

THE STATE LABORATORY OF NATURAL HISTORY.

BY S. A. FORBES.

The long and close association of the establishment now known as the State Laboratory of Natural History with the Normal University, and the influence continuously exerted by it upon the pupils of the Normal School, and upon the teachers and pupils of the State at large, make it proper that a history of the Normal University should contain some account of the origin and development of the laboratory. The history of the latter institution has been one, not only of growth, but of metamorphosis, also. Commencing as the museum of a natural history society, it was afterwards transferred to the State, and served for a time the purpose of a state museum, but was finally converted into a natural history laboratory, made a center of operations and a source of supply for the State at large, but relieved from the necessity of maintaining a public display of specimens. While by far the most extended and useful part of its work has been done since its conversion into a laboratory, its actual beginning dates from the time of the formation of the old State Natural History Society of Illinois, an organization which had its origin in the same general progressive impulse which gave rise to the Normal University. The first public movement for the formation of this society resulted from a discussion of the subject had at a meeting of the State Teachers' Association, held at Decatur, in December, 1857. The society was actually organized at a convention held in Bloomington on the thirtieth of June, 1858. Prof. J. B. Turner, of Jacksonville, was chosen the first president; Dr. E. R. Roe, of Bloomington, treasurer; Gen. Charles E. Hovey, then principal of the State Normal University, secretary; and C. D. Wilbur, general agent. Letters of congratulation were read from most of the working naturalists of the State who were not present in person, and the new organization set out with every assurance of an active and useful life. This promise was abundantly fulfilled for several years. The annual meetings steadily increased in numbers and interest, and the work carried forward became of continually higher character, as shown by the papers contributed and by the large collection of specimens accumulated. These specimens were placed in rooms of the State Normal University, especially set aside for the use of the society by the Board of Education.

The scope and character of the scientific work fostered by the society may be inferred from the following partial list of the papers read at its various meetings:

By Prof. J. B. Turner, of Jacksonville, "On Microscopic Insects" and "The Great Avalanche of the Ocean;" by Dr. F. Brendel, of Peoria, "Forests and Forest Trees," "Meteorology in

connection with Botanical Investigation," "On the Peculiar Growth of the Water Lily (*Nelumbium luteum*, Willd.)," "Additions to Robert Kennicott's Catalogue of the Flora of Illinois," "Meteorological Table," and "Trees and Shrubs of Illinois;" by Dr. George Vasey (now botanist of the agricultural department at Washington), "The Mosses of Illinois," "Catalogue of Illinois Flora, with Three Hundred and Eleven Recent Additions," "Pernicious Weeds," "Range of Arborescent Vegetation," and "Additions to Illinois Flora;" by Prof. Cyrus Thomas, afterwards State Entomologist, "Orthoptera of Illinois," "Notes on Illinois Insects," "Catalogue of the Mammals of Illinois," and "Plan of a Natural History Survey;" by B. D. Walsh, the first State Entomologist, "Insect Life" and "Fire Blight;" by Dr. E. R. Roe, of Bloomington, "Some Features of the Drift Formation;" by Hon. James Shaw, of Mt. Carroll, "The Great Tornado of 1860;" by C. D. Wilbur, "Mastodon Giganteus" and "Fuel in Illinois;" by Richard H. Holder, of Bloomington (now of Freeport), "Directions for Collecting and Preserving Specimens in Ornithology," and "A Catalogue of the Birds of Illinois."

Most of these papers, with several others of similar character, were published in the State agricultural reports, notably in the third and fourth volumes, and many of them were reprinted in 1862 by the society in the form of a volume of transactions.

The principal donations of specimens made by members were those of Illinois birds, by R. H. Holder; of Illinois fossils, by C. D. Wilbur; of fresh-water shells and southern fossils, by J. W. Powell, and a fine series of Illinois plants, by Dr. George Vasey.

The society was formally chartered by the Legislature, February 22, 1862. The museum was at first supported by contributions of members and the regular income of the society, but as the collections increased in size and importance, the expense of caring for them became too onerous a burden for the small membership of the society, and the aid of the State was invoked. By section four of "An Act concerning the Board of Education and the Illinois Natural History Society," approved February 28, 1867, an annual appropriation of \$2,500 was made for the salary of a curator and the improvement of the museum, and it was provided that this money should be expended under the direction of the Board of Education, by whom, with the advice and consent of the directors of the Natural History Society, said curator should be appointed. Under this act, Prof. John W. Powell, now in charge of the United States Government Surveys of the western territories, was appointed curator, March 30, 1867, and immediately prepared for an expedition to the valley of the Colorado River of the West. Appropriations were made for the expenses of his party by the State Board of Education, the State Industrial University, and the Chicago Academy of Sciences.

Collections of minerals, fossils, plants, insects, birds, and mammals, were made along his route from Council Bluffs to Denver, and thence to the canon of the South Platte, Pike's Peak, and the head waters of the Colorado, and this material was divided, at least in part, among the institutions sharing the principal expense of the trip. In the following year, Prof. Powell undertook a more elaborate exploration of the Colorado River, in behalf of which an appropriation had been made by Congress, and \$1,000 had been voted by the Board from the income of the museum. Prof. Powell spent the next four years chiefly in the western territories in the further prosecution of his explorations, the principal expense of which is understood to have been borne by the general government. The affairs of the museum were in the meantime administered by acting curators in his pay. The appropriation of \$2,500 per annum made by the Legislature in aid of the Natural History Society had been continued regularly up to this time, under the original conditions, but by an act approved April 14, 1871, this appropriation was made subject to the condition that the collections, cases, etc., of the State Natural History Society, then in the museum, should be made over to the State in such a way as should be satisfactory to the Governor. In accordance with this act, the transfer was authorized by the society, as is shown by the following transcript from its records:

“BLOOMINGTON, ILLINOIS, June 22, 1871.

“The Illinois State Natural History Society met, pursuant to adjournment, at the office of the city superintendent of schools, Vice-President Etter in the chair.

“On motion of R. H. Holder, J. A. Sewall was delegated as the agent of the society to transfer to the State Board of Education, for the use and benefit of the State, the collections in the museum, and other property belonging to the Illinois State Natural History Society, unconditionally.”

The following is a copy of the instrument executed by J. A. Sewall, as agent of the society;

“WHEREAS, The State Natural History Society, at a meeting held in the city of Bloomington, and State of Illinois, on the twenty-second day of June, 1871, appointed the undersigned agent for said society, to assign and transfer all the property of said society to the Board of Education of the State of Illinois, in pursuance of the resolutions of said society; therefore, by virtue of said authority, said Natural History Society hereby assigns and transfers all its property of every kind, now in the Normal University building, to the said Board of Education forever.

This twenty-eighth day of June, 1871.

THE STATE NATURAL HISTORY SOCIETY.

[SIGNED.]

By JOSEPH A. SEWALL, Agent.”

This conveyance was accepted by the following resolution of the Board of Education, extracted from the proceedings of their meeting held June 28 and 29, 1871:

"WHEREAS, The Illinois State Natural History Society did, on the twenty-second day of June, 1871, by formal resolution, determine and agree to transfer to the State of Illinois all the right and interest of said society in and to the property of the museum in the Normal University building, and did also then and there appoint and empower Joseph A. Sewall, as agent, to convey said resolution into effect; and,

WHEREAS, In pursuance of said resolution and authorization, the said Joseph A. Sewall did, on the twenty-eighth day of June, 1871, execute and deliver a conveyance of said property to the Board of Education in trust for the State of Illinois; now, therefore, be it

Resolved, That the Board of Education of the State of Illinois do hereby accept the said conveyance, and take possession of the property therein conveyed, for the use and benefit of the State of Illinois."

During the year following this transfer, Dr. George Vasey, then acting curator, made large botanical collections in various parts of the State, and added several hundred specimens to the museum herbarium from his large private collection. Specimens of fossils, minerals, woods, etc., were also obtained, and sets of minerals, geological specimens, woods, plants, and shells, were distributed to twelve of the principal public schools of the State.

On the twenty-eighth of June, 1872, the resignation of Prof. Powell was offered and accepted, and on the same day, Mr. S. A. Forbes was appointed to succeed him. A careful estimate of the contents of the museum was made at this time, with the following result:

Minerals, 1,500 specimens,	300 species
Plants, 9,000 specimens,	3,000 species
Shells, 5,000 specimens,	958 species
Fossils, 5,000 specimens,	1,200 species
Insects, 2,500 specimens,	1,500 species
Birds, 200 specimens,	191 species
Mammals, 30 specimens,	26 species

After the transfer of the museum to the State, no formal declaration of the views of the Board of Education concerning its relations and their intentions with respect to it was ever made, until the following resolutions were passed, December 15, 1875; but as these resolutions simply embodied the settled policy of the Board, in accordance with which the museum had been governed from the first, they may be properly introduced here:

"WHEREAS, Since the control of the museum of the Illinois State Natural History Society was transferred to the State Board of Education, no general declaration has ever been made by this Board of the

relations and policy of the museum, or of the purposes of the Board concerning it; and,

“*WHEREAS*, It seems desirable that the students and friends of science should know definitely and authoritatively the nature, scope, and promise of the work of said museum, in order that they may intelligently cooperate with its officers for the promotion of the scientific interests of the State; therefore,

“*Resolved*, That we regard the museum as a State institution, devoted to the prosecution of a natural history survey of the State, to the encouragement and aid of original research, and to the diffusion of knowledge and habits of thought among the people.

“*Resolved*, That we consider it an important part of its work to supply collections of specimens to the public schools, as far as this can be done consistently with its own general interests, and especially to provide all needed facilities for the instruction of teachers in natural history, and in the most approved and successful methods of teaching the same; and,

“*Resolved*, That we cordially invite the cooperation of the scientists of Illinois, offering them the free use of its collections, library, and apparatus, and assuring them that whatever may be contributed to its cabinets or its funds, shall be used faithfully and impartially for the advancement of science throughout the State.”

Until December, 1876, the establishment retained the obsolete title of “The Museum of the Illinois State Natural History Society;” but at that time the following resolution was adopted by the Board:

“*Resolved*, That the museum in the Normal University building, formerly the property of the Illinois State Natural History Society, but now under the control of this Board, be hereafter known by the name of “The Illinois Museum of Natural History.”

The changed relations of the museum made it now proper that its operations should be confined chiefly within the limits of the State. It was therefore determined to put the large but disordered collection into condition for use as rapidly as possible, by classifying, arranging, cataloguing, and indexing the specimens and the library; to give immediate attention to filling up the most important lacunæ in both, with the view of ultimately accumulating sufficient material for a botanical and zoological survey of Illinois; to give much greater attention to the supply of cabinets of specimens to the public schools, and to encourage and aid, in every way that could be devised, the rational study of nature by the teachers and children of the State; to promote original scientific research, by bringing together the essential instrumentalities for its successful prosecution, and by providing for the publication of its results; and to assist in the solution of scientific problems bearing upon the industries of the people.

The sudden introduction, in 1872, of four new sciences into the common-school course, a knowledge of which was required of candi-

dates for certificates, powerfully stimulated the study of natural history throughout the State, and made that part of the museum work relating to the public schools most pressing and important, especially as it soon became evident that the lack of preparation upon the part of teachers and school officers for the new duties which the law imposed upon them, threatened serious injury to educational interests, unless efficient help were given. Circulars were therefore issued from the museum, as soon as practicable, offering especial facilities free of charge to those who wished to fit themselves thoroughly for work in the new field, and proposing a series of mutual exchanges for the general benefit. While conducting these exchanges, all the available duplicates in the museum collections were issued to the schools which seemed most to need them. In continuation of this work it was determined, in the autumn of 1873, to attempt the organization of a new society of natural history, which should have for its leading purpose the supply of practical working collections to the schools, through the labor of the teachers and pupils of the schools themselves. With this view, after correspondence with several of the leading teachers of the State, the friends of the movement were invited to convene at Bloomington, Illinois, during the session, at that place, of the State Teachers' Association, in the Christmas holidays. The result was a large and earnest meeting of teachers, at which, after an animated discussion, a constitution was adopted, and the society formally organized by the election of Dr. Richard Edwards, as president, S. A. Forbes, curator, and Aaron Gove, secretary.

The purposes of this society were declared to be, to collect, study, and exchange specimens in natural history, to obtain for the schools with which its members were connected, suitable cabinets of specimens for study and reference, and to encourage and assist the rational study of nature by the pupils of our schools.

This society enlisted the teachers and pupils of more than forty of the colleges and public schools of the State, most of which did active work for the museum during the first two years. The duplicate specimens sent in, to the number of more than three thousand, were named and redistributed to these schools, and material to the amount of about four hundred and fifty dollars was added to the sets from the museum duplicates. This was largely alcoholic marine material, illustrating the sub-kingdoms, classes, and leading orders, representatives of which are otherwise beyond the reach of Illinois schools. A systematic check-list of these specimens, for use in making exchanges, was published during the winter.

Under the auspices of this association, a vacation school of natural history was held in the museum at Normal, in July and August, 1875. Instruction of a high grade, and good facilities for work and study, both elementary and advanced, were provided in

the following branches: Systematic and structural botany of the flowering plants; cryptogamic botany, with especial reference to mosses and fungi; systematic and structural zoölogy, illustrated by mounted skeletons and other preparations, and by series of dissections made by the students under the eye of competent instructors.

A sufficient number of microscopes was provided for the use of students in the study of histology and the lower forms of life. Marine material was furnished fresh from the sea, and inland specimens of all varieties, in great abundance. Occasional excursions were made by the class to give opportunity for field-work.

The following gentlemen acted as instructors for the term: Prof. B. G. Wilder, of Cornell University, New York; Prof. W. S. Barnard, Ph. D.; Prof. T. J. Burrill, of the Illinois Industrial University; Prof. Cyrus Thomas, State Entomologist; Dr. J. A. Sewall, of the State Normal University; and S. A. Forbes.

It was found necessary to limit the attendance to fifty students, but within this limit the school was open to the teachers of the State. Over seventy applications were received, from forty-two different counties. The specimens selected for study were typical ones, and the dissections and examinations were so planned and conducted that the chief facts demonstrated were true, not of the species or genus only, but of the whole classes or sub-kingdoms, or else furnished notable exceptions to general statements about these larger groups.

The fresh water collections for study and dissection were obtained from Lake Michigan and the Illinois River, and the marine animals were collected, as needed, along the New England coast. The laboratory work was made, throughout, the basis of the course, and the lectures were designed chiefly to explain and complete the knowledge gained with the scalpel and the microscope. The study of the anatomy of vertebrates included careful dissections of *Amphioxus*, of the ganoid and common fishes, and the sharks, and skates; turtles, serpents, frogs, and salamanders; and birds, and mammals.

Invertebrate zoölogy was illustrated by dissections of star fishes, brittle stars, sea urchins, sand dollars, and sea cucumbers; earth worms, marine worms, brachiopods and ascidians; lobsters, crawfishes, crabs, beetles, and caterpillars; the common river mussel, several species of marine gasteropods, and the common squid. Besides these dissections of typical animals by the class, many alcoholic preparations and other specimens were presented for their examination.

The study of entomology was especially provided for. The students were taught the characters of the orders of insects, and afforded abundant practice in the determination of genera in the most prominent of these.

About seventy species of flowering plants were analyzed by the

botany classes, representing some forty different orders. In structural and cryptogamic botany, the microscopes were in constant use. A key to the larger fungi was compiled by Prof. Burrill, and about half the session was given to these important but difficult and little known forms of vegetable life. The remainder was devoted to the ferns, mosses, algæ, etc., and to the study of the structure and development of plants. The students were incidentally taught to use the microscope, to mount objects, and to demonstrate important structures and processes. Considerable work was also done in ornithology, including the preparation of specimens. The lectures, thirty in number, were delivered one and two a day, and were brought into close relation to the laboratory work.

It will be seen that the amount of work done was tremendous; and yet it was so new, so varied, and intrinsically so interesting, that the students found themselves refreshed and rested rather than worn out, at the end of the term. The class separated delighted with the result of their studies, and expressing a lively desire to continue it in the future.

In accordance with a resolution of the Board of Education, adopted at their meeting in December, 1875, measures were taken to represent at the Centennial Exposition of the year following, the work done by the museum, for the benefit of the schools of the State. One set of specimens was prepared from those sent in by the schools connected with the School and College Association of Natural History, and another, intended to illustrate the character and condition of the material issued to these schools by way of distribution and exchange, was made up from the museum duplicates then on hand for such use.

Concerning this exhibit, the State agent says in his report: "This case contained, so far as I know, the only exhibit of the kind in the whole exposition. The fact that it was thought worthy of a medal by the board of judges is an indication of its merits, and should afford strong encouragement to the Society of Natural History to persevere in its work."

During the year 1875, investigations were begun upon the food of the birds and fishes of the State, and a paper upon the former subject, giving the results of an examination of the contents of two hundred and twenty stomachs, was published in the Transactions of the Illinois State Horticultural Society for the year 1875. More elaborate preparations were made for the distribution to schools and state educational institutions of more or less complete sets of specimens of the zoölogy and botany of the State. With a view to the further development of work of this character, it was determined to abandon all attempts at a complete exhibition of specimens, to pack the material in the museum as closely as was consistent with its arrangement for convenient and ready reference, and to occupy the

space thus vacated with tables for work and study; thus converting the establishment into a *biological laboratory* for the investigation of natural history subjects. It was further proposed, as a part of this plan, to establish in the new State house, at Springfield, a general exhibit of the natural history of the State, in connection with the collections of the State Geological Survey; and an act was passed by the general assembly, approved May 25, 1877, giving effect to this purpose.

By sections 8 and 9 of the act it was directed that the Illinois Museum of Natural History, at Normal, be converted into a State Laboratory of Natural History, at which, under the direction of the curator thereof the collection, preservation, and determination of all zoölogical and botanical material for said State Museum should be done. It was made a part of the duty of said curator to provide, as soon as possible, a series of specimens illustrating the zoölogy and botany of the State, to deposit them from time to time in the museum established by the act, and to furnish, as far as practicable, all zoölogical and botanical material needed by the State educational institutions for the proper performance of their work. It was also directed that one set of the duplicate zoölogical and botanical specimens then on hand in the Illinois Museum of Natural History, at Normal, which were not needed to illustrate the natural history work of the State Normal University, should be deposited, as soon as practicable, in the museum established by the act.

At the next meeting of the State Board of Education, directions were given for the necessary refurnishing and reorganization of the rooms and collection, the title of the Museum was changed to the "Illinois State Laboratory of Natural History," and sufficient appropriations were made to carry out the directions of the law in a liberal way. About two-thirds of the room was cleared of cases, those remaining were adapted to the systematic arrangement of specimens without reference to their display, and the space vacated was filled with the work tables and large cases of drawers.

This metamorphosis and reorganization of the establishment was the turning-point of its career, and amounted in fact to the founding of a new institution.

The following brief statement of its character and purposes, extracted from the report of its director for 1878, may therefore properly be introduced at this point.

"This is an institution whose chief objects are the prosecution and aid of original work on the natural history of the State (preference being given to subjects having special educational or economical value), the publication of the results of such work for the information of the people, the training and instruction of teachers of botany and zoölogy for the public schools, and the supply of the necessary scientific material to these schools, to the State Museum, and to the

State educational institutions. It affords a place to which any specialist or scientific student may come, with the assurance that he will find everything necessary for special study or original work on the natural history of Illinois, to which any teacher may come for preparation to teach these subjects intelligently, and upon which the officers of any school may draw for material to illustrate the scientific work of their school.

“Its operations are guided by the conviction that the spread of the knowledge and discipline of science among the people is essential to their highest prosperity; that this is a matter of public rather than of personal concern, and that it must be provided for by public rather than by private measures.

“To encourage the spontaneous and gratuitous labors of our scientific men, to assist them at least to the extent of supplying them with such facilities for work as are beyond the reach of individuals, and to furnish them a means of adding the results of their labors to the common stock of human knowledge, is obviously sound public policy. Without this class of workers, devoted to science for its own sake, no solid and valuable progress in science is possible. From them comes the initiative, the incitement. They are the root of the tree by which the raw elements of the natural world have been in all ages drawn together and made ready for the nourishment of the organism.

“As a means of putting the people in possession of scientific knowledge, museums and publications are necessary,—each serving similar ends in different ways,—the former instructing and arousing even the most ignorant as well as the most cultivated, but chiefly limited in its influence to those who visit it; the latter reaching a more widely diffused, but on the whole a better educated class. While the museum conveys instruction through the eye, and arouses, by a representative display of the natural history of the State, a popular interest in science which incites to study, and furnishes a basis of support for the higher scientific work, in the popular sympathy and intelligence, the laboratory is needed to provide ways and means by which this cultured interest may be converted into valuable knowledge and skill, and this, in turn, be bestowed upon the people through the press and the school.

“The functions of the museum and laboratory are too radically distinct to be successfully performed by one institution. The collections of the former are intended for display; of the latter, for study. The material, furniture, arrangement, and general equipment of the two must therefore be essentially different.

“It is also of great importance to the public welfare that the methods of work and habits of thought by which the achievements of modern science have been made, should be brought to bear as far as possible upon the daily life of all. For this, trained and intelli-

gent teachers of science are necessary, able to comprehend the work of specialists, and to assimilate and adapt it to the needs of the community at large,—able also to translate the spirit and methods of science into the work of the school, and through the school into the pursuits of business and labor.

“But a practical knowledge of nature cannot be imparted by books, or by word of mouth alone. The distinctive discipline of science can only be got by the immediate exercise of the mind upon objects and upon ideas directly derived from objects. Materials for study, and named cabinets as the standards of reference, are the *sine qua non* of work worth doing. To incite and reward natural history work, nothing has been found more effective than skeleton cabinets of representative species, which can afterwards be filled up by the collections of teachers and pupils. The cost of these is slight, the value very great. An easily accessible medium of mutual exchanges, a center of authority to which difficult questions can be referred for solution, are also indispensable to success.

“The pressing needs of these three classes, specialists in science, the teachers and the pupils of the public schools, it is the principal function of the state laboratory to supply.

“It is also evident that the large collections needed by the state museum, and in the work of the great state educational institutions, can be made more rapidly and much more economically by one thoroughly equipped central laboratory than by the separate institutions themselves, since one set of apparatus, materials and men can thus do the work which would otherwise require several. It is not intended to take from those institutions any work of special educational value, but to do for them in the least expensive way what each can not do separately without considerable special outlay.”

To follow in detail the various operations of the laboratory since its reorganization, would exceed the limit of this brief sketch, and a general summary of the work accomplished must suffice. Zoölogical and botanical collections have been steadily made in all parts of the State, with a view primarily to accumulating material for a thorough zoölogical and botanical survey of Illinois. In ornithology, a collection of two hundred and fifty species has been made, in northeastern Illinois, near Waukegan and Chicago; in western Illinois, near Galesburg and Warsaw; in the central part of the State, at Normal; and in Union, Jackson, and Alexander counties, in southern Illinois. A good beginning has also been made in collecting a full series of the nests and eggs of Illinois birds.

Insects of all orders have been regularly collected in northern Illinois, from Galena to Chicago; in the central part of the State, from Rock Island to Bloomington; and in southern Illinois generally, except in the Wabash valley. The entomological cabinet now contains about four thousand Illinois species, and twenty thou-

sand duplicates. With the appointment of the director of the laboratory as State Entomologist, in July, 1882, this department of the work assumed a new activity and importance.

The aquatic fauna of the State has been studied with especial care. The Illinois river and tributaries, from its headwaters to its mouth, have been thoroughly searched, as well as the lakes in the river bottoms. Rock river and its branches have been less carefully but sufficiently explored. The Mississippi and Ohio have been seined for weeks at Cairo, and numerous trips through southern Illinois have yielded an excellent collection from the lakes and smaller streams of that territory. Galena river, in northwestern Illinois, and the lakes in the northeast part of the State, have been exhaustively searched with seine, dredge, and towing net, and both the deep and shallow waters of Lake Michigan have been explored with dredge and trawl. These collections have included all orders of aquatic life, from fishes, amphibians, and reptiles, to the microscopic Entomostraca and Protozoa. Even the ponds and wayside pools have been searched everywhere for insects and minute Crustacea. Several large collections have also been made for the laboratory on the coast of New England, more especially for the supply of marine forms for use in our natural history schools, and for general distribution to the public high schools throughout the State.

The herbarium of flowering plants was already so large, that botanical field work has been confined chiefly to the cryptogams. An expert collector of fungi (Mr. A. B. Seymour) has been almost constantly in the field since July, 1881, and has sent to the laboratory about three thousand five hundred numbers, aggregating more than a hundred and fifty thousand specimens. About three thousand five hundred species of fungi have also been bought within this period, and eight hundred microscope slides of parasitic species have been mounted.

The laboratory has filled its function as a feeder to the State museum by supplying that institution with a series of three hundred and twenty species of mounted Illinois birds, each usually represented by male, female, and young, and a collection of sixty species of eggs; a good set of mounted mammals of species now occurring in the State, or known to have occurred here formerly; an extraordinary series of about fifty painted casts of Illinois fishes, together with about one hundred and fifty specimens in alcohol, and large cabinets of insects, mollusks, marine specimens, and plants, both flowering and cryptogamous. A series of mounted skeletons of mammals, birds, reptiles, amphibians and fishes, has also been sent down. To the Industrial University and the Southern Illinois Normal, good collections of fishes, insects, and plants have been given, with much miscellaneous material. Forty public high schools have been sup-

plied with representative cabinets of fishes, insects, crustaceans, marine animals, and other objects, aggregating over ten thousand specimens, and the material is now on hand for the supply of about as many more. These cabinets are all issued under such conditions and with such precautions that it is known beforehand that they are needed, that they will be used, and that they will be properly cared for.

In the course of the investigation of the food of birds, over six thousand stomachs, representing two hundred and twenty-five species, have been obtained, and about seven hundred of these have been critically and exhaustively studied with the microscope. The food of fishes, both young and old, from all parts of the State, and during all seasons of the year, has been investigated on an equally elaborate scale. About two hundred and fifty insects have been dissected for a study of the food of certain difficult and important families, and the contents of their alimentary canals mounted as microscopic slides. The results of this work have been embodied in papers published in the bulletins of the laboratory, in the transactions of the State Horticultural Society, in the *American Naturalist*, and in various other reports and periodicals.

For the purpose of making the work of the laboratory available for the information of the general public, a series of bulletins has been published and gratuitously distributed. The fourth in number was issued in May, 1881, a fifth is now in press, and a sixth will be published during the coming winter. These bulletins contain only original contributions to a knowledge of the natural history of the State. Besides papers prepared at the laboratory, they include about one hundred and twenty pages of matter contributed by naturalists not connected with the institution. Three hundred and seventy-six pages have thus far been printed, and about two hundred more will be added this winter. Among the more important papers are an annotated catalogue of the birds of Illinois; elaborate reports on the food of the thrush family and the bluebird; complete catalogues of the fishes of the State, with studies of the food of old and young; a descriptive catalogue of the reptiles and amphibians of the United States east of the Rocky mountains, with a list of Illinois species; papers on the food of predaceous insects; a descriptive list of the Crustacea of Illinois; a list of our mosses, liverworts, and lichens, and various papers on Illinois fungi.

The library has grown in the meantime from a small and ill-assorted set of books, to a carefully selected collection of 1,200 volumes, and about 1,000 pamphlets on natural history. A card catalogue of authors is now complete, and a subject catalogue well under way.

Mention should also be made of a second natural history school, held in July, 1878, similar to that more fully described above, and equally successful in all respects.

From a movement initiated at this school, sprang a second State Natural History Society, organized in December, 1878, of which the director of the laboratory has been secretary from the first. This society holds semi-annual meetings,—one in June for field work, and one in February for the reading and discussion of papers. It is an active and flourishing organization, and gives every indication of a long and useful life. The educational value of the establishment is greatly enhanced by the fact that all its material and appliances are free for the use of such special students of science as wish to push their studies independently. Many capable teachers of science, and several promising young naturalists, have found here the means of entering upon their careers, or of adding largely to their resources.

And so the State Laboratory of Natural History, embodying the earnest and devoted labors of many whose names have found no place in this brief record, has grown and developed with the steadily increasing wealth and intelligence of this great State, by a slow and healthy enlargement of its field and building up of its power, until to-day it stands unique among all the state institutions of America. Its work will not be done until the life of the great and varied region which its operations cover, is known in all its forms and details, and understood as a whole,—until the general system of laws by which this complex aggregate of living things is unified and governed, has been mastered and made known. It is properly only at the real beginning of its career,—now first actually equipped for systematic and effective service. Its prime and essential function is not to do that which has been done before, nor even to teach that which is already known, but to push forward the bounds of human knowledge along certain special lines, and to apply the knowledge gained to the welfare of the people of the State. Its office is to enlarge that knowledge and mastery of nature which distinguishes the civilized man from the savage, and the support which it receives is to be regarded as a contribution to human progress.

FURTHER IMPROVEMENTS.

The foregoing article shows the development of the work in natural history during the last few years. But, in the mean time, other departments have been increasing their facilities and changing their methods of work.

When Dr. Sewall left the school to take charge of the Colorado State University, in 1877, he was succeeded by M. L. Seymour, of Blue Island. This gentleman had already won considerable reputation on account of his skill in devising simple apparatus to illustrate the work in the natural sciences. Under his management, a change has