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ANNUAL REPORT
OF
THE CURATOR
OF THE
MUSEUM OF COMPARATIVE ZOÖLOGY
AT HARVARD COLLEGE,
TO THE
PRESIDENT AND FELLOWS OF HARVARD COLLEGE,
FOR
1888-89.

CAMBRIDGE, U. S. A. :
UNIVERSITY PRESS: JOHN WILSON AND SON.
1889.

FACULTY OF THE MUSEUM.

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ALEXANDER AGASSIZ, *Curator.*

GEORGE L. GOODALE.

JOSIAH D. WHITNEY, *Secretary.*

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E. L. MARK	<i>Hersey Professor of Anatomy.</i>
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J. ELIOT WOLFF	<i>Instructor in Petrography.</i>
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D. D. SLADE	<i>Assistant in Osteology.</i>
SAMUEL GARMAN	<i>Assistant in Herpetology and Ichthyology.</i>
WILLIAM BREWSTER	<i>Assistant in Ornithology and Mammalogy.</i>
ALPHEUS HYATT	<i>Assistant in Palæontology.</i>
MISS F. M. SLACK	<i>Librarian.</i>

REPORT.

TO THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE:—

DURING the past year the following courses of instruction have been given at the Museum:—

A course in Biology, by Professor Farlow and Mr. G. H. Parker, assisted by Mr. W. A. Setchell.

A course in Zoölogy, by Mr. G. H. Parker, who had charge of the Biological Laboratory.

General Lectures in Zoölogy, by Professor Mark. A course in Microscopic Anatomy and a course of Embryology were also given by Professor Mark. In the Laboratory work he was assisted by Mr. C. B. Davenport.

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

For the details of these courses of instruction I would refer to the accompanying special Reports of the Professors and Instructors.

The Assistants of the Museum, Professors Hagen and Faxon, Dr. Slade, Mr. Garman, Mr. Brewster, Professor Hyatt, and Dr. Fewkes, have devoted, as usual, a large share of their time in supplying specialists with material and information in their various departments.

The addition to the University Museum Building, containing the accommodation needed for the Geological and Geographical Departments, is now ready for its furniture, and I hope that by the next Academic year it may be completed and occupied. In order to make this possible, however, the Museum will have

to anticipate a part of its income for a number of years. The Botanical Section is also ready for the furniture and heating apparatus.

Beside these two sections, the last section of the Oxford Street façade will also be completed by the time this Report is printed. Professor J. P. Cooke has succeeded in obtaining from the friends of the College a sum sufficient for the erection of another section, which is to be devoted to the Mineralogical Department. With the exception of the southwest corner piece, the building will then be complete according to the scheme laid out in 1859 for the accommodation of the Natural History Departments. This should for some time to come give ample room for the working of the Departments it is intended to shelter, leaving for future exigencies the southwest corner piece, which will eventually connect the University Museum with the Peabody Museum.

I have annexed to my Report, —

1. An elevation of the University Museum as seen from Oxford Street.

2. A view of the University Museum Building, exclusive of the Mineralogical Section now erecting, as seen from the northwest corner, on Oxford Street.

3. A view of the interior of the Natural History Quadrangle, seen from the southeast side.

4. A ground plan of the Natural History Quadrangle, showing the North Wing, or the Museum of Comparative Zoölogy; the northwest corner piece, containing the Natural History Laboratories; the Oxford Street façade of the University Museum, comprising the Botanical Department, the Mineralogical Department, and the projected southwest corner of Laboratories and Lecture Rooms which are to connect the University Museum with the South Wing, or the Peabody Museum. The shaded parts indicate the portions of the building already erected, or in process of erection.

5. A plan of the BASEMENT, showing the storage and work rooms of the Alcoholic Collections in the North Wing, the receiving-room, boiler-room, and Aquarium and Vivarium in the northwest corner piece, and the engine-room, laboratories, workshops, and photographic rooms of the Geological and Lithological Department.

6. The **FIRST FLOOR** plan. — The Palæontological Exhibition Rooms and work-rooms of the North Wing and the Synoptic Room; the Geological and Palæontological Laboratories of the northwest corner piece, and the large Lecture Room of the Geological Department.

7. The **SECOND FLOOR** plan, containing in the North Wing the Entomological Department, the special collections, the room for special students of the Geological and Palæontological Department, and a part of the Library, which is continued in the northwest corner piece, which also contains the Curator's Room and the Lithological Laboratories.

8. The plan of the **THIRD FLOOR**, which shows the main Exhibition floor, containing in the North Wing the Systematic and Faunal Collections; in the corner piece, the Atlantic and Pacific Faunal, and the Geological and Geographical Exhibition Rooms.

9. The plan of the **GALLERY** and **FOURTH FLOOR** shows the continuation of the Systematic and Faunal Collection in the North Wing, the Zoölogical Laboratories in the northwest corner piece, and the Geographical Laboratories.

10. The plan of the **FIFTH FLOOR**, showing in the North Wing the storage and work rooms of Vertebrate Palæontology, and of skeletons and skins of birds and mammals, while the corner piece and the extension on Oxford Street contain the storage and work rooms for fish and reptile skeletons, a large Lecture Room, and the storage and work rooms of the other Invertebrates.

The arrangement shown in these plans does not differ materially from that published in the Twentieth Annual Report (1884-85), with the exception that the Geological and Geographical Departments now occupy their final quarters, while the collections of dry invertebrates have been moved to adjoining rooms, leaving the greater part of the fifth floor of the North Wing for the development of the fossil vertebrate collection.

Professor E. B. Wilson, of Bryn Mawr, was the only investigator at the Newport Marine Laboratory. He passed a short time there this summer, and collected material for his work on *Polygordius*. The Museum students and assistants, Messrs. E. R. Boyer, C. B. Davenport, and W. M. Woodworth, as well as Dr. Mark, availed themselves of the facilities offered by the

Biological Laboratory and the Museum Tables at the United States Fish Commission Station at Wood's Holl, for which the Museum is specially indebted to Colonel Macdonald, U. S. Fish Commissioner.

The usual amount of material from our collections has been sent for study to a number of specialists. The customary exchanges have been continued, and are mentioned in the special Reports of the Assistants. Professors Scott and Osborne have continued their work on our American Fossil Vertebrates, and another part of their report is nearly ready for publication.

Among our principal accessions I may mention a skeleton of a Right Whale, finely mounted by Ward, and now hung from the ceiling of the large room devoted to the Systematic Collection of Vertebrates. This skeleton was originally secured for the Museum by the late Captain N. E. Atwood, of Provincetown, where the whale had been thrown ashore. In the early days of my Natural History career, I had the unpleasant task of assisting in the preparation of the skeleton.

We have made interesting purchases of Alcoholic Reptiles for the Exhibition Rooms.

Through Professor Ward we have secured a series of valuable skeletons of a few of the large fossil Mammals of the Pampas in sufficiently good state of preservation to be mounted and placed on exhibition in the Tertiary Room. A number of mounted specimens have likewise been received from him to fill gaps in our Exhibition Rooms, as well as a number of casts of Pacific Islanders and other aborigines for the Faunal Rooms.

We have purchased also the continuation of the series of casts of Stegocephali from Dr. Anton Fritsch, of Prague, and casts of Phenacodus and Hyracotherium from Professor Cope.

From Lieutenant Moser, U. S. N., we have received an interesting collection of corals, taken from a cable laid off Key West in 1881, and taken up in 1888. I hope soon to publish an account of these corals, illustrating as they do the rate of growth of several species.

From Mr. Charles Wachsmuth was received a fine slab of Crinoids from the Kinderhook bed of Legrand, Marshall Co., Iowa.

We have also received a model of the Pacific Coast of the United States, prepared under the direction of Professor Davidson of the U. S. Coast Survey.

A number of collections sent out for study have been returned, and we have received from Mr. Godman a large suite of American Neuroptera, which will be worked up by Dr. Hagen for the *Biologia Centrali Americana*.

From the British Museum we have received a collection of five hundred Birds from Central America and New Guinea; and from the American Museum of Natural History of New York, an excellent plaster cast of the Chimpanzee known as "Mr. Crowley."

The Museum is greatly indebted to Messrs. Brewster, Cabot, and Slade for their interest in their respective Departments. Mr. Jackson has also continued during the past year to render efficient aid to Professor Hyatt in the work of his Department. Mrs. Le Conte has presented to the Museum five hundred dollars, to be expended for cabinets to include the collection of Coleoptera which Dr. Le Conte left by his will to the Museum.

Professor Faxon has kindly continued in charge of the collection of Crustacea, and he and Dr. Fewkes have spent some time in the arrangement of the Invertebrates of the Atlantic Faunal Exhibition Room, which was opened to the public during the past summer. It is still very imperfectly arranged, and there are many annoying gaps to be filled; but the room as a whole is an interesting one, and gives to the public an idea of a great marine realm such as no other Museum has as yet attempted to represent. It is hoped that the Pacific Room may also soon be opened to the public.

The Atlantic Room contains typical collections of Protozoa, Sponges, Radiates, Mollusks, Annelids, Crustacea, and Fishes, extending from the littoral to the abyssal fauna. There is also a limited space devoted to the Reptiles and the Birds characteristic of the sea-shores, and the Seals, Whales, and other marine Mammals. A case is devoted to the apparatus used in dredging expeditions. Samples of the deep-sea and littoral formations will also find their place in this room, and the pelagic fauna is fairly represented by glass models of the principal Acalephs, Cephalopods, and other groups not included among the alcoholic or dried specimens.

With each of their special Reports will be found a list of the publications of the Assistants of the Museum, and of the publications based upon the materials of the institution, as well as of

the investigations carried on by the Professors and students of the University in our Laboratories. It will be seen from these reports that our collections continue in excellent condition. The Museum has lost the services of Dr. Fewkes, who has had charge of the Collection of Invertebrates for the last three years, and of the Radiates since 1880.

Appendix A of this Report contains a list of the publications of the Museum issued during the past Academic Year. We have published eight numbers of the Bulletin, — four in the Geological Series, and four in the Zoölogical, including a volume by Dr. Dall containing the second part of the Report on the “Blake” Mollusca, illustrated by over thirty plates of excellent figures drawn by Dr. McConnell. This final Report contains 492 pages, and is a valuable contribution to our knowledge of the Mollusks of the East Coast of the United States, and of the Gulf of Mexico and Caribbean Sea. It has been prepared by Dr. Dall with his usual care and skill.

One number of the Memoirs has been issued, — the continuation by Professor Whitman and myself of our Memoir on the Development of Osseous Fishes.

Dr. P. H. Carpenter is making good progress in his final Report of the “Blake” Comatulæ. The proofs of six plates of the Memoir he is preparing have been received from him.

Among the monographs in preparation I may also mention a paper on the Genesis of the Arietidæ, by Professor Hyatt, now in press. This will be published jointly by the Smithsonian Institution and the Museum. The Smithsonian Institution has also published an Explanation of the Plates, by Mr. Fewkes, of a Memoir on Astrangia, prepared for Professor Louis Agassiz, but which he never completed. It was in the hands of Mr. Pourtalès for completion at the time of his death.

Mr. Louis Cabot is also preparing the third part of his Memoir on the early stages of the Odonata. The plates are completed.

Mr. Garman has sent in for publication in the Bulletin an interesting paper on the Cave Animals of Missouri.

I am myself preparing a Memoir on a new Stalked Crinoid (*Calamocrinus*) dredged by the “Albatross” off the Galapagos on her voyage from New York to San Francisco. This is one of the most interesting Crinoids dredged by any of the deep-sea

expeditions. It is closely allied to *Millericrinus* and other *Apiorionidæ*, and forms a part of the collection of Echinoderms made by the "Albatross," and kindly sent me for study by Colonel Macdonald, the U. S. Fish Commissioner.

The accessions to the Library are more numerous than in the previous year, and it now numbers more than twenty thousand volumes, exclusive of the Whitney Library. This growth is principally due to the increase of our exchange list.

This is the first year in which the Museum has practically lived within its income, while fully sustaining its usual work not only in instruction, but also in the increase of its collections and of its Library; its publications have equalled in importance those of former years, and the investigations carried on within its walls have not been in the least curtailed. Still, until the advances made to the Museum by the Corporation for the Geological Section and for the purchase of fossils have been repaid, we cannot be expected to show as great activity as if our resources were unencumbered. We need about thirty thousand dollars to place the Museum on a completely independent footing again.

ALEXANDER AGASSIZ.

CAMBRIDGE, October 1, 1889.

REPORT ON THE GEOLOGICAL DEPARTMENT.

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

IN this department two courses of lectures were given. The first of these was on the Physical Geography and Geology of North America, and the Past and probable Future Development of its Material Resources. This course (twice a week, lasting through the College year) was attended by about thirty-five persons, mostly Seniors, with a few special students and candidates for a higher degree. The second course (once a week, through the year) was on Mineral Veins and Metalliferous Deposits, their mode of occurrence, and theories of their origin. This course was attended by about half a dozen persons, mostly Seniors, with one or two officers of instruction in the College. For the current year (1889-90) an arrangement has been made with Mr. Wolff, Instructor in Petrography, by which his course, of four lectures a week, with laboratory work, will occupy the first half of the year, while during the second half the Sturgis-Hooper Professor will take the subject of Economical Geology, with a similar amount of lectures and library work. This is done in order that there may be more concentration of the student upon the subject selected, and also that those who wish to take Economical Geology may have the opportunity to become prepared for a course of this kind, in which a knowledge of mineralogy and some acquaintance with rocks is extremely desirable.

The volume entitled "The United States, Facts and Figures illustrating the Physical Geography of the Country and its Material Resources," mentioned in the last Report, has been published during the year, and occupies 472 pages. In this volume the statistics as prepared for the article in the *Encyclopædia Britannica*, of which the volume in question is mainly a reprint, have, as far as possible, been brought down to the year 1888. An

Appendix was also added, in which the subject of the geographical discovery of the Cordillera Region was treated at some length, and a sketch was given of the methods and results of hypsometrical measurements in the United States, with special reference to the probable accuracy of the results obtained. Furthermore, the subject of the cartography of the country was discussed in some detail.

The work done in preparing definitions of technical terms in physical geography, geology, mining, and metallurgy for the Century Dictionary has occupied a very considerable amount of time, and as five parts of the encyclopedic work are now before the public, bringing it down to D, those who are interested can judge for themselves of the nature and value of the material contributed in the branches of science specified.

Some field-work has also been done in continuation of the investigation of the surface and glacial geology of North America, to which allusion has been made in preceding Reports. The regions visited were the southern and eastern portions of Long Island and the adjacent mainland, and the valley of the St. Lawrence.

REPORT

ON THE INSTRUCTION IN GEOLOGY, PALÆONTOLOGY,
PHYSICAL GEOGRAPHY, AND PETROGRAPHY.

BY PROFESSORS N. S. SHALER AND W. M. DAVIS, AND MR. J. E. WOLFF.

DURING the Academic year 1888-89, the following courses of instruction were given in the Geological and Palæontological Laboratory, and in the field, by N. S. Shaler and his assistants.

1. N. H. 4. A course in Elementary Geology, by N. S. Shaler. Two lectures a week, with certain required reading; attended by one hundred and sixty students.

2. N. H. 4 *a*. A course of Practical Geological Exercises in the Laboratory and in the field, by Mr. T. W. Harris, designed especially for those who intend in subsequent years to continue the study of Geology and Palæontology; attended by fifty-five students.

3. N. H. 8. A course of Advanced Geology, by N. S. Shaler, W. M. Davis, J. E. Wolff, and T. W. Harris; two lectures a week, together with assigned field-work, which was conducted by Prof. W. M. Davis and Mr. J. E. Wolff. In the winter season the field-work was replaced by the study of models and geological maps, and of reports on selected geological areas. Students in this course were required to prepare a thesis on an assigned subject. Those only who have passed a satisfactory examination in the elementary courses are permitted to attend. Forty-nine persons received this instruction.

4. N. H. 14. A course on Palæontology, by N. S. Shaler. Two lectures a week, with laboratory work and theses.

5. N. H. 15. A course in Historical Geology, designed to train students in the determination of geological horizons, attended by three students.

6. N. H. 16. A course in field-work, designed to afford special training in the processes of geological surveying, by N. S. Shaler, W. M. Davis, J. E. Wolff, and T. W. Harris, attended by thirteen students.

During the winter season the students in advanced classes attended regular evening meetings designed to serve the purpose accomplished by the Seminaria of the German Universities.

During the summer of 1889, twenty-five students received systematic instruction in field-work. This instruction was given in two summer schools, that of Elementary Geology, which was taught at Cambridge, and an advanced course, taught in the States of New York, Connecticut, and Massachusetts. Instruction in these courses was given by N. S. Shaler, W. M. Davis, and T. W. Harris, with the assistance of Prof. H. S. Williams of Cornell University, who collaborated with the other instructors in the work done in the Genesee Valley.

During the year, the following papers of a scientific nature have been published by N. S. Shaler:—

1. Report on the Geology of Martha's Vineyard. Seventh Annual Report of the Director of the United States Geological Survey, 1885-86. Washington, 1888, pp. 297-363. With Illustrations and Two Maps.

2. On the Geology of the Cambrian District of Bristol County, Massachusetts. Bulletin of the Museum of Comparative Zoölogy, Vol. XVI. No. 2, pp. 13-41. With Map and Two Plates. Cambridge, October, 1888.

3. On the Occurrence of Fossils of the Cretaceous Age on the Island of Martha's Vineyard, Mass. Bulletin of the Museum of Comparative Zoölogy, Vol. XVI. No. 5, pp. 89-97. With Two Plates.

4. Chance or Design. The Andover Review, August, 1889, pp. 1-17.

5. Introduction to Bulletin No. 46, U. S. Geological Survey. On the Nature and Origin of Deposits of Phosphate of Lime, by Dr. R. A. F. Penrose, Jr.

6. Administrative Report of the Atlantic Coast Division of the United States Geological Survey. Annual Report of Director for 1885-86 (published in 1888), pp. 61-65.

7. Effects of Permanent Moisture on certain Forest Trees. Science, March, 1889, pp. 176, 177.

Owing to absence from Cambridge during the greater part of the past year, it was impossible for Mr. Davis to carry on the first course in Physical Geography (Natural History 1), and it was therefore placed in the hands of Mr. T. W. Harris, Instructor in Geology. Laboratory exercises and recitations were maintained once a week through the year, in addition to the regular lectures, with an attendance of forty students.

The advanced course in Physical Geography (Natural History 20) was in charge of Mr. Davis, with an attendance of five

students, all from the Senior Class. Various special subjects of study were followed; theses on those taken by Mr. Ward, "The Sea-breeze," and by Mr. Curry, "The Theory of Tornadoes," will be shortly published. The students from this class and two from the advanced class in geological field-work accompanied the instructor in an excursion during the April recess across Northern New Jersey and into Central Pennsylvania, with the object of examining the traces of ancient base-levels in that region, and thus learning something of the development of its river valleys. The results of this study are now published in the National Geographic Magazine.

Mr. Davis's other work of instruction in the year was in two geological courses, on which Professor Shaler has reported. During the summer, two weeks were spent at Madison, Wisconsin, taking part in the summer school for teachers opened there by the State University; fourteen lectures on Physical Geography were here given to a class of about fifty members. Later in the vacation, the Harvard Summer School of Geology was in his charge at Catskill, New York, and at Meriden, Connecticut.

The materials for use in the Geographical Laboratory have been increased during the year by the purchase of a set of relief maps, copies of those designed and in part made by Mr. Davis two years ago for the Teachers' School of Science of the Boston Society of Natural History. These have been found of much value in class instruction. There have also been purchased an excellent terrestrial globe; a set of the monthly volumes of tri-daily weather maps issued by the Signal Service, these being particularly for the use of students in the elementary course; Haardt's and other maps of the Alps; Kiepert's physical maps of the various countries of Europe; and several climatological maps. The Laboratory has also received as a gift from the Pennsylvania Railroad Company a valuable set of large photographs illustrating the scenery along its lines.

During the winter, Mr. C. L. Whittle, Assistant, United States Geological Survey, carried on, under Mr. Davis's direction, an investigation of the characteristics of the intrusive and extrusive trap sheets of the Connecticut Valley, the results of which are now ready for publication in the Museum Bulletin. Mr. Davis's publications during the year were as follows:—

Physical Geography and Climate of New England. Two chapters in Scudder's Butterflies of New England. 1888.

The Structure of the Triassic Formation of the Connecticut Valley. Seventh Annual Report, U. S. Geol. Survey, 1888, pp. 445-490.

The Faults in the Triassic Formation near Meriden, Connecticut. A Week's Work in the Harvard Summer School of Geology. Bulletin of the Museum, Vol. XVI. (Geol. Series, Vol. II.), pp. 61-87. With Five Plates.

The Ash-Bed at Meriden and its Structural Relations. Proc. Meriden (Conn.) Scientific Assoc., 1889.

Topographic Development of the Triassic Formation of the Connecticut Valley. Amer. Journ. Science, Vol. XXXVII., 1889, pp. 423-434.

Geographic Methods in Geologic Investigation. Nat. Geogr. Mag., Vol. I., 1888, pp. 11-26.

The Rivers and Valleys of Pennsylvania. Nat. Geogr. Mag., Vol. I., 1889.

Methods and Models in Geographic Teaching. Abstract of Lecture delivered before the University Scientific Association of Johns Hopkins University. Johns Hopkins Univ. Circular, No. 72, p. 62.

Synclinal Mountains and Anticlinal Valleys. Science, Vol. XII., 1888, p. 320.

A River Pirate. Science, Vol. XIII., 1889, pp. 100-109.

Some American Contributions to Meteorology. A Lecture delivered before the Franklin Institute of Philadelphia. Journ. Franklin Inst., Vol. CXXVII., 1889.

Six students worked in Petrography during the year, and occasional assistance was given to others. The equipment was increased by the purchase of two new petrographical microscopes, and of a lathe for sawing thin slices of rock by the diamond saw.

Mr. Wolff completed and prepared for publication his Report on the Geology of Hoosac Mountain and adjacent Territory, dealing with the geology and petrography of a portion of the Green Mountains. During the past summer, in connection with the United States Geological Survey, he has spent two months in an exploration of the Crazy Mountains, Montana, investigating the field relations of the nepheline rocks discovered there by him in 1883, to which, as types of a new family of rocks, Professor Rosenbusch gave the name of Theralite. The results have been very satisfactory, proving that these are true plutonic rocks, occurring in large laccolites. This and other interesting petrographical discoveries will be announced later in detail.

REPORT ON THE INSTRUCTION IN BIOLOGY.

BY PROFESSORS FARLOW AND MARK, AND MR. G. H. PARKER.

THE instruction in Zoölogy during the Academic year 1888-89 covered substantially the same ground as in the preceding year. The Nat. Hist. Courses 2, 13, and 9 were conducted by Dr. Mark; Nat. Hist. 6, and the zoölogical half of Nat. Hist. 5, by Mr. G. H. Parker.

In Nat. Hist. 2, there were fifty-eight students: one Graduate, five Seniors, twelve Juniors, sixteen Sophomores, fifteen Freshmen, four Specials, and five Scientific Students. In the laboratory work the instructor had the assistance of Mr. C. B. Davenport.

Nat. Hist. 13 was elected by nine students: three Graduates and six Undergraduates. The lectures were on methods of work in microscopic anatomy and embryology, and on the anatomy and histology of Hydra, Tænia, and Lumbricus, — the animals studied in the laboratory work of the course.

Nat. Hist. 9 was pursued by four Graduates and by Mr. Parker, the Instructor in Zoölogy. Mr. Parker's studies, which were continued from the preceding year, are completed, and his paper, "The Histology and Development of the Eyes in the Lobster," is ready for publication. A paper by Mr. C. H. Eigenmann, "On the Egg Membranes and Micropyle of some Osseous Fishes," which was begun in the autumn of 1887, was completed early in the year, and will soon be issued in the Museum Bulletin. One of the students was interrupted in his studies by a serious sickness of several months; the others will be able to present the results of their work during the current year.

Dr. Mark has published in the Twentieth Annual Report of the Massachusetts State Board of Health an article on "Trichinæ in Swine," and has finished the first part of his studies on the Embryology of *Lepidosteus*, the plates accompanying which are

nearly completed. The paper will be issued in the Museum Bulletin.

The Zoölogical Club has continued to hold regular meetings during the year, with profit to its members.

Natural History 6, a course on the Comparative Anatomy of Vertebrates, by Mr. G. H. Parker, was taken by four Seniors, four Juniors, and five Special Students.

The class in Elementary Biology, Nat. Hist. 5, was conducted by Dr. Farlow and Mr. G. H. Parker, assisted by Mr. W. A. Setchell, on the plan pursued in previous years. The course was attended by thirty-two students. It was voted by the Faculty, that, after the year 1889-90, all students intending to take this course should be required to have studied previously Nat. Hist. 2.

The courses Nat. Hist. 23 and Nat. Hist. 12, awaiting the completion of the laboratories specially intended for their use, were held in the room of the Cryptogamic Herbarium and one of the Museum work-rooms. The former was attended by four students, the latter by five students. Of the students in Nat. Hist. 12, Mr. Kingo Miyabe received the degree of Doctor of Science in June, presenting as his graduating thesis a paper on the Flora of the Kurile Islands, which will appear shortly in the Memoirs of the Boston Natural History Society. He also published in the Annals of Botany a paper on the "Life History of *Macrosporium parasiticum*," embodying work done in Nat. Hist. 12. A paper by Mr. H. M. Richards on "The Uredo-stage of *Gymnosporangium*" appeared in the Botanical Gazette of September. Two algological papers were written by Mr. Richards and Mr. J. P. Morgan, but have not yet gone to press. Other students in Nat. Hist. 12 have been engaged in the continuance of work on their graduating theses, which they intend to offer as candidates for the degree of Doctor of Philosophy during the coming year.

REPORT ON THE OSTEOLOGICAL DEPARTMENT.

BY D. D. SLADE.

INSTRUCTION in Comparative Osteology, Natural History 21, has been given during the past year by lectures, laboratory work, and examinations. The course has been followed by three Juniors and two Seniors. All the students were much interested in their work, as was shown by their faithful attendance, and by the final examination. Four of the above intend to pursue the medical profession.

Since the last report, the collection has received from Professor Ward an articulated skeleton of *Balaena cisarctica*, which has been hung in the Central Exhibition Room, and also an articulated skeleton, which has been cleaned, and also hung in the same room, of *Monodon monoceros*. Several skeletons, mostly of Cetacea, which have been suspended for many months in the hall without labels, have been properly designated.

An alcoholic specimen of one of the Marmosets, to be prepared as a skeleton, has been presented by one of the students who attended the course. The entire collection is in excellent preservation. The opportunities so generously offered for study and research in osteology are daily becoming better appreciated, as evinced by the increased number of those who have applied for the ensuing Academic year.

During the past year, the Assistant in this department has published a paper in Science, Vol. XIII., No. 333, entitled "Osteological Notes."

REPORT ON THE MAMMALS AND BIRDS.

 BY WILLIAM BREWSTER.

THE only important addition to the collection of Mounted Mammals is a Sea Elephant, *Macrorhinus leoninus*, — a remarkably large, fine male from the Cape of Good Hope.

Of birds the Museum has received the following. By gift from the British Museum, four hundred and fifty-nine skins, of which fifteen are from New Guinea, a few from India (from the Hume Collection), the remainder from South America. By gift from Allen Weeks a Paradise Trogon (*Pharomacrus paradiseus*). By exchange from the American Museum of New York, twenty-four skins of South American birds, including fourteen species not hitherto represented in the Cambridge Museum's collection.

In addition to these, about forty mounted specimens of wading or swimming birds have been bought for the collection in the Atlantic Room, which has been lately opened to the public. The cases in this room devoted to marine mammals are now about filled, but there is space for further additions to the collection of shore and sea birds.

During the past year series of bird skins were sent for examination and study to Mr. Robert Ridgway, of the Smithsonian Institution, and to Mr. J. A. Allen, of the American Museum of New York. All of these skins have been safely returned.

In the last report mention was made of the satisfactory re-arrangement of the Alcoholic Collection of Mammals at the hands of Mr. Garman. There is pressing need of equally thorough and systematic treatment of the Alcoholic Collection of Birds, which, at present, is in some confusion.

The Assistant has published the following papers and notes in "The Auk": —

“ Breeding of the Golden-crested Kinglet (*Regulus satrapa*) in Worcester County, Massachusetts, with a Description of its Nest and Eggs.”

“ Notes on the Birds of Winchendon, Worcester County, Massachusetts.”

“ Notes on the Birds of Fort Klamath, Orégon. By Dr. J. C. Merrill, U. S. A. With Remarks on certain Species, by William Brewster.”

“ A Second Maine (and Fourth New England) Specimen of Swainson’s Hawk (*Buteo swainsoni*).”

“ *Cistothorus palustris mariannæ* on the Coast of Georgia.”

“ The present Status of Forster’s Tern, as a Bird of New England.”

“ Occurrence of the Western Sandpiper (*Ereunetes occidentalis*) in Numbers on the Coast of Massachusetts.”

“ Krider’s Hawk (*Buteo borealis kriderii*) on the Coast of Georgia.”

“ Second Occurrence of the Prairie Horned Lark in Eastern Massachusetts.”

“ Descriptions of supposed New Birds from Western North America and Mexico.”

“ *Dendroica coronata* feeding upon Oranges.”

In “ Forest and Stream ” : —

Two Letters without formal titles relating to habits of the American Woodcock.

REPORT ON THE REPTILES AND FISHES.

BY SAMUEL GARMAN.

As has been the case in previous years, some time and labor has been given to the alcoholic collections in other departments. The identifications and the changes of alcohol, specimens, and labels have been continued, as also the process of disposing of the duplicates. In the storage rooms the bulk of the material has been further reduced by the withdrawal of some thirty large sharks, skates, and reptiles. The largest series of duplicates sent to correspondents were those sent to the Smithsonian Institution and to Professor Jordan; others were shipped to Professor C. S. Dolley, of the University of Pennsylvania, and to the Illinois State Laboratory of Natural History, and smaller lots were furnished Doctors M. Guitel, E. L. Mark, George Baur, and R. W. Shufeldt. For the students' use, at various times specimens were given out to Dr. Slade and Mr. Parker. Eleven comprehensive lots, special selections, have been prepared and are now ready to forward to their destinations. The space allotted to the Fishes and Reptiles in the faunal exhibit of the Atlantic has been filled.

By purchase an excellent lot of Reptiles and Batrachians, mainly African and East Indian, was obtained from the Linnaea Naturhistorisches Institut. :

A fine Series of Mediterranean Fishes was received from the Milan Museum, and this was followed by another, made up of Selachians, gathered by Professor Bellotti in answer to our request. Professor Dolley supplied a number of desiderata from the Bahamas; these, with a large number of fresh-water fishes from the U. S. Commissioner of Fisheries, and a number of Reptiles from Mr. N. L. Wilson, complete the list of exchanges.

We have received gifts of specimens from the following persons: Mrs. C. N. Willard, Miss Ruth Hoppin, Miss Mary

Woodman, Professors Alex. Agassiz, C. J. Maynard, H. Garman, W. M. Brackett, J. W. Fewkes, and F. W. Putnam, and Messieurs L. C. Jones, Geo. B. Appleton, E. A. Samuels, W. S. Wadsworth, W. W. Woodworth, N. Vickary, and P. R. Waughop. We have been greatly favored by the kindness of Hon. E. A. Brackett of the Massachusetts Fishery Commission.

The publications by the writer, directly based on the Museum Collections, include the following:

In the Museum Bulletin:—

“On the Lateral Canal System of the Selachia and Holocephala.”

In the Bulletin of the Essex Institute:—

“The Batrachia of Kalm’s *En Resa til Norra America*.”

In the Proceedings of the Boston Natural History Society:—

“A large Carp and its History.”

“On the Evolution of the Rattlesnake.”

And, besides the foregoing, in different publications, various articles and reviews, unsigned, connected with the work of these departments but indirectly.

REPORT ON THE ENTOMOLOGICAL DEPARTMENT.

 BY DR. H. A. HAGEN.

MR. HERBERT SMITH has sent his large collection of Centro-Brazilian species of Pseudoneuroptera and Neuroptera to the Museum for determination, with the privilege of retaining new species for the Museum.

Mr. F. D. Godman, of London, has also sent in the Odonata of Central America for description for his *Biologia Centrali Americana*, and has most kindly given permission to retain for the Museum a full set of the duplicates. This collection contains 3,248 specimens. There is little doubt that the Museum collection of American Odonata has from these gifts become the largest in existence.

As usual, Dr. H. G. Horn, of Philadelphia, Mr. S. Henshaw, of Cambridge, Mr. J. G. Jack, of the Arboretum, Mr. P. H. Dudley, of New York, and Mr. C. Cabot, of Brookline, have presented some new and very excellent species, chiefly for the biological collection.

Dr. John L. Le Conte's collection is in good order, and will be put in new cabinets, presented to the Museum by Mrs. Le Conte.

The numerous additions to the Biological Collection have already been distributed so far as space would allow in our present cases. Several new cabinets will soon enable us to complete this work. Some parts of this collection have been rearranged; others are entirely new, and usually not represented in Museums, as the Pulicidæ, the Thysanura, the Ixodidæ, Acarina, Mallephaga, and the *Phytoptus galls*.

The collection of Cave animals is of very recent date: the Blind Fish and the Blind Crawfish, and the Cave Grasshoppers collected in 1859 by Professor A. Hyatt, are the only ones represented. On the Survey of Professor N. S. Shaler, a number were

collected by Messrs. F. G. Sanborn, A. S. Packard, F. W. Putnam, and H. G. Hubbard. The Cave Beetles of Europe were furnished by European friends. I have just finished a very detailed catalogue of this collection, twenty-five pages in length. In my opinion it is unrivalled here or abroad.

In the Memoirs of the Museum, the third part of Mr. Louis Cabot's description of the earlier stages of the Odonata is in print, containing the Cordulina and the genera Pantala and Tramea. A large number of drawings for the fourth part, the Libellulina, are also finished.

The Assistant has published the following papers during the past academic year: —

Myrmelonidæ (end). Canadian Entomologist, 1888, Vol. XX. pp. 185-191, pp. 205-211.

The Life of Dr. Christian Zimmermann. Canadian Entomologist, 1889, Vol. XXI. pp. 53-57, pp. 71-73.

Die Spaltung einer Flügels am das doppelte Adernetz zu zeigen. Zoologischer Anzeiger, 1889, Vol. XII. pp. 377, 378. Mit einer photographischen Tafel.

The Female of Eutermes Rippertii. Anatomy. Psyche, 1889, Vol. X. pp. 203-208.

Do Animals Count? Nature, Vol. XL. p. 319.

Ueber die früheren Zustände der Libellen, nebst Andeutung über die Bildung der Thorax. Stettiner Entomologische Zeitung, 1889, Vol. L. pp. 1-4.

REPORT ON THE INVERTEBRATES.

 BY J. WALTER FEWKES.

MY time in Cambridge last year was occupied in work on the Atlantic Room, which, much to my regret, I was unable to finish.

A part of July and August was spent at Grand Menan, where I was engaged in a study of the development of Pteraster and certain other Echinoderms.

I wish to be permitted in this, my last Report, to express my gratitude for the opportunities for research which have been afforded me during the eight years in which I have been officially connected with the Museum.

The following papers have been printed for me during the past year:—

1. On the Serial Relationships of Ambulacral and Adambulacral Calcareous Plates of the Starfishes. Proc. Bost. Soc. Nat. Hist., Vol. XXIV. pp. 96-117.

2. On a Method of Defence among certain Medusæ. Ibid., pp. 200-208.

3. Natural History Illustrations. Prepared under the Direction of Louis Agassiz, 1849. The Anatomy of Astrangia Danæ. Six Lithographs from Drawings by A. Sonrel. Explanation of the Plates. Smithsonian Institution.

4. A Preliminary Notice of a Stalked Bryozoön (*Ascorhiza occidentalis*). Ann. Mag. Nat. Hist., Vol. III. No. 13, pp. 1-6.

5. On a New Athorybia. Ibid., Vol. III. No. 15, pp. 207-210.

6. On Angelopsis and its Relationship to certain Siphonophora taken by the "Challenger." Ibid., Vol. IV. pp. 146-155.

7. A Corner of Brittany. American Naturalist, Vol. XXIII. No. 226, pp. 95-109.

8. Across the Santa Barbara Channel. Ibid., Nos. 268, 269.

9. Report on the Medusæ collected by the United States Fish Commission Steamer "Albatross" in the Region of the Gulf Stream in 1885-86. Ann. Report of Com. Fish and Fisheries for 1886, pp. 512-536.

I have also edited the first part of Vol. XXIV. of the Proceedings of the Boston Society of Natural History.

REPORT ON PALÆONTOLOGY.

BY ALPHEUS HYATT.

DURING the early part of the present official year the work of this department was mainly directed to the identification and completion of the arrangement of the Trilobites, which was carried far enough to include most of the larger Silurian genera. During the latter part of the year the time was devoted to the selection of specimens for exhibition in the Stratigraphical Collection. This last undertaking has proved more difficult than had been anticipated. All the material belonging to the Museum has to be brought together in most groups, and considerable preliminary work done in sorting out specimens and identifying the species to which they belong, before the most suitable forms can be made available. Then this material has to be studied more or less in culling out the species characteristic or sufficiently characteristic of the different faunas in the past history of the globe to be used in a stratigraphical collection. Considerable advances have, however, been made in this direction, so far as the Mollusca and Trilobites are concerned. The work of cleaning and placing the specimens of the old collection of Echinoderms in safe condition has been continued. Similar work has been done for the fossils used by the Assistant in writing his "Genera of Fossil Cephalopods," which had never been fully labelled.

Work on the Gebhard Collection has been continued, and the preliminary labelling of this valuable local collection has been completed.

The department is indebted to Dr. Robert T. Jackson for voluntary labor upon the Gebhard and Hall Collections. This gentleman has also spent considerable time in the study and arrangement of the Lamellibranchs of the Palæozoic and Mesozoic,

and has picked out a series of the more remarkable forms of this group for exhibition in the Stratigraphical Collection.

Some work has been done upon the Anticosti Collection in picking over and culling out the loose material.

A small number of remarkable forms of Nautiloids and Ammonoids have been prepared for mounting for exhibition in the Systematic Collection.

The following papers have been published, or are ready for publication : —

Genesis of the Arietidæ, by Alpheus Hyatt. Mem. Mus. Comp. Zoöl., and Smithsonian Contributions to Knowledge, No. 673, pp. 238, and Fourteen Plates. (In press.)

Japanese Iris from Seed, by R. T. Jackson. Garden and Forest, Vol. I.

Hybridization of Gladioli, by R. T. Jackson. Garden and Forest, Vol. I. No. 52, with Three Figures.

Phylogeny of the Pelecypoda, by R. T. Jackson. Now in press.

REPORT ON THE LIBRARY

 BY MISS F. M. SLACK.

DURING the year ending September 1, 1889, the Library has received 516 volumes, 1,747 parts, and 111 pamphlets: —

	VOLUMES.	PARTS.	PAMPHLETS.
Gift	33	49	24
Exchange	169	741	62
Purchase	39	250	7
A. Agassiz	80	707	18
Binding Parts	195		
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	516	1747	111

The number of volumes now in the Library (exclusive of pamphlets and the Whitney Library) is 18,419. There are 12,527 pamphlets bound in 1,749 volumes, making the total number of volumes 20,168.

[A.]

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

FOR THE ACADEMIC YEAR 1888-89.

Of the Bulletin.

Vols. XVI. [Geological Series, Vol. II.].

No. 2. On the Geology of the CAMBRIAN DISTRICT of Bristol County, Massachusetts. By N. S. SHALER. pp. 30. Map and 2 Plates. October, 1888.

No. 3. FOSSIL PLANTS collected at Golden, Colorado. By LEO LESQUEREUX. pp. 18. December, 1888.

No. 4. The FAULTS in the TRIASSIC FORMATION near Meriden, Connecticut. By W. M. DAVIS. pp. 28. 5 Plates. April, 1889.

No. 5. On the Occurrence of FOSSILS of the CRETACEOUS AGE on the Island of Martha's Vineyard, Mass. By N. S. SHALER. pp. 10. 2 Plates. June, 1889.

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

Vol. XVII.

No. 2. On the LATERAL CANAL SYSTEM of the SELACHIA and HOLOCEPHALA. By S. GARMAN. pp. 64. 53 Plates. September, 1888.

No. 3. The CORAL REEFS of the Hawaiian Islands. By A. AGASSIZ. pp. 50. 13 Plates. April, 1889.

No. 4. Studies on the Primitive Axial SEGMENTATION of the CHICK. By JULIA B. PLATT. pp. 20. 2 Plates. July, 1889.

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

Vol. XVIII.

Reports on the Results of Dredging by the United States Coast Survey Steamer "Blake."—XXIX. Report on the MOLLUSCA. Part II. GASTROPODA and SCAPHOPODA. By W. H. DALL. pp. (2), 492. 31 Plates. June, 1889.

Of the Memoirs.

Vol. XIV.

No. 1. Part II. 1.—Studies from the Newport Marine Laboratory.—XVI. The Development of OSSEOUS FISHES. Part II. The PRE-EMBRYONIC STAGES of Development. Part I. The HISTORY of the EGG from Fertilization to Cleavage. By A. AGASSIZ and C. O. WHITMAN. pp. 40. 12 Plates. June, 1889.

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

In preparation : —

Illustrations of North American Marine Invertebrates, from Drawings by Burkhart, Sonrel, and A. Agassiz, prepared under the direction of L. Agassiz. Selections from Embryological Monographs, compiled by A. Agassiz, W. Faxon, and E. L. Mark (discontinued for the present). Papers, by E. L. Mark, on the Development of *Lepidosteus* and of *Arachnactis*; by M. E. Wadsworth; by Scott and Osborne, on Fossil Mammals; by C. H. Eigenman, on the Egg Membranes of some Osseous Fishes; by Messrs. Davis and Whittle, on the Triassic Traps of the Connecticut Valley; by S. Garman, on the Cave Fauna of Southwestern Missouri; by W. G. Binney, on California Land Shells; by N. S. Shaler, on the Boulder Train of Rhode Island; by H. Ayers, on *Chlamydoselachus*; and by G. H. Parker, on the Eyes of the Lobster.

Also, in conjunction with the Smithsonian Institution, a Memoir on the Genesis of the *Arietidæ*, by Alpheus Hyatt.

A Memoir on *Calamocrinus*, by Alexander Agassiz; a Memoir on the Early Stages of the Odonata, by Louis Cabot; and the continuation of a Memoir on the Development of Osseous Fishes, by Agassiz and Whitman.

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

[B.]

INVESTED FUNDS OF THE MUSEUM.

IN THE HANDS OF THE TREASURER OF HARVARD COLLEGE, SEPT. 1, 1888.

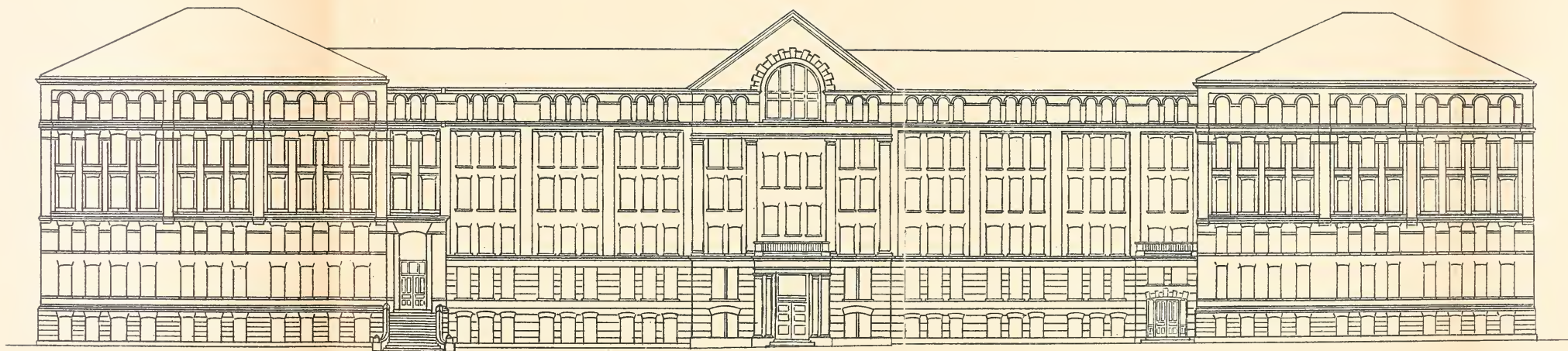
Sturgis-Hooper Fund	\$100,000.00
Gray Fund	50,000.00
Agassiz Memorial Fund	297,933.10
Teachers and Pupils Fund	7,594.01
Permanent Fund	117,469.34
Humboldt Fund	7,740.66
	<hr/>
	\$580,737.11

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

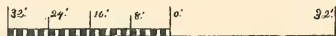
The income of the Gray Fund can be applied to the purchase and maintenance of collections, but not for salaries.

The income of the Humboldt Fund can be applied for the benefit of one or more students of Natural History, either at the Museum, the Newport Marine Laboratory, the United States Fish Commission Station at Wood's Holl, or elsewhere.

Applications for the two Tables reserved for advanced students at the Newport Marine Laboratory, and for the Table at the Wood's Holl Station, should be made to the Curator of the Museum before the 1st of May. Applicants should state their qualifications, and indicate the course of study they intend to pursue.



— UNIVERSITY MUSEUM, OXFORD ST. ELEVATION. —



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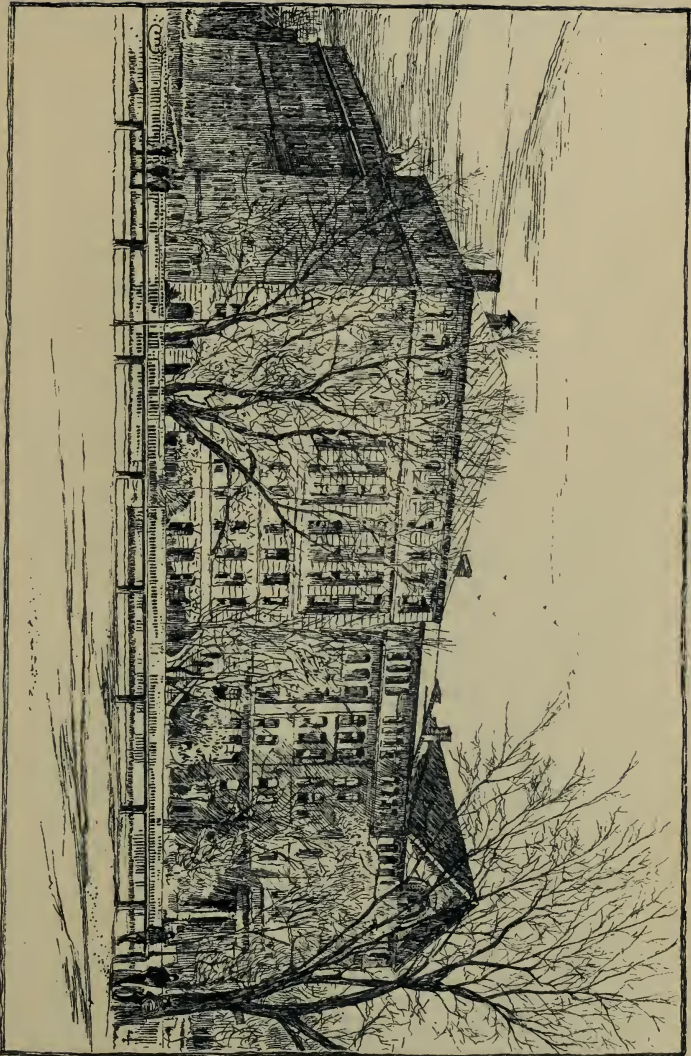


PLATE II.

Photo. Lith. by L. S. Punderson & Son, New Haven, Conn.

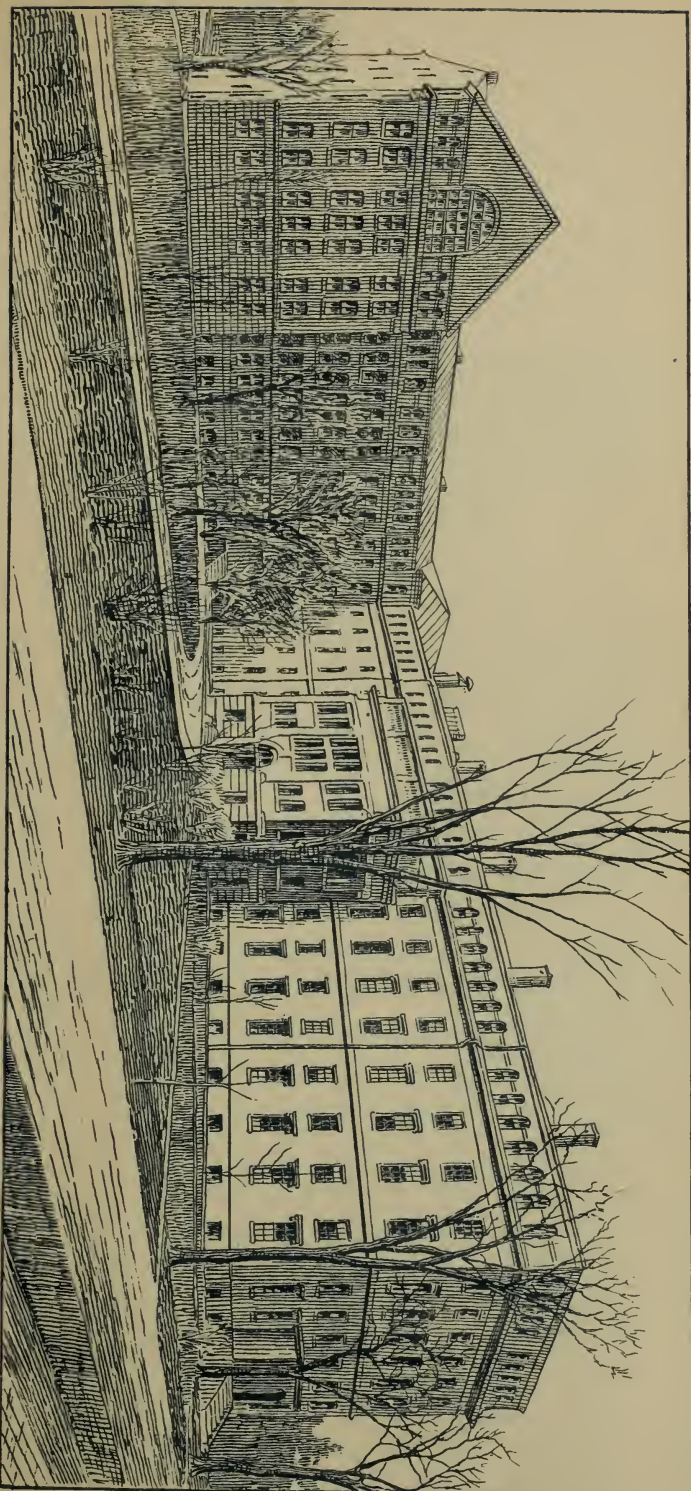
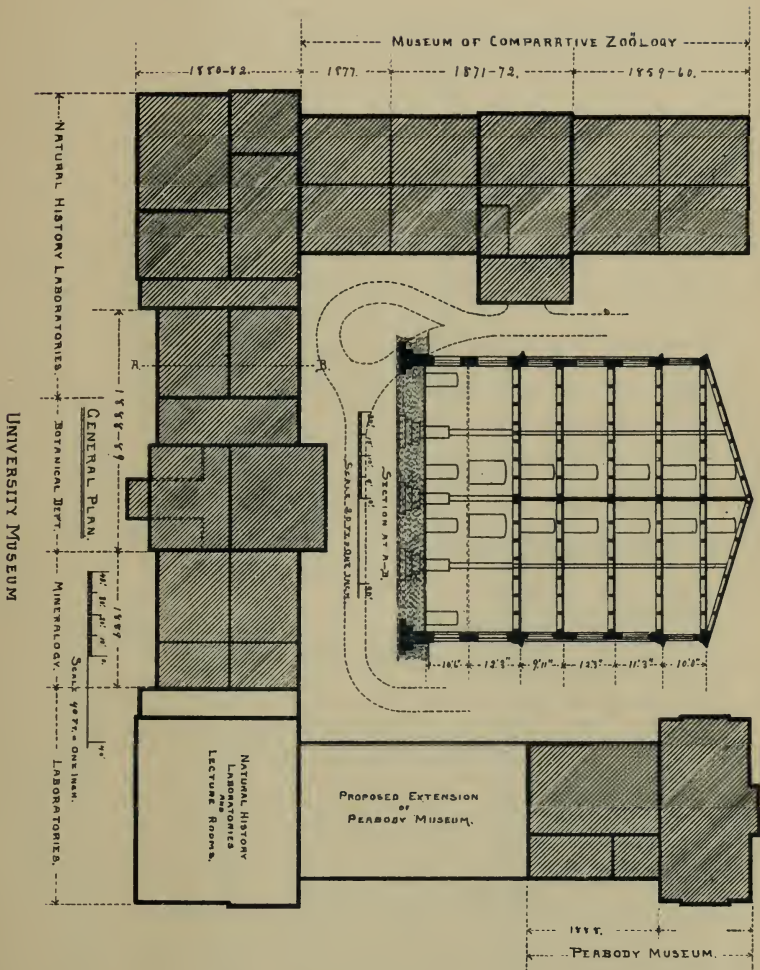


PLATE III

Photo. Lith. by L. S. Pinderson & Son, New Haven, Conn.

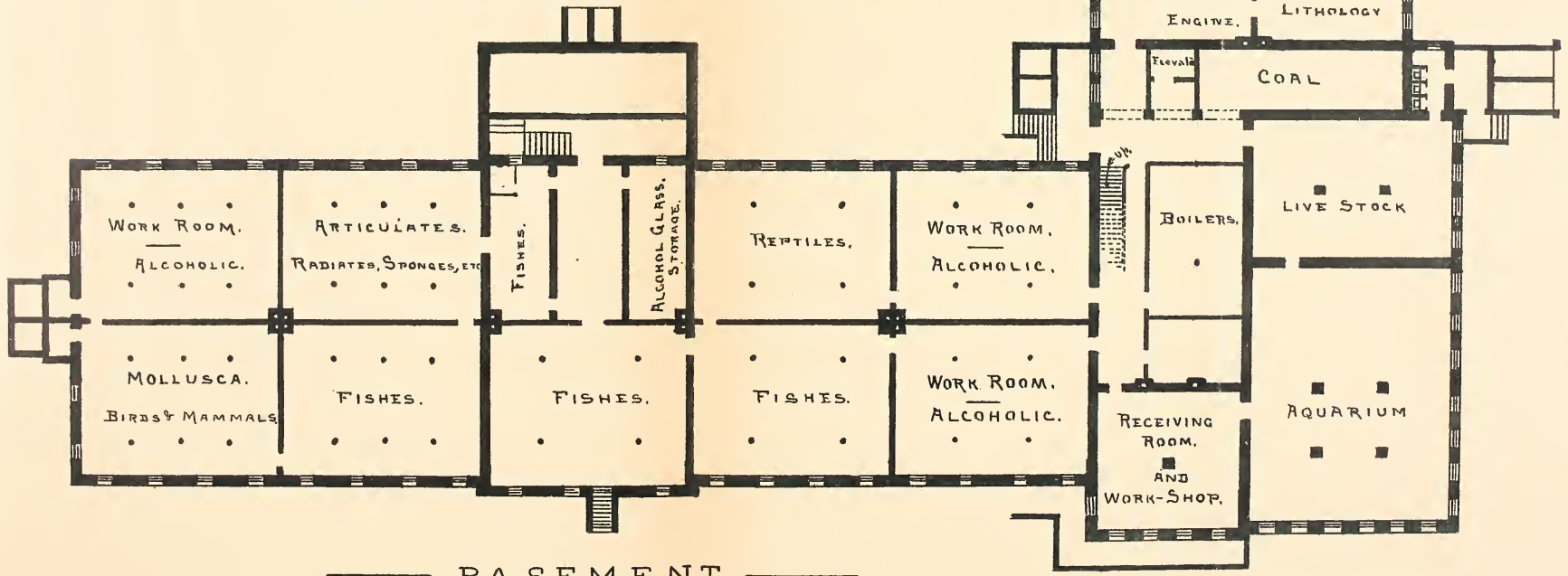


UNIVERSITY MUSEUM

BOTANICAL DEPARTMENT

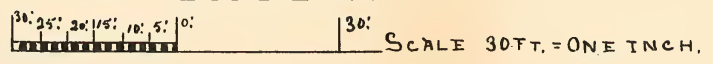
MUSEUM OF COMPARATIVE ZOOLOGY

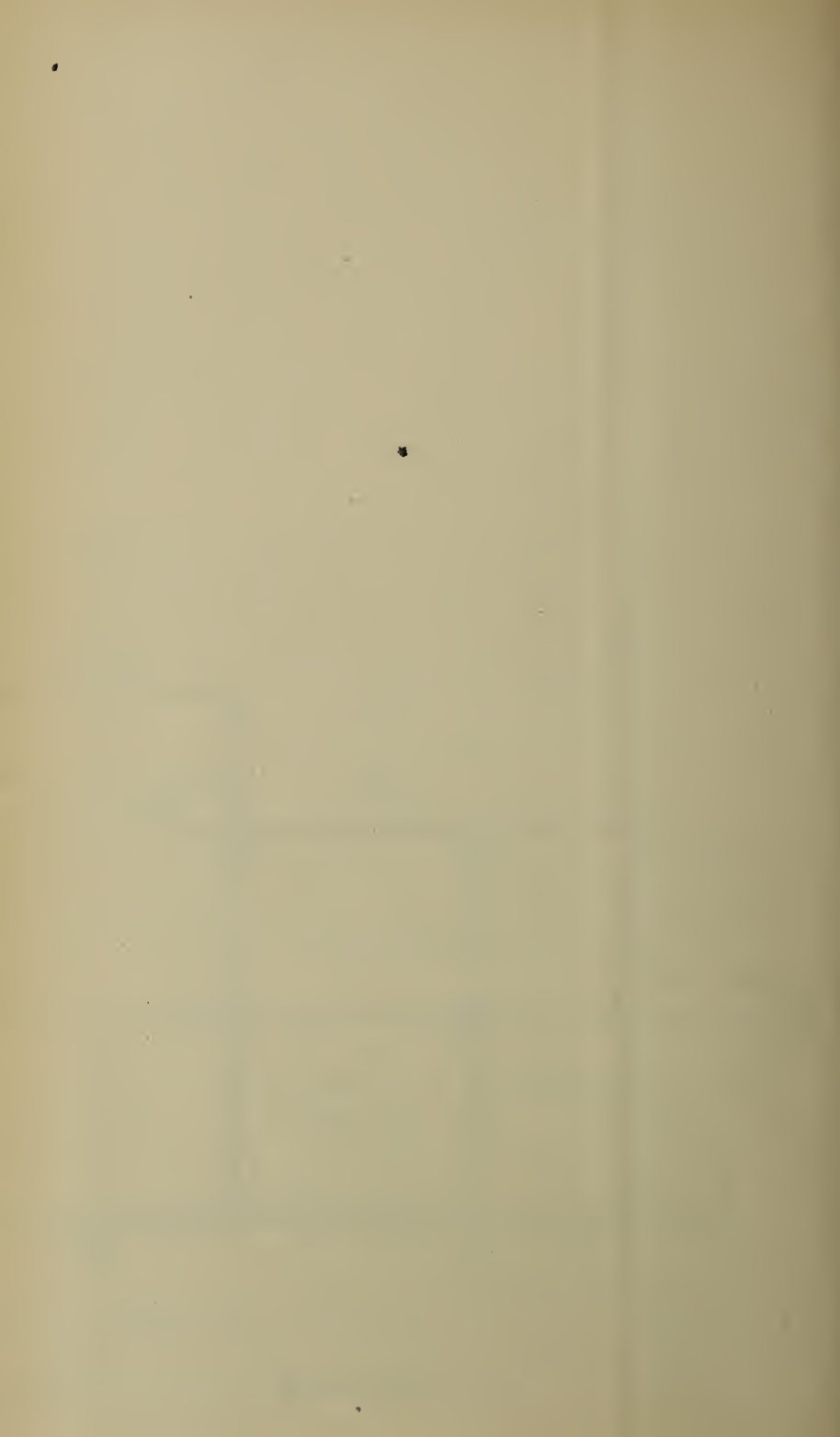
STORAGE FOR ALCOHOLIC COLLECTIONS.



NATURAL HISTORY LABORATORIES.

BASEMENT





BOTANICAL DEPARTMENT.

MUSEUM OF COMPARATIVE ZOOLOGY.

PALAEONTOLOGICAL DEPARTMENT.

DEPARTMENT.

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ELEVATOR

GEOLOGY PROFESSORS ROOM.

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LABORATORY FOR COLLEGE STUDENTS

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DEVONIAN. CAMBRIAN.

CRETACEOUS.

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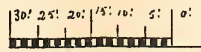
PROFESSOR'S ROOM.

PALAEONTOLOGICAL STORAGE & WORK ROOMS.

PALAEONTOLOGICAL STORAGE & WORK ROOMS.

SYNOPTIC ROOM ZOOLOGICAL

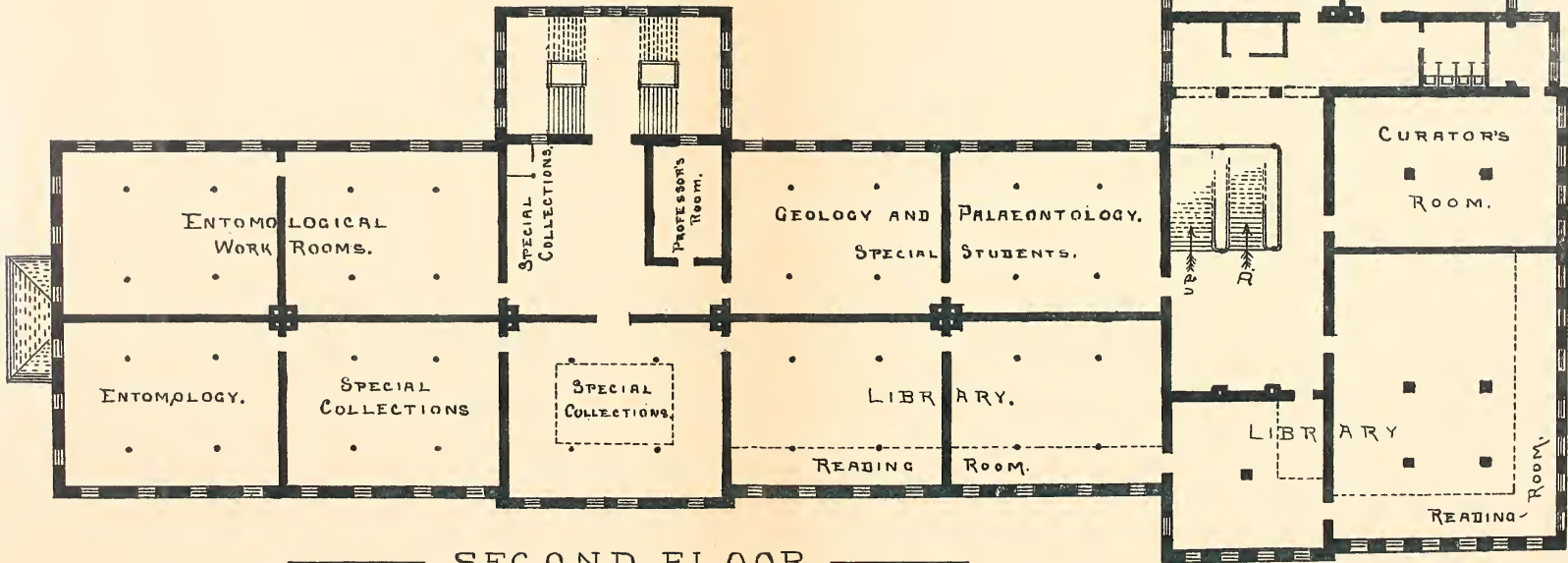
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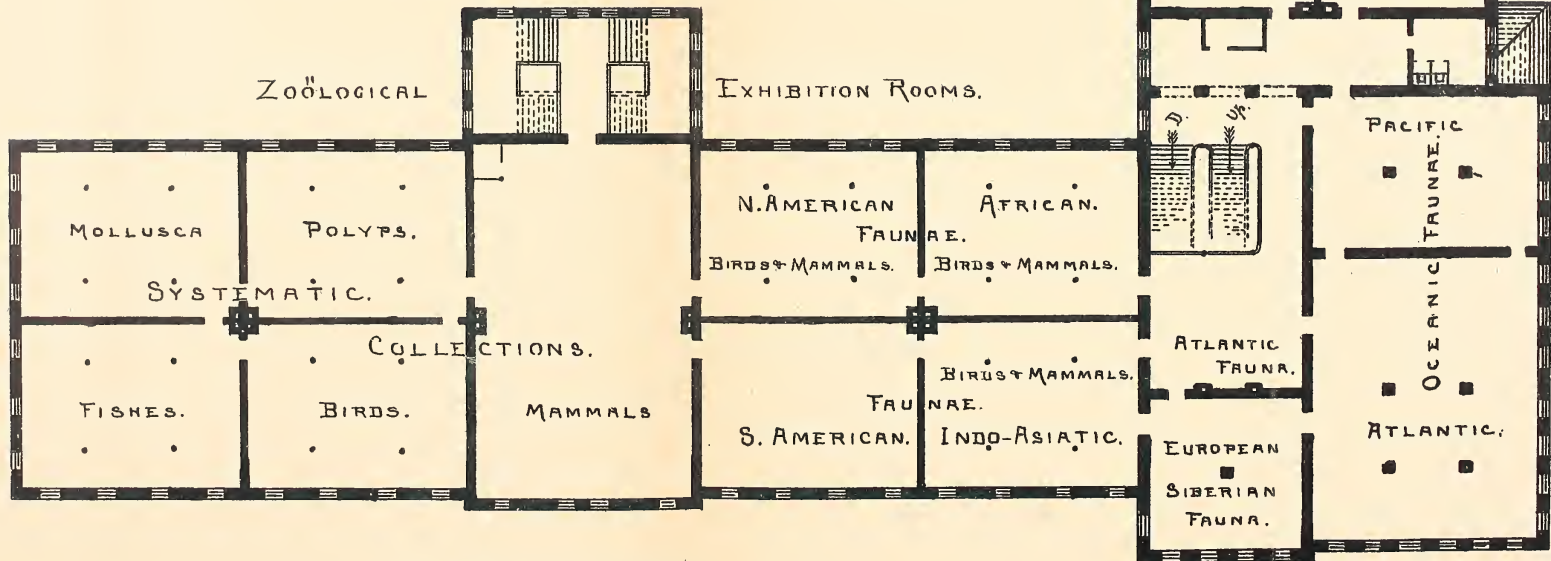


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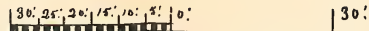


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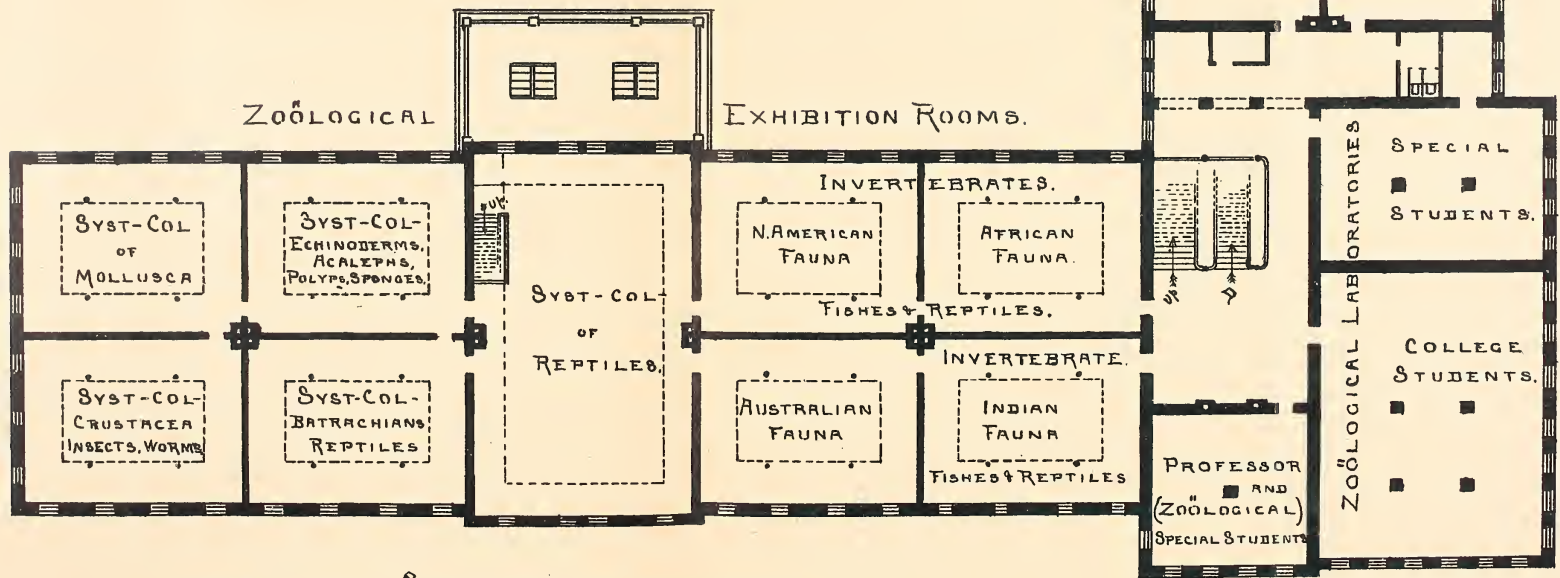


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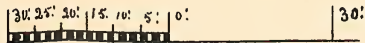
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NATURAL HISTORY LABORATORIES.

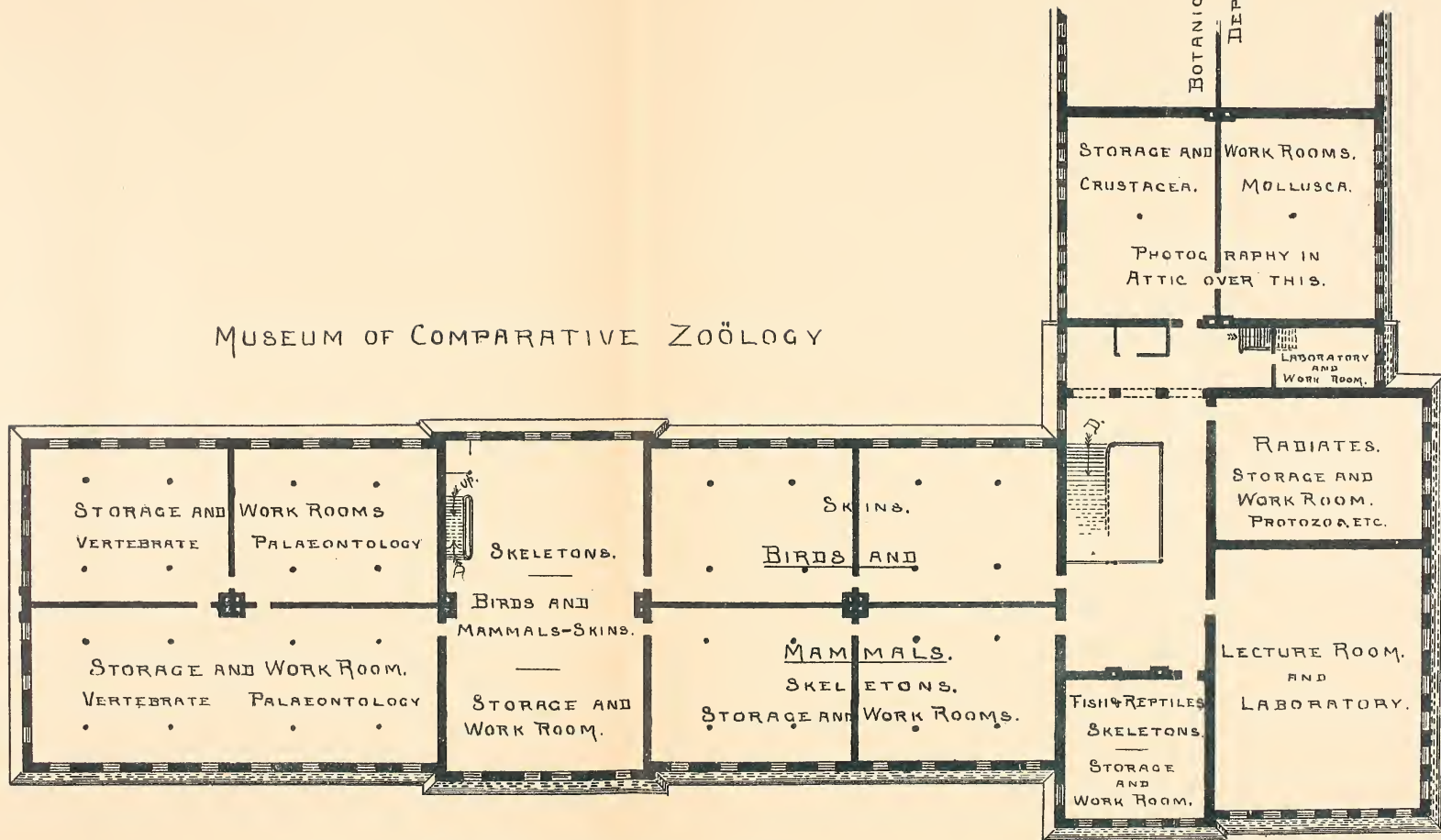
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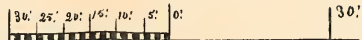
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BOTANICAL DEPARTMENT.

MUSEUM OF COMPARATIVE ZOOLOGY



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