

ANNUAL REPORT

OF THE

TRUSTEES

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY,

At Harvard College, in Cambridge,

TOGETHER WITH

(10)
THE REPORT OF THE DIRECTOR,

1868.

BOSTON:

WRIGHT & POTTER, STATE PRINTERS

79 MILK STREET, (CORNER OF FEDERAL.)

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Commonwealth of Massachusetts.

BOSTON, January 27, 1869.

To the Honorable the Senate and House of Representatives.

The Trustees of the Museum of Comparative Zoölogy respectfully present the Annual Report of the Director for the past year, marked [A.]

The paper marked [B] contains a list of the Trustees, their officers and committees, for 1869.

The past year has been distinguished by a grant of the legislature of \$75,000, payable in three annual instalments, conditioned on the raising by subscription, of like sums.

The first \$25,000 has been obtained, and the corresponding \$25,000 has been received from the State.

The Trustees propose to devote the money thus obtained from the State to an enlargement of the Museum building.

For the Trustees,

THEODORE LYMAN,

Secretary, pro tem.

[A.]

REPORT OF THE DIRECTOR

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY.

FOR THE YEAR 1868.

This year has been a memorable one in the history of our institution. When I prepared my report for the year 1867, it was under the depressing conviction that unless a large sum could be promptly obtained, the labor of years would be made of no avail, and the value of the materials collected in the Museum so impaired for want of the means essential to their preservation, that they would become in a great degree useless. By the intelligent liberality of the legislature, who took this matter into earnest and thoughtful consideration, and the generous co-operation of individuals, this danger is averted. I have never felt so hopeful of the future of the institution which has so long been my care as now. With the prospect for the next three years of an income large enough to secure the aid of competent assistants in the different departments, we shall be able to put our immense collections in complete order, and to enlarge the building sufficiently to exhibit all our specimens in their true relations. I hope that in three years any intelligent observer will be able to say that a mere walk through our Museum teaches him something of the geographical distribution of animals, of their history in past ages, of the laws controlling their growth as they now exist, and of their mutual affinities; in short, that the whole will be so combined as to illustrate all that science has thus far deciphered of the plan of creation. This is my hope, and it is shared by the efficient

corps of assistants on whose co-operation I largely depend for its fulfilment. All the efforts of the officers of the Museum now tend toward such an arrangement of the collections as will render their exhibition advantageous and prompt. For a long time all those engaged with me have, at the sacrifice of their personal advantage, and with the most praiseworthy zeal and abnegation, devoted their time to labors rather manual than intellectual, yet of a kind which, from their very nature, require a trained workman,—one who has an extensive familiarity with objects of natural history. It is the misfortune of naturalists that so little of the distasteful and purely manual work connected with their studies can be performed by more ignorant assistants. In the laboratory, the investigator must be his own servant. My associates in the task of organizing the Museum have shrunk from no sacrifice of this kind.

When the whole collection is so arranged that any specimen required for investigation can be reached with ease, and without loss of time, we shall all be rewarded by the comparative facility for original research. I may add, that this is an advantage by which, according to the policy adopted by our institution, not only our small corps of investigators, but all students of natural history throughout the scientific world, will profit. This assertion is justified by the readiness with which specimens have been sent out from the Museum wherever they were wanted by any one engaged in original researches whose scientific character made him worthy of our confidence. Assistance of this kind has been given whenever it has been in our power to afford it. I only lament that the bulk of our materials, so heaped together for want of room as to make them often inaccessible, and the very limited number of assistants in past years, so that there were not hands enough to put up the special collections to be sent abroad, have prevented us from exercising this liberality so largely, and with such promptness, as we hope to do hereafter.

At the last meeting of the Board of Trustees, a vote was passed devoting the \$75,000 granted to the Museum by the legislature of 1868, to the extension of the present building. While I rejoice in the prospect of this new building, as affording the means for a complete exhibition of the specimens now stored in our cellars and attics, and encumbering every room of

the present edifice, I yet can hardly look forward to the time when we shall be in possession of it, without shrinking from the grandeur of our undertaking. The past history of our science rises before me with its lessons. Thinking men, in every part of the world, have been stimulated to grapple with the infinite variety of problems connected with the countless animals scattered without apparent order throughout sea and land. They have been led to discover the affinities of various degrees and different kinds, which bind together this host of living beings. The past has yielded up its secrets, and has shown them that the animals now peopling the earth are but the successors of countless populations which have preceded them, and whose remains are buried in the crust of our globe. Farther study has revealed relations between the animals of past time and those now living, and between the law of succession in the former and the laws of growth and distribution in the latter, so intimate and comprehensive that this labyrinth of organic life assumes the character of a connected history, which opens before us with greater clearness in proportion as our knowledge increases. But when the museums of the Old World were founded, these relations were not even suspected. The collections of natural history gathered at immense expense in the great centres of human civilization, were accumulated mainly as an evidence of man's knowledge and skill in exhibiting to the best advantage not only the animals, but products and curiosities of all sorts, from various parts of the world. While we admire and emulate the industry and perseverance of the men who collected these materials, and did in the best way the work which it was possible to do in their time for science, we have no longer the right to build museums after this fashion. The originality and vigor of one generation become the subservience and indolence of the next, if we do but repeat the work of our predecessors. They prepared the ground for us by accumulating the materials for extensive comparison and research. They presented the problem; we ought to be ready with the solution. If I mistake not, the great object of our museums should be to exhibit the whole animal kingdom as a manifestation of the Supreme Intellect. Scientific investigation in our day should be inspired by a purpose as animating to the general sympathy as was the religious zeal which built the cathedral of

Cologne or the basilica of St. Peter's. The time is past when men expressed their deepest convictions by these wonderful and beautiful religious edifices; but it is my hope to see, with the progress of intellectual culture, a structure arise among us which may be a temple of the revelations written in the material universe. If this be so, our buildings for such an object can never be too comprehensive, for they are to embrace the infinite work of Infinite Wisdom. They can never be too costly, so far as cost secures permanence and solidity, for they are to contain the most instructive documents of Omnipotence.

From the earliest organization of the Museum I have had three great objects in view. First, to express in material forms the present state of our knowledge of the animal kingdom; second, to make it a centre of original research, where men who were engaged in studying the problems connected with natural history should find all they needed for comparative investigation; thirdly,—and this last object has been by no means less prominent than the two others, but, if possible, has engrossed my thoughts more,—to make it an educational institution; to give it a wide-spread influence upon the study, the love and the knowledge of nature throughout the country. I have wished—and I think the time is fast approaching when I shall be able to make this wish more completely a reality than it has hitherto been—to have the most various and extensive practical instruction in natural history going on there under the personal direction of the officers of the Museum in the different laboratories, and at the same time to have courses of lectures of a more general character, and open to all, upon natural history in its various aspects, geology, palæontology, general and special zoölogy, embryology, comparative anatomy, &c.

I have labored under many obstacles in the carrying out of this scheme. Often, for want of means to pay salaries, the assistants have been so few, and their knowledge so immature, that it was impossible to organize any extensive scheme of instruction. Often, too, we have been so overwhelmed by the amount of labor to be performed by some three or four men, that I have hesitated to diminish the working force of the Museum for a less pressing, though not less important aim. Nevertheless, ever since the Museum has been in existence, two

annual courses of lectures have been delivered there by myself, except when illness or necessary absence have occasionally interrupted them; while from time to time other courses, and very valuable ones, have been given by the gentlemen connected with the Museum. We have always had, also, a certain number of students pursuing special studies in the laboratories. This has been well, as far as it went; but the case is now very different. With very able men as assistants; with a distribution of labor which makes the work of the Museum itself easier, it is now possible to arrange a very complete system of general and special instruction. The programme for the current year embraces seven courses of lectures, and practical instruction, covering nearly the whole range of natural history. We hope to make it more comprehensive in proportion as some of those mature investigators who can act both as scientific assistants and as lecturers are drawn into our ranks.

During the past winter, the lectures have consisted of an able course from Mr. Perry, on the geology of Lake Champlain, including a description of the geological formation of Vermont, and especially a critical discussion of the controversy concerning the Taconic system. Mr. Shaler has also given a full and interesting course on palæontology, illustrating chiefly the gradation of organized beings throughout the series of geological formations. I have myself given a course on the natural history of Radiates. Of the latter I would say a few words. Since it may not be in my power to publish for some time the results upon which this course was founded, I wish to submit them summarily here, though they do not perhaps properly belong in this very general report of the Museum affairs. The object of this course was to show the strict homology pervading the structure of all Radiates, including the Echinoderms as well as the Polyyps and Acalephs, or the so-called Cœlenterata. This identity of structure being proved, the division of the Radiates into two distinct types, now adopted by most zoölogists, becomes unnatural. The argument rests upon facts, for it can be clearly shown that the chambers of the Polyyps, separated by their radiating partitions, are homologically identical with the radiating tubes of the Acalephs, and with the ambulacral system of the Echinoderms. These three classes form, structurally speaking, one and the same type. Moreover, these

homologies are circumscribed within the type of Radiates, and can by no means be extended beyond it; so that it may be said that the structure of Radiates is *sui generis* incompatible with the idea of any genetic relation between that and any other type of the animal kingdom. I also showed that the embryonic growth of all these animals is conformable, even the seemingly bi-lateral symmetry of the larval form of the Echinoderms, upon which Müller insisted so tenaciously, being as truly a radiate structure in its typical character as the Spatangoids, which also seem bi-lateral. I also compared the succession of this type in time with the growth of its present representatives in their embryonic condition, and carried out this illustration especially for the Crinoids; showing that in its successive transformations the Comatula passes through stages which, from their resemblance to the full grown Crinoids of earlier ages, I designated as the Cistidian, the Pentremitian, the Platycrinian, the Pentacrinian, and the Comatuline stages of growth. These phases of development coincide with the order of succession of the types of the same name in the geological ages. It was farther shown that even the Ophiurans, the Astेरians and the Echinoids have also their Crinoidal stages of growth, while their earliest embryonic forms recall in like manner the Polyps and Acalephs. Beside these courses of lectures Dr. Hagen has been training a few special students in entomology, and I have directed the private exercises in other departments.

As in the preceding year, Mr. Allen has had general charge of the Mammalia and Birds, and, as may be seen from his special report, he has greatly improved the condition of the collections entrusted to him. But the work is too extensive for one person, and I hope to divide it during the present year.

The collection of Reptiles has not been placed under the care of a special assistant during the past year. It is in a safe state of preservation, and for the distribution of specimens into separate jars, according to their species, I have thought it best to await the return of the numerous specimens entrusted to Professor Cope for identification. For the Batrachians, however, this task of division and distribution is already begun, and is going on under the charge of my son, Alexander Agassiz.

As usual, I have had the collection of Fishes under my special care, and, though an immense amount of work has been bestowed upon their arrangement, not by myself alone, but also by Dr. Stäheli, Mr. Bliss, and Mr. Lockwood, under my direction, yet it seems as if the task grew, instead of diminishing under our hands. The specimens contained in thirty-nine kegs and barrels have been put up in glass jars, and distributed according to their species. Dr. Stäheli has revised some 10,000 jars, containing the work of former years, and yet not half the collection has undergone more than a preliminary arrangement. I have, however, begun monographic examinations of the Goniodonts, the Characines and the Gymnonotes, and Mr. Bliss has also made a beginning with the Chromids; while Mr. Lockwood has been assisting me in the arrangement of the Characines, and Dr. Stäheli assorting the species contained in barrels. This work will be continued during the present year, with additional aids, and I have some hope of being able to complete the distribution of the whole collection in glass jars, though at this moment there remain three hundred and sixteen barrels of fishes unarranged in the store room.

Mr. Theodore Lyman, who has charge of the fisheries of the State, has added to our collections in this department an invaluable series of young fishes; especially of the family of Salmonidæ and Clupeoids. These specimens have been bred artificially in different parts of the country, and the value of the gift is greatly increased by minute information concerning their age, the conditions of their growth, &c. As often as possible, the specimens have been brought alive to the Museum, and have been drawn and painted from the life by Mr. Paul Roetter. We may in course of time have ample materials for a comparative embryological history of these families. I have already communicated to the National Academy some of my observations upon the early stages of growth of the salmon, and Mr. Lyman is now engaged upon a comparative study of the different species of salmon living in our waters.

The collection of Articulates has been not only overhauled in all its parts, but Dr. Hagen has completed a monograph of the North American Astaci, and has carried forward the general arrangement of the insects, which are put up according to the plan proposed by himself, and which I have sanctioned the

more readily, as it includes the simultaneous exhibition of the larval condition of these animals, as well as their perfect state.

Mr. Anthony has been constantly busy this year, as during so many previous ones, in the arrangement of the living shells, and has brought this part of our collections nearer to its final order than any other in the Museum. More than 17,000 tablets are now ready for systematic arrangement and for exhibition as soon as the new building is completed. The separation of a special systematic collection and of faunal collections, determined according to an investigation of their range of distribution, and not, as is so often the case, based only upon a consideration of the physical character of the country in which they occur, has been fully carried out, and may in future serve as a guide for the arrangement of other types. And yet a very important part of the work remains to be done. The species are labelled according to the names under which they were first described, and this was done with the view of securing authentic identification.

It will require a vast amount of research in the ultimate arrangement, to ascertain what are the generic relations of each and all of these species, as also to determine the family affinities of the genera. The combination of the families into natural orders is hardly begun. Mr. Blake is now engaged in drawing the characteristic features of the soft parts of our fresh water mollusks, with a view to illustrate the systematic collection.

Messrs. Theodore Lyman and Alexander Agassiz share the work upon the final arrangement of the Radiates. The exploration of the deep-sea fauna of the Gulf Stream, undertaken by Mr. Pourtales at the direction of the superintendent of the coast survey, has brought to light an unexpected number of new species. The results of this valuable investigation were given by Mr. Pourtales in the last two numbers of the Museum Bulletin.

The institution is indebted to Professor Peirce for the presentation of all the specimens collected during these explorations, the duplicates of which will be distributed to other institutions as soon as they are completely assorted.

The fossils have been entrusted to the care of three different assistants. Mr. Shaler has had general charge of the whole

collection, but has given his special attention to the arrangement of the bivalve shells. Mr. Perry has had charge of the tertiary fossils in general, but has been especially occupied with the arrangement of the Gasteropods. Mr. Lesquereux has been engaged upon the fossil plants. The reports of these gentlemen have left me little to add concerning the condition of these collections. I have to lament my inability thus far to provide for the arrangement of the fossil vertebrates, but I hope to remedy this deficiency in the course of the present year. I regret the neglect of these collections the more deeply because they contain a considerable number of rare and valuable specimens. The magnificent series of *Dinornis*, for instance, which the Museum owes to the liberality of Dr. Haast, will be one of its greatest ornaments, whenever these specimens can be mounted.

Report on the Fossil Plants of the Museum of Comparative Zoölogy, by L. LESQUEREUX.

The work done this year to increase, arrange and improve the collections of fossil plants of the Museum is scarcely important enough to furnish materials for a report. But as it is essential, not only to mark the progress of the collections, but also to indicate the means of increasing them, and of rendering those already acquired more useful, and therefore more valuable, it is proper, to say a few words of the actual state of the department of botanical palæontology, by reporting what has been done in it this year, and what should have been done under more favorable circumstances.

The report of the past year mentions, § 11, page 15, a number of specimens still in boxes in the magazine, which, from want of place, had not been exhibited, and which were still undetermined. The examination of these specimens has been completed this year, and all have been provided with labels bearing specific names, together with the names of the donors or former proprietors of the specimens, and indications of the localities whence they were obtained. At the same time, they have been assorted according to the age of the formations to which they belong.

Some of these specimens are valuable in themselves, as representing rare or new species; some others, like those obtained from Messrs. Lyell, Bronn and Marcou, and which mostly compose this collection, have a historical value, and are precious as mementoes of some of the most celebrated geologists of our time.

The distribution of these specimens according to the formations to which they are referable, and to their original proprietors, is as follows:—

Tertiary, Bronn's collection,	92 specimens.
“ Duval's “	47 “
Cretaceous, Bronn's “	35 “
Lias (of Virginia, by Mr. Wheeler,)	30 “
Carboniferous, Bronn's collection,	82 “
“ mostly from Lyell's collection,	123 “
Devonian and Silurian, Marcou's “	20 “
Specimens of coal and lignite, Bronn's collection,	25 “
Specimens of fossil wood, 4 of them polished, Bronn's collection,	18 “
	<hr/>
Total amount of specimens,	472

It was surmised in the former report that the Museum could this year obtain a large supply of specimens from Morris and Mazon Creek, Illinois, two contiguous localities, with strata identical in geological horizon and lithological characters, and which have become justly celebrated for the beauty of the specimens of fossil plants which they have furnished to science. But the want of place for the exhibition of large specimens prevented our spending money or making special exertions for increasing the collections of fossil plants. The only acquisition made for this department of the Museum, therefore, has been that of a lot of one hundred specimens in concretions, representing fossil plants from Mazon Creek, with twenty other specimens from the same place, representing the remains of animals of the coal measures, especially Crustacea. These, presented to the Museum by the curator, together with two specimens of wings of insects from the carboniferous measures

of Arkansas, are among the rarest fossil remains of that epoch. Another lot of sixty specimens of fossil plants was obtained by the curator in Rhode Island, some from the black shales exposed along the beach at Newport, and the largest number from the anthracite bed worked ten miles north of Newport, at Mount Hope coal mines.

The same opportunity is still offered to the Museum of purchasing at a low price a fine collection of fossil plants at Newport, from the carboniferous measures of Rhode Island, and another at Morris, essentially composed of specimens in concretions from Mazon Creek. Both these collections would be already a valuable acquisition for the Museum, if it were merely on account of the beauty and rarity of the remains of plants which they contain. But the fossil plants of these localities are, by their nature and their number, intimately connected with scientific questions of importance, which they may help to elucidate. For example, Morris and Mazon Creek have furnished till now, by their fossil remains, the largest number of species of plants found at the same place, and therefore they represent, far better than any other local flora, the vegetation of the carboniferous epoch, and its true character. For this reason, this fossil flora of Morris is a reliable point of comparison for the fossil plants of other deposits, considered either in their geographical or their stratigraphical distribution. A number of specimens are found in ferruginous concretions, in which even the most delicate species or organs of plants are preserved; and it would seem, from the riches of this flora, that we know as yet only that part of the vegetation of the coal epoch which is represented by hard, woody vegetables, while the more delicate ones have been totally destroyed by maceration. This supposition is confirmed by the number of small animals, Crustacea, Insects, Saurians, &c., whose remains, never found till now in the coal measures, are tolerably numerous in the concretions of Mazon Creek. At Newport, or in Rhode Island generally, where a number of remarkable species of plants have been discovered, which have not been found elsewhere in our American carboniferous measures, the vegetable remains are more or less deformed by metamorphism, either elongated or contracted in various ways. These remains show evidently the action of heat on the shales, and on the carbona-

ceous matter, while softened by maceration, or rather exhibit the transition of the vegetable from its natural state to a plastic one before its hardening by heat and mineralization. The peculiar dimorphism of the fossil plants of Rhode Island has not been observed elsewhere, not even in the anthracite basin of Pennsylvania.

The most important part of the work which, according to the directions of Professor Agassiz, should have been begun this year in the Museum, has been left nearly untouched, for reasons stated below. In the former report, (1867, page 15, § 12,) allusion has been made to the immense and most valuable collection of palms, fern-trees, and other species of equatorial plants, carefully selected as most appropriate materials for the comparative anatomy of the fossil floras of divers formations, and brought from Brazil to the Museum by its director. To fulfil the plan suggested, and to give to these specimens their real value, it is necessary to prepare them as models or samples for comparison, by making sections in various planes of direction, in order to show their internal structure, and displaying some of the surfaces under a high polish, while in others thin, transparent lamellæ should be cut and adjusted under glass for microscopical examination, &c., &c. Such a work demands the greatest care, not only in the selection and in the preparation of the specimens, but also in their arrangement, in order that every part destined to anatomical comparison, either as a whole organ or as a part of it, can be easily found and referred to its proper species and place, without possibility of a mistake. In attempting to begin the purposed work of preparation, it became evident—

1. That we had not yet in the Museum instruments which could be employed for that kind of work, without endangering the value of the specimens; and

2. That it was impossible to obtain sufficient room to have all the specimens conveniently disposed for a preliminary examination. For it is important, before beginning the anatomy of various species, to have under view all the specimens by which they are represented, in order to first exactly determine them, and afterward to select for preparations the parts or organs most appropriate to the end. As the Brazilian specimens are mostly of great size,—some of them whole trees, with leaves

and fruits still attached to them,—this preliminary examination cannot be made in the limited space left in a garret already full of heaped materials of various kinds. Moreover, these botanical specimens are all now properly packed, and in that state their displacement cannot endanger any part of them, while, once out of the bundles, some essential organs or valuable parts may be easily detached and lost by removal. Still another consideration prevented the beginning of this important work now. Some of the trees already obtained by the Museum, and others which it may be convenient to obtain hereafter, should be preserved whole, as much, at least, as it is possible, for comparison of size, of external character, the bark, mode of attachment of the leaves, of the fruits, &c., &c. Of course, these large trunks cannot be piled up in the Museum. They should be distributed around a special room, and left standing between rows of cases, or disposed in such a way that they may serve for ornaments, as well as for objects of instruction. Such a distribution can be made only on a carefully devised plan, and when the dimensions of the places destined for the specimens are known.

These reasons, I hope, will serve as a sufficient excuse for the postponement of a work which I consider of great importance if it can be properly conducted, and will account also for the short duration of my co-operation at the Museum this year.

P

Report on the Library, by REV. J. B. TERRY.

On looking over the Library, I find myself unable, for the present, to report upon its condition in full. I shall accordingly confine myself to a few incidental points.

After Mr. Uhler ceased to act as Librarian, and previously to my taking charge of the Museum collection of books, considerable time elapsed. As no one had special care of the Library during this interval, books were of course somewhat misplaced and interchanged. It was consequently my first aim and effort to restore all such volumes to their proper position, so far as this could be learned from the several alcove catalogues. This work was carried on by slow degrees, as opportu-

nities from time to time favored, and odd moments of leisure rendered the task feasible.

Soon learning by experience the great difficulty of finding many works needful for reference in the prosecution of my investigations, and that thus the valuable treasures of the Library were not so available as they might else and as they ought to be, I devoted myself for some time outside of the usual hours of Museum duty, to the dry and thankless task of supplying the deficiency. Taking the printed catalogue of De Koninck, I designated in the margin, opposite to the title of each work, by means of numerals, both the alcove and the shelf of every volume, monograph and pamphlet, the permanent place of which was already determined. Having done this much, I ceased my labors in this direction, as I did not wish to enter the alcove and shelf of volumes, the permanent places of which in the Library were still unsettled. This catalogue indicates the position of about four-fifths of the works belonging to the De Koninck Library.

Since that time, Dr. Stäheli has been busily engaged, when his other duties would allow, in pushing the arrangement further, in marking the number of the alcove and shelf of each work, so far as already determined, on the cards of the topical catalogue, and at the same time in noting missing volumes and all such defects as he might observe in the books composing the several departments of the Library. This work being still unfinished, a satisfactory statement in regard to the Library as a whole is out of the question. I hope, however, to be able, in the next annual report, to give a detailed account of its condition, of such defects as may then exist, and of many deficiencies supplied by additions made during the year.

Report on the Collection of Mollusks, by JOHN G. ANTHONY.

At the close of my last year's labors, I received from the Director of the Museum the following letter of instructions:—

“Thanks to your industry, the arrangement of the shells in the Museum is already so far advanced, that I wish henceforth you should make the identification of our specimens with original specimens of the species described by American conchologists the chief

object of your efforts. It is of the utmost importance that a reference to our collections should in future afford naturalists the means of recognizing all the species which have been described in this country, not only by your cotemporaries, but also by your predecessors.

“You know how difficult it has become to identify some of the species described by Say and Rafinesque, and unless proper care is taken in time to secure what remains of the tradition of the earlier American conchologists, the task may become hopeless.

“Therefore I would urge that you make a beginning at once. To this end I would advise you to make an excursion to Philadelphia as soon as convenient, and you can ascertain that you may receive there the necessary aid in your work. I have already once examined the remnant of Rafinesque’s collection, in the possession of the late Charles A. Poulson, but I wish you would go over the same ground, and not limit yourself, as I did, to the Naiades, but try to identify the other shells described by him. Next to this, I wish you would compare all the specimens of Say, Barnes and Ward that may be preserved in the Academy of Natural Sciences. Mr. Binney, whose father was a correspondent of those gentlemen, may assist you in identifying some of their species, of which there may not be authentic specimens in your own collection. At the same time you should identify all the species of Dr. Binney which are in his son’s possession.

“The next most important step would be the comparison of all the species described by Mr. Isaac Lea with those of the Museum. No naturalist in America has described and figured so large a number of species of shells as Mr. Lea. By his untiring industry and perseverance he has brought to light an astounding variety of fresh-water mollusks from our extensive river system, entirely unsuspected before; in fact, no one has made larger contributions to our knowledge of the American Naiades. It is therefore of paramount importance that we should obtain, at any reasonable cost, authentic specimens of all his species, whenever we have not ourselves specimens which can be identified with his.

“This is a very extensive and laborious task, and I do not suppose that you can accomplish the whole during one visit to Philadelphia; but you may get through with one family, say the *Melanixæ*, the arrangement of which you have lately completed in the Museum, and make arrangements with him to return to Philadelphia and complete the comparison whenever it may suit him to assist you in the investigation. As we have land and fresh-water shells in large quantities from localities from which Mr. Lea may

have none, you will propose to him exchanges on the most liberal terms for whatever he has that is wanting in our Museum.

“While in Philadelphia, make it also your business to visit the Academy of Natural Sciences, and identify there whatever original specimens may be in their museum. Do not neglect to interest Mr. Tryon in your work. He cannot fail to see the advantages that will accrue to Conchology from your errand, and as editor of the Conchological Journal, assist you as far as he can. Try to obtain from him, also, original specimens of all the species he has himself described, or descriptions of which are contained in his journal.

“I shall want you also to visit other cities in which valuable collections exist, especially New York, that you may do the same work there for the collections of various collectors in that city; and afterwards Amherst College, to compare the specimens described by Adams; and then Chicago, to see the originals of Stimpson’s species; not forgetting Albany, which has been so fortunate as to secure Dr. Gould’s collection; but with regard to these I shall write you more fully when the proper time comes.”

In conformity with the foregoing instructions, I made a journey to New York and Philadelphia, which occupied several weeks, and during that period examined more or less in detail the several collections alluded to, gaining thereby much useful information connected with my department. This visit, however, could only be considered a preliminary one, several visits being required to fully carry out all the suggestions contained in the instructions. It was made, moreover, at a time of the year when short days and cloudy weather formed strong impediments to a critical examination of species, and a subsequent visit, which was arranged to take place last May, was prevented by sickness. The plan, however, has not been abandoned, but will continue to be borne in mind and steadily pursued to completion.

In order to be prepared to carry out these instructions properly, much time has been devoted to mounting shells already on hand, by which means we have attained a better knowledge of our collection and of our wants. The number of tablets thus mounted is already very large, amounting to over 17,000 at the present time, and will be greatly increased during the coming year.

While laboring in this direction, less attention has been paid to our exchanges and other means of increasing the collection than formerly, and we have consequently less to report than usual in this department. The whole number of packages received during the past year has been 30, containing 1,523 species and 21,394 specimens from 26 persons.

Some of these packages have contained shells of unusual interest, deserving more than a passing notice. Among these we may mention two parcels received from W. G. Binney, Esq., one of them containing the type shells used by him in his own publications, and the other the specimens which his father referred to while writing his costly and valuable work on the "Terrestrial Air-breathing Mollusks of the United States." These type specimens, with the author's labels, are of more than ordinary interest, advancing as they do one of the special objects we have in view, viz., the procuring of undoubted representatives of all described forms of mollusks. In this way only may we hope to avoid one of the greatest obstacles the present generation of naturalists labor under in determining species, it being now impossible in many cases to know what an author really described, for want of authentic types of his species.

Another contributor, Mr. Geale, of London, has sent us 92 species of *Cypræa*, carefully labelled, from Mr. Cumings' collection, a collection unrivalled for beauty and perfection of specimens and accuracy of labels.

One of the most important additions made to our collection of mollusks during the past year has been by purchase from Mr. T. Bland, of New York, of his large and carefully labelled collection of North American land shells, the result of many years of patient labor on his part, and embracing 260 species and 2,494 specimens. The well known accuracy of Mr. Bland in this department, which has been a specialty with him for a lifetime, renders this collection one of no ordinary value, and it may well form, as we trust it will, the basis of a formal arrangement of the shells of North America, which has long been one of the prominent desiderata of our Museum.

The remaining specimens received during the year from various sources have been mainly derived from our exchanges. Nevertheless we have not failed to be remembered by our con-

stant friend and contributor Mr. Charles Wright, who has laid us under great obligations by a fine invoice of desirable Cuban shells, and our Thayer Expedition must also be credited with a small but valuable contribution of 35 species and 1,039 specimens of Brazilian land shells. Thus from twenty-six sources we have derived 1,523 species and 21,394 specimens as the result of our year's labors in this department, while our consignments have only been to seven persons, amounting to 443 species and 867 specimens.

We may add that during the past year we have had the pleasure of aiding, as far as we could, Mr. William G. Binney in his undertaking to edit the new edition of the late Dr. Gould's Report on the Invertebratæ of Massachusetts, and have furnished for that purpose a large number of our best specimens of New England mollusca, in order that new figures might be drawn to replace the lost plates of the first edition. In this connection we may remark that it seemed to us peculiarly fitting that this enterprise, ordered by the State, should be aided in every possible way by a State institution like our own, and we have cheerfully rendered every assistance in our power.

Report on the Mammals, by J. A. ALLEN.

Since the last announcement of the additions to this department, there have been added 369 specimens, representing 168 species, one-half of them through our exchanges, and about one-fourth each by donation and purchase. The most important additions have been a fine collection of skins from Australia, from Professor McCoy; a large invoice of European mammals, including a number of very fine specimens mounted, from Professor William Schimper; a fine lot of skulls from East India, from W. Theobald, Jr.; and an invoice from South Africa, from Professor Layard. These collections have all been added by exchanges. Some very desirable lots have also been added by purchase.

Except the cataloguing of the skins, which we have recently completed, little has been done in this department beyond the

necessary work of taking care of the invoices received, and attending to the general safety of the collections.

By Donation.

AGASSIZ, L. 2 skins (fresh) and 1 skull of *Antilocarpa Americana*, and 1 skull of black-tailed deer from Laramie Plains.

ALLEN, J. A. 1 *Lorex Cooperi* from Wayne Co., N. Y.; 3 specimens, 1 species of *Vespertilio*, from Ogle Co., Ill.; fossil tooth, (*Cervidæ* sp.), Redfield, Dallas Co., Ia.; 34 skins, 9 species; 30 specimens, 6 species in alcohol; 11 skulls, 7 species, from various localities in Massachusetts.

CARROLL, MICHAEL. 2 skeletons of seals; 1 skeleton and 1 skin of Caribou, from Newfoundland.

EAMES, H. H. 1 living *Jaculus hudsonius*, from Cambridge.

GOODNOW, E. 6 specimens, 1 species, from Cambridge.

HARTT, C. F., and COPELAND, C. (*Thayer Expedition.*) 1 human skull and 1 Capivara, from Spiritu Santo.

MAYNARD, C. J. 7 specimens, 6 species, skins, from Newtonville, Mass.

By Exchange.

BABCOCK, A. L. 5 specimens, 3 species, shrews and moles, in alcohol, from Sherborn, Mass.

BENNETT, C. W. 1 *Scalops aquaticus* skin, from Holyoke, Mass.

EDWARDS, Prof. H. MILNE. (*Jardin des Plantes.*) 9 specimens, 8 species.

LAYARD, E. L. (*South African Museum.*) 18 specimens, 17 species, from South Africa; 1 specimen from Japan.

MUSEUM COPENHAGUE. 1 skeleton of Cetacean.

MCCOY, Prof. C. 33 specimens skins, from Melbourne, Australia.

SCHIMPER, Prof. Wm. 38 species, 76 specimens, skins, including quite a number mounted, from Germany.

THEOBALD, W., Jr. 15 species, 30 specimens, skulls and bones, from East India.

By Purchase.

Eighty-three skins, and fourteen mounted specimens, representing twenty-seven species, nearly one-half of which were from Iowa and Illinois, and the remainder from Massachusetts.

Report on the Birds, by J. A. ALLEN.

The additions to the ornithological department since the last detailed report of receipts, have been very considerable, amounting in the aggregate to above two thousand one hundred skins, representing about five hundred and fifty species, including nearly three hundred mounted specimens, eighty-seven adult birds, and nearly three hundred embryos, in alcohol, five hundred and fifty-four dry eggs, and skeletons and parts of skeletons of about forty species.

Though the additions have been chiefly from North America, as shown in the subjoined schedule, and largely from New England, the foreign invoices received, mostly through exchanges with other museums and individuals, have contributed above one-fourth of the skins, and fully four hundred species. Among the donations, a collection of more than one hundred finely prepared skins of Brazilian birds, the gift of the Emperor of Brazil, is especially worthy of notice. Among the additions accruing from our exchanges, nearly complete skeletons of four species of *Dinornis*, the latter from Dr. Haast, of Christ-church, New Zealand, and from the same gentlemen, and through Professors Layard, McCoy, Kaup and Schimper, large invoices of skins from New Zealand, South Africa, Melbourne, the East Indies and Europe, are also deserving of particular mention. The invoice of Professor Schimper embraces a large series of very finely mounted European birds, representing nearly one hundred species. The domestic receipts include a fine lot of nearly one hundred and fifty mounted specimens of New England birds, selected with special reference to completing a faunal collection of this region for exhibition, and which contains many varieties.

In order not only to increase the stock of duplicates for exchanges, but to bring together large series of specimens of a considerable number of species from a single locality, for the purpose of affording means for the investigation of the amount and character of individual variation, it was decided early in the year to collect extensively Massachusetts birds, and in following out the plan, some thirteen hundred specimens have been added during the past season. In carrying on this work, we were most fortunate to secure the assistance of Mr. C. J. Maynard, of Newtonville, whose enthusiastic co-operation has

been of great value. What should be particularly noted in reference to these additions, is the fact that detailed measurements of each specimen were carefully made before skinning, and the sex determined in all cases by actual dissection. Of a few species, above fifty specimens of each have been collected. Such series show the exceptionable character of many distinctions commonly considered to be trustworthy guides in determining species, and not unfrequently present specimens differing so widely from each other, that if they came from remote localities, few ornithologists would hesitate to consider them as representing distinct species.

The work on the collections has been mainly confined to the skins. The cataloguing and arrangement of these have been continued, and a considerable number of duplicates set aside for exchanges, some of which have been packed, and are awaiting shipment. With the exception of very recent additions, all the American and European specimens are now catalogued, and the North American have been carefully identified. The arrangement of them into faunal and systematic series is also considerably advanced. In connection with the faunal arrangement of the collection, a special investigation of the Geographical Distribution of the Birds of North America has been commenced. To facilitate the collection of data concerning this subject, the subjoined circular has been issued, and extensively distributed among American ornithologists. Responses from a considerable number of observers have already been received, in which they have promised their co-operation. A few have also made valuable contributions of facts, among which we will here only mention a full list of the birds of the vicinity of Havana, Cuba, with annotations, from Dr. Gundlach.

During the year, the whole collection of embryos, preserved in alcohol, numbering above thirteen hundred lots and three thousand specimens, has been systematically arranged in the cellar, and the cataloguing of the same completed. More than two hundred mounted specimens of birds have been added to the collection on exhibition, while many more are stored in the bird-room for lack of space in the public rooms.

In conclusion, we may add that, through the great number of specimens accumulated from one locality now possessed by the Museum, we are provided with an amount of material

necessary for the successful investigation of many points bearing on the character of species, far exceeding that of any other Museum. It is still desirable, however, to considerably increase the number of specimens of the Grallæ and Anatidæ, and some other of the aquatic species, since of these we have but few specimens to spare for exchanges. It is hoped that this deficiency may be supplied during the ensuing year.

By Donation.

AGASSIZ, L. 1 *Falco peregrinus*, from Cambridge, Mass.

ALLEN, J. A. 76 specimens, 27 species, skins; 60 specimens, 20 species, in alcohol; 205 specimens, 17 species, eggs and young birds, in alcohol; 418 specimens, 15 species, dry eggs, from various localities in Massachusetts.

BABCOCK, A. L. 2 specimens, 2 species, skins, from Massachusetts.

BLISS, RICHARD, JR. 1 skin of *Butes borealis*, and 2 specimens, 2 species, in alcohol, from Ogdensburg, N. Y.

EMPEROR OF BRAZIL. 108 specimens, 67 species, skins, from Brazil.

GOODNOW, E. 13 specimens, 8 species, fresh, from Cambridge.

HARRISS, E. D., Cambridge. 2 young domestic pigeons.

JILLSON, S. 4 specimens, 4 species, from different foreign localities.

KNOWLTON, W. J. 1 live Carolina Rail, from Rockport, Mass.

LINCLEN, CHARLES. 1 *Pelionetta perspicillata*, from Buffalo, N. Y.

LOCKWOOD, S., JR. 2 specimens, 2 species, from Fallsburg, N. Y.

MAYNARD, C. J. 67 specimens, 19 species, eggs and young birds, in alcohol, chiefly from Newtonville, Mass.

SUPERINTENDENT OF THE MOUNT AUBURN CEMETERY. 1 swan, fresh.

PERRY, REV. J. B. 1 nest, and 2 eggs, from Burlington, Vt.

ROETTER, J. 10 specimens, 6 species, from Cambridge.

SMITHSONIAN INSTITUTION. 182 specimens, 58 species, chiefly from Arctic America.

THAYER EXPEDITION. HARTT, C. F. and COPELAND, C. 1 skeleton, from Spiritu Santo, Brazil.

By Exchange.

BENNETT, C. W. 6 specimens, 5 species, skins, from Holyoke, Mass.

EDWARDS, Prof. H. MILNE. (*Jardin des Plantes*.) 1 ostrich, and 1 cassowary, mounted, and 1 skeleton of cassowary.

HAAST, Dr. J., Christ-church, New Zealand. Skeletons, some of them sufficiently perfect to be mounted, of 4 species of *Dinornis*, (*D. crassus*, *D. elephantopus*, *D. dodiformis*, *D. casuarius*.) Also 50 specimens, 36 species of skins, from New Zealand.

KAUP, Dr. (*Museum of Darmstadt*.) 26 specimens, 23 species, chiefly from Celebes, Timor and Molucca.

LAYARD, Prof. E. L. (*South African Museum*.) 82 specimens, 66 species, from South Africa; 9 specimens, 7 species, from India, and 1 specimen from Australia, skins. Also 134 specimens, 59 species, dry eggs, from South Africa.

MCCOY, Prof. FREDERIC. (*Victoria Museum, Melbourne*.) 119 specimens, skins, from Melbourne.

SCHIMPER, Prof. WM. (*Museum of Strasburg*.) 178 specimens, 106 species, skins, the greater part finely mounted, chiefly from Germany.

By Purchase.

1,023 specimens, 124 species, skins; 146 mounted specimens, 80 species; 35 sternums, 31 species; and 12 skulls, 9 species; all from Eastern Massachusetts. Also 80 specimens, 35 species, skins, from Iowa and Illinois. Also 1 dodo, from Mauritius, (through Mr. Mellers, U. S. Consul at Mauritius.)

NOTE.

Circular in reference to obtaining data concerning the distribution of North American birds in the breeding season.

All naturalists are aware that the Geographical Distribution of animals and plants is a subject of great and general interest, and that its investigation is at present greatly retarded by the small number of facts on record. This is more particularly the case in reference to Birds, inasmuch as their range in the breeding season, which is by far the most essential, is less known than their general range, including their migratory journeys. The present Circular is issued by the Museum of Comparative Zoölogy, with the hope that, through the general co-operation of Ornithologists, such facts may be collected as will furnish much additional information relating to the distribution of the North American species at this season.

While complete lists of the species occurring in many localities is extremely desirable,—with full notes in reference to the times of their migrations, seasons of occurrence, time of nesting, and relative abundance,—partial lists, even embracing only the more com-

mon species observed during the breeding season, would be of great value. However few the facts, they will be very gratefully received.

The recipient of this is accordingly respectfully solicited to contribute such facts on the subject as he may have at command, transmitting them as directed below. Full credit will be given to each observer in the Annual Reports of the Museum, and finally, in working up the observations thus collected, his name will be given as a guaranty of their authenticity.

A series of specimens of the birds of any locality in the Southern and Western parts of the Continent, with or without their nests and eggs, with the date and place of collecting carefully noted and appended, would be thankfully received, and, if so desired by the collector, after careful examination, will be returned to him properly labelled.

Communications or packages should be addressed to J. A. ALLEN, care of Prof. LOUIS AGASSIZ, Museum of Comparative Zoölogy, Cambridge, Mass.

L. AGASSIZ.

MUSEUM OF COMPARATIVE ZOÖLOGY, }
CAMBRIDGE, MASS., June 4, 1868. }

Report on the Collection of Articulata, by Dr. H. HAGEN.

I arrived in Cambridge October 12th, 1867, having come to this country in order to take charge of the collection of Articulates in the Museum of Comparative Zoölogy, and especially to re-arrange the entomological collection. Prof. Agassiz desired me before beginning the work to draw up a detailed written plan, containing my views on the subject and explaining the method of arrangement which I thought best.

This plan being generally adopted, I began with the class of Crustacea, postponing my work upon the Insects, because it was very important that the new boxes and cabinets intended to contain them, should be made by a first-rate workman, and they could not be ready for some months to come. The first lot arrived in August, 1868.

The numerous objects received from Mr. Thayer's expedition had for some time occupied all working hands; the importance of putting them in safety being generally recognized. On this account it had been impossible to give more attention to the collection of articulata than was absolutely necessary to keep

them in good preservation. In the exhibition rooms there were about 500 species of crustacea, mostly determined by Messrs. Dana, W. Stimpson and others; all the rest had been stored for some years on the cellar shelves in kegs or glass jars. During the first three months I was occupied in cleaning, separating, and unpacking these jars. In this time, with the exception of some kegs containing mostly duplicates, the whole collection was assorted in 4,300 glass jars; these jars were filled with new alcohol and placed on provisional shelves put up for the purpose in the library and adjoining rooms ready for scientific purposes. The following months I was engaged in a general revision of the whole collection, nearly three-quarters of which consisted of *Brachyura* and *Macrura*, now arranged in families and genera. Some families are even farther revised, especially the Stomatopods, as well as some genera of the *Brachyura* and *Pagurina*. The very valuable collection of the American *Astaci* is monographically finished and now in the way of publication. An estimate made upon this careful revision shows the collection to contain more than 2,000 species, a considerable number when we remember that according to the most recent computation of the species of crustacea thus far known they do not exceed 5,500 species.

Meanwhile I formed a small but valuable collection of the family of Pseudo-scorpions, hitherto neglected in the study of the American fauna. By the help of Messrs. Francis Sanborn, Cresson, Packard, Burgess, Mann and others, I was able to bring together a collection of species from all the recognized genera of these interesting animals, hitherto unknown on this side of the water, with the exception of two species described by Mr. Say. Mr. Menge, of Danzig, Prussia, to whom we owe the best monographs of this family, was so kind as to present the Museum with a full set of his types. A monograph of this small family containing a complete synopsis of all described species, with drawings of all American species, is nearly ready for publication.

In the succeeding months the Insects, Myriapods and Arachnids in alcohol were revised, cleaned, and partly separated, and repacked in new alcohol. Mr. Burgess has had the kindness to revise, determine, and catalogue the North American Myria-

Pods. Mr. B. P. Mann partly revised the North American Lepidoptera in alcohol.

The arrival of the new insect boxes, enabled me to begin my work upon the entomological collections of dry specimens in November. The plan adopted for this portion of the articulate collection, is intended especially to fulfil the following conditions. 1. The whole collection is to be put up in such a way as to be secured as far as possible against the attacks of obnoxious and destructive insects, and adapted at the same time, for scientific purposes and study. The collection should be made a standard collection for all time, remarkable for its mode of preservation, remarkable for its systematic arrangement, remarkable as far as possible for its correct identification of species. It should always be a safe and useful guide for every entomologist, especially for every American entomologist who desires to determine his doubtful species; and, in short, it should form, in the highest sense, a national collection. To attain this end, the boxes and cabinets are ordered of the best quality and pattern. After careful consideration, we have adopted the fashion of cases used for the same purpose in the Berlin Museum, and approved after an experience of sixty years. A detailed description of the form of the boxes and cabinets, with certain improvements upon the original model, will perhaps be of interest hereafter. I may add that I have never seen insect boxes better made, than those furnished from Grant & Mann's factory, for the use of the Cambridge Museum.

2. The arrangement and ordering of the collection should agree in every respect with the comprehensive plan adopted by Prof. Agassiz, for all collections belonging to the Cambridge Museum. This plan, though easily understood for the other classes, may require some explanation as applied to the insects, because on account of the immense number of species, exceeding many times those of all other animals together, this class might seem to require some peculiar mode of treatment. The formation of the following collections is decided upon:—

1. A systematic general collection, serving as a dictionary for science and students.

2. A systematic collection for North American insects, intended especially for American entomologists and their purposes, and including typical specimens as much as possible.

3. Typical collections to be separately preserved, like the Melsheimer and Ziegler collections, now belonging to the Museum.

4. Faunal collections, agreeing with the general plan adopted by Prof. Agassiz for the other classes of animals, in the greatest possible extension of perfection.

5. A collection representing the metamorphoses and all different stages of the species, including their houses, cases, cocoons, &c.

6. A biological collection, containing all the obnoxious or useful insects, their products, their manner of working and feeding, as well as specimens of the artificial products derived from them; or the latter might be separated, as forming an economical collection by itself.

7. An anatomical collection, including microscopical preparations, and following the order of the different systems of organs through the whole class.

8. A palæontological collection, including insects contained in amber and in copal.

9. A physiological collection, containing monstrosities, hermaphrodites, and all objects belonging to this class of facts.

10. Since most of these collections require to be kept as much excluded from light and air as possible, there will be a collection for public exhibition, containing species remarkable for their beauty, or as being either useful or obnoxious; besides, a collection representing types of families, and genera for entomological students. The other collections will always be accessible on special application, or for purposes of study.

Of course, so comprehensive a plan cannot be accomplished under many years, nor without powerful support. To carry it on, requires ample means and able assistance. The collection, taking into account the time spent and the way in which it was gathered, is no doubt considerable. It consists of nearly 1,300 boxes, some very full and nearly 4,000 alcoholic bottles; one-half containing lepidoptera, one-third coleoptera, the rest the other orders. The fauna of North America and Europe are prominent. Micros are mostly wanting. The fauna of Brazil is, for Rio and the vicinity, very rich; for Para and other parts of the sea-shore, considerable.

From Africa, Zanzibar is very well represented; from Asia,

Japan, China and Burmah; from Australia, Melbourne. Other localities are more or less represented.

The first step is to secure the safety of the present collection in the new boxes; the second, to separate them as well as possible; the third, to enlarge the collections in such a way, as to fulfil as far as may be, the plan proposed.

To accomplish this purpose, I have begun to bring together the lepidoptera for the systematic and faunal collection, while Mr. Burgess has been doing the same work for the North American lepidoptera. Nearly 300 boxes are filled, and all the lepidoptera except the valuable European collections, are arranged.

Mr. B. P. Mann has commenced the same work for the North American coleoptera, especially with the view of putting in safety the valuable collections determined and arranged by Mr. Uhler, and partly revised by Mr. LeConte.

I have also begun the arrangement of the larvæ, pupa, &c., for the collection representing the metamorphoses of insects. They are arranged in glass tubes, in alcohol, and then placed like the insects themselves, in well closed boxes, insuring their perfect safety. This arrangement is made upon a peculiar plan, facilitating the study of the objects and permitting a better view and more ready comparison than is usual.

This is the beginning. Hard work, the sympathy and aid of all entomological students, and a liberal pecuniary support, are needed if the large and comprehensive scientific plan adopted, is to be fulfilled. I am sure that it will be!

Report on the Tertiary Gastropods, by REV. J. B. PERRY.

During the year just drawing to a close, my attention has been mainly confined to the Museum collections belonging to the Tertiary era. In reporting upon the investigations begun, and the progress thus far made, it may be well that I refer at the start, to the collections themselves, and to the condition in which I found them on assuming the position of assistant in the department of Palæontology.

The Tertiary fossils of the Museum consist of several important Tertiary collections brought together in one building—the

old Harvard collection, and the large gatherings made by individuals, in some cases during a lifetime of palæontological activity. Among these may be mentioned the extensive collections of Professor Agassiz, which having been for many years in process of accumulation, were presented in 1851; those of Professor Bronn, of Duval, and of Boucault, which were purchased in 1859; and the entire gatherings of De Koninck, and portions of those made by Carl Meyer, Eichwald, Hörnes, Michelotti, Bellardi, Appelius, Rigacci, Rouault, Tarbé, Krantz, Lyell, and many others, which were secured by purchase, exchange, or donation.

These various assemblages of Tertiary organic remains had been unpacked and placed in drawers previously to my connection with them. Considerable work had been also expended at an early day on the Plants, on the Radiates, on the Brachiopods, and the Cephalopoda. Of the remainder, the larger part was deposited in a single room, while a portion, by no means small, was scattered through the building. They were all safely stored, though all were not in equally good condition. Of these specimens, some were undistributed; others were placed together, apparently at hap-hazard, and certainly without system; while there were still others which had been partially arranged; that is, they were arranged so far as they could be said to have any arrangement, according to five or six different methods. In given instances, specimens in greater or less number had been disposed in small groups. These groups, however, were never found complete; they occurred, for the most part, in isolated conditions, there often being twenty, thirty, or even forty separate and different parcels, more or less alike, scattered through the various collections. In other instances, specimens had been thrown together, to some extent, according to countries, collocation being the main thought apparent, and this never carried out with rigorous exactness. In yet other instances, an effort to group the specimens was evident, a series of drawers being found to hold fossils from many different regions, a single drawer containing sometimes two or three groups, usually six or eight, often a dozen or twenty, and occasionally species from almost every branch in the animal kingdom.

Again, the specimens having come from a great number of collectors, of course bore the names given by various different

palæontologists, species widely unlike being designated as if they belonged to the same genus, and those agreeing in their generic characters, being referred to distinct genera. Under these circumstances, as is not surprising, fossils intimately related were often widely separated, even when there was an attempted arrangement, while those not at all closely allied, were arbitrarily placed in juxtaposition from a mechanical following of names — a result naturally to be expected in the first efforts to classify diverse objects. In this endeavor to arrange specimens systematically, as should be added, the work had been seldom, perhaps never, pushed so far, as to appear in the grouping of species according to their natural affinities; so, again, older specimens were frequently found mingled with the Tertiary, especially those of the Cretaceous era, there having been a failure to discriminate closely between those of the Mesozoic and those of the Cainozoic age. The same was likewise true of the Post-Tertiary fossils, the line of demarcation between them and the Tertiary not having been critically regarded, as was not indeed to be expected in the earlier stages of the work.

Once more: it became apparent that Tertiary specimens were to a considerable extent, scattered all through the building, some being here, a few more there, and others in additional corners, occasionally by themselves, though often mingled with fossils of various ages. It also became evident that there had been, in some instances, a mixing of fossils from different localities — a result scarcely to be avoided in the repeated removals of so many collections, consisting of such a vast number of specimens. To a very large extent, these specimens were in small pasteboard trays, accompanied by original labels — labels which give great value to the specimens, as being the determinations of such men as Bronn, Duval, De Koninck, Meyer, Eichwald, Hörnes, Michelotti, Bellardi, and others. In most instances they were accompanied by a sort of semi-duplicate labels, consisting of portions of the original labels, respecting which there was no question, with the designation of the collection to which the specimens respectively belonged, and occasionally of the year of purchase or exchange.

Such is substantially the state in which I found the Tertiary collections of the Museum — a state almost inseparable from the mode in which the specimens have been brought together,

and the aims which heretofore have been largely prominent. These specimens, as should be borne in mind, have been in process of collecting for more than twenty years. They have come from a vast variety of sources, under an almost endless multiplicity of forms, often in small numbers, and received at a great number of different times; so they have been packed away, not as the Director might have wished, but as the storage rooms would best allow, — the primary design being the accumulation of valuable materials, in as large amount as possible, for subsequent investigation and arrangement. Accordingly, the occasional mixing of specimens from different localities is a result, even when there is the utmost care, necessarily incident to the unpacking of large quantities of fossils from various localities, and the repeated handling of them on other occasions. At the same time, it is evident that such a condition of things renders a vast amount of labor imperative. A partial mingling of specimens, for instance, necessitates a deal of comparison, of examination of kindred groups, of study of minute points, characteristics of particular localities, if a restoration ever be effected, and even then leaves every such specimen destitute of that fixed certainty which is so important in all strictly scientific investigations, and in order to really trustworthy conclusions.

It is, therefore, clear that these several collections, while remaining in the condition referred to, kindred specimens being so widely separated and the same species being designated by such a variety of labels, could be made, only to a very small extent, available for the purposes of instruction and of advanced studies, or of intelligent comparison and of exchange. In order to become both theoretically and practically useful, they must be brought together in a systematic way, consolidated in consonance with a fixed plan, and so worked up that each species should have its appropriate place, as determined by its affinities, and receive its designation accordingly. And this, as is evident, must involve an immense amount of work, both on the specimens themselves, and in the consultation and comparison of authorities in respect to classification, synonymy, and the nomenclature to be adopted in each specific case. Without all these labors, and more than these, it was plainly impossible to have a single grand collection so arranged throughout according to both the affinities and the analogies of nature, as to be the

harmonious representation of the animal kingdom during the Tertiary age, — so disposed as to stand in becoming relation to the forms of an earlier day, no less than to those of the existing era, — with all the parts in such a way designated, as to give due credit to every previous collector, observer, and collaborator in this broad field of inquiry.

It was consequently natural for me to feel, in undertaking the systematic arrangement of the Tertiary fossils of the Museum, that I had a great task before me. I accordingly began at once to prepare for it by a more thorough study than had before been in my power, of the several branches of the animal kingdom, and especially by a more exhaustive and minute investigation of the Tertiary, as well in all the manifold phases embraced in itself, as in its relations alike to the past and to the present. Entering immediately upon the practical work to be done in the Museum, I found myself in due time separating all the zoölogical remains of the Cainozoic age into grand groups or parcels, according to the several branches and classes to which they respectively belong. At the suggestion of the Director, I took up, at the very start, the *Pleurotoma*, a group of *Gasteropods*, as a special study. Bringing this group of fossils together by slow degrees, and devoting myself to a minute investigation of them as they appear in a fossil state, and in their relations to their living representatives, I gradually from this group as a centre, worked my way outward in different directions, as occasion offered. Advancing in this manner, I proceeded to separate the entire assemblage of tertiary *Gasteropods* into kindred groups of about the same equivalence, as *Murex*, *Fusus*, *Cerithium*, and the like, according to their zoölogical affinities. This work has been diligently prosecuted, and is largely accomplished.

In addition to this, I have also been over these several different groups, one after another, aiming to bring together in small specific circles, all the individuals in each larger section, according to their specific affinities. Having done this roughly for the entire division of *Gasteropodous Mollusks*, I have in several large groups taken up every specimen, examined it closely, and thus endeavored by critical study, to bring into its appropriate specific circle, each individual according to its natural and characteristic features, as indicated by the object itself. This

has prepared the way for another process, which has been carried on to a considerable extent in a number of large groups; viz., that of bringing together all the species, and arranging them in distinct generic circles; that is, in circles of species determined by generic affinities, or according to their kinds; all this being done in the light derived from the study of the fossils themselves. And this has suggested, and if the truth of nature be carried out, it necessitates an additional step equally important with the preceding; to wit, the disposing of these several genera in more comprehensive groups, holding intimate or remote relations to each other, according to their sub-family or family likenesses and differences. Still another step contemplated and all along kept in mind, but in respect to which I have as yet done little in the practical arranging of the collections I am investigating, is such a co-ordination of these several large groups, as shall cause them to stand in due and proper relation to each other, as making up the various great divisions composing the class to which they respectively belong.

In connection with, yet in addition to, this work on the specimens themselves, there has been a large amount of labor expended in the examination and comparison, as well of the earlier names, figures and descriptions of species, as of those now prevalent, and for the most part to be met with in recent publications. This is necessary, in order that what has been heretofore done by palæontologists may be definitely known, and so the way made clear for intelligent advancement. It is also desirable, in order that every species which has been accurately named and figured, may be determined and designated with strict historic fidelity; and that thus such specific groups as have not yet been properly worked up, may be in due time accurately arranged, named and described, as truth and the exigencies of each case shall dictate. In this direction a large amount of preliminary work has been done, and the result briefly noted, — a work which has necessitated the ransacking of many musty tomes, some of them long out of print, in English, French, German and Italian; for original documents have been in all cases consulted, so far as practicable, in connection with more recent authorities.

There is another important aim involved in the work under consideration, — an aim, which as suggested by the Director of

the Museum, has been constantly borne in mind, and actually carried into execution as rapidly as the advancement in the arrangement of species has allowed. Reference is made to the selection of specimens from this large mass of material, as it receives systematic consolidation, for three Museum collections.

First of all, with a view to the formation of a grand *systematic collection*, choice has been carefully made of a type-specimen — intended to be the best single representative to be found — in each specific group. In all cases, so far as possible, these type-examples are authentic specimens selected from the collections of the palæontologists who described the species, great pains having been taken to secure such specimens. The purpose of this assemblage of representative individuals is the presentation to the eye, by actual examples, of the true scientific relations of the animal kingdom, viewed as a systematic whole, so far as they are already recognized, or may from time to time come to be known, and to just the extent the additions to the Museum will warrant. Of course, in this collection, which is designed to be a sort of world in miniature, every species of which the institution possesses an authentic example, will be represented.

In the second place, specimens are in process of selection, from each specific group, for a grand *faunal collection*. With the design of making this assemblage as complete as possible, specimens are chosen in sufficient number to show all individual and specific characteristics — the relations of sex, with the various other points, both of agreement and of variation — as well as to illustrate whatever peculiarities have been noticed, or may come to light in the process of investigation. At the same time, this collection is intended, as its name implies, to demonstrate by positive ocular evidence, the geographical limitation and distribution of each species, so far as its actual extension is indicated, or shall come hereafter to be indicated, by the materials at the disposal of the Museum. Of course, this assemblage of specimens, as progress is made in its formation, naturally divides itself in various more or less distinct partitions, according to the regions, basins, or zoölogical provinces to which the species respectively belong; while these as readily subdivide themselves into sections answering to the different chronologic horizons which they severally represent. In making up this

collection, the utmost care is taken to select those specimens alone, in respect to which there is no doubt whatever as to geological horizon and geographical position.

In the third place, specimens are in process of selection from all the different specific groups, a single one from each locality, intended to make up a grand *chronologic collection*. The design of this last assemblage of fossils, is the visible representation of what I have been wont to term life-periods. In other words, it is the actual exhibition of the vertical extension or geologic duration of each species in every locality, of which the Museum has, or may come to have, specimens; and so of the succession in time, both of species and of all the different divisions of the animal kingdom. The indication of succession, with other closely allied points, being the prominent purpose of this collection, ordinary specimens are used; while sometimes in the lack of them, or, if the species be rare and the fossils of great value, simple tablets, appropriately labelled, with references both to the systematic and to the faunal collection, will be for a while employed. This, however, will only be the case until the deficiency can be supplied by the reception of a larger amount of material; for it is desirable that each collection be as full of instruction as possible, without detraction from its predominant aim.

As this work has gone on, two results have come to light, each of which is deserving of notice. I refer to the completeness and deficiency of the Tertiary collections belonging to the institution. In my study of these organic remains, the richness of the Museum stores has become more and more evident, surpassing in some instances even the highest expectations entertained in regard to them. As an instance of this amplitude and fulness, I may cite the consolidated collection of fossil *Pleurotoma*,—a group, the specimens of which have been for the most part brought together and pretty thoroughly worked up, though many details yet remain unexecuted. In this group alone, the Tertiary species belonging to the Museum, and in most instances represented by a fair number of individuals, probably exceed 450; while the whole number cited by S. P. Woodward, of the British Museum, is 300. The *Cerithium* group, the systematic arrangement of which is considerably, though by no means so far advanced, seems to be equally large. Many other groups,

in the arrangement of which no small progress has been already made, such as the *Voluta*, *Pyrula*, *Fusus*, *Murex*, and the like, are very well represented in the Museum collections.

But the study of these fossil remains has also revealed deficiencies in various directions. Some groups, as we might naturally expect, are much less richly represented than others. So there are localities famous for their Tertiary fossils, of which the Museum has only a meagre supply of specimens. These and other like defects, as it is hoped, will constantly become less as time advances. In connection with this point, it may be proper for me to say that there have been lately received in this department about 300 specimens, comprising some twenty species, from Mr. J. G. Anthony's collection. While making a vacation gathering of Palæozoic fossils last summer, I was able to add about 200 specimens of fossil seeds and fruits, from the Pleiocene beds of Brandon, Vt.; likewise, upward of 900 specimens, consisting of about a dozen species, from the Pleistocene formations of western Vermont and of Montreal. During the past year nothing has been done in the way of making exchanges of Tertiary fossils, it being the aim, first of all, to get the Museum collections into a well organized condition. And I am happy in being able to say, that this work is now so far advanced, as to render it proper to turn attention in this direction. Indeed, the reference to existing deficiencies was made in the hope that it will lead to a system of active and more extensive exchanges, which must prove at once advantageous to others, and beneficial to the institution.

This reference to exchanges suggests an additional point, which may receive a moment's notice. In making up the three Museum collections, a considerable amount of unemployed material is in process of gradual elimination, which may hereafter serve for purposes of study and illustration, of donation and exchange. This unused material naturally divides itself into two parts. The first portion consists of such specimens as have been mixed, either accidentally or in process of moving—in fact, of all those specimens which are eliminated because of some doubt which may be entertained, either as regards their locality, their geologic horizon, or any other point impairing their scientific worth. Specimens of this kind, though their value in one direction be diminished, are still of great use; and

they are all preserved, and will be put to good service, either as objects on which students may be engaged in learning to note likenesses and to discriminate differences, or as material for the making of sections illustrative of the interior structure of fossil remains. The other portion of this material, steadily increasing as the Museum collections advance, and in respect to which there is no question, is laid aside and will be faithfully reserved for purposes of donation and exchange. Although this be a subordinate and incidental feature of the work that is going on, it is yet one of no small importance as respects the permanent usefulness and interest of the institution in advancing the aims of science. This surplus material being worked up, in many cases with as much thoroughness as that reserved for the use of the Museum, is coming to be greatly enhanced in value, as well in a pecuniary, as in a scientific point of view; and it is believed that, as judiciously employed, it will in the end contribute not a little to the prosperity, because it is calculated to add so much to the usefulness abroad, and to the efficiency at home of this cosmopolitan school for the training of naturalists.

In what has been said, I have had primary and exclusive reference to the systematic arrangement of the Tertiary collections of the Museum. Substantially, the same remarks might be made in regard to the rich assemblages of Mesozoic and Palæozoic fossils in the possession of the institution. Indeed, essentially the same principles are applicable, and, as I infer, are to be carried out in the entire department of Palæontology, as well as in the several other departments, of course receiving modifications as exigencies may vary, but everywhere pervaded by singleness of purpose, and brought to bear in the light of one all-controlling idea. It is the aim of the Director to build up a Museum, in the proper scientific sense of the term — a Museum in which the whole animal kingdom shall be represented, both under its existing relations, and as it was in the past, the vast assemblage of specimens being so arranged as to exhibit, in one picture, distribution in space as it has appeared from age to age; in another, succession in time; and in a third, a systematic view, at once of the affinities and of the diversities of all recognized animal forms, — a Museum which shall stand as a transcript of the world of animated existence, everywhere revealing the thoughts of a Supreme Intelligence, working out under

an endless multiplicity of structures, a primal and all-pervading unity of design, — thus a Museum which shall stand as a monument of all that is yet known of the living forms which have peopled our globe, on the one hand suggesting the true philosophy of nature, and on the other, teaching its history by a manifold variety of well-selected examples.

In closing this Report, I desire to say that in the little I have done, I have all along received kindly counsel and valuable suggestions from Professor Agassiz; and that I have been able in all points cordially to sympathize, and, as I trust, in some actively to co-operate with him in his various plans and efforts to advance the interests of the Museum.

Report on the Collection of Fossil Remains in general, by N. S. SHALER.

The assistant in Palæontology has to report a resumption of the work upon the collections under his charge, which had been interrupted by two years' absence from duty in the Museum. During this time he has had the opportunity of visiting about fifty of the principal museums of Europe, of carefully examining the various matters connected with their administration, and of obtaining much information which may in the future be made useful in the arrangement of our own collections. Although this systematic study of the great European collections resulted in the acquisition of many valuable details concerning the mechanical appliances for the care and arrangement of materials, it afforded no results which could have an influence upon the general plan which should regulate the arrangement of the stores of a museum. So far as his observations extended he found no museum where any other purpose than a desire to produce a pleasing and convenient disposition of the specimens, was manifested in the general plan of arrangement. In the few cases where there was an evident intention of showing some of the more important general features connected with the distribution of life over the face of the globe or in the successive geological formations, the imperfection of the means has been too great to afford any great result. Among the fifty museums visited not one was found in a building especially designed for

the purpose of exhibiting collections arranged to show the history of life. Where, as in the Oxford, Heidelberg, and other university museums, buildings have been constructed to hold scientific collections, they have been designed to contain other museums besides the zoölogical, and have thus had their shape partly determined by the needs of other departments. The great collections of Europe are crowded into buildings which were not planned for their accommodation. The liberality of the people of Massachusetts has given to zoölogical science the first, and as yet the only structure erected for its sole use.

The work of cataloguing the collections of fossils has been resumed. This work has been nearly finished in the order of Brachiopoda, and is already well advanced in the Lamellibranchiata. Over twelve thousand (12,000) lots of fossils have been entered on the lists, and corresponding numbers written on the one hundred thousand specimens they contain; thus permanently securing those specimens against loss from accidental displacement. The arrangement of the Brachiopoda into its proper subordinate groups, and the separation into the different geological and faunal divisions, has been carried so far that the greater part of the specimens are in order for the work of placing on tablets for exhibition. The collection of Brachiopoda now in our hands, is one of the most extensive, if not the most complete in the world. We have added to the large and valuable collections purchased from Bronn, De Koninck, Campiche, and many others in Europe, very large collections from the most important American localities. Every effort will be directed towards making this collection of fossils useful in the development of our knowledge of the history of life on this continent, by increasing our stores of American fossils, and by extending the work of comparison of our own species with those found in other regions. As soon as the whole collection has been secured against mischance by the system of cataloguing and numbering, it can then be intrusted without danger to students and preparators for study and for the work of preparing for exhibition. The completion of the series of racks now being built to hold the two thousand drawers in which our fossils are stored, will greatly facilitate the work of arrangement and enable us to have all our materials readily accessible.

Although our collection of fossils is in many respects unsurpassed, many things are still necessary to give it the value it should have to accomplish the ends in view. Assistance for cleaning and mounting the specimens is imperatively necessary. At least two persons could be employed on this work for the next year without going out of the material already catalogued. There is also need of some expenditures to complete the series of forms now in our stores, which having been purchased from many hands, require considerable additions to fill the blanks which remain. We ought also to have at least one collector constantly at work on our American rocks, in order that our representation from them be more complete, and that we may have ample means for exchange. It is no exaggeration to say that for every lot of carefully collected American fossils we can obtain valuable European specimens, which would cost us twice or thrice as much to purchase as we pay by exchange. The assistant is now preparing a map to show the regions from which we have collections of American fossils to guide the work of collecting, should it be concluded to undertake it. The most serious deficiencies are to be found in the collections from the Southern States. The war prevented collection for many years, and the disturbed state of the country has made it difficult to get collectors to go there since its close. Now that this difficulty is removed, there should be more attention paid to the rich Cretaceous and Tertiary localities so generally absent in the seaboard Northern States. Several correspondents are very desirous of having collections from that region.

Since the resumption of work in September, several exchanges have been prepared for our European correspondents. During his journey, the assistant in charge of this department, was so fortunate as to make arrangements which secure this sort of cooperation on the part of about a dozen valuable correspondents, in addition to the thirty or more already on our books, to whom collections will be forwarded as rapidly as possible.

The assistant in Palæontology has given thirteen lectures of a course on Palæontology, which will be continued during the remainder of the present term and part of the next. The second part of the course will be especially devoted to instruction in the identification of fossils.

The Museum is indebted to the following persons for donations of fossils:—

GREENOUGH, HORATIO, Mrs. 1 lot of fossil, from Vaches Noires Calvados.

WHITNEY, Prof. J. D. Teeth of fossil elephant.

CLARK, President, of Mass. Agricultural College. 2 specimens of fossils, from South Carolina.

MCPHERSON, Wm., Jackson County, Florida. 1 mastodon tooth.

ELLIS, C. STUART, of Muscatine, Iowa. 1 fossil plant.

RAPIN, Dr., of Grandson, Switzerland. 1 lot of neocomian fossils.

GIBBON, Gen., U. S. A. Fossils, from Laramie Plain.

AGASSIZ, Prof. L., Curator of the Museum. Boxes of fossils, from the Smoky Hill route, Rocky Mountains.

AGASSIZ, Prof. L., Curator of the Museum. Boxes of fossils, from Ithaca, New York.

AGASSIZ, ALEX., Assistant in the Museum. A lot of fossils from the drift beds of the Lake Superior region.

BARNARD, JAMES M. Fragments of vertebrate skeleton, from Washington Territory.

BOUTELLE, Capt. Fossil tooth, from Ashley River, South Carolina.

WYMAN, Prof. J. 1 lot of fossils, from Florida.

RICE, Prof. J. M. 1 box of fossils, from Annapolis, Md.

SHALER, N. S., Assistant in the Dep't of Palæontology. 1,200 species, about 30,000 specimens of European fossils, representing about 100 localities, and most of the European horizons.

SHALER, N. S. 50 species, 300 specimens Silurian and Tertiary fossils, from Ohio and Kentucky.

PERRY, Rev. J. B., Assistant in the Museum. 915 specimens Pleistocene shells; 200 specimens Tertiary seeds and fruits, from Vermont and Canada, and 850 specimens of Palæozoic fossils, from Vermont and New York.

SERRES, M. HECTOR, à Dax, France. 1 lot of Tertiary fossils.

RAVEY, SAM'L. One large Orthoceratite, from Nashville, Tenn.

The following lots have been received in exchange since the last report of the assistant:—

DAVIS, H., McGregor, Iowa. 1 box of fossils.

HERZER, Dr., Delaware, Ohio. 1 box of fossils.

ALLEN, Prof. G. N., Oberlin College. 2 boxes of fossils.

PICKET, E. J. 1 box of fossils.

LAYARD, F. A lot of European fossils.

HAAST, Dr., New Zealand. A lot of *Dinornis* bones, embracing several nearly perfect skeletons.

PYBAS, A. 1 lot of American fossils.

Owing to the long absence of the assistant in Palæontology from his place, it is not impossible that some omissions will afterwards be detected in the list of persons to whom the thanks of the Museum are due; should such be discovered, the acknowledgment will be made in the next report.

[B.]

TRUSTEES OF THE MUSEUM OF COMPARATIVE ZOÖLOGY.
1869.

THE GOVERNOR OF THE COMMONWEALTH,
WILLIAM CLAFLIN.

THE LIEUTENANT-GOVERNOR,
JOSEPH TUCKER.

THE PRESIDENT OF THE SENATE,
ROBERT C. PITMAN.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES,
HARVEY JEWELL.

THE SECRETARY OF THE BOARD OF EDUCATION,
JOSEPH WHITE.

THE CHIEF JUSTICE OF THE SUPREME JUDICIAL COURT,
REUBEN A. CHAPMAN.

LOUIS AGASSIZ.

JAMES WALKER.

NATHANIEL THAYER.

SAMUEL HOOPER.

JAMES LAWRENCE.

THEODORE LYMAN.

C. W. FREELAND.

(And two vacancies.)

OFFICERS OF THE MUSEUM OF COMPARATIVE ZOÖLOGY FOR
1869.

His Excellency WILLIAM CLAFLIN, Governor of the Commonwealth,
President.

THEODORE LYMAN, *Treasurer and Secretary pro. tem.*

LOUIS AGASSIZ, *Director of the Museum.*

SAMUEL HOOPER, JOSEPH WHITE, NATHANIEL THAYER, JAMES LAW-
RENCE, *Committee on Finance.*

LOUIS AGASSIZ, REUBEN A. CHAPMAN, *Committee on the Museum.*



