described the Blake material in connection with that of the Challenger, so that his Report is a complete monograph of the recent Stalked Crinoids. The material available for some of the species of *Pentacrinus* was very abundant, and of this Mr. Carpenter has made admirable use. The monograph includes not only a description of the various species, but also a most thorough comparison of the Neocrinoids with the Palæocrinoids. The species collected by the Blake have supplied valuable material in the description of some of the Stalked Crinoids included in the Report on the Challenger Expedition Crinoidea.

The collection of the Blake Myzostomida sent to Dr. L. von Graff for study has been returned by him. The result of his examination of the Blake species has been incorporated in the final Report on the Challenger Myzostomida published in 1884.† A Preliminary Report of the Blake species has already appeared in the tenth volume of the Museum Bulletin. In addition to the twenty-eight species of the Blake expedition, and the thirty-three of the Challenger, Dr. Graff's Report is a complete monograph of this small group of animals, based upon the collections of the principal Museums of Europe.

* Report upon the Crinoidea collected during the Voyage of H. M. S. Challenger during the Years 1873-76. By P. Herbert Carpenter, D. Sc., Assistant Master at Eton College. pp. i.-xxii., 1-442, Pls. I.-LXII. Zoöl., Vol. XI. London, 1884.

† Report on the Myzostomida collected during the Voyage of H. M. S. Challenger during the Years 1873-76. By Dr. L. von Graff. pp. 1-82, Pls. I.-XVI. London, 1884.

Professor E. Perrier of the Jardin des Plantes has published in the *Nouvelles Archives du Muséum* his final Report on the Starfishes of the Blake, of which the administration of the Jardin des Plantes kindly sent us fifty copies for the use of the Museum.* Professor Perrier having already published, in 1875 and 1876, a general Revision of the Starfishes, based upon the examination of the collections of the principal Museums of Europe and of our own, we could not have intrusted the Blake collections to better hands. Professor Perrier's memoir describes forty-six new species from the region explored by the Blake. There were known previously from the same district only twenty-seven species, and the species first brought to light by the Blake have added nearly one tenth to the number of species of Starfishes known.

It would be advisable, if possible, to change the somewhat cumbrous official name by which the Museum has been known for the past twenty-five years into a simpler and at the same time more comprehensive title, according better with the extended field now covered by the Museum.

ALEXANDER AGASSIZ.

CAMBRIDGE, October 1, 1885.

* *Mémoire sur les Étoiles de Mer recueillies dans la Mer des Antilles et le Golfe du Mexique durant les Expéditions de dragage sous la Direction de M. Alexandre Agassiz. Par Edmond Perrier, Professeur Administrateur au Muséum d'Histoire Naturelle de Paris. Nouvelles Archives du Muséum. Paris, 1884. Tom. VI. pp. 127-276.*

REPORT ON THE GEOLOGICAL DEPARTMENT.

BY JOSIAH D. WHITNEY, *Sturgis-Hooper Professor.*

DURING the College year 1884-85 a course of forty-eight lectures on Economical Geology was given by the Sturgis-Hooper Professor, which was attended by about twelve College students, mostly Seniors. This course was made more popular than it had before been, and special attention was given to the mineral and metallic resources of the United States, and to their economical development.

There were no special students in Geology or Lithology.

Doctor Wadsworth, after the completion of the first part of the "Lithological Studies," of which there was given in the last Report of this Department a full account, went to Europe, where he spent most of the year. His object was to make himself acquainted with the leading European lithologists, and to examine the most important collections in this department in England and on the Continent. Every facility was given him for the study of such of these collections as he had time to visit, and especially those of Vienna, Berlin, and London. Dr. Wadsworth has published several lithological papers during the year. He has now left Cambridge to enter upon the duties of the Professorship of Geology in Colby University, at Waterville, Maine; but the publication of the "Lithological Studies" can be resumed at any time, if the necessary pecuniary arrangements can be made. A large portion of the work is already done, and when published it will complete the eleventh volume of the Memoirs of the Museum. The Sturgis-Hooper Professor has published one or two brief geographical papers, and also prepared the definitions in Physical Geography, Geology, Mining, and Metallurgy, for the new dictionary to be issued by the Century Company of New York. As a special subject of

investigation, he has taken up the surface and glacial geology of the United States, and has done considerable field work in various regions for the purpose of getting facts which might throw light on some of the extremely difficult and perplexing problems presented in that field of investigation. The observations thus far made are of a nature to encourage a belief that, with sufficient time and labor, some important results may be reached in this direction.

CAMBRIDGE, October 1, 1885.

REPORT ON THE INSTRUCTION IN GEOLOGY, PALÆ-
ONTOLOGY, AND PHYSICAL GEOGRAPHY.

BY PROFESSORS N. S. SHALER AND W. M. DAVIS.

DURING the past year this instruction was given by sections, field and laboratory teaching as follows, viz. : —

1. An elementary course in Descriptive Geology, consisting of sixty lectures and fifteen days of field work on the geology of Eastern Massachusetts. Students in this course were also required to pass an examination on the more important parts of Dana's Manual of Geology. Those who desired to pursue the higher courses in Geology mentioned below were required to take a course on Determinative Mineralogy, given by Mr. O. W. Huntington, Instructor, in the mineral cabinet. The total number of students in this course was one hundred and sixty-five.

2. A course in Advanced Geology, designed to give an acquaintance with the history of the science, with criticisms upon its methods of inquiry; together with some practical knowledge of the methods of field work. In addition to the sixty lectures, the students were required to become familiar with Lyell's Principles of Geology, and also to pursue, under the immediate direction of Prof. W. M. Davis, a systematic course in field work. This course was attended by twenty-five students.

3. A course in advanced field work, in which the students are required to study a selected geological field, and to prepare a report on the same, with a geological map and sections. This course was attended by four students.

4. A course in Palæontology, open only to those who have taken the elementary course in Zoölogy as well as the two courses in Geology named above. Sixty lectures were given in this course, and the students were required to become familiar with the synoptic collection of the Museum, as well as with the small systematic collection of the teachers' cabinet. In addition to my own Lectures on this subject, a short course on Fossil Plants was given by my Assistant, Mr. R. T. Jackson. This course was attended by seventeen students.

5. A course in Historical Geology, designed to give the student the training necessary to recognizing the principal geological horizons by their characteristic fossils. No lectures were given in this course, the instruction being altogether by directed study on the materials contained in the cabinet appropriated to students' use. This course was attended by two students.

Two courses of meetings for the discussion of work done by the students in Geology and Palæontology were held during the winter months.

During the summer months ten of the advanced students in Geology received instruction in field work. Two graduates trained in this department, who received their degrees at the last Commencement, have been appointed to places in the United States Geological Survey.

During the time when not occupied in teaching, I have been engaged as Geologist on the work of the United States Geological Survey on the coast line of New England. The results of this work will in part be found in the forthcoming Report of the Director of that Survey.

The following papers have been published by Prof. N. S. Shaler:—

- On the Origin of Kames. Proc. Bost. Soc. Nat. Hist., Vol. XXIII.
- Kentucky: a Pioneer Commonwealth. Houghton, Mifflin, & Co., Boston, 1885.
- The Negro Problem. Atlantic Monthly, 1884.

The course of Lectures on Physical Geography and Meteorology was given by Professor Davis in about the same form as during the previous year; it was attended by fifty-five students.

During the year Professor Davis has written the following papers:—

1. Geographic Classification, illustrated by a Study of Plains, Plateaus, and their Derivatives. Proc. Amer. Assoc. Adv. Sci., XXXIII., 1884.
2. Drumlins. Science, 1884.
3. On the Origin of Drumlins. Amer. Journ. Sci., 1884.
4. The Cold Island in Michigan. Amer. Meteorol. Journ., II., 1885.
5. Temperature Diagrams. Amer. Meteorol. Journ., II., 1885, pp. 169-175.

REPORT ON THE INSTRUCTION IN BIOLOGY.

BY PROFESSORS GOODALE, FAXON, AND MARK.

IN the absence of Professor Farlow the botanical part of the course in Biology was conducted by Professors Goodale and Faxon. This course was taken by 40 students,—9 Seniors, 20 Juniors, 7 Sophomores, 1 special student, 1 Graduate, and 2 Scientific students. Mr. W. W. Nolen assisted in directing the laboratory work of this class.

The course in Advanced Zoölogy under Professor Faxon was attended by 14 students,—8 Seniors, 1 Junior, 2 special, and 3 Scientific students.

Natural History 2 and 9 were, as usual, in charge of Dr. E. L. Mark.

Of the 104 students who elected Nat. Hist. 2 (Zoölogy) during the academic year 1884–85, 96 took the mid-year examination, and 88 completed the course. Of the latter, 7 were Seniors, 22 Juniors, 37 Sophomores, 16 Freshmen, 4 special students, and 2 in the Scientific School.

The course in Nat. Hist. 9 (Embryology) was pursued by a single post-graduate student,—holder of one of the recently established Morgan Fellowships,—who devoted a large share of his time to an embryological investigation, the results of which will be published soon in the Bulletin of the Museum, under the title: “Observations on the Development of *Agelena nævia*. By William A. Locy.”

REPORT ON OSTEOLOGY.

BY D. D. SLADE.

THE osteological collection of Mammalia is in excellent condition. A few additions have been made during the past year, chiefly by the return to the Museum of skeletons that had been sent to Prof. H. A. Ward for preparation.

A few Cetacean bones from Florida have also been received from the Smithsonian.

The Fossil Vertebrates from the Jurassic, Cretaceous, and Tertiary formations, collected in recent years by Messrs. S. Gorman, Clifford, Allaman, and Hollywood, have been opened and disposed in systematic order in the cases provided for them, and are now ready for determination.

A Systematic Catalogue of the entire osteological collection of Mammals has been prepared.

REPORT ON THE BIRDS AND MAMMALS.

BY WILLIAM BREWSTER.

THE only important acquisition in the Ornithological Department during the past four months is a collection of skins of Patagonian birds, received in exchange from the Jardin des Plantes.

Early in July a thorough examination was made of the collection of skins of the larger Mammals. Their condition proved decidedly unsatisfactory. Many had been originally so badly skinned or preserved that they were nearly worthless; others were broken or defaced in various ways; while a large number had been materially injured, and not a few ruined, by the attacks of moths and museum pests.

This state of affairs was evidently due, not to any neglect in the care of the specimens, but to the gradual accumulation of poor skins inevitable with all large collections, and to the difficulty, if not impossibility, of guarding so much bulky material from insects, especially as many of the cases in which it was stored were far from insect-proof.

As the construction of a sufficient number of suitable cases would have involved a large expense, and as most of the skins belonged to common species, which can be easily replaced, and which, in most cases, are represented by perfect specimens in the mounted collections, it seemed best to dispose, by exchange or otherwise, of everything that could be safely regarded as either a duplicate or worthless. This has been done, and the collection thereby brought within such limits that the really valuable material which remains can be easily preserved from further injury.

REPORT ON THE FISHES, SELACHIANS, BATRACHIANS,
AND REPTILES.

BY SAMUEL GARMAN.

THE process of reducing the bulk of these collections by exchanging the duplicates has been continued. A large number of identifications have been added to the lists. In the exhibition-rooms a number of additions and changes have been made, and considerable attention has been paid to anatomical preparations.

The Museum is indebted for donations to Professor Agassiz, W. S. Bryant, S. E. Cassino, A. P. Chadbourne, S. F. Denton, J. W. Fewkes, F. H. Gould, Miss Helen Lennebacker, J. H. Noble, Prof. F. W. Putnam, Miss Rosa Smith, Prof. S. Watson, Charles White, C. O. Whitman, and N. Vickary. The largest accessions were secured by exchanges, through Dr. Ehlers, Dr. Pagenstecher, and Prof. John Robinson of the Peabody Museum, and in a lot purchased by Professor Agassiz in New Mexico. The series from the Peabody Academy is large and valuable, though the majority of the specimens are duplicates of species already on hand. Those from Göttingen and Hamburg supply a large number of species previously unrepresented here.

Large series of Fishes, of more than a hundred species each, were sent to Museums in Bremen, Florence, Frankfurt (Main), Göttingen, Hamburg, and Stockholm. Another invoice, of specially selected species, was sent to the Milan Museum. Materials for various special investigations were sent to Dr. G. Baur, Prof. F. A. Smitt, Dr. B. G. Wilder, and Prof. R. R. Wright.

The following publications have been based wholly or mainly on material in our collections : —

"On the Use of Polynomials as Names in Zoölogy," in the Proceedings of the Boston Natural History Society.

"The American Salmon and Trout," in the Sixteenth Annual Report of the Commissioners of Inland Fisheries of Massachusetts.

"Notes and Descriptions from Selachians in the United States National Museum," in the Proceedings of the U. S. National Museum.

A Monograph of "Chlamydoselachus," in the Bulletin of the Museum, Vol. XII.

"On the Frilled Shark," in the Proceedings of the American Association for the Advancement of Science, Vol. XXXIII., Philadelphia Meeting.

REPORT ON THE ENTOMOLOGICAL DEPARTMENT.

BY DR. H. A. HAGEN.

THE collections of dry and alcoholic insects sent us by the Peabody Academy at Salem, Mass., is not only the most important addition of the year, but the largest ever received. The pinned insects filled three cabinets, besides several hundred large boxes, most of them crowded with specimens. The alcoholic insects filled several thousand smaller jars or tubes.

Dr. C. A. Dohrn has sent in exchange three different lots of five hundred species new to our collection, Carabidæ, Lamellicornia, Scolytidæ, and Anthribidæ, among them many rare type specimens. Mr. H. Wilson and Prof. S. Watson, of Cambridge, have presented us an excellent collection of Butterflies, Coleoptera, and larvæ, which they collected in Livingston, Guatemala, most of them new to the collection. We have also received valuable specimens from Messrs. Ph. R. Uhler, Baltimore, Md.; B. P. Mann, Washington, D. C.; Chas. V. Riley; J. A. Moffat, Hamilton, Canada; Lieut. Th. Casey and Dr. Geo. H. Horn, Philadelphia, Pa.; Messrs. Th. G. Wood, London, England; G. Künow, Königsberg, Prussia; A. Bell, Nashua, N. H.; and R. Thaxter, Cambridge, Mass.

Mr. S. Henshaw has sent us in exchange very excellent biological specimens, among them a full lot of the types of galls and gall-flies from Florida published by Mr. Ashmead.

H. A. Hagen has presented to the Museum (1.) a large lot of Neuroptera and Pseudoneuroptera collected in S. E. Borneo by Mr. Grabowsky; (2.) three large lots of biological specimens collected in Western Texas; (3.) the types of Mr. Asa Fitch, Hemerobidæ and Chrysopidæ.

The collection, as far as stored in the regular Museum and cabinets, has remained in very good condition. The others,

the collection of Dr. J. L. Le Conte, the collection of Professor Loew, and the collection of Dr. Hagen, packed in old-fashioned, unsafe boxes. As I stated in my last Report, they are in a more than precarious condition. There is no remedy for this state of things, except good boxes and equally good cabinets.

A large part of the Salem collection, chiefly exotic Lepidoptera and Hymenoptera, was infested, and its examination and the rejection of the useless material have occupied four months. Fortunately, the valuable types of North American Insects by Prof. A. S. Packard, A. R. Grote, and V. T. Chambers, and the types of prominent European entomologists, Zeller, Staudinger, Mann, Förster, Walker, etc., placed in better boxes, were in good or tolerable condition, and form now a valuable supplement to our collection. Of the types of Packard's monograph of Geometrinæ only four species are wanting, and nine described by him from specimens belonging to other entomologists. These additions rendered necessary a new arrangement of the North American and European Lepidoptera; they fill now 162 boxes. The collection has been largely used both abroad and here.

Part III. of Rev. A. E. Eaton's monograph of Ephemera was published in the Transactions of the Linnæan Society of London. Count Keyserling has published two papers on our North American spiders in Vienna, *Verhandlungen der Zoöl. Botan. Ges.*, Wien, 1885.

Dr. Meinert's monograph of the North American Chilopoda is just printed in Philadelphia.

Mr. L. Brunner has published a paper on the Orthoptera collected in Washington Territory. Mr. Ph. R. Uhler is occupied in preparing a memoir on a large part of the Hemiptera of the Museum. Dr. S. W. Williston has in his possession the Diptera collected in Washington Territory. Lieut. Th. Casey has published descriptions of a number of species of Coleoptera of the Le Conte and the Museum collections.

A number of entomologists have visited the Museum and compared its types in the preparation of monographs. Among them, Dr. S. W. Williston, for his monograph of North American Syrphidæ (O. Sacken's and Loew's collections); Mr. W. Blanchard, of Lowell, Mass.; Dr. Horn and S. Henshaw (Le Conte's collection), for their new list of North American Coleoptera; Mr. J. B. Smith, for a monograph of Noctuidæ; and Baron

von Osten-Sacken, for a memoir on the Diptera of Central America.

One student (Junior) has worked through the whole year on a special work (synopsis of Rhopalocera); another (Postgraduate) has given what time he could spare to the determination of North American Noctuina and Bombyces. Another special student from Canada has worked throughout the winter here.

The correspondence was as large as usual.

In addition to the purchases by the College, the Assistant has added to the library a number of rare old works and papers, by Peck, Say, and Harris.

The Assistant has published in "Nature," two papers on C. C. Sprengel, and one on Devonian Insects. In Carus Zoölog. Anzeiger, "Ueber Devonische Insecten." In "Papilio," several papers and lists of the types of North American Tineina in the collection, with notes by Prof. H. Frey, Zürich. In "The Canadian Entomologist," papers On *Chalcographa scalaris* and its Enemies; On *Scolytus rugulosus* and the Pear Blight; List of the Phytoptocidia or Mite Galls in the Museum; The Melsheimer Family and the Melsheimer Collection; A Biographical Notice of the Rev. D. Ziegler; On *Xylorydetes Satyrus*; On the Habits of *Coelopa frigida*; White Ants destroying living Trees and changing the Foliage in Cambridge, Mass.; Further Materials on the Hessian Fly, — partly from the old records of the Philosophical Society in Philadelphia, destroying the old tale of the importation by Hessians; and On the Hessian Fly in Italy.

A Monograph of the Embidina is just going through the press; and the First Part of a Monograph of the Immature Stages of the Odonata is in the hands of the printer in Philadelphia.

REPORT ON THE CRUSTACEA.

BY WALTER FAXON.

SINCE the last Annual Report of the Curator of the Museum the collection of Crustacea has been enriched through exchange with Mr. Charles Chilton of Christchurch, New Zealand, and Prof. B. F. Koons of Mansfield, Conn., and through gifts from Prof. D. S. Jordan and Mr. A. W. Butler.

A representative collection of Crustacea has been presented by the Museum to the University of Wisconsin, to repair the loss of the old collection, which was burned.

The Cymothoids belonging to the Museum, which have been for some time in the hands of Messrs. Schiödte and Meinert of Copenhagen, have been restored during the past year. This collection formed an important part of the material upon which these gentlemen based their elaborate Monograph of the Cymothoidæ, published at Copenhagen in the "Naturhistorisk Tidsskrift," 3d Series.

The determination and cataloguing of the collection has gone on as far as the time at the disposal of the Assistant would allow. In connection with this work the Assistant has published "Descriptions of New Species of *Cambarus*; to which is added a Synonymical List of the Known Species of *Cambarus* and *Astacus*," in Proc. Amer. Acad. Arts and Sci., Vol. XX. pp. 107-158, December, 1884; "A Revision of the *Astacidæ*," in Mem. Mus. Comp. Zoöl., Vol. X., 186 pp., 10 plates; also a "List of the *Astacidæ* in the U. S. National Museum," in Proc. U. S. Nat. Mus., Vol. VIII.

REPORT OF THE PALÆONTOLOGICAL AND CONCHOLOGICAL DEPARTMENTS.

BY CHARLES E. HAMLIN.

DURING the past year there have been added in the Palæontological Department:—

1. A collection of Fossil Plants from the Tertiary of Golden, Colorado, purchased from Prof. Arthur Lakes, of the State School of Mines, at Golden.

2. A series of Fossil Fishes from the Huron Shales (Upper Devonian) of Lorraine County, Ohio, collected by and purchased of Mr. Jay Terrell, of Oberlin, Ohio.

The general collections of Cambrian, Silurian, and Devonian Fossil Invertebrata, and the special collection of Fossil Echinoderms, temporarily stored in the old lecture-room of the Museum, have been removed to glazed cases in the rooms upon the first floor, which have been fitted up for their permanent deposit.

The various collections of Vertebrate Fossils have been placed in the cases of the new room assigned to them on the fifth floor.

The Day and Taylor collections of Fossil Invertebrata—the one from the Racine Limestone of Wisconsin, the other from the New York Silurian,—have been taken from the packing-boxes, and, after preliminary classification, have been arranged in cases recently constructed for them.

A series of Cretaceous Plants, selected from the collection made in Kansas by Mr. C. H. Sternberg, and another of Tertiary Plants from the Lakes collection above mentioned, have been forwarded to Prof. Leo Lesquereux, of Columbus, Ohio, to be figured for volumes now in course of preparation by him.

The systematic collection of recent Mollusca has been removed from the room where it has been stored since 1877, and

arranged in the glazed cases of the room upon the fifth floor assigned for the use of the Conchological Department, where this very large and valuable collection is now for the first time conveniently accessible for reference and study. Upon this and the collection of duplicate shells, which has also been transferred from its old quarters, work has been commenced toward putting them in more satisfactory order and condition than were possible until the conchological material could be brought together from distant parts of the building.

The very extensive collection of alcoholic Mollusca, in the basement, has been overhauled, and a great amount of material, hardened and rendered useless for purposes of dissection through long immersion in alcohol, has been rejected.

During the year a series of marine, fresh-water, and land shells from Europe has been selected, mounted, and arranged for exhibition in the European Faunal Room. Corresponding series from South America and Africa have been selected, and in large part mounted, and will shortly be arranged in the exhibition cases.

The conchological exchanges effected during the year have been few and unimportant; but by direction of the Curator suites of shells have been prepared and presented to educational institutions, as follows:—

1. To the Public High School of Gloucester, Mass., 166 species, 383 specimens, of generic types, for use in instruction.
2. To the Western Normal College of Shenandoah, Page County, Iowa, 177 species, to illustrate the more important genera of Mollusks.

REPORT ON THE RADIATES

BY J. WALTER FEWKES.

DURING the past year a collection of Corals illustrating the Indo-Asiatic fauna has been mounted and placed on exhibition.

The large collection of alcoholic duplicate Starfishes and Sea-urchins, which for many years has been stored in copper cans in the cellar, has been looked over, and from it ten large duplicate boxes of specimens have been picked out. These boxes have been sent to different institutions by the Curator. Many duplicates from the same source have been sent to Mr. Ward. In this way the original collection has been reduced to about one third its former size, and the collection retained in the Museum has been put in a better condition for permanent preservation.

Mr. P. H. Carpenter has returned the collection of Blake Crinoids which was sent to him for study. This collection contains valuable types, descriptions of which are found in his reports on the "Blake" and "Challenger" Crinoidea.

I have prepared for publication two papers on the Medusæ collected by the "Albatross" in the Gulf Stream and West Indian waters; they are to be published in the Annual Report of the United States Fish Commission.

The Museum has printed in the Bulletin an account of my observations made in the Newport Laboratory on the development of *Agalma*.

REPORT ON THE LIBRARY.

BY MISS F. M. SLACK.

DURING the year ending September 1, 1885, the Library has been increased by 882 volumes, 1262 parts, and 605 pamphlets.

	VOLUMES.	PARTS.	PAMPHLETS.
Gift	19	52	80
Exchange	123	472	90
Purchase	55	135	18
A. Agassiz	97	598	416
Museum Publications	2	5	1
Binding Parts and Pamphlets	586		
	882	1262	605

The whole number of volumes now in the Library (exclusive of pamphlets and of the Whitney Library) is 17,549.

[A.]

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOOLOGY

FOR THE ACADEMIC YEAR 1884-85.

Of the Bulletin.

Vol. XI, completing the volume:—

- No. 11. Studies from the Newport Marine Laboratory.—XV. On the Development of AGALMA. By J. W. FEWKES. 36 pp. 4 Plates. July, 1885.

Vol. XII.

- No. 1. CHLAMYDOSELACHUS ANGUINEUS Garm.—A Living Species of Cladodont Shark. By SAMUEL GARMAN. July, 1885. 35 pp. 20 Plates.
 No. 2. Reports on the Results of Dredging by the United States Coast Survey Steamer "Blake."—XXVII. Report on the Specimens of Bottom Deposits. By JOHN MURRAY. (In press.)

(Vol. XII. *to be continued.*)

Of the Memoirs.

Vol. IX.

- No. 3. Selections from Embryological Monographs. Compiled by ALEXANDER AGASSIZ, W. FAXON, and E. L. MARK.—POLYPS AND ACALEPHS. By E. L. MARK and J. W. FEWKES. 52 pp. 13 Plates. September, 1884.

(Vol. IX. *to be continued.*)

Vol. X.

- No. 3. On a Species of FOSSIL DOG. By J. A. ALLEN. (In press.)
 No. 4. A Revision of the ASTACIDÆ. By WALTER FAXON. pp. i-vi., 186. 10 Plates. September, 1885.

Vol. XI.

- No. 1. LITHOLOGICAL STUDIES. By M. E. WADSWORTH. pp. i-xvi., 208, xxxii. 8 Plates. October, 1884.

(Vol. XI. *to be continued.*)

Vol. XIV.

- No. 1. Studies from the Newport Marine Laboratory.—XVI. Development of OSSEOUS FISHES.—I. Pelagic Stages of YOUNG FISHES. By ALEXANDER AGASSIZ and C. O. WHITMAN. pp. 56. 19 Plates. September, 1885.

(Vol. XIV. *to be continued.*)

Also preparing : —

Illustrations of North American Marine Invertebrates, from Drawings by Burkhardt, Sourel, and A. Agassiz, prepared under the Direction of L. Agassiz. Selections from Embryological Monographs, compiled by A. Agassiz, W. Faxon, and E. L. Mark (discontinued for the present). Papers by Prof. E. Ehlers on the Annelids of the Straits of Florida, dredged by Messrs. Pourtalès and Agassiz; in Connection with the Geological Survey of Kentucky, by Prof. N. S. Shaler, on the Brachiopoda of the Ohio Valley; by A. Hyatt, on Cephalopods; by M. E. Wadsworth; by E. L. Mark, on the Development of *Lepidosteus* and of *Arachnactis*; and by A. Agassiz and C. O. Whitman, on the Embryology of Bony Fishes.

Reports on the Dredging Operations for 1877, 1878, 1879, and 1880, in charge of Alexander Agassiz, by the U. S. Coast Survey Steamer "Blake." H. B. Brady (Foraminifera), P. H. Carpenter (Comatulæ), W. H. Dall (Mollusks of the Gulf of Mexico and the Caribbean Sea), G. B. Goode and T. H. Bean (East Coast Fishes and Fishes of the Gulf of Mexico and the Caribbean Sea), C. E. Hamlin (East Coast Mollusks), A. A. Hubrecht (Nemerteans), A. Milne-Edwards (Crustacea), A. E. Verrill (Alcyonaria), and H. Théel (Holothuroidea).

General Report on the Cruises of the "Blake." By Alexander Agassiz.

[B.]

INVESTED FUNDS OF THE MUSEUM.

IN THE HANDS OF THE TREASURER OF HARVARD COLLEGE, SEPT. 1, 1885.

Sturgis-Hooper Fund	\$100,000.00
Gray Memorial Fund	50,000.00
Agassiz Memorial Fund	297,983.10
Teachers' and Pupils' Fund	7,594.01
Permanent Fund	117,469.84
Humboldt Fund	7,740.66
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	\$580,737.11

The payments on account of the Museum are made by the Bursar of Harvard College on vouchers approved by the Curator. The accounts are annually examined by a committee of the Museum Faculty. The only funds the income of which is restricted, the Gray and the Humboldt Funds, are annually charged in an analysis of the accounts with vouchers to the payment of which the income is applicable.

The income of the Gray Fund can be applied to the purchase and maintenance of collections, but not for salaries.

The income of the Humboldt Fund can be applied for the benefit of one or more students of Natural History.